Assessment of options for reinforcing the Packaging and Packaging Waste Directive's essential requirements and other measures to reduce the generation of packaging waste

Appendices

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DECEMBER 2021

Assessment of options for reinforcing the Packaging and Packaging Waste Directive's essential requirements and other measures to reduce the generation of packaging waste: **Appendices**

FRAMEWORK CONTRACT ENV.F.1/FRA/2019/0001

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LIST OF ABBREVIATIONS

Abbreviation	Description
AD	Anaerobic Digestion
AdCo	Administrative Cooperation Groups
AQ	Air Quality
B2B	Business to Business
B2C	Business to Consumer
BRG	Better Regulation Guidelines
CBA	Cost-benefit Analysis
CBI	Confidential Business Information
CEA	Cost-effectiveness Analysis
CEN	European Committee for Standardization
CLP	Classification, Labelling and Packaging
CMR	Carcinogenic, Mutagenic or Reprotoxic
CPA	Circular Plastics Alliance
CPPdb	Chemicals associated with Plastic Packaging database
CPV	Common Procurement Vocabulary
Downcycling	Recycling of waste in cases where the recycled material is of a lower quality and functionality than the original material
DRS	Deposit Return Scheme
ECHA	European Chemicals Agency
EN	European Standard
EoW	End of Waste
EPR	Extended Producer Responsibility
ETS	Emissions Trading Scheme
FCM(R)	Food Contact Material (Rules)
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHG	Greenhouse Gas (emissions)
GPP	Green Public Procurement
HORECA	Hotels, restaurants and catering
ICT	Information and Communication Technologies
IVC	In-Vessel Composting
JRC	Joint Research Centre
LCA	Life Cycle Analysis
MCA	Multi-criteria Analysis

Abbreviation	Description
MS	Member State
nCEAP	new Circular Economy Action Plan
NIAS	Non Intentionally Added Substances
OPC	Online Public Consultation
OPRL	On-Pack Recycling Label
PBT	Persistent Bioaccumalative Toxic
PEF	Product Environmental Footprint
POM	Placed on the Market
PPWD	Packaging and Packaging Waste Directive
PRO	Producer Responsibility Organisation
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RTP	Returnable Transport Packaging
SHVC	Substances of Very High Concern
SKU	Stock Keeping Unit
SME	Small and Medium Enterprises
SUP(D)	Single Use Plastic (Directive)
TED	Tenders Electronic Daily
vPvB	Very Persistent and Very Bioaccumalative (substances)
WFD	Waste Framework Directive

APPENDIX A - PROBLEM DEFINITION

In line with the Better Regulation Guidelines on Impact Assessment, this section further defines the problems that are being addressed by this review of the Directive (as summarised in the main report, section 2.0) with a focus on the scale of these problems, their consequences and underlying drivers.

The current scale and trends associated with each problem are discussed first, based on an assessment of the available data on packaging waste and packaging markets. This is accompanied by an overview of the current consequences of each problem, presented for particular affected stakeholder groups, as well as in terms of the problem's relative significance in terms of the Commission's current policy objectives in this area (as discussed in Section 1 of the main report).

The main causes of the problems are then identified and assessed, including any underlying drivers that are either regulatory in nature, owing to market forces (in the absence of any counteracting regulations), or due to socio-demographic and behavioural factors. These have been limited to those drivers that are within the EU remit to influence, as well as those that have an overbearing influence on the problem in question.

Finally, based on the evidence compiled regarding the scale, trends and drivers of the problems, an assessment is made regarding the likely evolution of the problem in the absence of further intervention – its likely persistence as well as the probability of its scale increasing or declining in the future if no action is taken.

1.0 High and growing levels of packaging waste

1.1 High levels of avoidable packaging

1.1.1 Overview

In this section, the continued growth of packaging waste, and increasing use of largely unnecessary and excess packaging is addressed. A discussion of packaging waste generation across the EU at an overall material level is followed by an analysis of the trends across particular packaging types. Subsequently, the trends in packaging light-weighting are discussed in the context of increased packaging waste generation followed by a discussion of the trends in excess packaging. This section is completed with an overview of some of the consequences of these trends.

1.1.1.1 Macro Trends

The quantity of packaging generated within the EU has seen a general upward trend both in absolute terms and in terms of packaging waste generated per capita since the introduction of the PPWD in 1994. According to Eurostat, around 69 million tonnes of packaging waste were generated in 2005, and an estimated 77.5 million tonnes in 2017 – representing a 12% growth in tonnage of packaging waste generated in the EU in this period.[1] Even when accounting for population growth within the EU, packaging waste generated per capita increased from 158 kg per person in 2005 to 174kg per person in 2017 representing a 10% increase Whilst there has been significant economic growth in this period, packaging waste generation is still increasing faster than GDP. Figure 1-1 shows the % change in packaging waste generation and GDP from 2009 (earlier years are omitted due to impact of 2008 financial crisis skewing the trend) and 2017. Over this period, it is clear that packaging waste generation and GDP show a 'negative decoupling' trend.

[1] Eurostat *Eurostat - Data Explorer - Packaging waste by waste management operations and waste flow*, accessed 25 April 2019, http://appsso.eurostat.ec.europa.eu/nui/show.do?lang=en&dataset=env_waspac

Figure 1-1 Trends in Packaging Waste Generation and GDP adjusted by PPP, EU (27 countries - from 2020)

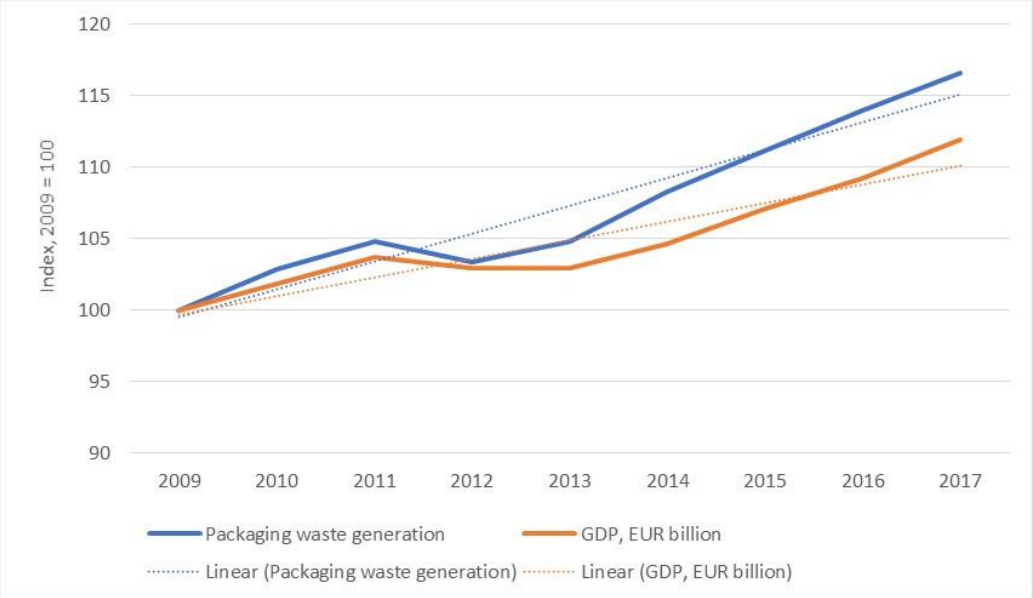
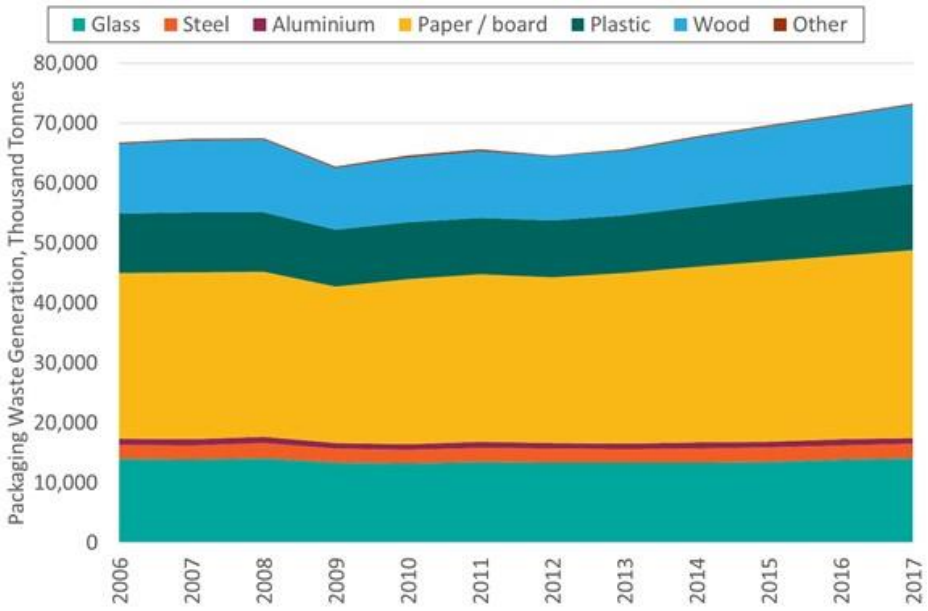


Figure 1-2 and Figure 1-3 show the more marked changes in relative market shares, with the market share of paper/board and plastic gaining more prominence and a declining use of metal and glass.[2]

Figure 1-2 Trend in Packaging Waste Generation by Tonnage (EU (27 countries - from 2020))



Source: Eurostat

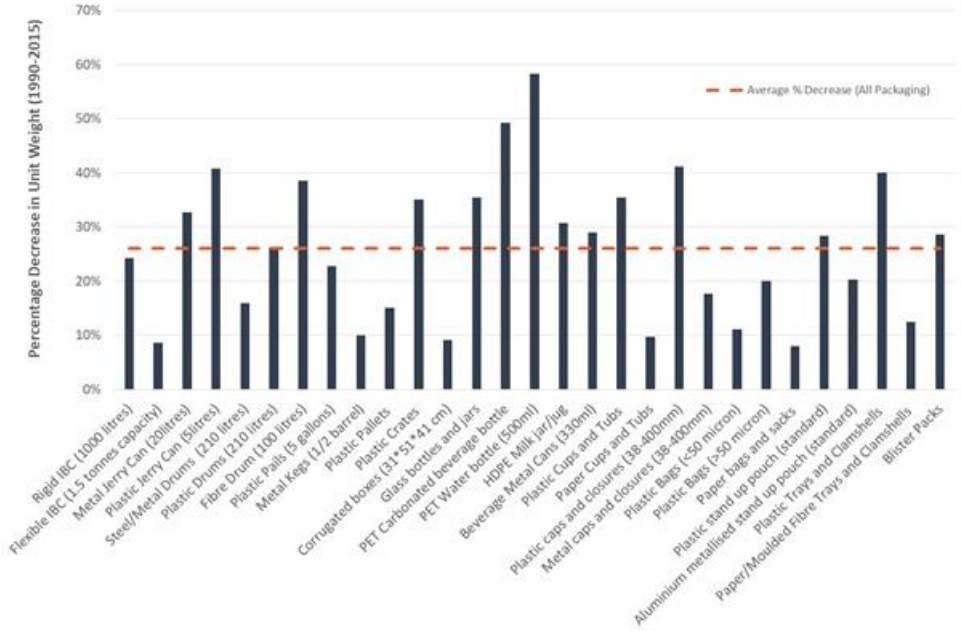
[2] Eurostat (2017) *Packaging Waste Statistics*, http://ec.europa.eu/eurostat/statistics-explained/index.php/Packaging_waste_statistics

In parallel to these trends, the choice and design of product packaging by manufacturers and retailers has shifted in important ways. Notably, there has been a general increase in the material efficiency of packaging, in addition to heavier packaging materials like glass and metal being replaced by plastic and paper. According to Transparency Market Research (TMR) data, a decrease in unit weight has been observed across all packaging types between 1990 and 2015, as shown by Figure 1-3,[3] reducing by an average 26% in unit weight, with some packaging types reducing by a more significant amount. Moreover, of the packaging types covered, all saw a reduction in unit weight over this period. There are however, limits, to material efficiency improvements. The primary functions of packaging remain product protection, safety, hygiene, shelf life and labelling and continued efficiency improvements at the detriment of these functions would be counterproductive, and as such, it should not be presumed that light-weighting trends will continue indefinitely.

In addition to the light-weighting of specific packaging types, some product areas have seen a shift in the packaging material commonly chosen. For instance, some glass beverage containers and jars have been replaced by PET and HDPE bottles, or the substitution of bottled wine with bag-in-box packaging. This is evidenced in Figure 1-4 where since 1999, the quantity of beverages sold in plastic containers has increased by over 150%, whilst glass containers have reduced by 27%. In more recent years, other product categories have experienced a similar change. Fruit juices, condiments, preserves, oils and vinegars have often switched to plastic bottles, or alternatively to liquid carton board whilst plastic pouches have replaced steel cans, and glass jars in product categories such as baby food, pet food. Similar trends can be seen in non-food categories such as cleaning supplies where washing tablets are commonly packaged in individually wrapped doses within a larger plastic pouch, where previously, this may have been packaged in a bottle, or cardboard box.

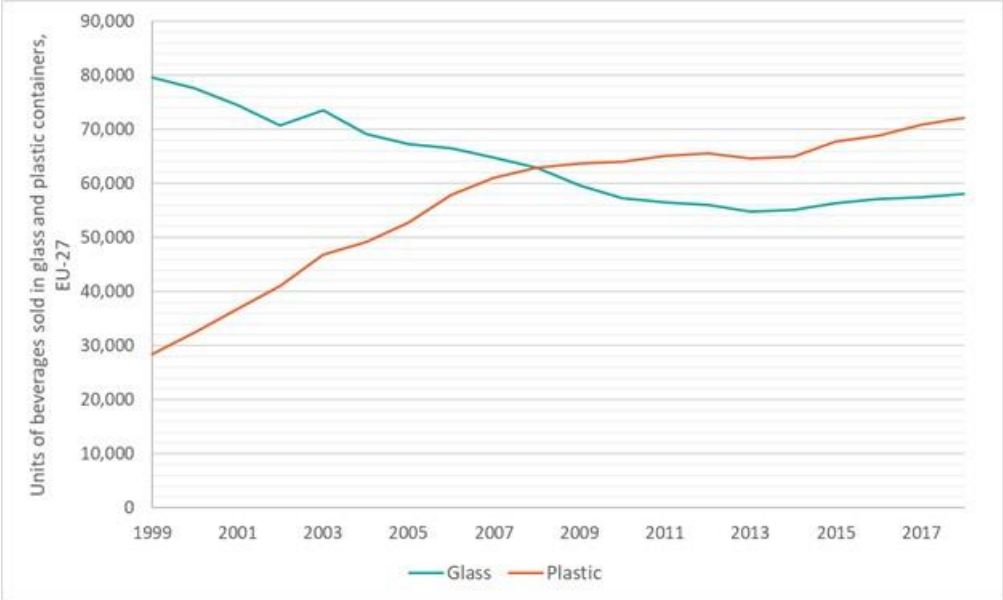
[3] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

Figure 1-3: Reductions in Packaging Unit Weights over Time (1990 to 2015)



Source: Transparency Market Research

Figure 1-4: Volume of beverages sold in the EU (27 countries - from 2020)



Source: Global Data

1.1.1.2 Identified Examples of over-packaging or unnecessary Packaging

An Online Public Consultation was distributed to relevant stakeholders (companies, associations, EU citizens, non-governmental organisations, etc) in January gathering views on packaging, packaging waste, and reuse options to help inform the assessment of the Packaging and Packaging Waste Directive. Of the respondents, 68% thought that there was either too much or far too much packaging being placed on the EU market. When asked which categories of

products exhibited unnecessary or over-packaging, over two thirds of respondents thought that either cosmetics, ready meals, electronic goods, children's toys had too much or far too much packaging. While there has been a drive from product brands and retailers to lightweight packaging for several decades, evidently there is the perception that there are still instances of unnecessary packaging, packaging that has not yet reached its optimum weight or size. Instances of over-packaging can broadly split into the following categories:

- Functionally necessary packaging which is excessive in terms of its volume or weight;
- Packaging that is unnecessary in that it serves no essential function and could be avoided without the need for an alternative;
- Packaging that could be replaced by a reuse system.

Work by Eunomia for WRAP and other clients, and confirmed by industry experts in the food retail sector[4], has highlighted, for example, that some wine and beer bottles vary greatly in weight, despite having exactly the same functionality. Wine bottles, for example, can vary from 300g for a 75cl bottle, to over 600g for the same volume. Some references[5] give a 'standard' glass wine bottle as 540g (per 75cl) and a 'lightweighted' bottle 420g or less. Vinbudin, the state alcohol company of Iceland, allows a search of wine bottles on its website by those that have been lightweighted, showing that many have not[6].

In a recent survey by Forbes Insights and DS Smith, 60% of e-commerce executives indicated that more than a quarter of their packaging (25%) is empty space, while separate research across product categories indicated that the empty space in e-commerce packaging ranges from 18% for clothing and footwear to 64% for glassware.[7] According to a recent JRC study, an additional layer of packaging (excluding inner protective materials) provides an additional demand for almost 1.5 million tonnes of cardboard and around 26,000 tonnes of light density polyethylene foil for Europe generated by e-commerce.[8] The JRC study presented a baseline scenario data for 2030, which showed that under the conditions where expected annual revenue growth rates between 2019 and 2021 can be applied for the linear increase of fulfilled units, packaging materials can be expected to roughly double in total for cardboard and LDPE film by 2030.

The problem is not confined to e-commerce however, despite the publicity this receives; significant over-packaging issues are evident in the categories of food and drink, home and hygiene, cosmetics, hardware (e.g. home improvement, vehicle maintenance), and consumer electronics [9]. The OPC survey supporting this study showed that 68% out of 280 of respondents considered that there is currently too much packaging (37% indicated too much packaging and 31% indicated far too much packaging) around products placed on the EU market in general,

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[4] Environment Manager, Commercial Team – Food Policy, UK Co-Operative Group

[5] https://www.vinbudin.is/english/home/um_atvr/samfelagsabyrgd-og-umhverfi/tabid-2388/weight-of-packaging

[6] https://www.vinbudin.is/english/home/products/vorur?lightglass=true

[7] Forbes Insights & DS Smith (2018) The Empty Space Economy.

[8] Romagnoli, V., Aigner, J.F., Berlinghof, T., Bey, N., Rödger, J. and Pätz, C. (2020), Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce. Ed. Orveillon, G., Garbarino, E. and Saveyn, H. Luxembourg, Publications Office of the European Union.

[9] This reflects the expert opinion of consultees based on market observations, declared priorities by Plastics Pacts, and stakeholder feedback under the OPC.

with a particular concern over electronics/electricals, toys, cosmetics, ready meals and fashion accessories (in declining order from 82% to 66% noting too much or far too much packaging).[10]

In France, evaluations of the reduction potential of single-use plastic packaging have been made based on feedback from stakeholders, including Citeo.[11] The findings of this work are summarised in Table 1-1, in regard to where there is significant potential for reduction.

Table 1-1 Links and trade offs relating to general objectives

Category	Reduction potential	Of which avoidance and reduced size / weight	Of which reuse potential
Prepared dishes	40%	50%	50%
Fruit and vegetables	40%	Mostly elimination/substitution	Limited potential
Water, Soft Drinks	20%	25%	75%
Savoury groceries	20%	50%	50%
Hygiene/beauty	25%	40%	60%
Home improvement	25%	40%	60%
Other (e.g. toys, hardware, electronics)	50%	100%	0%
Secondary packaging	20%	100%	0%
E-commerce	75%	33%	67%
Rigid transport packaging	80%	0%	100%

Source: Citeo

Stakeholder feedback to this current study has broadly acknowledged the potential for further improvement, including strong support from CITEO, and the Consumer Council at the Austrian Standards Institute which had identified many examples of overpackaging in previous studies[12], picking out electronics, toys, cosmetics, software, food and DIY (e.g. home improvement) products with potential for substantial improvement in terms of reduced packaging volume or weight.

While overpackaging can occur in various packaging styles and materials, single use glass is known to be particularly problematic in that glass bottles are bought by style and weight to reflect brand placement (with heavier weight being perceived as equating to higher quality)

[10] Source: OPC Question "Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging." Valid responses: 280.

[11] Preparatory work for decree 3R – Elements for consultation on the potential for reduction, reuse and recycle of single-use plastic packaging, July 2020.

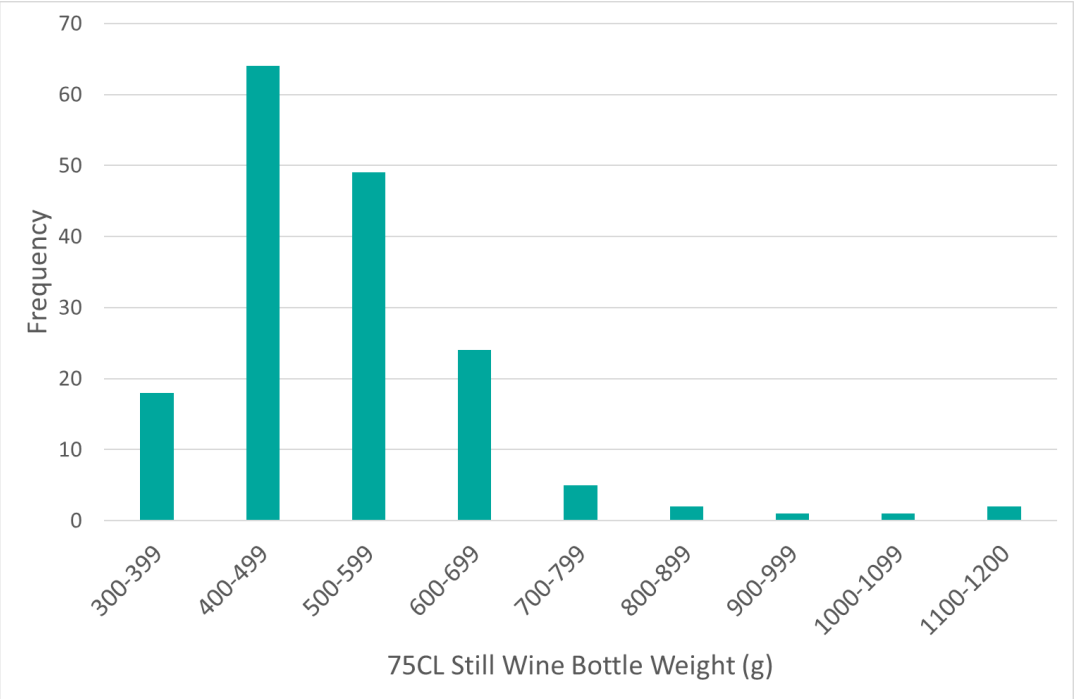
[12] Packaging waste – Consumer council of the Austrian Standards Institute, March 2005.

rather than just functionality. One expert[13] noted that there are three broad categories for wine bottles that are well understood in the wine trade (all 70cl):

- 290g to 320g for budget/entry-level brands
- 320g to 360g for mid-range brands
- 360g plus for high end brands

Further evidence of the wide range of glass bottle weights is found when looking at the range of bottle weights available from one of the leading global glass packaging manufacturers Owens-Illinois (OI). The range of weights of their 75CL still wine bottles, 70CL spirits bottles and 500ml beer bottles are shown in Figure 1-5, Figure 1-6, and Figure 1-7. Clearly, for each bottle type there is wide variation in bottle weights, pointing to the conclusion that there are significant numbers of bottles being placed on the market for which significant light-weighting could still be undertaken.

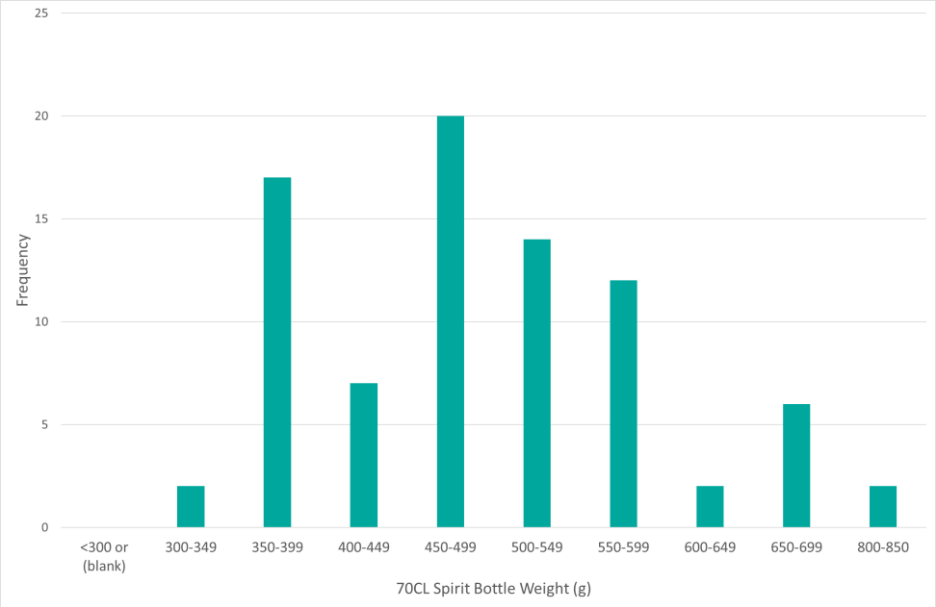
Figure 1-5 Variation in Packaging Weights of Still Wine Bottles



Source: OI Glass Catalogue

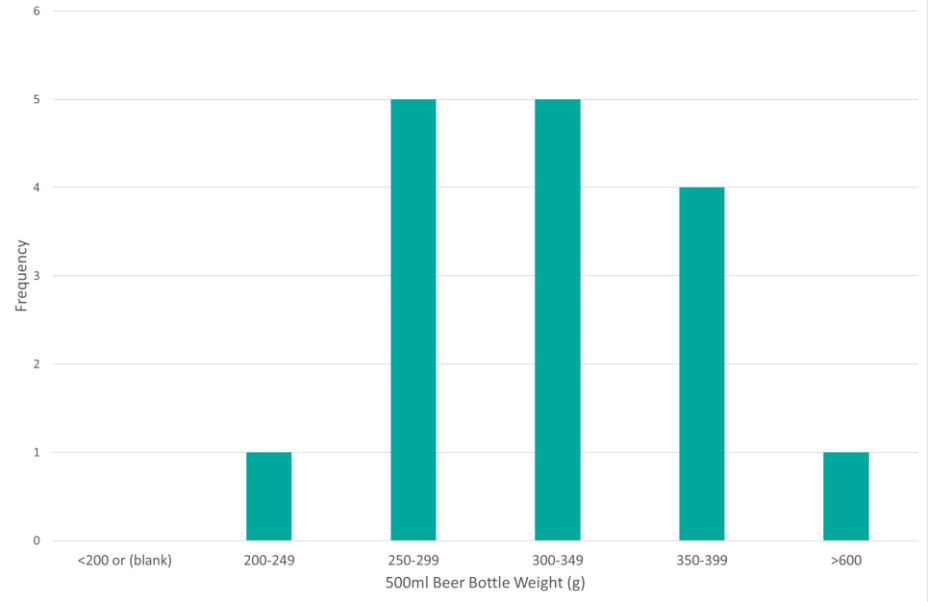
[13] Paula Chin, WWF, formerly packaging sustainability at the second largest UK supermarket, Sainsbury

Figure 1-6 Variation in Packaging Weights of 70CL Spirit Bottles



Source: OI Glass Catalogue

Figure 1-7 Variation in Packaging Weights of 500ml Beer Bottles



Source: OI Glass Catalogue

A comprehensive 2016 LCA for the Nordic Alcohol Monopolies[14] states that "… *the large variation in the weight of individual packaging for the same purpose shows that reduction in packaging weight is an important improvement option. This is obviously especially important for glass*

[14] Environmental impacts of alcoholic beverages as distributed by the Nordic Alcohol Monopolies 2014, 2.-0 LCA Consultants, 2016

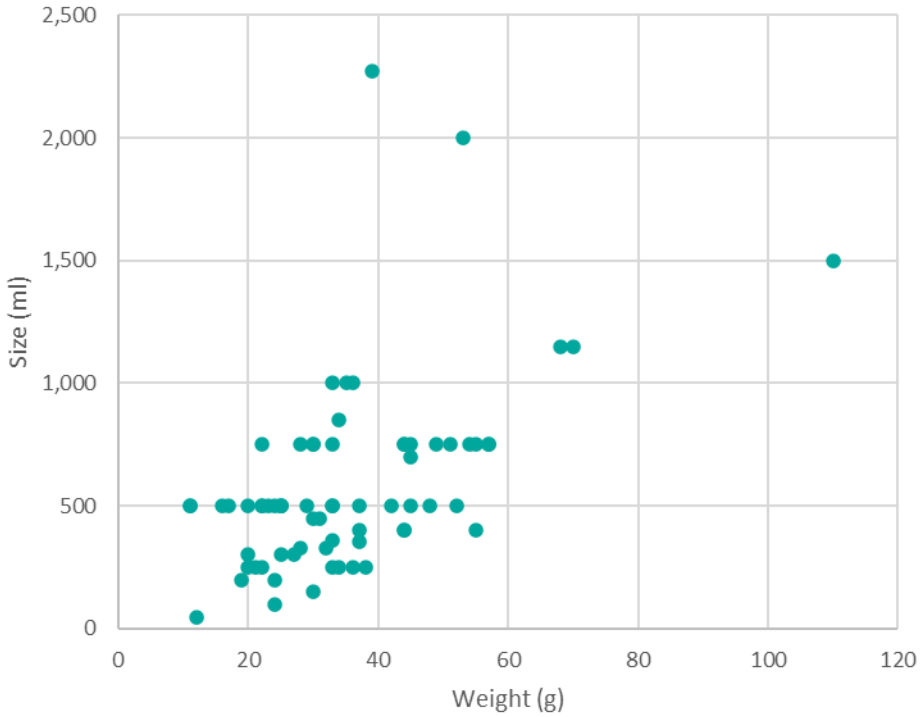
bottles, but also PET bottles, aluminium cans, and Bag-in-Box show large variations in weight for the same volumes."

Similar data can be established for spirit bottles (where again weight is perceived as equating to quality) and jars. Malt whiskies and specialist gins are often bottled in 70cl bottles that are in excess of 600g and sometimes over 800g, showing huge potential for reduction. While it can be argued that some alcohol bottles need to be stored for considerable periods, this is perfectly possible with any wine or spirits bottle, all of which have to withstand robust handling in distribution and transport by consumers.

Bottle unit weight data gathered by Eunomia show a very large variation across all plastic and glass bottles (Figure 1-8 and

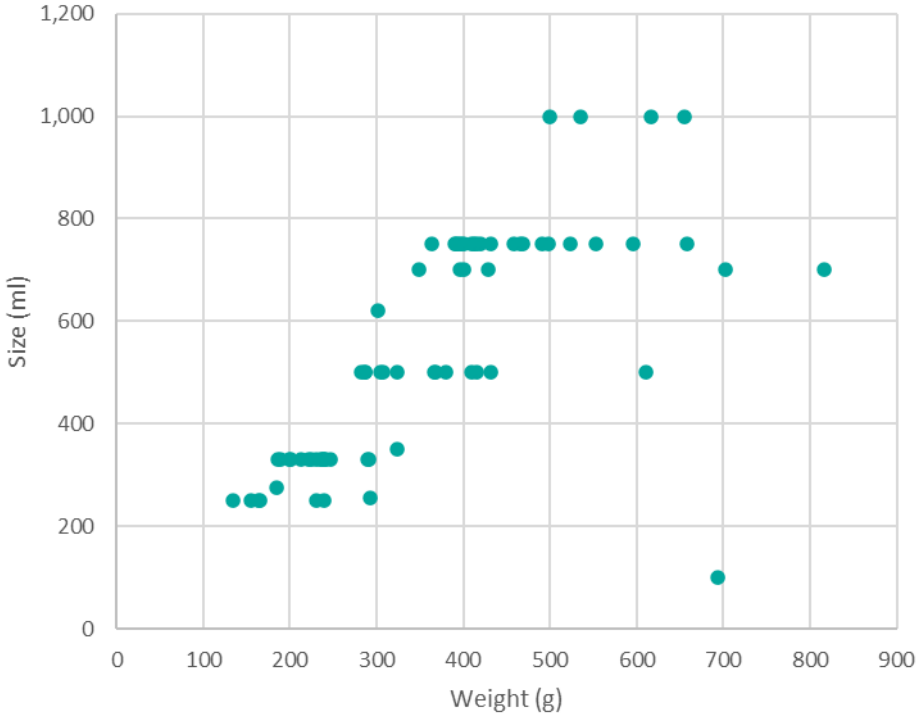
Figure 1-9 for still drinks, sparkling showing similar variation), and even within a subcategory like beer and wine in glass or soft drinks in plastic (Figure 1-10, Figure 1-11 and Figure 1-12).

Figure 1-8 Plastic (still beverage) bottle unit weight variation



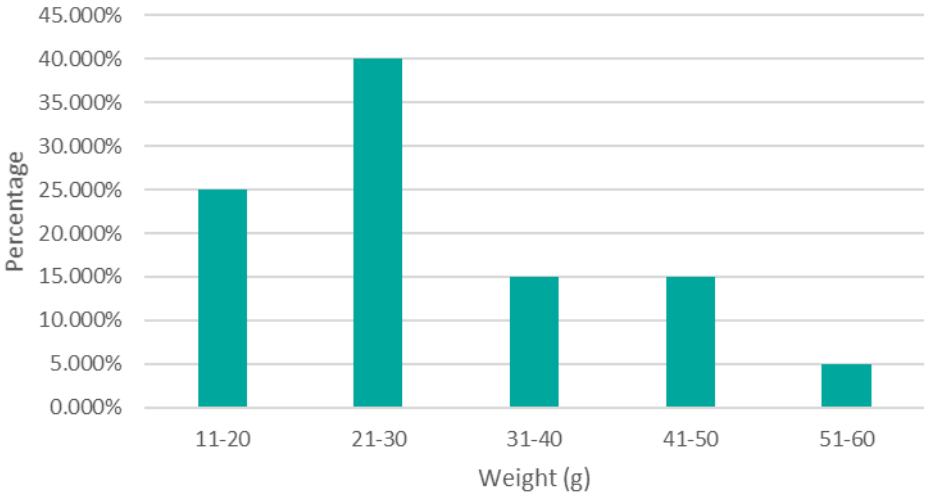
Source: Eunomia sample data

Figure 1-9 Glass (still beverage) bottle unit weight variation



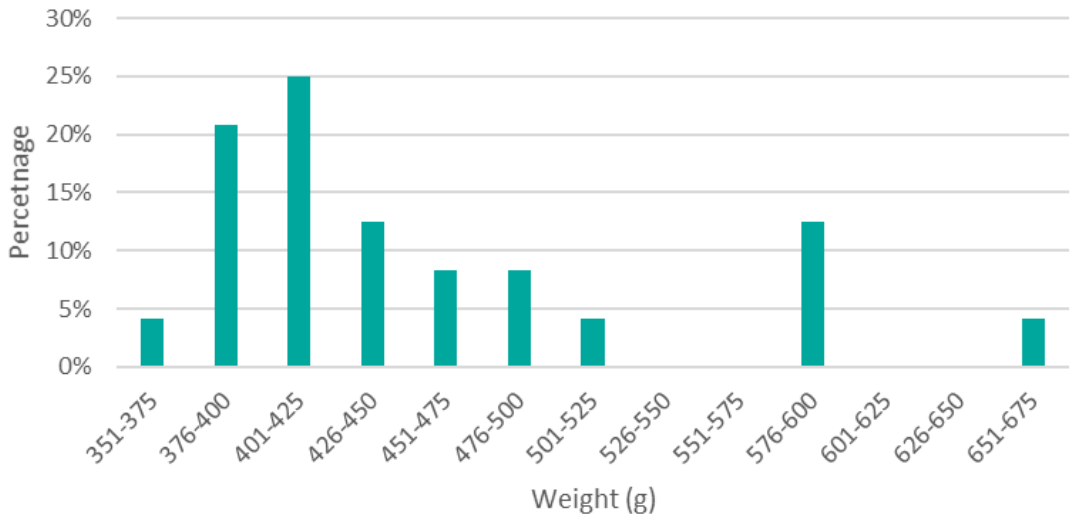
Source: Eunomia sample data

Figure 1-10 Plastic 500ml (still beverage) bottle weight distribution



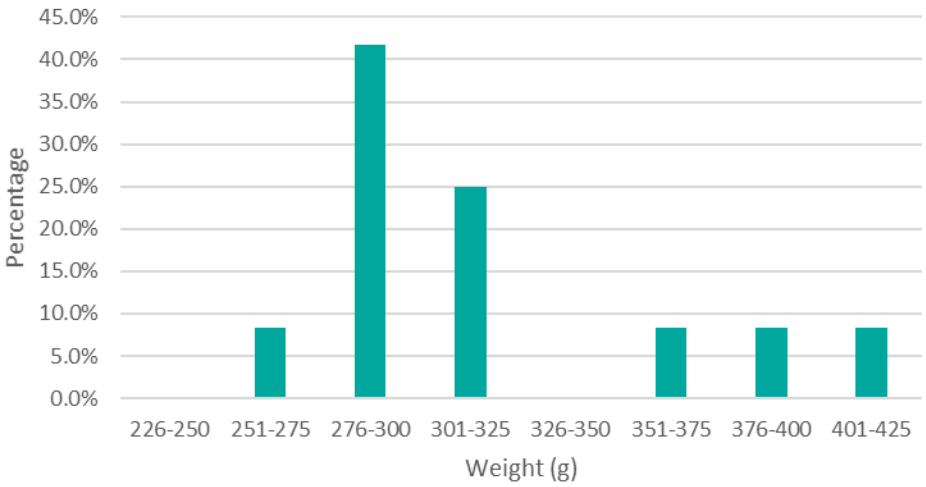
Source: Eunomia sample data

Figure 1-11 Glass wine bottle (700ml) weight distribution



Source: Eunomia sample data

Figure 1-12 Glass beer and cider bottle (500ml) weight distribution



Source: Eunomia sample data

There are also some special cases where the product weight is close to or even less than the packaging weight. An extreme example of this is the single serve glass preserves jar as seen below and used in hospitality. In this case the product itself weighs 28g (when the jar is full) whilst the packaging weighs 25g. Additionally, these types of packs often have high quantities of residue, i.e. product that is not easily removed to be eaten, hence resulting in product waste.

Figure 1-13 - Example of Excess Packaging Weight, Single Use Portion of Honey

Cosmetics and personal hygiene is another area that often provides examples of over-packaging. Glass and plastic jars often have thick walls and bottoms, or even double walls and false bottoms. This hair-care product in *Figure 1-14* shows a thick plastic outer jar with a much smaller inner plastic liner. The product weight is approximately 60g vs 110g of packaging, despite this being plastic rather than glass.

Figure 1-14 Example of Excess Packaging, Haircare product

This does not need to be the case, as demonstrated by Italian glass maker Luigi Bormioli, which has developed an innovative press-blow glass forming technique to reduce wall and bottom glass thickness to cut the weight of a glass jar in half for equal capacity[15]. Light-weighting leads to a saving in CO2 emissions up to 60% compared to an equivalent conventional glass jar. Moreover, Ecojars's external dimensions are reduced by 40% which results in a further reduction of the environmental impact for transport along the supply chain. There is evidence however that these examples of good practise only apply to a minority of the cosmetics products. In a report by the Joint Research Centre (JRC) on the revision of the EU Ecolabel criteria for rinse-off cosmetics, the Packaging Impact Ratio (PIR) was calculated for a selection of different cosmetics brands. For products for which refill is not foreseen, it is a ratio between the packaging and product weights. The JRC proposed that the PIR should not exceed 0.24 in

[15] https://feve.org/case-study-bormioli-luigi-ecojars-ultra-light-glass-packaging-luxury-cosmetics/

order to fulfil the EU Ecolabel criteria, however of the products surveyed in the study, 18.6% of the products surveyed would not meet this criteria, indicating that there is still progress to be made in the light-weighting of cosmetics products.

Figure 1-15 Example of recently lightweighted jar for a cosmetic product (new version on right)

In some cases, it appears that economies of scale result in a standard pack size being used for multiple products or multiple-denominations of the same product. In the example below, two identical pack sizes are used for the same type of screw – one with 100 screws in a durable cardboard pack and one with 20 screws in a robust plastic pack. The pack of 20 screws is therefore over-packaged, both in terms of the volume and weight of the pack. E-commerce packaging is also known to be subject to this same issue, with large packs being used for one or more small items (further detail is given on this below).

Figure 1-16 Example of Excess Packaging, DIY / Hardware Product

A further distinct problem lies in the use of additional packaging layers that aren't always necessary; for example a plastic tray within a card pack, a cardboard outer on a robust tube (such as toothpaste), a cardboard sleeve on a ready meal, and a shrink sleeve on a bottle. Cardboard sleeves on ready meal trays, for example, could be considered excessive and could be removed were the information to be printed directly on the film of the tray and film lid, although this would increase the risk of puncture (and hence food waste) unless the lidding film was made tougher. A cardboard box on a tube of toothpaste is there to allow the product to be easily and well-presented on the supermarket shelves, and is not necessary either to display consumer information (which is repeated on the tube) or protect the thick plastic tube which is very robust.

Progress is still being made in this area, demonstrating the wider potential. Often, for example, a tube of toothpaste is sold in some countries without the cardboard outer, the closure (flip cap) being designed to support the tube as in the photo below. In Italy, Colgate Palmolive removed carton pads from tertiary packaging and shrink sleeves from shampoo bottles in 2019, reducing card use by 43 tonnes per year and plastic by 117 tonnes per year[16].

Figure 1-17 Example of toothpaste without outer cardboard pack, and a coffee pack with additional cardboard sleeve

Multi-pack (collation) packaging has been raised as examples of over-packaging in the stakeholder workshop in the Essential Requirements scoping study. In particular nets surrounding garlic cloves, onions, and citrus fruits were not thought to be essential to protecting the product. Whether multi-pack packaging is necessary or not is questionable. Indeed, one of the steps taken by a UK supermarket, Waitrose, in minimising their use of packaging was to remove the outer-wrap of their own-brand canned goods.[17] With other major brands such as Heinz trialling similar initiatives,[18] evidently multi-pack packaging is not always essential to protecting the product and may be considered unnecessary. The WRAP Plastics Pact notes the following in this vein in relation to Problematic and Unnecessary plastic packaging reduction priorities[19]:

- **Multi-pack rings for canned drinks:** Potentially avoidable and not currently recycled.
- **Multi-veg/fruit net bags** e.g. citrus and some vegetables: In some cases could be avoided and not currently recycled.
- **Multi-buy bulk (secondary) wrapping** e.g. multipack crisps packaging and tins: Not widely recycled and sometimes excessive.

[16] https://www.colgatepalmolive.com/en-us/core-values/sustainability/performance

[17] Waitrose & Partners *Plastics and packaging*, accessed 26 October 2020, https://www.waitrose.com/home/inspiration/about_waitrose/the_waitrose_way/packaging.html

[18] Heinz *Heinz 'Cans' Plastic Packaging*, accessed 26 October 2020, https://www.heinz.co.uk/article/0000000000226999/heinz-cans-plastic-packaging

[19] Eliminating Problem Plastics – WRAP December 2019

It is interesting to note that the fourth largest supermarket chain in the EU, Tesco, has recently noted (August 2019) that it would "reserve the right not to list" (i.e. sell) products with excessive non-recyclable plastic from 2020 onwards[20]. It is notable that the fight against the use of excess packaging that is non-recyclable is a priority for major retailers such as Tesco, rather than excess packaging in general, reflecting recent changes in consumer attitudes, and in particular towards non-recyclable plastic packaging.

It is also important to note that in some instances the nature of the packaging is such that product wastage is almost inevitable – for example tubes of skin cream or toothpaste, and pump type dispensers, where the last few percent of product cannot be discharged. This is far more harmful in carbon impact terms and we believe also needs to be addressed along with excessive packaging under the Essential Requirements. Use of extra packaging, such as the pink base on the packaging in Figure 1-18 below, could be considered legitimate where, as in this case, the intention is to allow concentration of the product at the bottom of the pipe, through a conical inner, to allow the minimisation of the product residue.

Figure 1-18 Use of additional packaging to minimise product waste

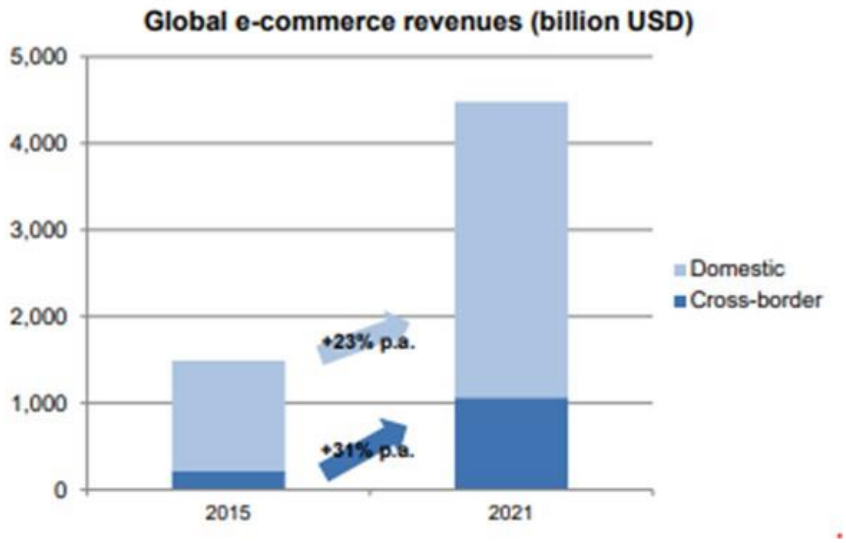
E-commerce sector

E-commerce is another sector which can lead to the excess use of packaging. Global e-commerce sales in the B2C segment were estimated at around EUR 2 trillion (USD 2.3 trillion) in 2017. Growth rate of cross-border e-commerce significantly outperforms the growth trends of domestic e-commerce.[21]

[20] https://www.theguardian.com/business/2019/aug/22/tesco-effort-packaging-national-recycling-target

[21] European Commission (2019), Development of Cross-border E-commerce through Parcel Delivery, written by WIK Consultant.

Figure 1-19 Global e-commerce revenues in 2017 and projected trends



Source: European Commission[22]

Ecommerce Europe estimated that the European B2C e-commerce market (including non-EU/EEA countries like Russia, Serbia, Turkey and Ukraine), comprising online sales of services and goods, has reached an estimated turnover of EUR 534 billion in 2017, from EUR 307 billion in 2013.[23] Furthermore, the e-commerce sector in Europe is growing rapidly, with an increase of 14.2% in 2019 and expected increase of 12.7% by the end of the year 2020 compared to the previous year, reaching a turnover of EUR 717 billion by the end of 2020 (see Figure 1-19). [24, 25] Based on data of Ecommerce Europe and national e-commerce associations, WIK estimated that the EU/EEA e-commerce market increased its revenues by around EUR 200 billion since 2013 to EUR 490 million in 2017.

Due to the COVID-19 developments, e-commerce is expected to grow in 2020 much more than initially forecasted. The pandemic which forced people to stay at home to avoid spreading the virus, has caused unprecedented global traffic increase for e-commerce retailers between January 2019 and June 2020, surpassing even usual holiday season traffic peaks. Based on Statista, retail websites generated almost 22 billion visits in June 2020, an increase of approximately 5.9 billion global visits or 36.6% since January 2020.[26] Due to the new

[22] Ibid. The figure is based on IPC (2018), Cross-border E-commerce, Market overview and consumer preferences, presented by Mark Harrison on 8 June 2018.

[23] E-commerce Europe (2018), European B2C ecommerce still growing fast, with national markets moving at different speeds, press release of July 2, 2018.

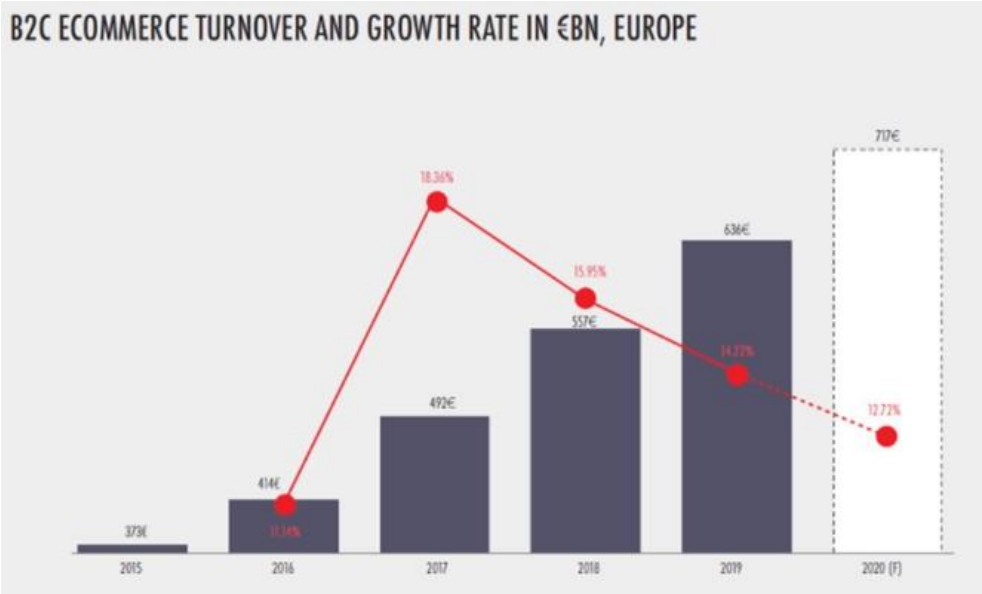
[24] Ecommerce News Europe (2020) Ecommerce in Europe: €717 billion in 2020. Available at: https://ecommercenews.eu/ecommerce-in-europe-e717-billion-in-2020/ (accessed 27 October 2020).

[25] Ecommerce Europe and EuroCommerce (2020), Europe 2020: Ecommerce Region Report.

[26] Statista (2020), COVID-19 impact on global retail e-commerce site traffic 2019-2020. Available at: https://www.statista.com/statistics/1112595/covid-19-impact-retail-e-commerce-site-traffic-global/

circumstances, the B2C online sales of physical goods have experienced a surge of demand in certain products, particularly for medical supplies, household essentials and food products.[27]

Figure 1-20 European e-commerce growth rate between 2015 and 2019 and forecast for 2020 (in billion euros)



Source: Ecommerce Europe and EuroCommerce (2020), Europe 2020: Ecommerce Region Report. Based on data from national ecommerce associations, Statista, Retailx Analysis.

The statistics from the past years show that shopping habits in many European countries have been changing fast and e-commerce activities have already a few years ago accounted for a steeply rising share of total revenues (i.e. in Germany, France).[28] The results of the 2019 Eurostat survey on ICT demonstrate that in 2019, more than two thirds of internet users in the EU had shopped online in 12 months prior to the survey, with the highest proportions found in the age groups 16-24 (78%) and 25-54 (76%).[29] Of the e-buyers who made purchases from sellers outside their own country, 80% bought or ordered physical goods such as electronics, clothes, toys, food, groceries, books or CDs/DVDs and the most popular type of goods were clothes and sports equipment (65% of e-buyers). Lower proportions of e-shoppers bought or ordered from abroad services such as travel, accommodation or holiday arrangements (34%) and products downloaded or accessed from websites or apps (25%). When considering all individuals, and their last online purchase of any types of goods and services in the last 3 months, proportion of e-shoppers varied considerably across the EU, ranging from 14% of

[27] WTO (2020), E-commerce, trade and the covid-19 pandemic - Information note, 4 May 2020. Available at: https://www.wto.org/english/tratop_e/covid19_e/ecommerce_report_e.pdf

[28] Morganti, E., Seidel, S., Blanquart, C., Dablanc, L., and Lenz, B. (2014) The Impact of Ecommerce on Final Deliveries: Alternative Parcel Delivery Services in France and Germany, Transportation Research Procedia, Vol.4, pp.178–190.

[29] Eurostat (2020), E-commerce statistics for individuals. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/E-commerce_statistics_for_individuals#General_overview

individuals in Bulgaria to 80% of individuals in UK in 2019 (see Figure 1-21).[30] According to several studies, the proportion of e-commerce continues and will continue to grow over time worldwide and in Europe.[31,32] This is facilitated also by increasing adoption of omni-channel approaches, by combining different channels, ensuring both a physical and digital presence of retailers.

Figure 1-21 Internet purchases by individuals (from 2010 until 2019) [Last online purchase in the last 3 months, % of individuals]

TIME / GEO	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
European Union - 28 countries (2013-2020)	31	33	35	38	41	43	45	48	50	53
Belgium	27	31	33	36	41	42	46	49	49	55
Bulgaria	3	5	6	8	10	12	11	11	13	14
Czechia	15	16	18	21	25	26	29	34	37	43
Denmark	54	57	60	65	66	67	71	69	73	74
Germany (until 1990 former territory of the FRG)	48	54	55	60	61	64	64	66	68	71
Estonia	13	16	17	16	37 (b)	46	45	46	51	56
Ireland	28	34	35	37	43	44	41	44	52	59
Greece	9	13	16	17	20	24	23	26	30	32
Spain	17	19	22	23	28	32	35	40	43	47
France	40	40	42	44	49	49	52	54	55	58
Croatia	9	11	16	19	22	26	25	21	27	35
Italy	9	10	11	14	15	18	20	23	26	28
Cyprus	14	16	17	20	23	19	22	24	20	31
Latvia	8	10	18	21	24	27	31 (b)	33	33	34
Lithuania	7	10	14	19	19	22	24	29	34	38
Luxembourg	47	52	57	59	62	63	69	69	60 (b)	63
Hungary	10	12	15	17	20	23	27	26	29	35
Malta	32	35	37	39	42	44	42	43	46	50
Netherlands	52	53	52	55	59	59	63	68	70	70
Austria	32	35	39	46	43	46	48	53	53	54
Poland	20	20	21	23	24	24	31	33	37	41
Portugal	10	10	13	15	17	23	23	25	27	28
Romania	2	4	3	5	6 (b)	8	8	11	13	15
Slovenia	17	20	22	25	26	28	30	35	39	45
Slovakia	19	23	30	30	31	35	41	46	44	47
Finland	41	45	47	49	53	49	48	58	51	55
Sweden	58	53	58	57	62	56	63 (b)	67	64	70
United Kingdom	68	64	64	71	72	75	76	78	77	80

Source: Eurostat (2020), Internet purchases by individuals (until 2019).

The most commonly used global e-commerce platforms (for the most recent cross-border purchase) according to a 2019 cross-border shopper survey represented Amazon, Alibaba / AliExpress, eBay and Wish. In Europe the leading e-retailers were Amazon, Ebay, Otto group, Wish and Zalando.[33] Earlier research showed that the e-commerce market is also quite diversified, as there were notable difference across the countries in 2017. For instance, the leading e-commerce platform in Germany, France and UK was Amazon, while in Poland, only two foreign platforms (Zalando and AliExpress) were on the list of top 10 e-retailers.[34]

This growth in e-commerce will inevitably affect quantities of packaging placed on the market. Whilst EU wide data is not currently available, Germany can provide an indication where paper

[30] Eurostat (2020), Internet purchases by individuals (until 2019). Available at: https://ec.europa.eu/eurostat/databrowser/view/isoc_ec_ibuy/default/bar?lang=en

[31] Ecommerce Europe (2018) The European Ecommerce Report 2018: relevant findings outlined.

[32] International Post Corporation (2017), State of e-commerce: global outlook 2016-21. Available at: https://www.ipc.be/sector-data/e-commerce/articles/global-ecommerce-figures-2017

[33] International Post Corporation (2020), Cross-border e-commerce shopper survey 2019.

[34] International Post Corporation (2017), State of e-commerce: global outlook 2016-21. Available at: https://www.ipc.be/sector-data/e-commerce/articles/global-ecommerce-figures-2017

and cardboard packaging from e-commerce increased from 120,000 tonnes in 1996 to 849,000 tonnes in 2017 and it is estimated, that over a quarter of packaging waste from paper and cardboard in private households is due to e-commerce. [35,36] Purchasing goods via e-commerce is much more wide spread in Northern and Western Europe, and is significantly driving increases in cardboard packaging in these regions with 49% of parcels in Europe being delivered to either France or Germany.[37]

Supply chain complexity

The growth and success of the e-commerce sector relies on the smooth running of a complex supply chain. E-commerce for physical goods has generated significant demand for dedicated delivery services to end-consumer[38] as well as associated increase in packaging for delivery. The packaging for products shipped via e-commerce must be strong and protective enough, due the high numbers of (manual) touchpoints during a product's journey and final delivery to the customer. To illustrate, products are handled an average of five times in a traditional retail supply chain (in a highly mechanized way), while in e-commerce products tend to be handled manually, altogether up to 20 times or more.[39] The feedback from stakeholder interviews revealed that the e-commerce supply logistics are much more challenging than in classical retail and that parcel handling at couriers can be often problematic, especially if fillers and delivery staff are not appropriately trained.[40]

Although exact data is scarce, e-commerce packaging may take a number of forms including cardboard boxes, padded mail bags, or plastic mail bags.[41] It seems that the most often used packaging is corrugated cardboard, however, this also depends whether primary, secondary or tertiary packaging is considered. Further to that, products vary considerably in size, weight and levels of fragility. Therefore, "one-size-fits-all" is far from a realistic approach in terms of e-commerce packaging, rather the opposite. To achieve a goal of better packaging optimization, this maturing sector is required to undergo relatively drastic changes compared to the classical retail, where packaging design is much more developed.

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[35] UBA (2017) Generation and recycling of packaging waste in Germany in 2017

[36] pulswerk GmbH (2019) *MTV 2019 in Österreich: Überblick über den Einsatz von Mehrwegtransportverpackungen in Österreich*, accessed 24 June 2020, http://www.pulswerk.at/mtv2019.htm

[37] WIK Consult (2018) *Assessment of EU Parcel Delivery Markets*, accessed 15 July 2020, https://www.wik.org/uploads/media/wik_GROW_ParcelsStudy_ERGP.pdf

[38] Morganti, E., Seidel, S., Blanquart, C., Dablanc, L., and Lenz, B. (2014) The Impact of Ecommerce on Final Deliveries: Alternative Parcel Delivery Services in France and Germany, Transportation Research Procedia, Vol.4, pp.178–190.

[39] American Institute for Packaging and the Environment (2017), Optimizing Packaging for an E-commerce World.

[40] Several videos publicly available show shocking images of inappropriate handling of parcels, for example, see: https://www.youtube.com/watch?v=jF_w7uSnOj0

[41] European Commission (2020), Effectiveness of the Essential Requirements for Packaging and Packaging Waste and Proposals for Reinforcement, Final report. Drafted by Eunomia, COWI, Adelphi, Ecofys and Milieu.

Figure 1-22 Simplified logistics system in e-commerce

Source: American Institute for Packaging and the Environment (2017), Optimizing Packaging for an E-commerce World.

The packaging associated with parcel deliveries is a crucial component of the online shopping experience, as the satisfaction of e-buyers will be influenced by the packaging.[42] The packaging protects a shipped product and any damage in transit may lead to a negative customer experience, return of a product, re-shipping costs, decreased profitability. On the other hand, over packaging also faces criticism among customers, as they continue to become increasingly aware of the environmental implications of packaging. This was confirmed in the 2019 cross-border e-commerce survey,[43] in which two thirds of cross-border online shoppers indicated that they would prefer recyclable packaging (47% strongly agreeing and 19% agreeing) almost a half of surveyed customers would prefer a carbon-neutral delivery of parcels (28% strongly agreeing and another 17% agreeing). The customers in the survey expressed a much stronger preference for receiving parcels in cardboard as opposed to plastic. There is also a growing share of e-shoppers in the e-commerce market that are more aware of the impact that their online shopping has on the environment.[44] This has been additionally facilitated by the COVID-19 pandemic in 2020, which forced customers to become more flexible but it also made them slow down and reflect on ecological aspects.[45]

Problem definition in relation to e-commerce

According to a packaging study conducted by Peerless Research Group on behalf of Logistics Management and Modern Materials Handling, a company's overall materials handling budget is spent on packaging solutions and materials used in packing shipments.[46] In the same survey, respondents[47] estimated that, on average, 20% of each box or container shipped is made up of

[42] AirPackSystems (2018), Packaging Trends For 2019. Available at: https://www.airpacksystems.com/packaging-trends-for-2019/

[43] International Post Corporation (2020), Cross-border e-commerce shopper survey 2019.

[44] DPD (2020), E-shoppers in Europe - 2019 Barometer.

[45] E-commerce Germany (2020), Key takeaways from E-commerce Region Report: Europe 2020. Drafted by Kinga Odziemek. Available at: https://ecommercegermany.com/blog/key-takeaways-from-e-commerce-region-report-europe-2020

[46] Peerless Research Group (2012), Packaging + Shipping Efficiencies = Cost Savings: On Demand Packaging™. Available at: https://www.mmh.com/images/site/Packsize_Brief_F.pdf

[47] The survey included 521 top logistics and materials handling managers.

unused or void space, or area not taken up by the actual item being shipped. Similar findings were revealed in the survey by Forbes Insights and DS Smith, in which 60% of e-commerce executives indicated that more than a quarter of their packaging is empty space and in toy packaging this approached 52%.A separate research study across product categories indicated that the empty space in e-commerce packaging ranges from 18% for clothing and footwear to 64% for glassware.[48] This also aligns with the results of the Online Public Consultation, which found that 82% of respondents thought that there was either too much or far too much packaging used for e-commerce. According to the same study, the majority of the e-commerce businesses seem to be using standard-size cartons, which are often oversized. They fill the empty space with different types of material, most often with air pillows, paper filler or polystyrene - all of which add to the excessive packaging material used. Some of these materials are not readily recycled by households due to exclusion from scope of flexible plastic packaging and expanded polystyrene from most municipal waste recycling collection services.

The Essential Requirements scoping study[49] commissioned by the European Commission revealed that e-commerce packaging was recognized by interviewees as an area that is more prone to over-packaging than any other. Examples from online sources and personal experience of the authors of this report suggest that packaging in e-commerce can often be excessive. In some cases, non-fragile products are packed in large packages leaving more than 50% to 90%+ of void space. However, there are also some good packaging examples. Several (good and bad) packaging examples can be seen in below figures.

Figure 1-23 Example of oversized packaging for two small cosmetic items

Source: Own (2020).

[48] Forbes Insights & DS Smith (2018) The Empty Space Economy.

[49] European Commission (2020), Effectiveness of the Essential Requirements for Packaging and Packaging Waste and Proposals for Reinforcement - Final Report. Written by Eunomia Research & Consulting Ltd, COWI, Adelphi, Ecofys (Navigant), Milieu.

Figure 1-24 Examples of e-commerce packaging

Source: Own (2020)

Figure 1-25 Example of e-commerce packaging

Source: Business Waste[50]

[50] Business Waste (2013). *Internet mail order companies guilty over over-packaging*. Available at: https://www.businesswaste.co.uk/internet-mail-order-companies-guilty-over-over-packaging

Figure 1-26 Example of e-commerce packaging

Source: Packhelp[51]

Figure 1-27 Example of e-commerce packaging

Source: GWP Group[52]

[51] Packhelp (n.d.),13 *Bad Packaging Examples That'll Make You Cry For the Environment*. Available at: https://packhelp.co.uk/bad-packaging/

[52] GWP Group (2020), *Packaging to Make You Laugh (or Cry)*. Available at: https://www.gwp.co.uk/guides/excessive-packaging-fails/

Some examples of e-commerce transport packaging that is more suitably sized are also found.

Figure 1-28 An example of appropriate size of e-commerce packaging

Source: Own (2020)..

Packaging for online clothes deliveries tends to be plastic film which is wrapped to size around the items, and so excessive void space appears to be less of an issue for that this type of product. The same is also true, to a large extent, for books that are more tightly wrapped in the card or plastic transport packaging.

E-commerce also includes deliveries of larger household items directly to consumers, such as TVs, washing machines etc. However, the item is generally already housed in transport packaging which is needed for delivery from manufacturing sites and is often taken back by the deliverers. This packaging is already being designed to balance amounts used against product damage, and so is not considered to be an area where there is significant unnecessary void space. However, there could be a potential for single use packaging to be replaced with reusable packaging systems, and this is discussed further in Section 1.2.

Whilst exact data on the amounts of packaging used for e-commerce are not available, the evidence suggests that there is a clear concern about the amount of packaging used in a large number of cases. Given the significant size of the e-commerce sector, and the fact it is projected to grow significantly, there is a high degree of likelihood that the impacts from wasting packaging material in the delivery of products to households could be reduced. This is most related to unnecessary void space within cardboard boxes, used as outer transport packaging, to deliver smaller items to consumers.

1.1.1.3 Consequences of excessive and avoidable packaging waste generation

As discussed, the quantity of packaging waste generated per capita across the EU is increasing despite improvements achieved by producers in light-weighting. The use of packaging has impacts on the environment at each stage along its life cycle. GHGs are emitted in the extraction of the raw materials used for packaging, be that wood, minerals, or oil, whilst the conversion of raw materials into packaging is also an energy intensive process. The modelled GHG emissions impact of packaging waste generation are shown in Figure 1-29 and Figure 1-24, which show the bulk of emissions associated with the manufacture of packaging. Whilst the recycling of the packaging partially reduces the life cycle emissions by substituting primary packaging materials, this is in effect, is still outweighed by the emissions associated with

manufacturing. This indicates that the prevention of packaging waste (assuming this does not lead to an increase in food waste) results in saving more GHG emissions in comparison to the recycling of packaging waste, due to the energy and resources required for waste collection, sorting and reprocessing.[53]

Additionally, with increased packaging waste generation, and in particular single use, disposable, packaging, comes the likelihood of increased littering. This tends to be more prevalent if greater waste generation is driven by out-of-home consumption of beverages, snacks and other food service items. Indeed, beverage containers, crisp packets/sweet wrappers, and fast food packaging were each amongst the top 10 most commonly items littered on beaches within the EU.[54] Once litter enters the environment, in addition to the impact on visual disamenity of the surrounding area, it can, if not intercepted, reach rivers or seas. Furthermore, increased waste generation places a larger burden on municipalities responsible for the collection and sorting of waste, in addition to the increased costs of street cleansing where items are littered. The litter impacts in particular were one of the primary drivers of the introduction of the SUP Directive which will be tackling many of the packaging items most likely to become litter, such as beverage and food containers.

Other impacts also relate to the increased amount of packaging waste, for example, primary material usage is increased, and the increase in plastic packaging has led to increased risks of chemicals release, although for example issues relate food contact are addressed through other legislation.

The light-weighting of packaging has had several environmental benefits, such as reduction in the use of virgin materials and subsequent benefits for transportation. The use of light, flexible, packaging in place of rigid packaging can require 70% less material (by weight) when compared to rigid packaging for the same quantity of goods.[55] In addition, size and shape of a flexible package can reduce shelf space and transit space requirement. Together, these facets have the potential to reduce the number of transport units required for transport of packaged goods and reduce the total weight transported and offer significant greenhouse gas emissions savings.[56]

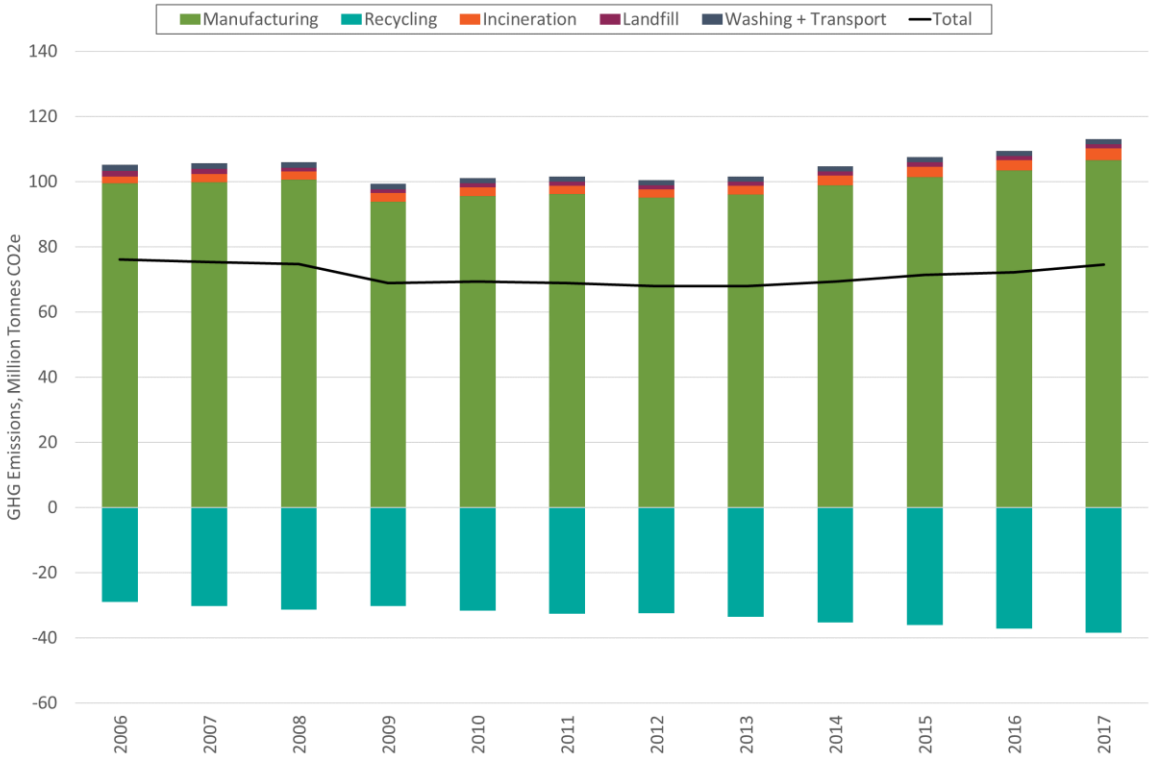
[53] Magrini, C., D'Addato, F., and Bonoli, A. (2020) Municipal solid waste prevention: A review of market-based instruments in six European Union countries, *Waste Management & Research*, Vol.38, pp.3–22

[54] Eunomia Research & Consulting (2018) *Plastics: Reuse, recycling and marine litter – Impact assessment of measures to reduce litter from single use plastics*, Report for DG Environment, 2018, http://ec.europa.eu/environment/waste/pdf/Study_sups.pdf

[55] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

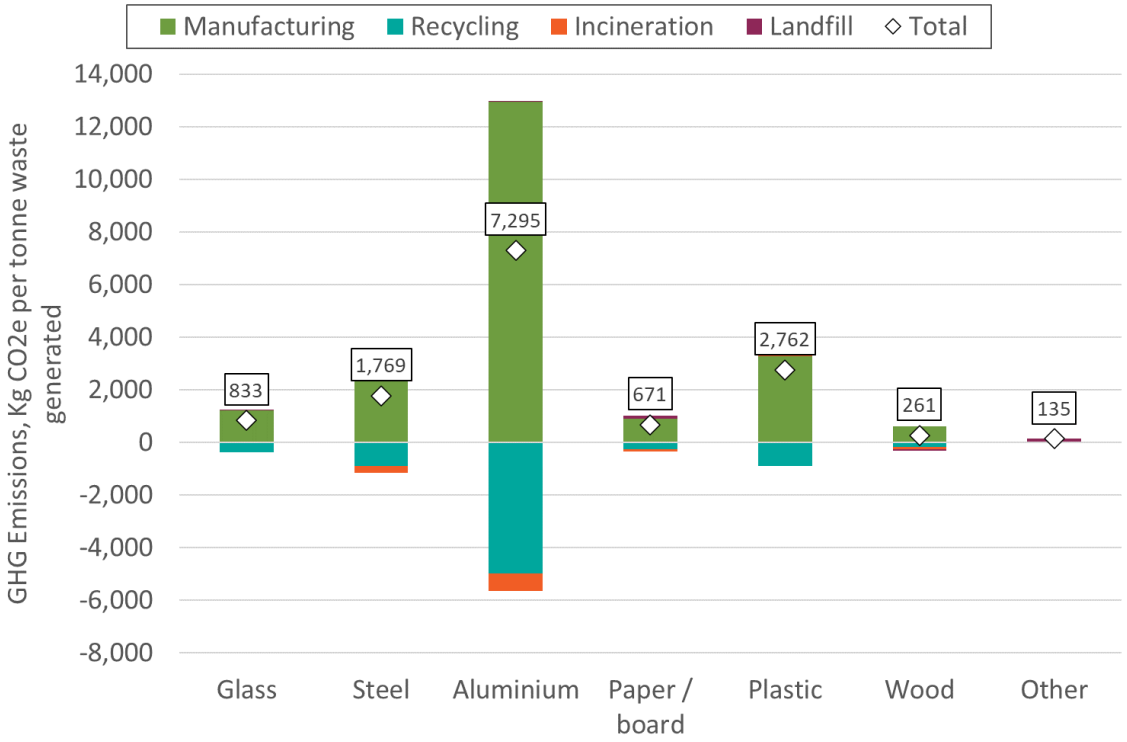
[56] University, H.-W. (2018) *Ban on plastics could increase damage to planet*, accessed 26 April 2019, https://www.hw.ac.uk/about/news/2018/a-plastic-ban-could-increase-damage-to.htm

Figure 1-29 GHG emissions from packaging waste generation



Source: Eunomia baseline report

Figure 1-30 GHG emissions associated with packaging waste generation, by material



Source: Eunomia baseline report

However, the shift away from glass and metal packaging towards alternative materials, such as multi-layer flexible packaging, tubs, and trays, puts greater requirements on re-processors who must either increase their sorting and recycling capabilities, or, as is more likely in the short term, reject these types of packaging. In this case, this packaging waste is likely to be either incinerated, landfilled, or exported abroad, all of which have associated high environmental impacts. The greenhouse gas emissions resulting from the incineration of packaging waste will pose challenges to Member States looking to decarbonise, in addition to the air quality impacts - see Section 5.0 in the main report describes initial estimates of GHG emissions of the baseline scenario, and shows that GHGs are projected to be stable over the period, which is not aligned with EU policy to reduce GHGs over time. If the waste is exported to outside of the EU, it is difficult to verify whether the material is actually re-processed, incinerated, or mismanaged. Across Europe, some studies estimate that 46% of post-consumer plastic destined for recycling is exported, with up to 7.3% being mismanaged and entering the ocean (this aspect will be further expanded upon during the cost benefit analysis).[57]

E-commerce

According to the LCA case study performed in the scoping study,[58] an optimized box could generate greenhouse gas emission savings of 13% and could offer improved environmental performance. The transport was not considered in the analysis, however, reducing through diminishing the size of packages could potentially improve the efficiency of logistics operations, i.e. smaller vehicles would be needed or a larger amount of packages could be transported at the same time.

1.1.1.4 Problem Summary

Packaging waste generation within the EU is currently at its highest ever level, both in absolute terms and in terms of packaging waste generated per capita. While a shift in packaging materials, e.g. from glass to plastic, combined with light-weighting efforts within material categories, has led to an increase in packaging material efficiency and a net decline (by just over 10% between 2007 and 2016) in packaging weight per € of GDP, the rate of per capita GDP growth, combined with population growth, has resulted in far more packaging overall, outstripped the efficiency gains made in some areas. So, while progress has been made to decouple growth in packaging waste from economic growth, the efforts to date have not been sufficient to even halt the growth in waste, let alone reverse it.

This increased generation of packaging waste within the EU poses challenges to Member States in terms of waste management, in addition to the environmental problems associated with the production of the packaging and its management as waste at the end of its useful life, especially lower down the waste hierarchy. In particular, increased use of virgin materials to produce packaging is likely to lead to increased greenhouse gas emissions, which is of particular importance in view of the EU policy objective of achieving climate neutrality by 2050, and objectives to reduce pollution to air and water as well as commitment to tackle the pressures that contribute to the decline of biodiversity.

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[57] Bishop, G., Styles, D., and Lens, P.N.L. (2020) Recycling of European plastic is a pathway for plastic debris in the ocean, *Environment International*, Vol.142, p.105893

[58] European Commission (2020), Effectiveness of the Essential Requirements for Packaging and Packaging Waste and Proposals for Reinforcement - Final Report. Written by Eunomia Research & Consulting Ltd, COWI, Adelphi, Ecofys (Navigant), Milieu.

While there are many case study examples of progress being made to lightweight and reduce the volume of packaging, there are equally many examples of packaging that remains heavier and larger than necessary, as often evidenced by comparison with the same products from other brands where less packaging is used. The problem is not confined to e-commerce, despite the publicity this receives, with significant over-packaging issues being evident in food and drink, home and hygiene, hardware, cosmetics and other sectors including food supplements. As noted in the next section on drivers, the world of consumer packaging is a constant battle between sustainability, product protection, consumer preference and marketing demands, with the last two of these often having a disproportionate negative impact.

In addition, strong anti-plastic sentiments from consumers and NGOs, related to marine pollution and littering, have led to commitments from many of the largest global brands and retailers in regards to moving to 100% recyclability, and is discussed further in 2.0.. . Whilst not yet clear in the EU data, this will almost inevitably result in a rise in packaging weight and potentially GHG emissions, as cardboard and glass replace plastic. And, on top of this, we will have continued GDP growth which, to the extent that this is translated in a higher goods consumption, will add further to the packaging waste mountain, recyclable and otherwise.

1.1.2 Problem Drivers

Evidently, whilst manufacturers and producers of packaging have successfully lightweighted significant quantities of packaging, packaging waste generation within the EU is still increasing, and examples of over-packaging are still commonplace. The following section identifies and examines the underlying factors driving this.

1.1.2.1 Socio-Demographic Drivers

It is important to note that socio-demographic changes are contributing to the increased packaging waste generation within the EU. The amount of packaging waste generated across the EU is dependent on its population. More people are likely to consume more products and produce more packaging waste. Since 2005, the population of the EU-27 has increased from 434 million to 447 million, an increase of 3%. However, as previously stated, packaging waste generation per capita has increased by 10% within the same period, indicating that there are other drivers affecting overall generation more significantly than simply population growth.

There is strong evidence that reducing average household size is associated with higher levels of packaging waste intensity. Smaller households generate more packaging waste per household member due to the increased consumption of products with smaller portion sizes.[59,60,61] The number of single and two-person households within the EU has risen consistently since 2010, as displayed in *Figure 1-31*. The number of single adult households without children has risen by 18.7%, against an overall increase in the number of households in the EU of 7%. Contrastingly,

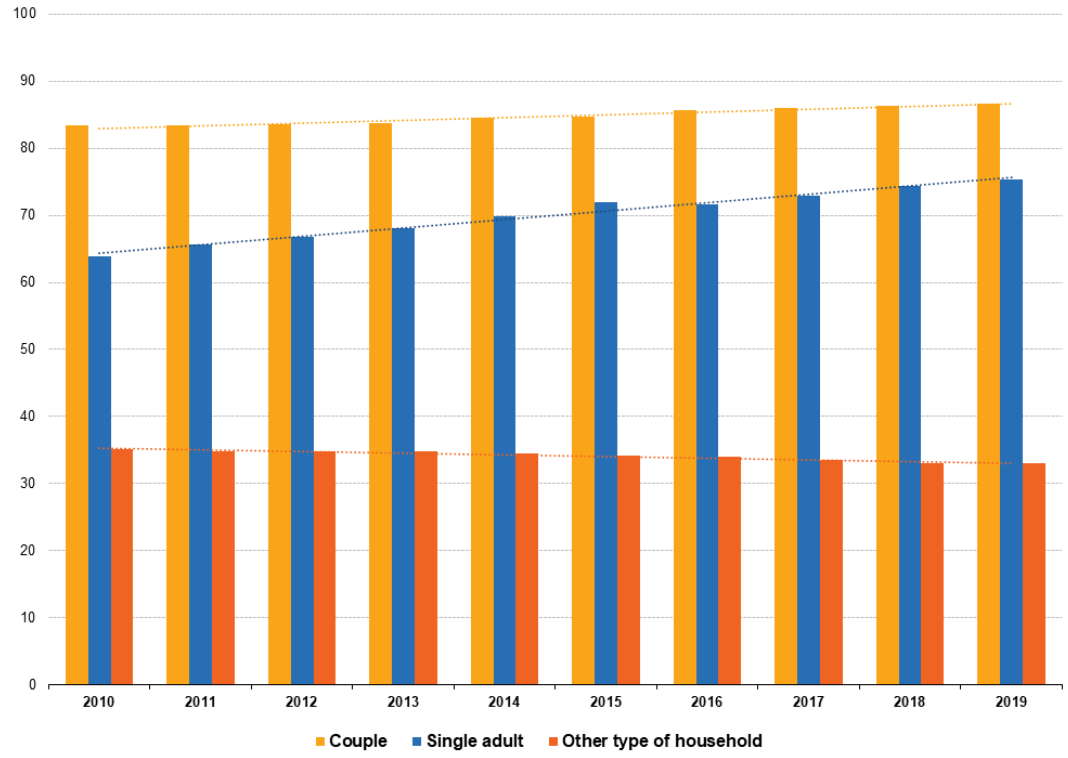
[59] Johnstone, N., and Labonne, J. (2004) Generation of Household Solid Waste in OECD Countries: An Empirical Analysis Using Macroeconomic Data, *Land Economics*, Vol.80, No.4, p.529

[60] OECD (2008) *Household Behaviour and the Environment*, accessed 9 July 2020, https://www.oecd.org/environment/consumption-innovation/42183878.pdf

[61] Xiao, L. (2015) *Characterizing Urban Household Waste Generation and Metabolism Considering Community Stratification in a Rapid Urbanizing Area of China*, accessed 9 July 2020, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145405

households with two adults and children have reduced in number by 14%.[62] The extent to which these demographic drivers apply varies across the EU. The proportion of single person households varies from approximately 20% to over 50% in 2017, and although the average increase in the number of single person households across the EU was 2.4% between 2010 and 2017, this figure was as high as 10% in some Member States during this period.[63] Improvements in packaging functionality have allowed the market to cater to these demographic changes, by producing products with re-sealable packaging, dosing functionality, and increased portion sizing. Although these features are intended to preserve the shelf life of food products, they also drive the packaging intensity upwards.

Figure 1-31: Households by type, millions, EU - 27, 2010-2019



Source: Eurostat, 2019

1.1.2.2 Market Drivers

As can be seen in 1.1.1, the concept of over-packaging is known by producers and consumers, though there is debate over the specific definition. Indeed, there are numerous examples cited as over-packaging, when the packaging is critical to the preservation of the product. Pre-

[62] *Household composition statistics - Statistics Explained*, accessed 26 June 2020, https://ec.europa.eu/eurostat/statistics-explained/index.php/Household_composition_statistics#More_and_more_households_consisting_of_adults_living_alone

[63] Eurostat, E.C. *Rising proportion of single person households in the EU - Product - Eurostat*, accessed 5 May 2020, https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20180706-1?inheritRedirect=true

prepared food including pre-packaged sandwiches, salads, or pre-cut fruit and vegetables have been raised as examples of over-packaging[64] due to the high packaging intensity of the product.

However, due to society's increasingly on-the-go lifestyle there is demand for these products, and without appropriate packaging, these products would not be preserved for the length of time needed to sell the product, without large amounts of product waste. Whilst there may be concerns as to whether the product in these cases should be supplied at all, if the packaging is intrinsic to the preservation of the product these are arguably not cases of over-packaging.

Developments in packaging design and technology have expanded the potential functionality of packaging, allowing features that enhance convenience and extend shelf life of products. For reasons of convenience, household economy and the desire to avoid food waste, consumers increasingly require packaging that is able to store products after opening, dose and allocate portion sizes through re-sealable features, controlled removal and individually wrapped portions. However, portion sizing of grocery products such as biscuits, cheeses, yoghurts and sliced cheese and meat products, has led to more plastic packaging being used to package the same quantity of product. Sliced cheese and meat products, whose market share has almost doubled in Germany since 1999, can triple the amount of packaging required to package a given amount of product.[65] The increasing prevalence of grated cheese in re-sealable plastic pouches has a similar impact, increasing the amount of packaging needed to wrap an equivalent amount of product.

Furthermore, fruit and vegetable packaging has seen a sizable shift towards plastic packaging in recent years. In Germany, one study found that although the quantity of paper and cardboard packaging used for fruit and vegetables reduced by 43% between 2000 and 2019, the quantity of plastic packaging in fruit and vegetables increased by 134% and 205% respectively, resulting in an overall increase of 21%. There is little reason to think that this trend is not commonplace across the EU, and in the Netherlands, between 2014 and 2018 the proportion of vegetables packaged in plastic increased from 70% to 76% and the proportion of fruit increased from 56% to 60%.[66]

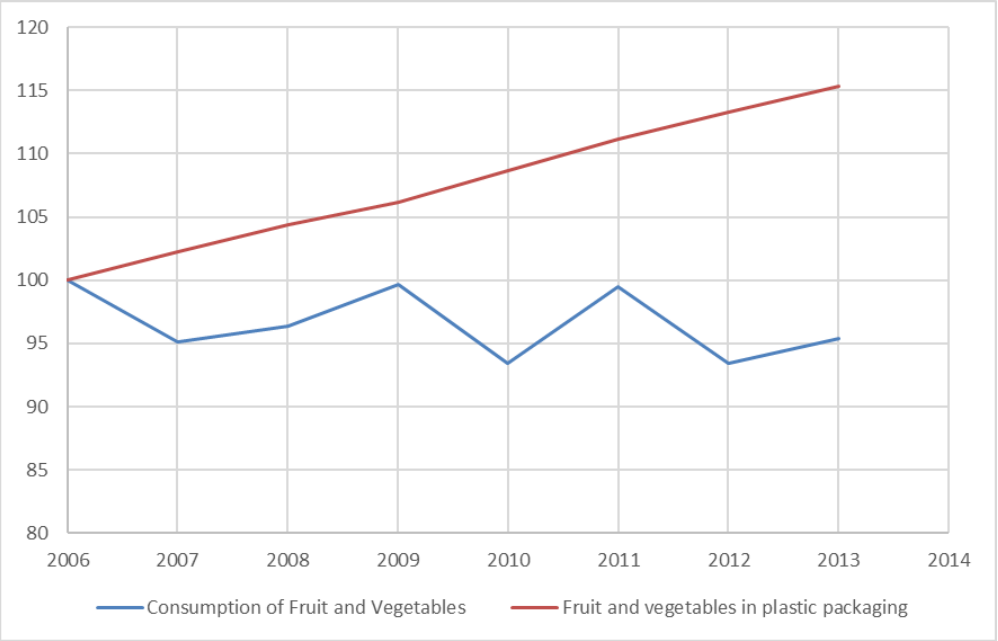
Across the EU, a basic analysis was performed of the number of units of fruit and vegetable products packaged in plastic packaging, and the change in the overall quantity of fruit and vegetables consumed per capita, the results of which are shown in *Figure 1-32*. The consumption of fruit and vegetables within the EU has remained relatively stable within the EU, whilst the number of units of fruit and vegetables packaged in plastic has increased significantly, indicating that the intensity of plastic packaging for fruit and vegetables has increased across the EU in recent years.

[64] Friends of the Earth Europe, Zero Waste Europe, and Rethink Plastic (2018) Unwrapped: How throwaway plastic is failing to solve Europe's food waste problem (and what we need to do instead), p.28

[65] UBA (2017) Generation and recycling of packaging waste in Germany in 2017

[66] ING *Plastic Packaging in the Food Sector*, accessed 7 May 2020, https://think.ing.com/uploads/reports/ING_-_The_plastic_puzzle_-_December_2019_%28003%29.pdf

Figure 1-32 Consumption of fruits and vegetables and fruit and vegetables sold in plastic, EU (27 countries - from 2020), Index 2006 = 100



Source: World Health Organisation and Global Data

While variable from one product to another, as a general rule, a majority of the environmental impacts of a product are usually contained within the product, rather than the packaging (for example, 90% of the carbon impacts associated with food are in the product compared to the packaging). There is therefore a strong rationale on sustainability grounds to investing in packaging that delivers good protection of product both on the shelf and in the home. Increasing the shelf lives of products is one method used by producers to reduce food waste, with these products less likely to expire before being sold and thus go to waste. This has subsequently driven the prevalence of multi-layer flexible packaging that significantly extends a products shelf-life, as evidenced by the previously discussed trends in flexible packaging.

There is evidence that cases of over-packaging may be driven by a sellers desire to influence consumer buying choices, by reintroducing a product to market with larger packaging and persuading them that there is a greater quantity of product. The Commission's Directorate General for Internal Policies (European Parliament)[67] identified the following practises used in this way:

- Void space within packaging;
- False bottoms;
- Double wall thickness;
- Larger than necessary caps
- Outsized outer box.

Examples of these practises were identified in Germany, Italy, Ireland, Lithuania and Poland.

[67] *Misleading packaging practices, Briefing Paper: European Parliament. IP/A/IMCO/NT/2011-19 JANUARY 2012*

There are cases however where what may be thought to be over-packaging is actually a result of standard manufacturing processes. For example, cereal boxes and crisps packets have been raised as examples of over-packaging due to the empty space found in the flexible packets. In addition to being considered misleading, due to exaggerating the quantity of product found within, this may be thought of as excessive use of packaging, due to the empty headspace found within the product. The headspace however is determined by both the machinery capabilities and the extent to which the cereal 'settles' after filling. Under some filling processes, if the packet is filled in excess of 70-90% the bag may become distorted and deform the shape of the box it sits within. Although there is technology available that can minimise this effect, such as the use of vibrating lines, or post-fill compression, often the empty headspace is required to minimise product waste.[68]

Over- and excessive packaging is, however, recognised as a problem, and in the Circular Economy Action Plan one of the objectives under packaging title is "reducing (over)packaging and packaging waste". There is, however, not one clear definition of over-packaging, and examples of overpackaging are often disputed by those who cite critical functionality of packaging and the overriding need to protect the product, bearing in mind the environmental impact of the product is often greater than the environmental impact of the packaging. However, there is evidence that retailers and producers themselves recognise that the volume and/ or weight of packaging is not always "limited to the minimum adequate amount" to deliver critical functionalities and that marketing or consumer's convenience overrides other, in particular environmental and sustainability, considerations in packaging design.

For instance, Ellen MacArthur Foundation's Global Commitment includes a commitment to reduce unnecessary plastic packaging if *"It can be avoided (or replaced by a reuse model) while maintaining utility"* and over a third of relevant signatories have active reuse pilots[69]. The UK Plastics Pact (a form of loose voluntary agreement) includes a similar pledge, and focuses in on the following areas (through consultation with signatories):

- **Multi-packs** – such as packs of beer, snack foods, tins of food etc.
- **Fruit & veg punnets/trays** e.g. grape, tomato, mushroom etc. Plastic could be avoided in some instances where food waste would not increase.
- **Internal plastic trays** (within card) e.g. trays for premium biscuits. Sometimes avoidable.
- **Milk and salad dressing jiggers, single serving pots and sachets**, e.g. on-the-go salads, milk sticks, condiments, cosmetics and samples. Potentially avoidable.

Greenpeace examined companies' commitments relating to packaging and points out that "at least three companies have mentioned that they will be committed to 'take action to eliminate problematic or unnecessary plastic packaging by 2025'". In the Essential Requirements scoping study completed in 2020, a majority of stakeholders agreed that although difficult to define, there are instances where packaging goes beyond what is necessary to protect the product.[70]

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[68] WRAP (2009) *Efficient use of resources in breakfast cereal packaging design*, accessed 26 October 2020, https://www.wrap.org.uk/sites/files/wrap/RSC003-010%20Breakfast%20Cereals.pdf

[69] NEW PLASTICS ECONOMY GLOBAL COMMITMENT PROGRESS REPORT OCTOBER 2019

[70] European Commission (2020) *Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement : final report and appendices.*, accessed 16 September 2020, http://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

Producers often use packaging as a tool to market their products to consumers in competitive markets. For example, there are many examples for which the product is sufficiently robust that it does not require any primary packaging, such as electronic cables, or some children's toys. However, using packaging allows the producer to signal particular features of the product to consumers, or make the product more aesthetically pleasing, examples of which can be found in Figure 1-33.

Figure 1-33:Packaging of a phone charging cable and a toy

It is widely accepted that these product marketing and/or consumer convenience considerations often overrides sustainability concerns, or material cost considerations, in packaging design. Businesses are generally quite rational in that they will consider an extra cent on larger or heavier packaging money well spent if it increases sales. Tilo Quink from Henkel (the global packaging adhesives and home and hygiene products manufacturer) says, in the context of potential 2020 improvements[71], that **"***The first step would be to avoid the use of non-recyclable materials that serve no purpose other than making the packaging visually appealing for marketing purposes.*" The Dutch (KIDV) report on the way ahead for sustainable packaging[72] (2020) notes that "*Requirements in regards to the marketing, sales, visibility and turnover rate of products are often at odds with sustainability concerns. Fortunately, we do see some changes in this regard: in more and more businesses, marketers opt for the sustainable alternative, even at the expense of their product's original appearance. The innovation of the packaging for new retail (e-commerce) still lags behind this development, which often leads to overpackaging (such as the use of large outer boxes). The sector is gradually taking measures to resolve this issue*."

A final but important market driver is simply that of economies of scale. Packaging is bought by brands and contract manufacturers from packaging suppliers, and the larger the quantity the lower the unit cost. This means that there is an imperative to minimise the number of pack sizes purchased, which results in some packs being over-sized for their purpose, but with the result that the overall packaging purchase cost to a business is minimised.

[71] Packaging Europe; Sustainability through the lens of 2020
[72] *The State of Sustainable Packaging,* Netherlands Institute for Sustainable Packaging (KIDV) 2020

E-commerce sector

Important incentive for companies is related to savings from reducing empty space. It can lead to lower freight costs, reduced packaging material costs for fillers and potentially also lower unit costs due to lesser material to build a parcel. 65% of executives surveyed by Forbes Insights and DS Smith believed they can achieve a packaging cost reduction of at least 25%, and 62% believed that they can achieve such savings in their logistics costs.[73] DS Smith estimated that this translates into $46 billion globally of potential annual savings. The estimation accounts for potential savings in logistics costs, but it does not include further savings in material reduction or storage and handling costs, for instance (*ibid.*). The packaging optimization can be facilitated by delivery services. Couriers have traditionally priced parcels according to their weight. Based on the findings from interviews, recently, this approach is being replaced by the dimensional pricing. For example, UPS and FedEx instituted dimensional pricing in 2015 in order to save space in trucks and compensate for the revenue lost due transportation of oversized parcels (over-sized parcels took a lot of space, however, the cost based on weight was too little too compensate for the empty space).[74]

Based on the procurement research analysis carried out by SpendEdge, the demand for lightweight packaging is increasing mostly because companies are focusing on reducing the overall weight of the packaging to reduce the transportation cost.[75] The potential for environmental gains is greater in the e-commerce sector than a bricks and mortar supply chain, because there are according to DS Smith at least four times as many touchpoints in this sector.

Additionally, reduction in packaging in e-commerce has advantages because it can improve customer's satisfaction, as there is a growing number of eco-conscious consumers and because households face increasing recycling obligations from their municipalities waste collection services. According to the BillerudKorsnäs Consumer Panel, 64% of respondents (based in 16 megacities around the world) indicated that they may change a product for another one if it clearly provides a more sustainable choice.[76]

E-commerce often comes in for criticism in regards to excess packaging, and this is often because of the automated processes used, and the difficulty and cost associated with storing the multitude of bag and box sizes that would be needed to optimise. While box-on-demand systems are available to create the right-sized box, these are generally too slow for fast moving fulfilment warehouses. There is a positive facet to the move to greater e-commerce however.

Amazon, for example, has for ten years been running its Frustration Free Packaging initiative with suppliers with the aim of shipping single items in their original primary packs, without the need for an outer collation box or bag. While the number of case studies are small compared to huge array of products sold on Amazon, this shows the potential for further minimisation.

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[73] Forbes Insights & DS Smith (2018) The Empty Space Economy.

[74] CMS (N.d.), 6 Practical Tips To Reduce Shipping Costs Even With Dimensional Pricing. Written by Paul Johnson. Available at: https://cms-colorado.com/6-tips-reduce-shipping-costs-even-dimensional-pricing/

[75] BillerudKorsnäs (n.d.), Transport Packaging Optimization Best Practices. Available at: https://www.billerudkorsnas.com/managed-packaging/knowledge-center/articles/transport-packaging-optimization-best-practices

[76] BillerudKorsnäs (2018), Packaging Sustainability for Helpful Brands - Views on the role of brand owners in packaging sustainability. Available at: https://www.billerudkorsnas.com/globalassets/billerudkorsnas/about-us/global-trends/billerudkorsnas-packaging-sustainability-for-helpful-brands-2018.pdf

Amazon has, for example, recently worked with Hasbro, the toy manufacturer, to produce better packaging for a popular toy, thereby reducing the amount of material used and the pack volume by over 50%. Similar work has been done with Fisher Price and other toy brands77. This is an interesting example in that toys that are sold from the shelf in a toy shop 'need' to be larger for shelf impact reasons, being attractive to children. Internet shopping avoids the side-by-side comparison and hence allows the pack to be properly sized for its main purpose – product protection.

1.1.2.3 Regulatory Drivers

The cases highlighted as clear examples of overpackaging suggest the regulatory measures used to date have not been wholly effective. Under Article 4 and 9 of the Waste Framework Directive, Member States must implement waste prevention measures but these articles do not specify minimal requirements on the content or extent of these measures. Here are examples of some relevant waste prevention measures reported by Member States in the questionnaire – there were only a limited number of responses, so a more systematic assessment was not carried out:

- In Belgium, the largest 20% of packers/fillers and importers by packaging placed on the market must introduce a packaging prevention plan every three years, with the aim of committing to packaging waste prevention measures. Belgium have also introduced a tax on single use beverage packaging and through the Producer Responsibility Organisation, Fostplus, operates a platform where consumers may report instances of over-packaging.
- In Germany, the legal framework of the German Packaging Act is complemented by voluntary measures. For instance, the Federal Ministry for the Environment has launched a 'round table' dialogue between important producers with the aim of reducing unnecessary plastic packaging. This has led to prominent producers making commitments to reduce their use of plastic packaging.
- In Italy, the Producer Responsibility Organisation CONAI has implemented a number of initiatives with the aim of assisting producers with waste prevention through light-weighting. Examples include 'Prevention Awards' that reward packaging manufacturers who have been able to reduce the environmental impact of their packaging, online tools that allows producers to apply 'eco-design' principles to their products, and an online platform that provides information on good practise in packaging design.
- In Spain, producers are also required to submit packaging waste prevention programmes that include quantitative reduction measures that achieve reductions on a per unit basis.

Whilst the PPWD sets material specific targets for recycling, with an overall target of 65% to be met by 2025, there are no targets in respect of waste prevention but rather the general obligation for packaging to be conform the 'essential requirements'. PPWD Annex II states that:

> *"Packaging shall be so manufactured that the packaging volume and weight be limited to the minimum adequate amount to maintain the necessary level of safety, hygiene and acceptance for the packed product and for the consumer".*

[77] https://www.aboutamazon.com/packaging/case-studies

The Harmonized European Standard EN 13428:2000,[78] compliance with which provides presumption of conformity (how the Essential Requirements were implemented in practice) with the above mentioned requirement for all packaging placed on the market, provides for a procedure for assessing compliance on prevention by source reduction. This procedure relies on identifying one or more **"critical areas",** which are specific performance criterion that prevents further reductions in the weight and/ or volume of packaging. There is little detail in the Standard about how to test and verify the critical areas, but **the performance criteria (equally weighted)** are specified as:

- Product protection
- Manufacturing process
- Packing/ filling process
- Logistics
- Product presentation and marketing
- User/ consumer acceptance
- Information
- Safety
- Legislation
- Other issues

Assessments should state that for each relevant criterion whether this is a "critical area" meaning that no reduction of packaging is possible due to this criterion. Essentially, each of the above criteria outranks the need to reduce packaging at source.

Defining "product presentation and marketing" as a critical area gives suppliers significant latitude to claim that the quantity of packaging is necessary to effectively market the product and hence not infringe the standard. Indeed, in the Member State questionnaire, it was cited that there were many cases of excessive quantities of packaging being used for protection and distribution due to the packaging's marketing needs. Furthermore, the concept of "consumer acceptance" is also contestable, with previous studies concluding that it is "difficult to define or to evaluate". What is acceptable to consumer is a relative concept, of course, and could be used to reflect the desires or needs of a small niche group rather than to reflect a far wider societal need or desire. It should also be noted that "consumer acceptance" does not necessarily prevent reductions in the volume of weight of packaging, as consumers can be concerned by perceived 'over-packaging' just as much as they can be concerned about the convenience offered by a pack for example. While "other issues" is an all-encompassing category and there is no guidance on who should adjudicate upon whether any "other issues" cited are appropriate

Section A.2 of the Standard explains that tests or studies will be used to identify critical areas, however no further information is provided on what form these tests should take or how they are to be verified. Importantly, the procedures taken from the standard series EN ISO 9000 ff and EN ISO 14000 do not contain any clear, quantifiable criterion for reducing the use of packaging. In short, "the minimum adequate amount" of packaging lacks the necessary clarity to be enforceable and the standards do not help determine what can and cannot be placed on the market – so the problem is with both the Essential Requirements and the standard.

[78] Standards, E. *Packaging - Requirements specific to manufacturing and composition - Prevention by source reduction*, accessed 15 May 2020, https://www.en-standard.eu/din-en-13428-packaging-requirements-specific-to-manufacturing-and-composition-prevention-by-source-reduction/

Furthermore, in the context of the PPWD, Extended Producer Responsibility (EPR) for packaging has been introduced in most Member States, whereby producers are required to bear the cost of recovery for the packaging they place on the market with fees typically based on the weight of packaging placed on the market. These schemes shall be established for all packaging in accordance with Articles 8 and 8a of the Waste Framework Directive by end of 2024 at the latest (see Art. 7 PPWD), and the existing schemes that have been established before 4 July 2018 shall be made compliant with these provisions by 5 January 2023. In addition to the funding of collection and recycling infrastructure, EPR fees are also intended to drive producers towards minimising the packaging generated by providing a financial incentive to reduce the weight. When expressed in terms of the costs per item of packaging, the costs of EPR fees are rather low and not of the scale to encourage producers to change their choice of packaging, or move to different business models, such as those based on reuse and refill. This is exacerbated in the case of plastic packaging, where despite tonnage based fees being, generally higher than for other materials, the lower package weights in comparison to packaging made from other materials leads to a very low cost per item of plastic packaging. And while the fees as a proportion of the cost of the packaging tend to be low, they are even smaller relative to the cost of the packaged product. Although Member States will be required to modulate their fees even further, the modulation would need to be relatively high in order for the costs of EPR fees to be a significant proportion of the costs of a packaging item and to drive change. In the Member State survey, it was pointed out that the revenue raised through increased marketing and the resulting increase in packaging would likely outweigh increased costs associated with EPR.

Pharmaceutical packaging

Pharmaceutical packaging was highlighted in Article 20 of the PPWD as an area that may require special measures to address primary packaging for medical devices and pharmaceutical products due to the many restrictions on the design and use of pharmaceutical packaging that provide a barrier to waste prevention, and as such are set out below (no other legislation with packaging specific requirements of this nature was found in the review):

- **Pharmaceutical packaging criteria / restrictions** are implemented through the following EU legislation:
  - Regulation (EC) NO 726/2004 on the authorisation and supervision of medicinal products for human and veterinary use and establishing a European Medicines Agency
  - Directive 2010/84/EU amending Directive 2001/83/EC medicinal products for human use
  - Falsified Medicines Directive (Directive 2011/62/EU)
  - Pharmacopoeia (European Pharmacopoeia)
  - Also some international guidelines are applicable to pharmaceutical packaging:
  - ICH note for guidance on stability testing: stability testing of new drug substances and products (ref: cpmp/ich/2736/99)
  - WHO guidelines on stability testing of pharmaceutical products containing well established drug substances in conventional dosage forms
  - WHO - general aspects of packaging
- **Registration procedure:** After the clinical trials, the registration authorities will decide whether a drug substance and the primary (immediate and outer) packaging can be admitted to the market. The primary (immediate and outer) packaging is an integral part of the registration file and thus will be the subject of a thorough investigation (integrity and stability of the drug substance, patient compliance etc.). The registration procedure is

stopped in the case that the packaging was insufficiently tested or does not meet the abovementioned requirements of public health.

- **Stability study:** The mandatory stability studies need to demonstrate that the packaging guarantees the integrity and full stability of the drug substance, and this during at least the shelf life of the drug substance. Next, the primary packaging should be adapted to the specific physical characteristics of the patient (e.g. user-friendly for an elderly person, adequate protection for children).
- **Product standards:** Product standards for pharmaceuticals include standards for their packaging. Packaging standards are related to the protection of the drugs from temperature fluctuations, storage or use. An important criterion therefore is e.g. the sturdiness of the packaging. These standards result in little freedom in the choice of primary packaging of pharmaceuticals. Some examples:
  - recycled glass as primary immediate packaging is explicitly prohibited;
  - the primary outer packaging cannot be made entirely from recycled cardboard because recycled cardboard is less sturdy and the medicinal products are less protected;
  - blister packs are usually only manufactured with multiple inseparable layers in order to create an adequate barrier for external organisms.
- **Multifunctionality:** The primary packaging of a medicine has a specific role and in most cases must be able to perform several functions at the same time. Packaging prevention is therefore limited to the extent that these different functions can be fulfilled. The following functions are deemed essential:
  - Distribution: transport must be possible without damage or deterioration and must also be able to withstand handling by the patient.
  - Hygiene: protection of the active substance of the medicinal product throughout its shelf life. The packaging must therefore contribute to ensuring good hygiene of the product.
  - Portioning: design in such a way that a correct dosage can be administered.
  - Information: contains legally defined information, such as the expiry date, lot number, manufacturer's name, brand name, active substance name and information on the correct use of the medicinal product.
  - Storage of the product: protection against external influences (light, humidity, air, temperature differences, etc.). The primary (immediate and outer) packaging must offer protection against external influences (light, humidity, air, temperature differences, etc.).
  - Safety conditions: pharmaceutical legislation requires additional safety requirements to be met by a particular form of packaging due to the risks associated with the misuse of medicines.

1.1.3 Problem Evolution

Understanding in what way the generation of packaging waste has evolved and thus may evolve further in the future is challenging. As discussed above, there are many influencing factors. Population is one factor, and as the population in the EU is expected to increase, other things

being equal, waste generation would continue to go up.[79] This in itself is not a 'problem' per se, as it is normal for waste generation to be correlated to population. However, packaging waste generation per capita has also increased due to changes in the population's household composition as well as to rising levels of goods consumption and increasing packaging intensity in certain market areas (incl. e-commerce). As GDP has increased across Member States, so too has consumption, with waste not yet fully decoupling from GDP across all Member States – see Appendix E.1. With these drivers in mind, the levels of packaging waste generated are likely to continue to increase.

In addition to the increased consumption, the increasing demand for convenient products, including purchasing through e-commerce and on-the-go consumption is not forecast to reduce in the future. The European flexible packaging market is set to grow at an annual rate of 2% over the next three years, [80] and one source suggests the e-commerce market for packaging will grow at a rate of 5.59% in the years to 2023 in Europe,[81] which in the light of Covid-19 may be an underestimation. The unit weight of packaging has reduced significantly since the introduction of the Packaging and Packaging Waste Directive; however, there are physical limits to how much more can be achieved especially considering the tendencies going in the opposite direction of more packaging consumption.

These trends may get a counterweight in the increasing concerns of national regulators and consumers regarding over-packaging and packaging waste in general. As has already been stated, though, whilst there is greater public awareness of environmental issues, it is not certain to what extent this will have impact on consumption trends, with consumers likely to hold producers primarily responsible for realising the reduction in packaging waste. There is evidence that industry groups are beginning to make commitments on the absolute reduction of packaging waste placed on the market. The Plastics Pact is a network of regional and local initiatives initiated by the Ellen Macarthur Foundation that connects stakeholders to implement circular solutions for plastic packaging waste.[82] Through this, national networks have been set up in Portugal, France, the Netherlands, and Poland, with members – both national authorities and industry as well as other stakeholders - making pledges to reduce their use of plastic packaging. In this context, the signatories of the Dutch plastic pact have pledged to reduce their use of plastic packaging by 20% per kilogram of product by 2025. Furthermore, a European wide network of stakeholders has been initiated, with a core aim to prevent and reduce over-packaging and packaging waste.

These types of industry initiatives have resulted in companies making further voluntary pledges. Notably, Unilever has pledged to halve its use of virgin plastic by 2025, by reducing its absolute use of plastic packaging by more than 100,000 tonnes, although if this is achieved through switching to heavier materials, this may not result in a reduction in packaging. Similarly, Aldi has pledged to reduce its use of plastic packaging by 25% by 2023. The majority of industry pledges have, however, focused on ensuring all packaging is reusable or recyclable, whilst refraining from making reduction pledges.

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[79] Eurostat, E.C. (2019) *The EU's population projected up to 2100*, accessed 7 May 2020, https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190710-1

[80] Packaging News (2019) *European flexible packaging forecast to grow to €16bn by 2023*

[81] *E-commerce Packaging Market in Retail Industry 2018 Ongoing Trends - Reuters*, accessed 29 April 2019, https://www.reuters.com/brandfeatures/venture-capital/article?id=34305

[82] Ellen MacArthur Foundation *Plastics Pact*, accessed 30 June 2020, https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy/plastics-pact

The Ellen Macarthur Foundation identify further examples of producers eliminating packaging components from their products in their Global Commitment 2020 Progress Report.[83]

An example of direct elimination was provided by ASOS, the fashion retailer, who removed plastic hangers, swing tickets, and plastic kimbals from some of its brands. These components were largely superfluous and were not essential to the protection of those products. Indeed, as an online retailer, there is less need to use packaging to market products.

In the food and drink sector, producers such as Mars Incorporated, Kesko Corporation, and Barilla G.e R. Fratelli SpA are eliminating plastic windows from some of their products including boxes of rice, bread packaging, and pasta boxes. These plastic windows serve a marketing function by allowing the consumer visibility of the product and do not provide a product preservation function.

Cosmetics producers such as Natura Cosmetics and L'Occitane en Provence raised the elimination of seals and shrink wrap as a method of removing unnecessary packaging. Whilst some products do require seals to extend the lifetime of products, this is often not the case and in the case of shrink wrap, it is often used to sell multi-packs together when arguably, these products could just as easily be sold individually.

The retail company Ahold Delhaize, who operates in several Member States, is trialling the sale of unpackaged fresh fruit and vegetables, using an innovative technique involving the spraying of produce with a 'dry, fine mist' that extends the lifetime of the produce. This is claimed to potentially save 270 tonnes of packaging each year. In a similar vein, this retailer is also replacing the stickers used on fresh fruit and vegetables with 'natural branding' saving 13 tonnes annually of plastic packaging

The cross-border aspects of some of the problem drivers present challenges for solutions at the national level, which is being highlighted in particular by industry. Firstly, according to multiple industry members, the level of cross-border e-commerce is increasing more rapidly than domestic e-commerce. Measures implemented at a national level to ban specific packaging types or materials place additional burden on producers who sell products across the EU, who would be required to use multiple packaging types to comply with a range of national requirements, depending on the scope of the national measures. Measures taken to address over-packaging, such as standards or minimum dimensions, will be difficult to enforce across borders and as such may negatively impact the competitiveness of domestic companies. Similarly, if waste prevention targets that apply to producers are implemented, non-domestic companies for whom the targets do not apply, may be given a competitive advantage. Such measures have therefore been criticised by industry as potentially undermining the functioning of the single market and the freedom of movement of packaged goods.

[83] Ellen MacArther Foundation (2020) *The Global Commitment 2020 Progress Report*, accessed 9 November 2020, https://www.ellenmacarthurfoundation.org/assets/downloads/Global-Commitment-2020-Progress-Report.pdf

Box 1-1: Impact of Covid-19

Impact of Covid-19 On the Generation of Unnecessary Packaging Waste

The restrictions placed on consumers and businesses through the course of the Covid-19 crisis has severely impacted levels of consumption across the EU. The household saving rate in the EU recorded its all-time highest year-on-year increase in the first and second quarters of 2020. This was largely due to significant reduction in household consumption expenditure, which in the second quarter, was 17.6% less than in 2019.

However, whilst household expenditure has fallen across Europe in 2020, it does not necessarily follow that the generation of packaging waste has fallen too. Indeed, in Ireland whilst there was a fall in commercial waste generation of 50% between March and May, this was offset by increases in residual waste and recycling of 19% and 8% respectively. With citizens spending much more time at home, the sales of groceries rose by 25% and likely drove this increase in waste generation. Furthermore, whilst under the strictest lockdowns all hospitality venues were required to close, when restrictions were eased many hospitality businesses turned to offering take-away, leading to increases in demand for service packaging from these businesses.

The Covid-19 crisis has been an accelerator for some pre-existing trends. E-commerce was already gaining market share, however since the beginning of the pandemic the B2C online sales of physical goods have experienced a surge of demand in certain products, particularly for medical supplies, household essentials and food products. In addition to the primary packaging surrounding the products, additional transport packaging is now being generated of and disposed of too.

As discussed, existing regulations have weaknesses with regards to the prevention of packaging waste, and will need to be strengthened in order to reduce unnecessary packaging. The Waste Framework Directive (WFD) instructs Member States to take waste prevention measures on multiple occasions. Article 4 WFD mandates Member States to encourage options that deliver the best environmental outcome in accordance with the waste hierarchy:

> 2. *When applying the waste hierarchy referred to in paragraph 1, Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.*

Furthermore, according to the 2018 modification of the Waste Framework Directive, under Article 9, Member States are required to implement further waste prevention measures covering a large number of waste areas. Whilst packaging is one of the areas that Member States are asked to target, the Article does not specify what measures should be taken and leaves Member States significant latitude to choose the measures taken. As evidenced earlier, Member States have not taken a consistent approach with differing levels of effectiveness. Similarly, Article 29 requires Member States to adopt National Waste Prevention Programmes, in which they were advised to set quantitative targets and indicators for the reduction of waste. Whilst many of

these plans do set quantitative targets for the reduction of municipal waste generation,[84] this is not specific to the generation of packaging waste, and the measures involved often relate to other aspects of municipal waste, such as the separation of food waste.

Article 4 of PPWD sets out additional waste prevention measures related to packaging and refers to the WFD:

> *1. Member States shall ensure that, in addition to the measures taken in accordance with Article 9, other preventive measures are implemented in order to prevent generation of packaging waste and to minimise the environmental impact of packaging.*
> *Such other preventive measures may consist of national programmes, incentives through extended producer responsibility schemes to minimise the environmental impact of packaging, or similar actions adopted, if appropriate, in consultation with economic operators, and consumer and environmental organisations, and designed to bring together and take advantage of the many initiatives taken within Member States as regards prevention.*
> *Member States shall make use of economic instruments and other measures to provide incentives for the application of the waste hierarchy such as those indicated in Annex IVa to Directive 2008/98/EC[85] or other appropriate instruments and measures.*

In order to tackle the growing amounts of packaging waste generated, Member States were consulted via a survey to identify their preferred waste management measures as well as the level at which such measures should be taken. Member States are divided in their views of a preferred way forward. A minority thought that consumption reduction targets could be an effective measure, provided it was implemented at a sectoral level - although most raised concerns as to whether targets set at an EU-level would be achievable for all Member States and may put some at a disadvantage. A requirement for producers to implement corporate waste prevention policies was suggested by several Member States, from a range of geographies, as an effective method.

In accordance with the Waste Framework Directive Articles 4 and 9, some measures have already been implemented in Member States. For example, some Member States, including Spain and Belgium, require producers to create and implement packaging prevention plans, where producers must include in the plans measures to reduce packaging use per product, and remove the superfluous use of packaging. Several 'informative' measures have also been implemented in Member States, largely through Producer Responsibility Organisations (PRO), that offer advice, guidance and training to producers who are seeking to reduce their use of packaging. In Italy, for instance, the PRO offers an eco-design and LCA tool to producers, whilst in Ireland, Repak deliver a certified training course. Regulatory measures that limit or support the use of certain types of packaging (e.g. requirements for bio-based plastic packaging or plastic packaging containing recycled content), as well as national bans for certain single-use plastic packaging, which are not covered by the SUP Directive, are being increasingly implemented at a Member State level and would benefit from an EU-wide approach. For some non-packaging items covered by the SUP Directive, Article 192 TFEU which is the legal basis for the SUP Directive, would seem to allow for such bans under the general conditions of proportionality and non-discrimination, however for many packaging items be it covered or not

[84] Magrini, C., D'Addato, F., and Bonoli, A. (2020) Municipal solid waste prevention: A review of market-based instruments in six European Union countries, *Waste Management & Research*, Vol.38, pp.3–22

[85] The Waste Framework Directive (WFD)

by the SUP Directive, these bans are not permitted as placing on the market of packaging is harmonized at the EU level and any national packaging waste prevention measures taken to implement Article 4(1) of the PPWD must comply with Art. 18 of the PPWD. However, an EU-wide approach would prevent these occasions from occurring and remove any doubts.

The new Circular Economy Action Plan (nCEAP) as published on 11 March 2020 specifically states the aim of "reducing (over)packaging and packaging waste, including by setting targets and other waste prevention measures",[86] in addition to committing to reviewing the legislation for specific waste streams, including packaging, with the view, *i.a.* to preventing waste, the new CEAP commits to preventing waste and setting waste reduction targets as part of a broader set of measures on waste prevention in the context of a review of Directive 2008/98/EC.[87] Furthermore, the CEAP announces a Sustainable Product Policy Initiative, with the aim to make products on the EU market more sustainable, *i.a.* by extending their lifetimes and promoting reuse and repair. This could reduce the pace at which products are discarded and replaced by new products and thereby also the packaging used for the new products. Approximately half of the items covered by the Single Use Plastic Directive (2019/904) are packaging, and contains objectives for consumption reduction of items through measures such as setting national reduction targets and bans on specific packaging types such as food containers made of EPS.[88]

In summary, whilst there are some indications that producers are seeking to eliminate unnecessary packaging (either whole or elements), and reduce packaging weight in some quarters, the publicised examples are very few and far between compared to the overall market, despite there being hundreds if not thousands of brand signatories. The voluntary agreements and 'Pacts' all have their strongest focus on 100% recyclability and/or compostability and/or reuse. Where avoidance is mentioned at all this is limited to a very small selection of packaging items that the brands and retailers are willing to sacrifice, such as collation packaging. Very few individual brands, in their commitments, say anything at all about their commitments to reduce and eliminate.

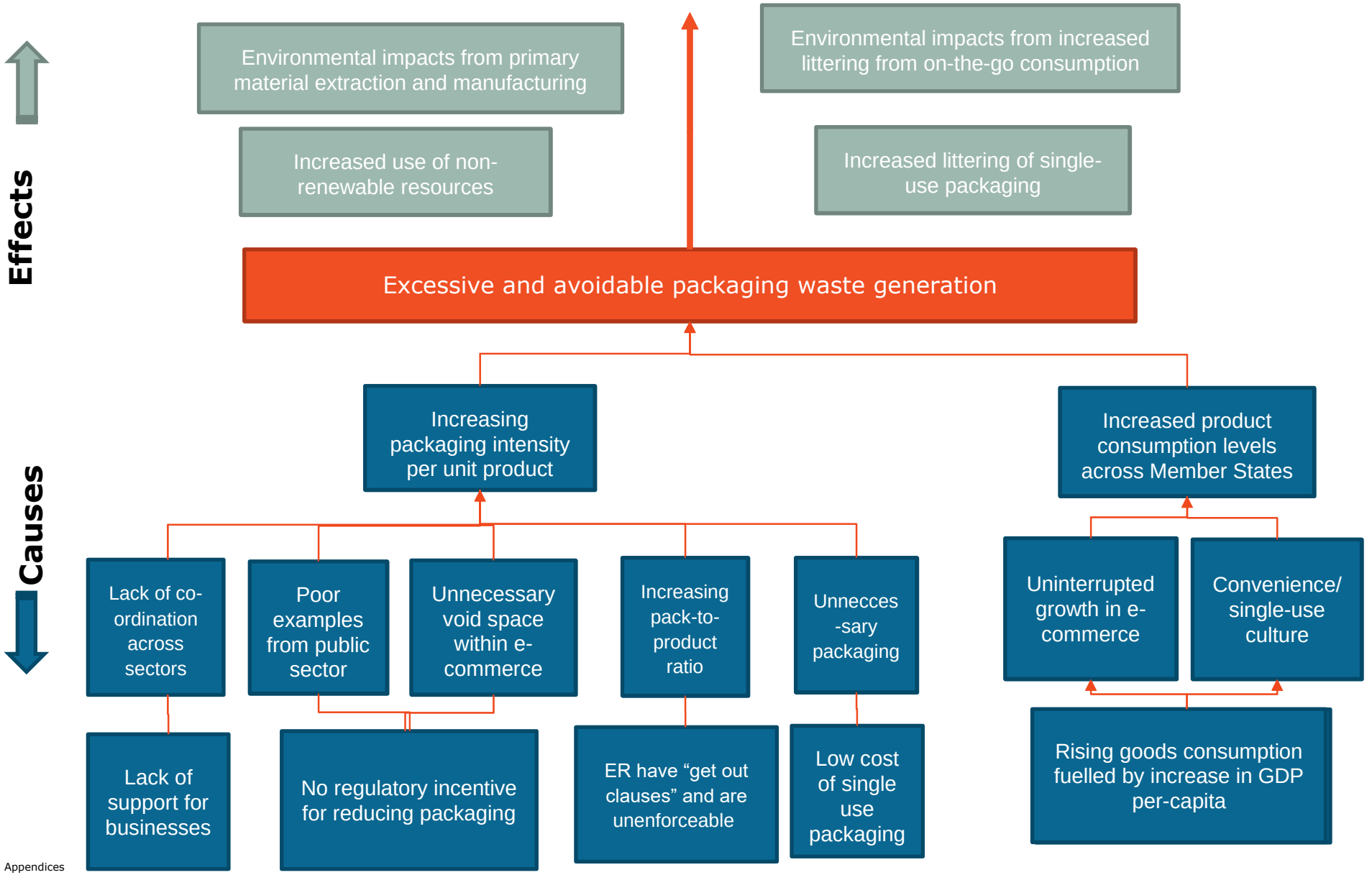
While recent or recently announced policy interventions could contribute to reducing the rate of increase of packaging use in the EU, in the absence of further regulatory efforts, there is no strong evidence that the trend for increasing packaging waste generation in absolute terms will diminish. In fact, consumer pressure, and brand commitments, in regard to 100% recyclability and less plastic may well further drive weight increases as there is switch back, in some product categories, to cardboard and glass from plastic.

[86] European Comission (2020) *A new Circular Economy Action Plan*, accessed 7 May 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

[87] European Comission *Implementation Tracking Table - Circular Economy Action Plan*, accessed 7 May 2020, https://ec.europa.eu/environment/circular-economy/pdf/implementation_tracking_table.pdf

[88] European Commission *Single-use plastics: New EU rules to reduce marine litter*, accessed 18 June 2020, https://ec.europa.eu/commission/presscorner/detail/en/MEMO_18_3909

1.1.4 Problem Tree



1.2 Increase in the proportion of packaging that is single-use

1.2.1 Overview

This section addresses the problem of a reduction in the reuse of packaging across Europe. The report provides an overview of the scale of the problem, key trends and commentary on the nature of the problem. First, definitions and data limitations are discussed, and the most commonly reused packaging items are presented, both for sales/consumer packaging, also referred to as primary and secondary packaging, and transport, or tertiary, packaging. Second, high-level trends and changes over time for packaging reuse are examined, supported by data from Member States, where available. Finally, the consequences of these trends are outlined.

As defined in Article 3(2a) of the revised Packaging and Packaging Waste Directive (PPWD):

> *"reusable packaging" shall mean packaging which has been conceived, designed and placed on the market to accomplish within its lifecycle multiple trips or rotations by being refilled or reused for the same purpose for which it was conceived;*[89]

Very few Member States have official data on reusable packaging or report voluntarily on reusable packaging under the PPWD. Only Denmark, Finland and Luxembourg regularly report to Eurostat on the amount of packaging reused within their national boundaries. Where data is available, there are issues with different data collection methods, different products and varying modes of reuse. In some instances, the data are not available from organisations or businesses due to competition concerns. These trends are discussed first, then the drivers of them are set out in detail in the subsequent section.

There are a number of difficulties in reporting packaging reuse data. Principally, it is difficult to quantify the reuse of most materials, as they do not enter the waste stream. This is compounded by the lack of a unified reporting system across Member States, meaning that reuse is measured in a variety of ways, at different channels and for diverse materials. Thus, data on packaging reuse currently collected on an official basis is limited; although, this is likely to improve with the revised PPWD requiring reporting on reusable packaging from 2022 (for reference year 2020) as well as the Commission Implementing Decision 2019/665[90] regarding the reporting formats for reusable packaging. Additionally, in May 2020, the Commission published Eurostat guidance on the compilation and reporting of data on packaging and packaging waste[91]. This includes guidelines for completing reporting Table 3, as established by Commission Implementing Decision 2019/665/EC, on reusable packaging.

The available data shows that certain packaging materials are more commonly reused than others. In the consumer sector (primary and secondary packaging), rigid packaging is most

[89] European Parliament and the Council (2018) Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste

[90] Commission Implementing Decision (EU) 2019/665 of 17 April 2019 amending Decision 2005/270/EC establishing the formats relating to the database system pursuant to European Parliament and Council Directive 94/62/EC on packaging and packaging waste

[91] European Commission (2020) *Guidance for the compilation and reporting of data on packaging and packaging waste according to Decision 2005/270/EC*, accessed 15 September 2020, https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+for+the+compilation+and+reporting+of+data+on+packaging+and+packaging+waste+%E2%80%93+20+May+2020+version

often reused, such as glass bottles and jars and rigid plastic bottles, rather than flexibles, which are less easy to clean or to refill and are more likely to be ripped. The amount of reusable paper and cardboard packaging is generally low, as they are less robust materials than metals or rigid plastics. Cardboard boxes are sometimes reused by SMEs and in households, although the data is lacking to quantify this. Transport packaging made of metal, wood and plastic is also frequently designed for reuse. Reusable transport packaging types include: reusable sacks, pallets, crates, drums, kegs and racks.

For instance, reuse statistics for consumer and transport packaging in Denmark for 2013 are presented in Table 1-2; shipping containers are not included although metal butchers' hooks are.[92] The data demonstrate the variety of products and types of packaging for which reuse occurs, as well as the quantities. Notably, wooden pallets used in transport have the highest annual consumption in tonnes followed by plastic crates and glass beer bottles. A similar prevalence of refillable beer packaging is evident in GlobalData regarding Austria, France, Germany, Italy and Sweden.

Table 1-2 Data on Returned and Recyclable/Refillable Packaging in Denmark (2013)

Material	Type	Product	Trips Per Year	Number of Units in Circulation per Annum (thousands)	Weight per Unit (kg)	Annual Consumption (thousand tonnes)
Glass	Bottles	Beer	4	66,607	0.30	73
Glass	Bottles	Soft drinks	4	97,486	0.20	78
Plastic	Crates	Beer/Soft drinks	6	5,251	2	53
Plastic	Trays	Beer/Soft drinks	10	182	4	6
Metal	Kegs	Beer	10	164	10	14
Plastic	Pallets	Food	7	486	3	10
Wood	Pallets	All	5	9,600	25	1,200
Plastic	Crates	Distribution	30	2,308	2	138
Wood	Cable drums	Diverse	1	10	100	1
Metal	Vessels	Food	10	15	50	8
Metal / Plastic	Drums / containers	Diverse	3	100	50	15
Metal	Cylinders	Gas	4	750	10	25
Metal	Roll containers	Food	50	36	20	36
Metal	Butchers hooks	Meat	12	1,400	1	14
Total				**184,395**		**1,671**

Source: Danish Ministry of Environment and Food (2019)

[92] Danish Ministry of the Environment and Food (2019) *Statistik for emballageforsyning og indsamling af emballageaffald 2017*, accessed 2 July 2020, https://www2.mst.dk/Udgiv/publikationer/2019/10/978-87-7038-121-5.pdf

Reuse of packaging is most common in the business-to-business sector, such as reuse of plastic, metal and wooden returnable transport packaging (RTP) between manufacturers, retailers and logistics companies. RTP can be operated in house, where a company using RTP also owns it, or through a pooling system in which companies rent the RTP from a distribution system, which is responsible for the distribution and washing of the packaging. Indeed, it was estimated that the plastic RTP pool (the RTP currently in use and circulation) consisted of around 2 billion units across the EU25 in 2006.[93] For the same time period, the three primary European beverage associations estimated that their members had 1.5 billion plastic crates in circulation, significantly increasing the total estimated plastic RTP pool [data to be updated].[94] Additionally, in 2018, the total number of SEFA reusable steel drums in 11 countries across Europe, including the UK and Turkey, was around 34 million.[95]

In addition, a significant amount of packaging reuse takes place in the hospitality sector (hotels, catering and restaurants). This is predominantly glass beverage bottles, such as for beer, water and soft drinks. The system works through channels of distribution between companies and restaurants for instance. Collection and redistribution occurs through the same channel. Empty reusable bottles are collected and stored by the restaurant, and are returned to the bottling plant to be washed and refilled.

Furthermore, reuse systems are emerging in the wine industry. Notable examples include:

- In 2011, the region of Styria in Austria initiated a wine bottle reuse system for small and medium sized wine companies. Around 60 producers are now involved and the bottles circulate between vineyards, supermarkets, restaurants, retailers and bottle-washing facilities. The number of refills increased by 3.5% during the project's first year.[96]
- In Spain, the reWINE project established a system for reusing wine bottles in the Catalan wine industry. The project involved producers, bars, restaurants, wholesalers and shops and uses reWINE stickers on labels. A pilot test was completed in June 2019 and expects to recover around 100,000 bottles, reducing glass packaging waste by about 45 tonnes.[97] The project plans to extend the system throughout Catalonia and to other wine-growing regions of Spain.

[93] BIO Intelligence Service, and Mudgal, S. (2008) Study to analyse the derogation request on the use of heavy metals in plastic crates and plastic pallets

[94] BIO Intelligence Service, and Mudgal, S. (2008) Study to analyse the derogation request on the use of heavy metals in plastic crates and plastic pallets

[95] SEFA (2019) SEFA at a glance. Presentation at EIPA 12th Annual Meeting, Berlin.

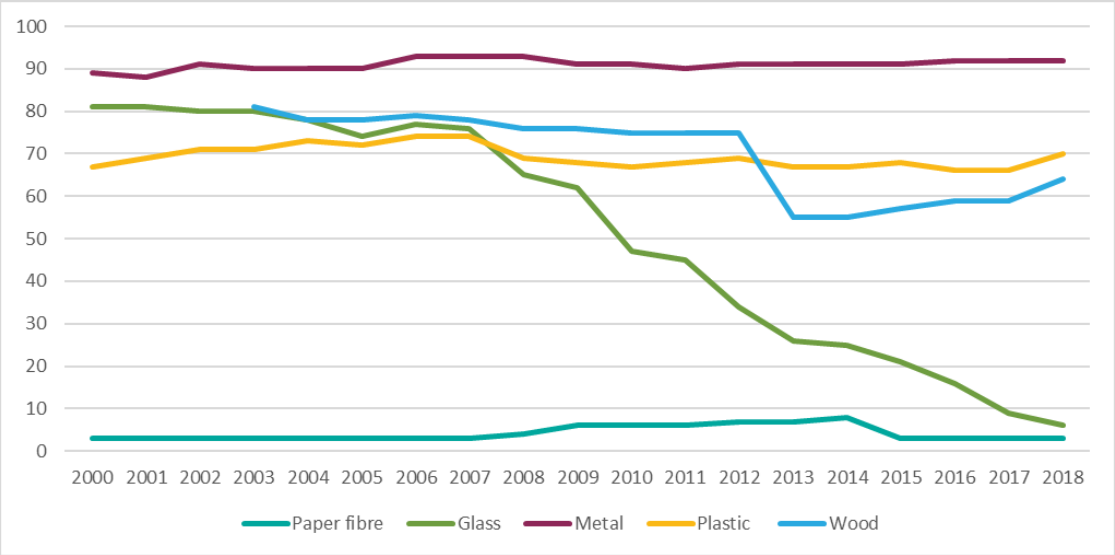
[96] Meiningers Wine Business International (2019) *Ingenious ways to reuse bottles instead of recycling them*, accessed 15 September 2020, https://www.wine-business-international.com/wine/general/ingenious-ways-reuse-bottles-instead-recycling-them

[97] Rewine (2019) *reWINE*, accessed 15 September 2020, https://www.google.com/maps/d/viewer?mid=1DdNZrBF26NxSmPPXoaz82PTznr5v8xNc&hl=ca

- Launched in 2017, in France, the Bout à Bout reuse scheme based in Pays Nantais, allows producers to wash seven sizes of Burgundy bottles at a facility in Clisson. The scheme involves wine producer, distributors, shops and restaurants.[98]

Data provided by Finland presents an overview of reuse trends for different materials and all packaging types. Figure 1-34 shows data, which combines all packaging that is used again for its original purpose, including reused beverage bottles, plastic and cardboard boxes, roller cages and wooden pallets. The reuse rate is calculated as the amount of refilled packaging divided by the amount of total use of packaging (one-way plus refillable packaging) – not clear whether the method is aligned with the EU methodology or not. The rate is presented as a percentage. Between 2000 and 2018, wood packaging decreased by 17%, although there are now signs of a recovery in the market. Metal, plastic and paper packaging reuse have remained fairly static while glass has had the biggest decline; there has been a switch from refillable glass beer bottles to aluminium cans.

*Figure 1-34 Packaging Reuse Statistics, Finland, 2000-2018 (%)**



** Reuse rate (%) is the amount of refilled packaging divided by the amount of total use of packaging. Total use of packaging includes one-way packaging and refilled packaging.*

Source: RINKI 2020 [99]

To conclude, there are two key European level trends for reusable packaging: I) the reuse of transport packaging shows relative stability, although there is some variation according to packaging type, and II) the reuse of consumer (primary) packaging is increasingly uncommon and has declined to particularly low levels over recent decades, limited primarily to beverage packaging at national scale, with individual retailer schemes operating for some other kinds of packaging in some Member States.

[98] Meiningers Wine Business International (2019) *Ingenious ways to reuse bottles instead of recycling them*, accessed 15 September 2020, https://www.wine-business-international.com/wine/general/ingenious-ways-reuse-bottles-instead-recycling-them

[99] RINKI (2020) *Packaging statistics*, accessed 5 May 2020, https://rinkiin.fi/for-firms/packaging-statistics/

1.2.1.1 Transport Packaging

Trends in the reuse of transport packaging show relative stability, although there is some variation according to packaging type and some switches to plastic materials. There is an ongoing shift from corrugated single-use packaging towards reusable plastic RTPs (Returnable Transport Packaging), such as pallets and crates for fresh products including eggs, fruit and vegetables, meat and fish.[100] The use of RTPs for meat crates has increased by around 30% to 400 million containers in Europe between 2012 and 2019. Bread crates increased by around 50% to 600 million containers and fruit and vegetable crates increased by 7-8% to around 350 million containers over the same period.[101] This growth has been attributed to the requirement for stable, conveyor-technology compatible standard boxes which are necessary for automated processes.[102]

In Austria for instance, approx. 8.5 million RTP are in circulation between suppliers and dealers (excluding pallets/roll containers). The boxes are reused around ten times per year. [103] Table 1-3 presents data regarding RTP in Austria including both inhouse and cross-company systems, indicating the number and circulations of RTP in different industries. The food/grocery sector holds the largest share of RTP, although the report notes that since exact RTP numbers could not be quantified in some industries, it is assumed that the real number of RTPs is higher.

Table 1-3 RTP across companies and inhouse for Austria

Industry	Crates/boxes/other load carriers			Pallets/Movable container	
	Number	Weight [t]	Circulation	Number	Weight [t]
RTP inhouse					
Food/grocery	1.000.000	2.000	10.000.000	22.000.000	440.000
RTP across companies					
Food/grocery	8.500.000	12.700	85.200.000	-	-
Pharmaceutical	130.000	200	23.590.000	-	-
Book trade	155.000	200	-	-	-
Chemical industry	1.150.000	2.300	9.230.000	450.000	78.800

[100] Deutsche Umwelthilfe (DUH) (2019) *Aufkommen und Verwertung von Verpackungsabfällen in Deutschland im Jahr 2017*, accessed 5 May 2020, https://www.umweltbundesamt.de/publikationen/aufkommen-verwertung-von-verpackungsabfaellen-in-12

[101] pulswerk GmbH (2019) *MTV 2019 in Österreich: Überblick über den Einsatz von Mehrwegtransportverpackungen in Österreich*, accessed 24 June 2020, http://www.pulswerk.at/mtv2019.htm

[102] Ibid.

[103] Ibid.

Industry	Crates/boxes/other load carriers			Pallets/Movable container	
	Number	Weight [t]	Circulation	Number	Weight [t]
Electricals and electronics	4.230.000	8.000	-	60.000	-
Total	15.165.000	25.400	128.020.000	22.510.000	-
Pooling pallets - equivalents in Austria across all industries				28.500.000	620.000

Source: http://www.pulswerk.at/mtv2019.htm

The consumption of reusable wooden pallets has also risen in the past decade, having recovered from a sharp decline after the financial crisis of 2007/8.[104] [105] On the other hand, SERRED, the European Association of Reconditioners, notes that reuse/reconditioning of steel drums has fallen. This is partly due to switches to plastic drums and Intermediate Bulk Containers (IBCs).

1.2.1.2 Consumer Packaging

In comparison, reuse of consumer packaging is increasingly uncommon and has declined to particularly low levels over recent decades. [106] In a report to the European Commission focused on primary packaging reuse across Europe, two key trends were highlighted: the transition from glass to plastic beverage bottles, and an overall increase in single-use packaging since the 1960s.[107] These trends have occurred simultaneously but at different rates and to differing degrees across Member States. Consumption, product mix, retail trends and demographics are factors which influence the extent of these trends in different countries.

With regards to reusable beverage packaging specifically, between 2000 and 2015, the share of the total beverage market for drinks sold in refillable containers across Europe decreased from 41% to 21%.[108] This includes the following types of drinks: carbonates, water, beer/cider, juice and energy drinks, and the following package types: refillable glass, refillable PET and metal cans. Indeed, Figure 1-35 shows the decline in sales of reusable glass beverage containers between 1999 and 2018 across Member States in Europe (excluding Cyprus and the UK).

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[104] Deutsche Umwelthilfe (DUH) (2019) *Aufkommen und Verwertung von Verpackungsabfällen in Deutschland im Jahr 2017*, accessed 5 May 2020, https://www.umweltbundesamt.de/publikationen/aufkommen-verwertung-von-verpackungsabfaellen-in-12

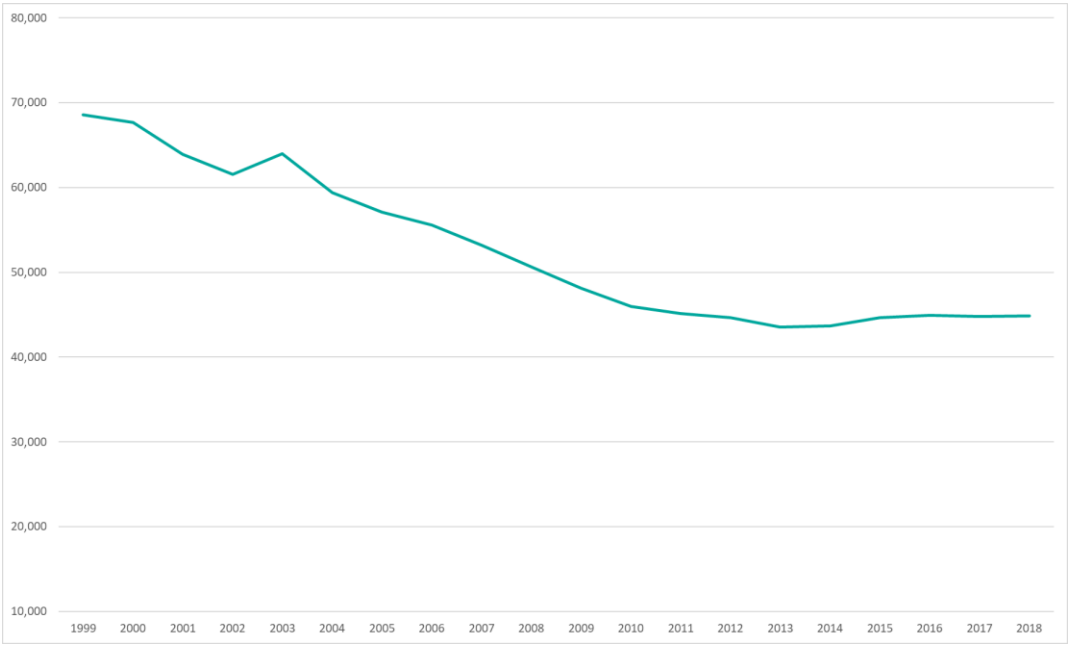
[105] UN Committee on Forests and Forest Industry (2016) *Trends and perspectives for pallets and wooden packaging*, accessed 5 May 2020, https://www.unece.org/fileadmin/DAM/timber/meetings/20161018/E/ECE_TIM_2016_6_FINAL_wooden_packaging.pdf

[106] European Commission (2018) *A European Strategy for Plastics in a Circular Economy*, January 2018, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

[107] Golding, A. (1999) *Reuse of Primary Packaging: Final Report, Part I- Main Report*, accessed 17 April 2020, https://ec.europa.eu/environment/waste/studies/packaging/reuse_main.pdf

[108] Reloop (2020) *The Vanishing Refillable*, accessed 17 April 2020, https://www.reloopplatform.org/beverage-sales-by-container-type-in-austria-16/

Figure 1-35 Sale of Reusable Glass Beverage Containers, 1999-2018 (millions of units sold)

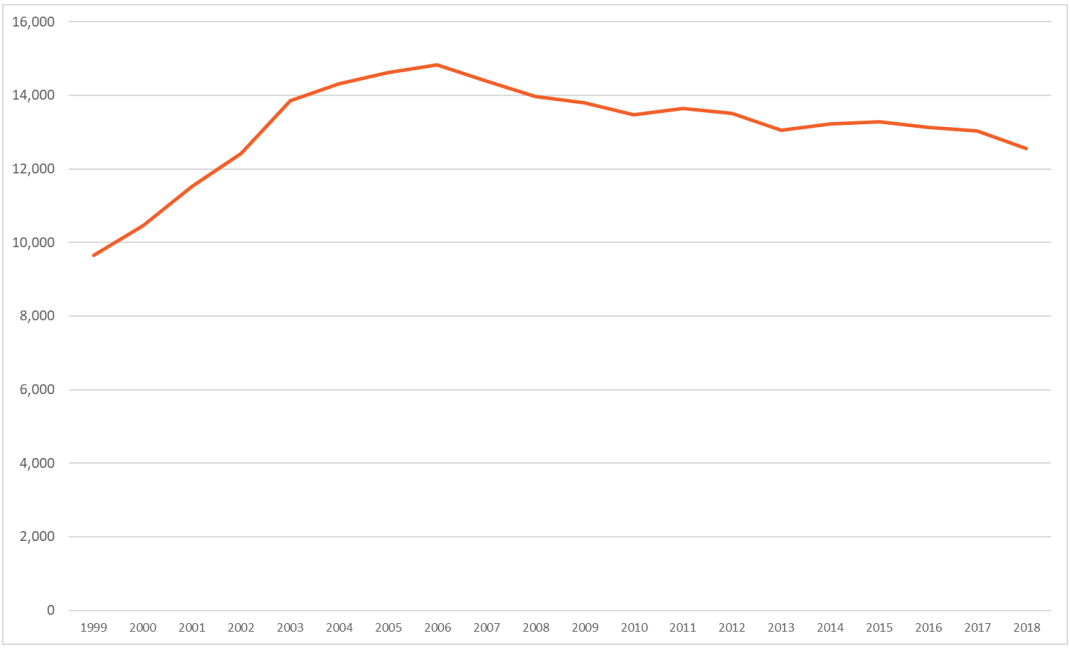


Source: GlobalData (2019)

In comparison, the sale of reusable plastic beverage containers increased between 1999 and 2006, before declining steadily to 2018, as shown in

Figure 1-36.

Figure 1-36 Sale of Reusable Plastic Beverage Containers, 1999-2018 (millions of units sold)



Data does not include Cyprus, Estonia, Greece, Italy, Latvia, Portugal, Romania, Slovenia or UK.

Source: GlobalData (2019)

GlobalData shows that in 1999, North-East Europe had an overall market share of 60% for refillables, falling to 15% in 2018. The most notable reductions in market share in the region were in Sweden, Finland and Norway.[109] As previously discussed, this is related to national policy changes as well as the introduction of deposit refund system (DRS) for single-use beverage containers. Additionally, in 2018, Western Europe had an overall market share of 25% for refillables, with Germany responsible for over half of refillables sold in this region. The lowest market shares are found in France and Ireland. Indeed, reuse systems for beverage bottles in countries such as France, Ireland and the UK have almost disappeared from the market, covering market shares of less than 5%. Table 1-4, shows the Member States, which have experienced the greatest market share decreases over the study period, the highest being Denmark with a 76% reduction in market share of refillables.

Table 1-4 Change in Refillables' Market Share for Beverages, 1999-2018

Country	Market Share refillables 1999	Market Share refillables 2018	Percentage difference (+/-)
Denmark	91%	15%	-76%
Finland	79%	5%	-74%
Norway	77%	8%	-69%
Romania	70%	15%	-55%
Bulgaria	74%	22%	-52%
Hungary	63%	15%	-48%

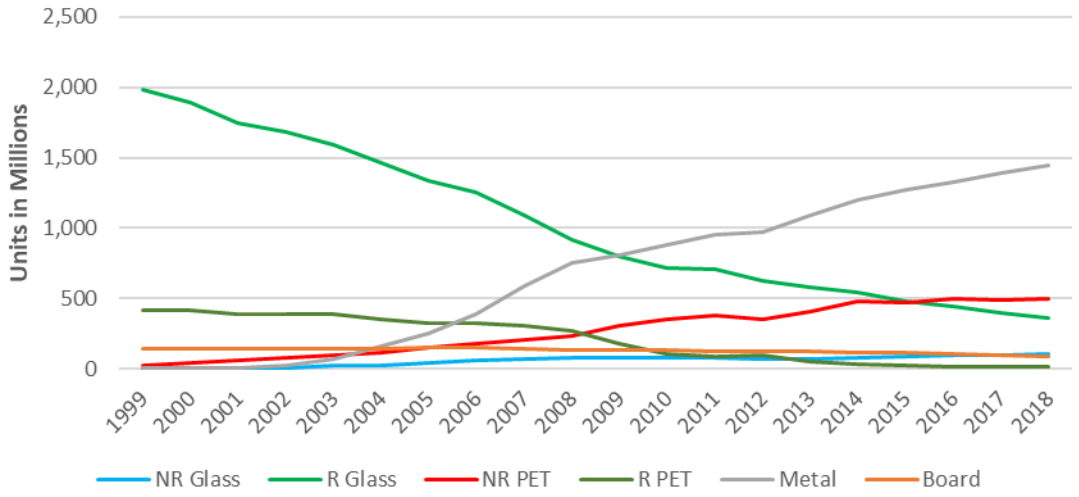
Source: Reloop, GlobalData (2019)

As previously noted, Denmark experienced a combination of policy change and implementation of a DRS for single-use containers. Denmark had a DRS for refillable beverage containers decades before a system was introduced for single-use equivalents. Indeed, in 1997, 260 million glass bottles for wine and spirits were consumed in the country. The return rate for bottles in the voluntary DRS was close to 90%, enabling the majority of bottles to be washed and refilled.[110] In 2002, the Danish government lifted the ban on canned beer and soft drinks and established a recycling scheme in retail shops (DRS for single-use beverage containers). As shown in Figure 1-37, this resulted in the steady increase in the use of beverage cans, which overtook the use of refillable glass bottles in 2009.

[109] Reloop (forthcoming) Global data on refillable beverage containers, 1999-2018.

[110] edie (2002) *Denmark lifts ban on one-use-only drinks cans*, accessed 16 September 2020, https://www.edie.net/news/0/Denmark-lifts-ban-on-one-use-only-drinks-cans/5084/

Figure 1-37 Sales of All Beverages (soft drinks, beer/cider) by Material Type, Denmark, 1999-2018. R = Refillables; NR = Non-Refillables



Source: Reloop, GlobalData 2019

In Finland, glass reuse experienced the greatest decline, from 81% to 6%. This happened during the period in which a Deposit Return System (DRS) for single-use packaging was introduced. In a DRS, the consumer typically pays a deposit at the point of purchase which can be redeemed when they return their used container. DRS are most commonly used for beverage bottles. Evidence from a number of countries across Europe, including Finland, the Netherlands and Germany, indicates that return rates consistently above 90% are possible with a DRS. Principally, a well-designed DRS for single-use beverage bottles is likely to increase the recycling rate by providing a source of separately collected, clean and therefore higher-quality material. Indeed, some Member States have introduced mandatory deposit systems for non-reusable beverage packaging in order to increase the recycling rate of this packaging type.

Alternatively, a DRS for reusable beverage packaging uses a deposit to encourage the return of containers for refilling. Denmark for instance, has two DRSs: one for reusable containers which involves the collection through breweries for refilling, and another for one-way containers which are collected through Dansk Retursystem A/S for recycling.[111]

The product categories for which DRSs have been introduced were traditionally in refillable containers often managed by industry-operated voluntary schemes; predominantly glass bottles for beer, water and soft drinks. In some countries, notably Denmark, Finland and Sweden, the shift to one-way beverage packaging and subsequent implementation of DRSs for one-way containers have together impacted the use of refillables. In Denmark for example, when the DRS for single-use containers was introduced in 2002, the market share of refills fell from 90.3% in 2000 to 16.9% in 2017.[112] This occurred at the same time as the abolition of the country's ban on the use of cans for beverages. This resulted in a shift from previous reuse

[111] European Parliament (2011) *A European Refunding Scheme for Drinks Containers*, accessed 16 September 2020, https://www.europarl.europa.eu/RegData/etudes/note/join/2011/457065/IPOL-AFET_NT(2011)457065_EN.pdf

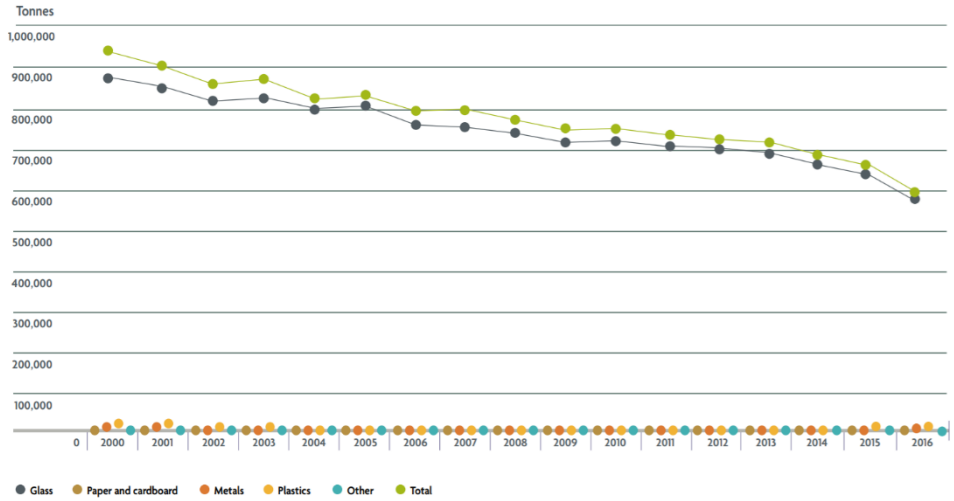
[112] Oakdene Hollins Research & Consulting (2018) *Raise the Glass*, https://feve.org/wp-content/uploads/2018/11/FINAL-Raise-the-Glass-Study-FULL.pdf

systems for beer and soft-drinks in glass bottles, to the greater use of recyclable beverage cans.[113]

What is more, for consumers, the return systems for both refillable and one-way containers appear the same.[114] This is likely to cause issues of confusion for consumers. Indeed, in personal correspondence with DUH, this was highlighted as a current issue.[115] Bar codes on RVMs will prevent refillables entering the recycling system, although this may happen manually in some systems in small amounts. Ultimately, whilst there is correlation between the introduction of DRSs for one-way containers and the decline in use of reusables, wider policy making and shift in materials play a more significant role.

With regards to household packaging, the figure below shows the reduction in reusable household packaging in Belgium from 2000-2016, as reported by Fost Plus members.

Figure 1-38 Overall trend in reusable household beverage packaging reported by Fost Plus (tonnes)



Source: Interregional Packaging Commission, Activity Report 2017, Brussels.

The decline in reusable beverage packaging has occurred at uneven rates across Member States and different sectors. Indeed, reuse occurs predominantly in hospitality: hotels, restaurants and catering (HORECA), a sector which is particularly strong in southern European countries. The drivers behind this trend are discussed further in the following section (1.2.2).

In 2018, Spain and Portugal for instance each had market shares of 20% for refillable beverage bottles, with reuse especially high in the beer industry. [116] In Portugal, although having fallen from 79% in 1999, the refillable glass bottle still held a 45% share of the Portuguese beer/cider market in 2018, as shown in

[113] Foodnavigator (2008) *End to 20 year Danish can ban*, accessed 15 September 2020, https://www.foodnavigator.com/Article/2002/01/15/End-to-20-year-Danish-can-ban

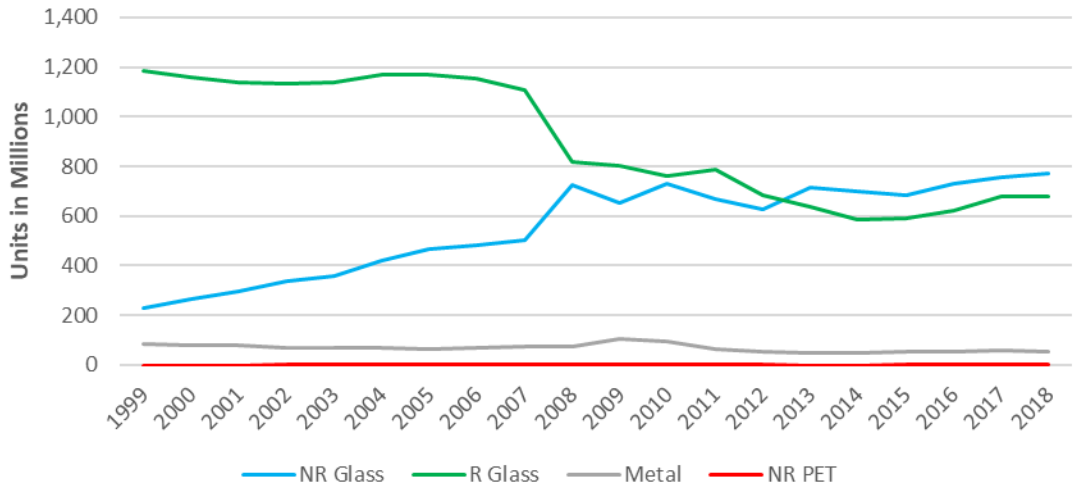
[114] Oakdene Hollins Research & Consulting (2018) *Raise the Glass*, https://feve.org/wp-content/uploads/2018/11/FINAL-Raise-the-Glass-Study-FULL.pdf

[115] Personal communication with DUH (2020)

[116] Reloop (forthcoming) Global data on refillable beverage containers, 1999-2018.

Figure 1-39, eclipsed by non-refillables in 2013. Similarly in Spain, the refillable held 31% of the Spanish beer/cider market in 2018, having decreased from 49% in 1999.

Figure 1-39 Sales of Beer/Cider by Material, Portugal, 1999-2018. R = Refillables; NR = Non-Refillables



Source: Reloop, GlobalData, 2019

While the dominant trend for the reuse of consumer packaging is decline, there are some recent indications of areas where there may be upward trends. The number of packaging free shops for instance has increased across Europe, signalling a growing demand for refillables. Evidence from a survey of packaging free shops in Europe shows that from a very low baseline, the sector has experienced strong growth over the past ten years, a trend which is forecast to continue. The study showed that the most common product types sold are food and drink products, particularly alcoholic beverages, eggs and spices. For non-consumerables, cleaning products, cosmetic products and zero waste accessories were the most commonly sold. It should also be noted, that 74% of the shops which responded to the survey were located in city centres with far fewer located in city peripheries and countryside locations.[117]

1.2.1.3 Consequences

This section discusses the impacts of the decline in reusable packaging and the range of stakeholders affected by this trend.

Firstly, the decline in reuse has contributed to the increase in overall packaging waste generation. With the recent shift to convenience and on-the-go consumption, consumers are likely to increase their generation of single-use packaging waste. For instance, in Germany, disposable tableware and on-the-go packaging contributed to a 44% increase in waste generation between 1994 and 2017. Specifically, the amount of waste generated by disposable cups/mugs for drinks (only which a part of is packaging) increased by 102%, for disposable plates, boxes and bowls for food the increase was 173% and waste generated by disposable

117 Zero Waste Europe, Eunomia Research & Consulting, and Reseau Vrac (2020) *Packaging free shops in Europe an initial report*, accessed 7 July 2020, https://zerowasteeurope.eu/wp-content/uploads/2020/06/2020_06_30_zwe_pfs_executive_summary.pdf

cutlery increased by 114%.[118] As a result, local authorities, municipalities and waste companies will also be collecting, processing and disposing of more single-use packaging waste. This may increase the cost of waste management.

The increased incidence of litter from on-the-go consumption, particularly of single-use plastic packaging, has been shown to have severe consequences on ecosystems, especially on marine life.[119] Once such litter enters the environment, it can move through a number of pathways, including sewerage systems and rivers, often reaching the ocean where it impacts the health of marine flora and fauna. Notably, the 2019 SUP Directive seeks to address the issue of single-use plastic marine litter.

On the contrary, reuse ensures that a material's value is maintained and used in the economy for as long as possible and that less waste is generated on the whole. For instance, in some countries, refillable glass bottles are reused up to 50 times, whilst reusable plastic pallets and crates with a life-span of 10-15 years can be used up to 200 times.[120] [121] This removes the need to manufacture more bottles and avoids the environmental impacts associated with bottle production and waste management. Crucially, the decline in reuse presents a challenge to the principles of the EU's Circular Economy Action Plan and the overarching objective to increase circularity across the EU.

Secondly, the reduction in reusable packaging might not align with the European Green Deal. Launched in 2020, the Deal presents a roadmap to transition to climate neutrality in Europe by 2050. The Deal seeks to foster a transition away from carbon-intensive processes, towards climate-neutral and climate-resilient activities, and also proposes to set the framework for removing fossil fuel subsidies.[122] Counter to these aims, the heightened demand for single-use plastic packaging depends to some degree upon the extraction and use of fossil fuels as raw materials in production, although this can be countered by the use of recycled content in packaging, which also results in a less carbon intensive packaging. With regards to aluminium beverage cans for instance, evidence suggests that the carbon intensity can be as low as 0.5 tonnes CO_2 equivalent per tonne of recycled aluminium compared to up to 20 tonnes CO_2 equivalent per tonne of aluminium from coal-based production.[123]

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[118] NABU (2018) *Einweggeschirr und To-Go-Verpackungen Abfallaufkommen in Deutschland 1994 bis 2017*, accessed 5 May 2020, https://www.nabu.de/umwelt-und-ressourcen/abfall-und-recycling/25294.html

[119] ICF and Eunomia Research & Consulting (2018) *Plastics: Reuse, recycling and marine litter – Impact assessment of measures to reduce litter from single use plastics*, Report for DG Environment, 2018, http://ec.europa.eu/environment/waste/pdf/Study_sups.pdf

[120] Reloop (2017) *Policy instruments to promote refillable beverage containers*, accessed 25 June 2020, https://www.reloopplatform.org/wp-content/uploads/2017/10/Refillables-policy-Final-Fact-sheet-June30.pdf

[121] Svenska Returnsystem *Eurocrate: A full-scale demonstration of reusable crates and pallets*, accessed 25 June 2020, https://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE00_ENV_S_000867_LAYMAN.pdf

[122] European Commission (2019) *The European Green Deal Communication*, accessed 30 June 2020, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

[123] European Aluminium (2019) *Circular Economy Action Plan*, accessed 8 September 2020, https://european-aluminium.eu/media/2903/european-aluminium-circular-aluminium-action-plan.pdf

The environmental impacts of reusable beverage packaging systems vary according to a number of parameters, including: [124,125,126]

- Distance between filler and retail;
- Number of reuse/refill cycles;
- Characteristics of reusable items: pool size of reusables, item weights and related impact on vehicle utilisation; and
- Impacts associated with washing and repair of reusables (energy and water).

Life Cycle Analysis (LCA) studies generally agree that refilling bottles can decrease the environmental impact of beverage packaging, although this is very much contingent on the type of material, the volume of the bottle, length of journey and number of reuses.[127] [128] [129]

Studies of existing systems have also indicated emissions savings. For instance, Svenska Returnsystem operates a pooling system for RTP in Sweden. In 2019, the system transported more than 8 million reusable plastic pallets and 150 million standardised reusable crates between the majority manufacturers and wholesale/retailers in the Swedish food industry. The reusable system has reduced product damage and eliminated 50,000 tonnes of waste annually. Indeed, since the programme inception in 2001, reusable crates have replaced over 1.3 billion pieces of disposable packaging. Around $22 million is saved annually in retail store labour and in 2016, a life-cycle analysis showed that reusable crates reduced CO_2e emissions by 78% compared with the equivalent disposable packaging.[130] [131] Thus, under certain conditions, reusable packaging systems have the potential to reduce greenhouse gas emissions. There are a number of upcoming studies which will examine the carbon impact of single-use compared to reusable packaging in more detail[132].

Producers, distributers and retailers are impacted in different ways by a decline in packaging reuse. On the one hand, there can be labour savings for producers. For instance, Svenska

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[124] WRAP (2010) *Single Trip or Reusable Packaging - Considering the Right Choice for the Environment*, 2010, http://www.wrap.org.uk/sites/files/wrap/FINAL%20Reusable%20Packaging%20Factors%20Report.pdf

[125] Owen, T.H., and Boyd, K. (2013) Beverage Container Review

[126] Mata, T.M., and Costa, C.A. (2001) Life cycle assessment of different reuse percentages for glass beer bottles, *The International Journal of Life Cycle Assessment*, Vol.6, No.5, pp.307–319

[127] Owen, T.H., and Boyd, K. (2013) Beverage Container Review

[128] WRAP (2010) *Single Trip or Reusable Packaging - Considering the Right Choice for the Environment*, 2010, http://www.wrap.org.uk/sites/files/wrap/FINAL%20Reusable%20Packaging%20Factors%20Report.pdf

[129] Simon, B., Amor, M.B., and Földényi, R. (2016) Life cycle impact assessment of beverage packaging systems: focus on the collection of post-consumer bottles, *Journal of Cleaner Production*, Vol.112, pp.238–248

[130] Svenska Retursystem (2020) *Svenska Retursystem*, accessed 14 May 2020, https://www.retursystem.se/en/

[131] Reloop (2017) *Making the Switch: The Business Case for Reusable Packaging*, accessed 14 May 2020, https://www.reloopplatform.org/wp-content/uploads/2017/10/BusinessCaseReusablePackaging-MAY-181.pdf

[132] Zero Waste Europe and Reloop (2020) *Re-usable vs single-use packaging: A review of environmental impacts, https://zerowasteeurope.eu/wp-content/uploads/2020/12/zwe_reloop_report_reusable-vs-single-use-packaging-a-review-of-environmental-impact_en.pdf.pdf_v2.pdf*

Returnsystem records annual savings in retail store labour of around $22 million.[133] Additionally, when PepsiCo switched from wooden pallets to leasing reusable ones in Oakland, California, $20,000/year were saved from the reduced labour needed to deal with defunct/damaged pellets. Similarly, Full Belly Farm in California switched from disposable cardboard boxes to reusable plastic totes, resulting in net labour savings as washing the totes took less time than assembling and lining cardboard boxes.[134]

On the other hand, the employment created by upscaling reusable packaging systems could represent significant economic and social benefits. For instance, in 1998 in Germany, of the 161,000 jobs which were directly connected to the production, filling, distribution and retailing of beverage packaging, the market share of reuse packaging was around 73%.[135]

For retailers, reuse can present dis-economies of scale, a typical consequence of which is increased prices, both for the retailer and the consumer. In the UK, for instance, 94% of UK milk was delivered in glass bottles historically, but this had dropped to 3% by 2016.[136] [137] [138] Compared to £1.10 for a four-pint plastic bottle of semi-skimmed in a supermarket, the equivalent can cost £2.27 to be delivered in glass. Refill systems can also result in the loss of retail space due to the storage required for both full and empty containers, as well as additional handling costs associated with returned containers. In order to manage such costs however, some refill systems apply a handling fee as part of deposits on containers, such as in Finland.[139] The fee is paid to retailers to cover some or all of the costs of collection, sorting and handling.

1.2.1.4 Problem Summary

Data on packaging reuse across Europe is limited, but overall country specific trends indicate a reduction in reusable primary and tertiary packaging over the past two decades, in particular for beverages with some exceptions in the hospitality sector. Notwithstanding, there have been recent signals, albeit on a small scale, that this decline may be slowing in some areas and for some consumer packaging types, through packaging free shops. The picture is more mixed with regards to transport packaging, showing overall stability with variation in some specific products.

As products, materials and consumption have evolved, there has been a significant rise in the use of one-way packaging, especially single-use plastic primary packaging. This has strongly influenced a shift from reusable to more convenient, single-use packaging; a trend which looks

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[133] Reloop (2017) *Making the Switch: The Business Case for Reusable Packaging*, accessed 14 May 2020, https://www.reloopplatform.org/wp-content/uploads/2017/10/BusinessCaseReusablePackaging-MAY-181.pdf

[134] Ibid.

[135] Golding, A. (1999) *Reuse of Primary Packaging: Final Report, Part I- Main Report*, accessed 17 April 2020, https://ec.europa.eu/environment/waste/studies/packaging/reuse_main.pdf

[136] Lee, D.P., Vaughan, P., Bartlett, C., Hollins, O., Bhamra, T., and Trimingham, R. (2008) Refillable glass beverage container systems in the UK

[137] Dairy UK (2018) *The UK Dairy industry*, accessed 4 May 2020, https://www.dairyuk.org/the-uk-dairy-industry/

[138] Turns, A. (2018) *Best in glass – can the return of the milkround help squash our plastic problem?*, accessed 25 June 2020, https://www.theguardian.com/lifeandstyle/2018/feb/07/return-milkround-plastic-problem-glass-bottle-deliveries

[139] Crittenden, G. (2003) *Costs and Benefits of Established Refilling Systems*, accessed 14 May 2020, https://www.solidwastemag.com/feature/costs-and-benefits-of-established-refilling-systems/

set to continue despite the introduction of the SUP Directive, which requires Member States to implement certain consumption reduction measures for plastic packaging – i.e. a switch to non-plastic single use items is likely rather than a wholesale shift to reusable solutions. This presents a critical problem if the resource efficiency principles and greenhouse gas reduction targets of the EU Circular Economy Action Plan and European Green Deal are to be met.

1.2.2 Problem Drivers

There are a number of social, political and economic factors, which have driven the decline in reusable consumer packaging. These factors interlink and are connected by deeper-seated changes across different aspects of society. This section first addresses the market drivers of the decline, before examining the systemic and regulatory factors, which have contributed to these changes.

1.2.2.1 Market Drivers

Over the past decades retail in most Member States has shifted from many small stores, to fewer, larger stores. Self-service supermarkets have increased market share, whilst home delivery of some products in reusable packaging, such as milk in glass bottles, has declined. For retailers, barriers to reuse include: the retail space required and the capital costs of facilities for cleaning, repair and storage, establishing management and collection system and procuring dispensers or refillable containers.

Meanwhile, over the past 25 years the single market, combined with globalisation, has driven increasingly diffuse supply chains both across Europe and the globe. Coupled with cheaper transport, the costs of distributing single-use primary packaging between countries have reduced. This is compounded by the cost of collecting, washing and refilling reusable packaging. Moreover, favourable economies of scale have seen consolidation as industry can lower average costs by increasing in size. Similar economic incentives have driven industries to grow distribution networks, particularly in international trade.

In an open EU market, where packaged products are transported between countries, the return of empty reusable containers is a significant challenge. Moreover, with the growth in number of products, less standardised packaging and the emergence of large multinational corporations with centralised facilities, the logistics (such as sorting a wide range of brands) and costs of running refillable schemes have increased compared to the low costs of single-use packaging materials.

Some retailers and brand owners also oppose reusables on commercial grounds. In the fast-moving soft drinks sector for instance, one-way packaging can provide greater flexibility for packaging design. Indeed, many companies have developed bespoke bottles as additional means of brand differentiation. With greater emphasis on product image, some brand owners are concerned that scuffing and wear on bottles as a result of re-use could damage brand image.[140] [141]

Demand for cost-savings has also been driven by stakeholders throughout the supply chain, including distributers, retailers and consumers. Compared to those stakeholders placing one-

[140] Lee, D.P., Vaughan, P., Bartlett, C., Hollins, O., Bhamra, T., and Trimingham, R. (2008) Refillable glass beverage container systems in the UK

[141] Smithers (2018) *4 Trends That Will Change Packaging Industry by 2028*, accessed 24 June 2020, https://www.smithers.com/en-gb/resources/2019/feb/future-packaging-trends-2018-to-2028

way packaging on the market, who typically only pay for a share of end-of-life management cost, those who place refillable containers on the market incur the full costs of refill and collection. This imbalance creates an economic incentive to use single-use packaging rather than reusables. Although, this could also be rectified somewhat by changes to EPR schemes, which are now required to cover the full net costs of packaging recycling under the 2018 revised WFD (and littering, under Directive 2019/904 on the reduction of the impact of certain plastic products on the environment), but would depend on the magnitude of the fee differential required.

Demand for cost-savings have also driven a shift by some producers to replace glass containers with more lightweight packaging, as examined in Section 1.1.1. Lighter packaging made from more fragile materials can compromise the durability of the packaging and thus reduce its reusability. There is anecdotal evidence from DRS operators, for instance, that returnable glass bottles have become more fragile over time. With regards to RTP, a trend towards light-weighting has further contributed to the decline in reusability. As shown in Figure 1-40, the average weight of steel drums in Europe for example, has reduced by 9.6% from 18.3kg to 16.73kg (1992-2019) and the thickness has also reduced from 1.3mm to 1mm.[142] Light-weighting has primarily been driven by cost savings associated with reduced raw material requirement, as well as cheaper transport costs due to lighter products. However, light-weight transport packaging raises challenges for reconditioners as the packaging is more likely to be damaged during use.[143]

Figure 1-40 SEFA Average Steel Drum Weight, 1992-2018 (kg)

Source: European Association of Steel Drum Manufacturers (SEFA), 2019

Yet, return systems can also achieve economies of scale which make reuse cheaper than producing new packaging. This can be achieved through large-scale closed-loop or pool systems in which reusable packaging is standardised and leased to companies by a third party which manages the collection, washing and repair.

The Euro Pool Group, for instance, operates a pooling system for trays and returnable transport items across 27 countries in Europe. The Euro Pool System (EPS) is based on the rental and return of trays for fresh and packaged food. The lifespan of the trays is at least 7 years. EPS

[142] SEFA (2019) SEFA at a Glance: EIPA 12th Annual Meeting 2019-06-14.

[143] Personal communication with Serred.

manages the traceability, collection, sorting, washing and repair of the trays in 73 service centres in 18 countries. For example, in 2014, EPS established the Tesco Recycling and Service Units in the Czech Republic. Reusable trays for fresh food products were introduced, increasing from 14 million trays in 2014 to over 40 million in 2018.[144] In 2019, the EPS achieved a total of over 1.1 billion tray rotations across Europe.[145] Information sharing throughout the supply chain is a key component of the logistic service and it has resulted in increased efficiency and cost savings for retail partners.[146]

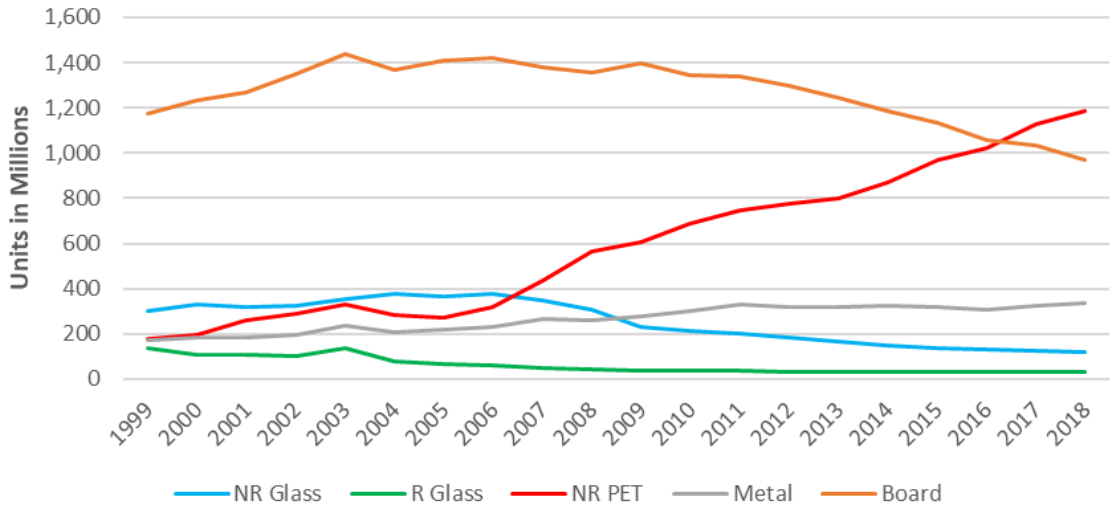
In conclusion, the evolving retail landscape and growing international distribution networks have exerted a downward pressure on reuse.

1.2.2.2 Consumption Drivers

Historically, the reuse of packaging was more commonplace. However, the rise in single-use packaging especially single-use plastic, such as PET for beverage bottles, has been ubiquitous and can be largely attributed to the low cost of plastic.

Figure 1-41 shows the decline in both glass and board beverage packaging compared to the steep increase in use of PET in France. Indeed, the market share of refillables in the juice and still drinks category fell from 7% in 1999 to 1% in 2018.

Figure 1-41 Sales of Juice/Nectar/Still Drinks by Material, France, 1999-2018. R = Refillables; NR = Non-Refillables



Source: Reloop, GlobalData (2019)

A key driver of this trend has been the upsurge in on-the-go/convenience consumption of items such as food, drinks, as well as an increase in online and food takeaway markets. As more single-use plastic packaging has been placed on the market, there has been a shift towards the

[144] Euro Pool System (2019) *Case Study Tesco*, accessed 30 June 2020, https://cdn2.hubspot.net/hubfs/5799001/Offers/Case-Study-Tesco.pdf?hsCtaTracking=e78961ca-d472-4ad8-9b20-8269c1ec3f3e%7C98ff85c4-a913-495e-823f-157332d28f74

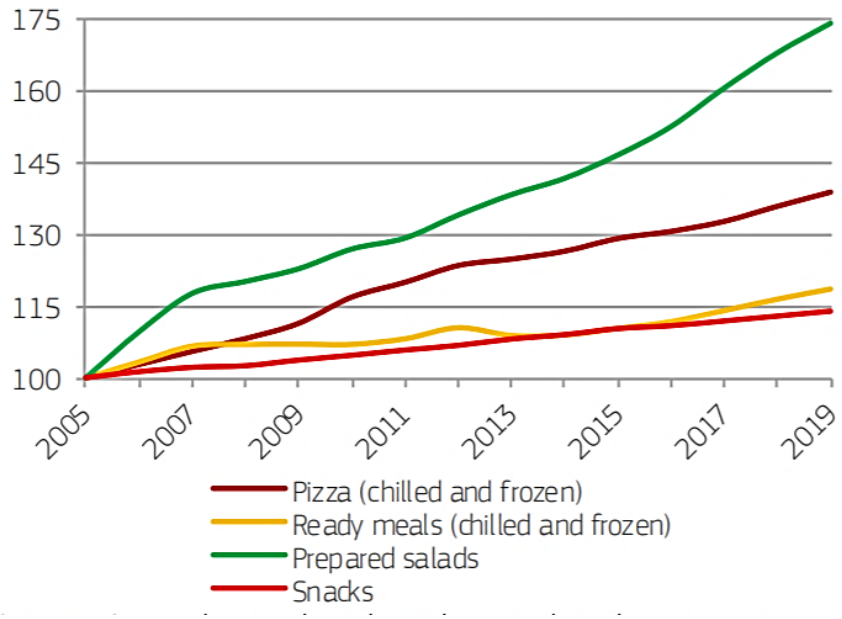
[145] European Commission (2020) *EU Agricultural Outlook For Markets and Income 2019 - 2030*, accessed 30 June 2020, https://www.europoolsystem.com/about-us/euro-pool-system

[146] Euro Pool Group (2018) *Tother Towards a Circular Economy: Sustainability Report 2018*, accessed 30 June 2020, https://www.europoolgroup.com/assets/files/EPG%20Sustainability%20Report%202018.pdf

consumption of such packaging, which is more convenient and portable, in particular flexible plastics.[147] As evidenced in Section 1.1.2, the amount of flexible packaging placed on the market has grown significantly in recent years.

Indeed, a 2018 study by Nielsen, reports that 27% of consumers want products which make their lives easier, and 26% want them to be more convenient to use.[148] As shown in Figure 1-42, since 2005, there has been a significant increase in the sales of on-the-go food products such as ready meals, prepared salads and snacks.[149] With regards to snacks, there has been significant growth in the snack bar market, which reported revenues of over €3bn in 2016. Growth is set to continue at a Compound Annual Growth Rate (CAGR) of 4.9% between 2020 and 2025.[150]

Figure 1-42 Retail Volumes of Selected Products in Top 10 EU Markets (2005=100)



Source: DG Agriculture and Rural Development, based on Eurobaromitor

In Germany for example, on-the-go/out-of-home consumption has increased significantly: sales in self-service restaurants grew by 110% between 2005 and 2015, while sales from snack bars

[147] Smithers (2018) *4 Trends That Will Change Packaging Industry by 2028*, accessed 24 June 2020, https://www.smithers.com/en-gb/resources/2019/feb/future-packaging-trends-2018-to-2028

[148] Nielsen (2018) *Six Factors Driving Consumers' Quest for Convenience*, accessed 24 June 2020, https://www.nielsen.com/eu/en/insights/article/2018/six-factors-driving-consumers-quest-for-convenience

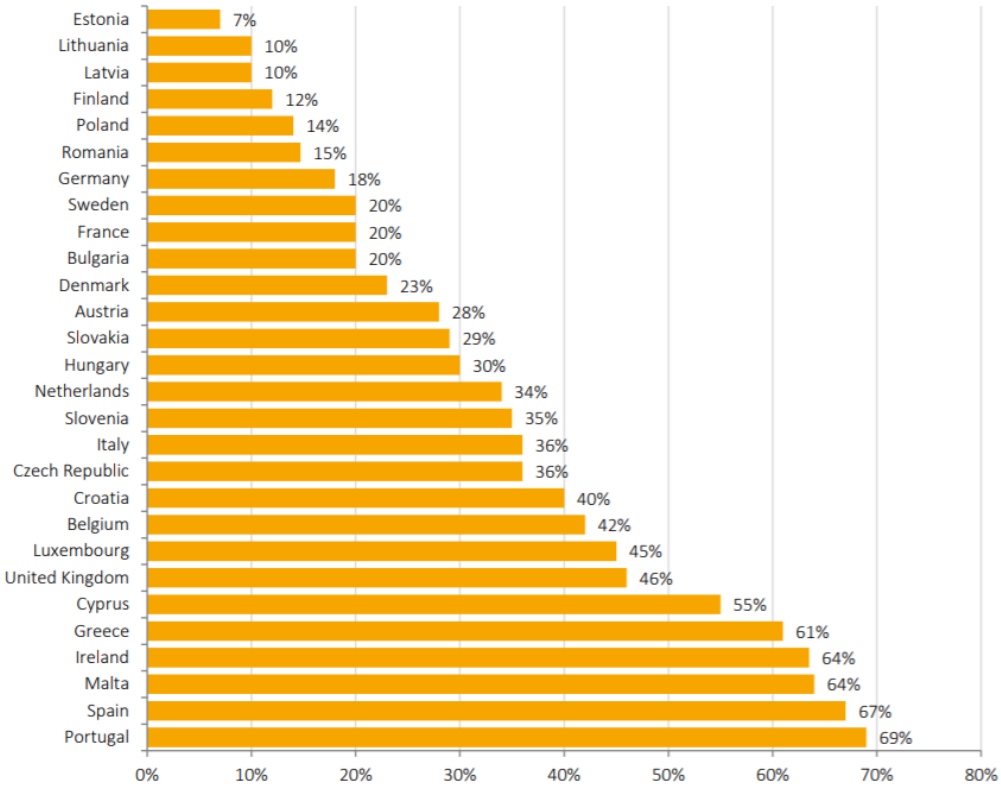
[149] European Union (2019) *EU Agricultural Outlook: for Markets and Income 2019-2030*, accessed 24 June 2020, https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agricultural-outlook-2019-report_en.pdf

[150] Mordor Intelligence (2020) *Europe Snack Bar Market- Growth, Trend and Forecasts (2020-2025)*, accessed 24 June 2020, https://www.mordorintelligence.com/industry-reports/europe-snack-bars-market-industry

and cafés nearly tripled.[151] Also, between 2009 and 2015, sales of on-the-go, disposable tableware and other packaging increased by around 16%.[152]

As previously noted, these consumption trends have been experienced to varying degrees and at different rates across Europe and between sectors. The slower decline in refillables in the beer sectors of certain countries, such as Germany and eastern and southern European countries, is partly attributable to the prevalence of local breweries as opposed to large scale national production, as well as the HORECA sector. Portugal, Spain and Malta for instance have the largest shares by volume (over 60%) of on-trade beer sales (beer sold in bars, restaurants, cafes etc), as shown in Figure 1-43.[153] The lowest are in the Baltic states. Higher on-trade consumption in certain countries reflects cultural traditions and deeper social norms, as well as the size of the tourism sector.

Figure 1-43 Beer consumption in hectolitres, on-trade share by country (2018)



Source: Europe Economics (2020)

However, between 2010 and 2018, there has been a steady shift in Europe from the on-trade (bars, restaurants, cafes etc) to the off-trade market (retail outlets including supermarkets). In

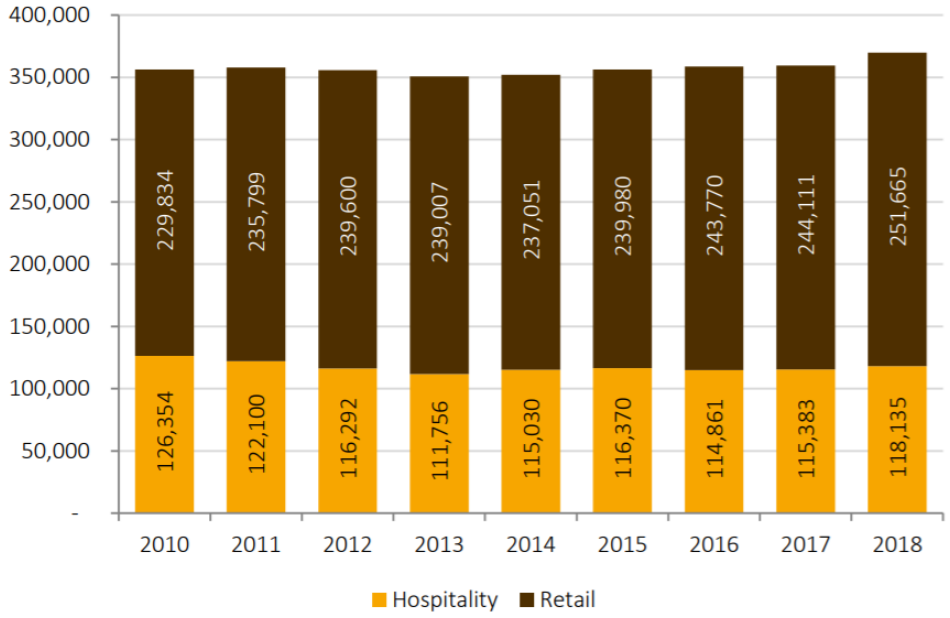
[151] NABU (2018) *Einweggeschirr und To-Go-Verpackungen Abfallaufkommen in Deutschland 1994 bis 2017*, accessed 5 May 2020, https://www.nabu.de/umwelt-und-ressourcen/abfall-und-recycling/25294.html

[152] Gesellschaft für Verpackungsmarktforschung (2018) Abfallaufkommen durch Einweggeschirr und andere Verpackungen für den Sofortverzehr, Mainz, June 2018

[153] Europe Economics (2020) *Contribution made by beer to the European economy: EU Report, March 2020*, accessed 25 June 2020, https://brewersofeurope.org/uploads/mycms-files/documents/publications/2020/contribution-made-by-beer-to-EU-economy-2020.pdf

2018, on-trade sales of beer was 34% of the market compared to 66% off-trade.[154] The consumption of beer in the hospitality sector decreased from 35% to 32% over the same period, as shown in Figure 1-44. However, total beer consumption in Europe has increased: from 356 million hectolitres in 2012 to 370 million hectolitres in 2018.[155]

Figure 1-44 Beer consumption in hectolitres, on- and off-trade share, 2010-2018



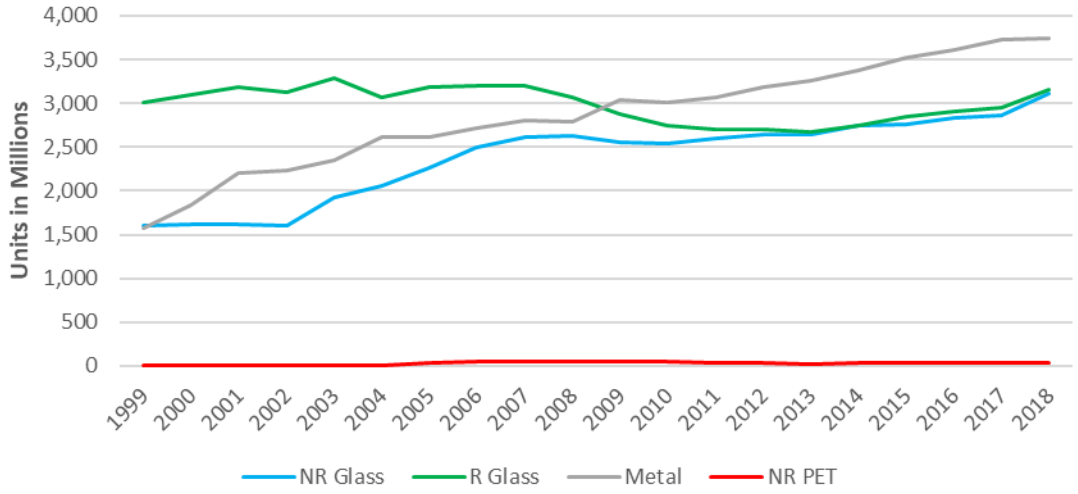
Source: Europe Economics (2020)

The rise in off-trade consumption is in part due to a shift in preference of consumers for lower-priced products in retail/off-trade coupled with a rise in e-commerce which has facilitated home consumption. This shift was particularly noticeable during the economic downturn of 2007/8. As shown for Spain in Figure 1-45, in 2007/8 refillable sales started to fall. The financial crisis is a likely factor in the consumption of cheaper beer at home or other private spaces, rather than at bars and restaurants. As the economy of Spain has recovered, sales of refillables have improved again.

[154] The Brewers of Europe (2019) *Beer Statistics - Statistics for Europe*, accessed 16 September 2020, https://brewersofeurope.org/site/countries/key-facts-figures.php

[155] Ibid.

Figure 1-45 Sales of beer/cider by Material, Spain, 1999-2018



Source: Reloop, GlobalData (2019)

Although the overall direction for reusable packaging has been decline, there is some indication of a recent buck in this trend, albeit on a small scale. There has been an EU-wide rise in public awareness regarding plastic pollution and climate change. Indeed, Eurobarometer data from 2017 noted that 87% of citizens in the EU are worried about the impact of plastic production on the environment and 34% of Europeans avoided single-use plastic goods (other than plastic bags) or bought reusable plastic products.[156] Unilever further notes that in the UK, 62% of people say reuse is more important to them than recycling and 83% of people want access to more refillable products.[157] Notably in Germany, the decline in the share of reusables slowed from 2019-2020. In the bottled water market, for example, the share of glass reusable bottles rose by just over 5% in 2019, with SUP water bottles losing 10-11% market share. This reversal has been attributed to a rising anti-plastic consumer trend, combined with a cooler summer. The trend continued into the first quarter of 2020.[158]

Furthermore, package-free shops, reuse start-ups, trials and aisles in supermarkets have increased across Europe, not only in the food and beverage industry but also for cosmetics and household cleaning products. Recent reuse schemes and initiatives include:

- Coca-Cola's shift to returnable one litre glass bottles in retail stores in Germany;
- Unilever's 'Cif eco-refill' which enables customers to reuse Cif spray bottles;
- RePack - a reusable packaging service for e-commerce in Europe and North America;
- Loop - piloted in the US, France and the UK. Loop is a physical and online store selling a range of products from well-known brands in reusable packaging. The packaging includes a deposit to incentivise return. Loop manages the reverse logistics, cleaning and redistribution of products;

[156] European Commission (2017) Special Eurobarometer 468 - October 2017 "Attitudes of European citizens towards the environment"

[157] Unilever (2019) Cif innovative at-home refill will remove 1.5 million plastic bottles from UK supermarkets, accessed 17 April 2020, https://www.unilever.com/news/press-releases/2019/cif-innovative-at-home-refill-will-remove-1-5-million-plastic-bottles-from-uk-supermarkets.html

[158] Personal communication with the Reusable Working Group, Mehrweg (2020).

- ECOBOX- a reusable food container scheme in Luxembourg. Participating companies are identified through a logo and customers can take meals away in an ECOBOX for a deposit of €5. Consumers can then return the box to receive the deposit or exchange for another, professionally washed box, to take away another meal.
- ReCircle - an on-the-go DRS with 27 partner restaurants in Germany. Restaurants pay a €135 annual subscription, with 20 containers included. Customers identify participating restaurants using the ReCircle website, and pay a €10 deposit for a container. The deposit is refunded on return to the restaurant where it is washed.[159]
- MIWA - a pilot initiative in Prague in 2019. MIWA provides standard reusable capsules to producers who fill them and send them to retailers to install. Empty capsules are returned to MIWA for cleaning and redistribution.

One other challenge of potential relevance, is consumers mistakenly putting reusable beverage packaging into the recycling system along with single-use beverage packaging.[160] Such behaviour reduces the efficiency of the reuse system, which depends upon the packaging being returned in the near future for re-sale. Efforts are being made to combat this through adequate product labelling and awareness raising with regards to the existence of deposit return schemes. For instance, in Germany, returnable packaging can be identified by the word 'Mehrweg' on the label, as well as return symbols such as the Blue Angel. Single-use beverage bottles subject to a deposit have a Deutsche Pfandsystem GmbH (DPG) label to signify inclusion in the nationwide return system for one-way beverage packaging.[161]

1.2.2.3 Regulatory drivers

Certain aspects, or absences, of EU and national regulation have challenged packaging reuse.

Notably: food and drink hygiene regulations, discrepancies in the application and interpretation of legal definitions of waste, reuse and preparing for reuse (as set out in the Waste Framework Directive) across Member States and regions, and the lack of a mandatory reuse target, reporting obligation and calculation methodology at the EU level. This section outlines the key national and EU level regulations and strategies, which have shaped the market and consumer behaviour, and their likely impact over the future decade.

Firstly, the reuse of packaging has been both encouraged and stymied by specific packaging policies. Finland, for instance, has experienced a sharp decline in market share of refillable beverage containers. In 2000, 98% of soft drinks, and 73% of the beer consumed, was purchased in refillable containers. Such high rates were largely attributed to the success of Finland's packaging tax, established in 1994. Participants in a registered DRS had a low tax rate for one-way containers, while refillable bottles in a DRS were exempt from the tax entirely.

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[159] Bolger, M., Miller, S., and Copello, L. (2019) *Reusable solutions: How governments can help stop single-use plastic pollution*, Report for Oxford, UK, 2019, https://refill.org.uk/wp-content/uploads/2019/11/bffp_rpa_reusable_solutions_report.pdf

[160] Personal communication with DUH and the Reusable Working Group, Mehrweg (2020).

[161] Deutsche Pfandsystem GmbH *Labelling*, accessed 16 September 2020, https://dpg-pfandsystem.de/index.php/de/die-funktionsweise-des-dpg-einwegpfandsystem/getraenkehersteller-und-importeure/kennzeichnung.html

Since 2008, however, one-way containers are also exempt from the tax if in a DRS.[162] Consequently, in just one year, one-way PET containers came to dominate the carbonates and water markets as refillable PET bottles disappeared.

In comparison, the decline has been less severe in Member States with specific regulatory measures to encourage reusable packaging. For instance, since 1993, Germany has had a reusable beverage packaging quota which requires industry to maintain a minimum percentage of refillable containers for beer, soft drinks, fruit juice, wine and mineral water.[163] However, the quota has reduced, and currently stands at 43% compared to 72% when first implemented.

Secondly, food and drink health and safety rules may have influenced packaging reuse to some extent. Not only may food retailers and consumers be concerned about the spread of bacteria and viruses if food or drink passes through contaminated containers or dispensing units, but single-use packaging may be preferred by retailers in particular when seeking to comply with health and safety legislation. Regulation EC 852/2004 on the Hygiene of Foodstuffs sets out obligations for food business operators. This includes implementation of core hygiene procedures at all stages of production, processing and distribution, and requirements with regards to the safe production, cleaning and distribution of reusable packaging. Chapter V on equipment requirements notes that:

> *1. All articles, fittings and equipment with which food comes into contact are to:*
>
> *(a) be effectively cleaned and, where necessary, disinfected. Cleaning and disinfection are to take place at a frequency sufficient to avoid any risk of contamination;*
>
> *(b) be so constructed, be of such materials and be kept in such good order, repair and condition as to minimise any risk of contamination;*
>
> *(c) with the exception of non-returnable containers and packaging, be so constructed, be of such materials and be kept in such good order, repair and condition as to enable them to be kept clean and, where necessary, to be disinfected; and*
>
> *(d) be installed in such a manner as to allow adequate cleaning of the equipment and the surrounding area.*[164]

Although there is no explicit mention of unpacked food in this Regulation, this passage would apply to the use of reusable/refill containers in packaging free shops. What is more, the term 'bulk sales', i.e. goods sold without being pre-packaged (except for traditional "over the counter" businesses: delicatessen, caterer, bakery, fishmonger's, etc.) via self-service, is not

[162] DG Environment (2017) *Capacity building, programmatic development and communication in the field of environmental taxation and budgetary reform*, accessed 14 May 2020, https://ieep.eu/uploads/articles/attachments/de8980ef-e9cc-49f2-b66e-ac7a71be9e15/ETR%20and%20Civil%20Society%20Final%20Report%20191217%20FINAL.pdf?v=63680917736

[163] Container Recycling Institute (2020) *Germany*, accessed 5 May 2020, http://www.bottlebill.org/index.php/current-and-proposed-laws/worldwide/germany

[164] European Commission (2004) *Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs*, accessed 15 May 2020, http://data.europa.eu/eli/reg/2004/852/oj/eng

subject to any legal definition in EU legislation.[165] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25th October 2011 Council concerning consumers information on foodstuffs only contains provisions applicable to the sale of non-pre-packaged products in the context of traditional 'over the counter' businesses. [166] It does not include specific provision for self-service bulk sales.

In addition, it is worth considering Food Contact Materials (FCM) legislation in relation to single-use and reusable packaging. The EU framework on FCM is set through the regulation on FCMs (EC) 1935/2004, together with the EU Regulation on Good Manufacturing Practices for materials and articles intended to come into contact with food, Regulation (EC) 2023/2006. This is complemented by specific Commission Regulations, particularly Regulation (EU) No 10/2011 on plastic food contact materials and Regulation (EC) No 282/2008 on recycled plastic food contact materials.

In general, tableware and reusable food packaging in commercial systems is made from inert materials, while non-inert materials tend to be single-use, and often in complex multi-layered structures.[167] In Belgium for example, stainless steel boxes are used in the 'Tiffin' lunch box reuse scheme. Consumers reusing a Tiffin box for take-aways are entitled to a price reduction in certain restaurants across Belgium.[168] This is important given recent regulations, such as the SUP Directive, aiming to tackle issues related to plastic packaging and which have started to cause a shift towards single-use paper, cardboard and bamboo alternatives for instance, rather than to inert and reusable alternatives. Not only could this shift have impacts on packaging reuse, but also on human health.[169]

Thirdly, there is currently little guidance on measures to promote reuse or how to design a reuse system to optimise the environmental impact. Compounding this are the definitions of 'waste', 'reuse' and 'preparing for reuse' outlined in the Waste Framework Directive (WFD). As defined in Article 3 of the WFD, waste is:

> *"…any substance or object which the holder discards or intends or is required to discard;"*

Defining a material as waste determines how the material is handled, which administrative procedures apply to its transport and processing and what costs are borne by the waste handler. Moreover, under Article 3 of the WFD, reuse and preparation for reuse are defined as:

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[165] Zero Waste Europe, Eunomia Research & Consulting, and Reseau Vrac (2020) *Packaging free shops in Europe an initial report*, accessed 7 July 2020, https://zerowasteeurope.eu/wp-content/uploads/2020/06/2020_06_30_zwe_pfs_executive_summary.pdf

[166] European Commission (2011) *Regulation (EU) no 1169/2011 of the European Parliament and of the Council of 25 October 2011*, accessed 13 July 2020, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:304:0018:0063:en:PDF

[167] Zero Waste Europe (2020) *Towards safe food contact materials in a toxic-free circular economy*, accessed 16 September 2020, https://zerowasteeurope.eu/wp-content/uploads/2020/05/towards_safe_food_contact_materials.pdf

[168] Tiffin (2018) *Tiffin, une lunchbox réutilisable pour vos plats à emporter !*, accessed 16 September 2020, https://tiffin.be/

[169] Zero Waste Europe (2020) *Towards safe food contact materials in a toxic-free circular economy*, accessed 16 September 2020, https://zerowasteeurope.eu/wp-content/uploads/2020/05/towards_safe_food_contact_materials.pdf

> *'reuse' means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived;*
>
> *'preparing for reuse' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing.*[170]

Thus, if an item becomes waste and is then reused, it must undergo a 'preparing for reuse' process. The application and interpretation of waste, reuse and preparing for reuse varies across Member States and regions, leading to discrepancies in how re-usable packaging, especially transport packaging, is legally treated. This challenge is particularly pertinent to open-loop packaging systems. In schemes of this type, after the reusable packaging (e.g. a steel drum) is used, it is collected for reuse. However, the original seller of the reusable packaging may be different from the reconditioner – the material is transferred from one actor to another. This is different from closed-loop reuse in which the reusable packaging is owned by one company, such as pallet pooling company, who provides the reusable packaging, collects it again after use and washes/refurbishes the packaging to be used again. In the open-loop system, due to the transfer of material between actors, some national jurisdictions have used the waste definition to classify such packaging as waste (even though it is subsequently reused, though this could be consistent if preparation for reuse occurred).[171,172] The resulting administrative burden and additional costs, such as from applying and re-applying for multiple waste licences, dissuades companies from reconditioning the transport packaging, often scrapping it instead.[173]

Moreover, no reuse target exists at the EU level. Instead, Member States can set quantitative and qualitative reuse targets: as required in Article 9 of the revised WFD (to encourage the re-use of products and the setting up of systems promoting repair and re-use activities); and under Article 5(1) of the PPWD (measures to increase the share of reusable packaging placed on the market). Also under the PPWD, Member States can calculate the recycling rate of packaging waste using up to 5% reusable packaging. This is outlined in Article 5(2) of the revised PPWD as given below:

> *2. A Member State may decide to attain an adjusted level of the targets referred to in points (f) to (i) of Article 6(1) for a given year by taking into account the average share, in the preceding three years, of reusable sales packaging placed on the market for the first time and reused as part of a system to reuse packaging. The adjusted level shall be calculated by subtracting:*
>
> *(a) from the targets laid down in points (f) and (h) of Article 6(1), the share of the reusable sales packaging referred to in the first subparagraph of this paragraph in all sales packaging placed on the market, and*
> *(b) from the targets laid down in points (g) and (i) of Article 6(1), the share of the reusable sales packaging referred to in the first subparagraph of this paragraph, composed of the respective packaging material, in all sales packaging composed of that material placed on the market.*

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[170] European Parliament and the Council of the European Union (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives, 2008/98/EC

[171] Communication with Reloop, 25th May 2020

[172] Communication with SERRED, 25th May 2020

[173] SERRED (2020) Serred policy positions

> *No more than five percentage points of such share shall be taken into account for the calculation of the respective adjusted target level.*[174]

The lack of a defined target, as well as no incentive to report more than 5% reusable sales packaging, constitutes a weak regulatory driver to increase reuse.

Looking to 2030, there are a number of existing and proposed policies, which go some way in encouraging packaging reuse. Notably, the 2018 revision of the WFD introduced more ambitious targets including 55% of municipal waste to be recycled and prepared for reuse by 2025, 60% by 2030 and 65% by 2035. Article 9 of the WFD also requires Member States to take measures to:[175]

> *(b) encourage the design, manufacturing and use of products that are [...] re-usable [...];*
>
> *(d) encourage the re-use of products and the setting up of systems promoting repair and re-use activities, including [...] packaging [...];*

Article 5 of the revised PPWD, meanwhile, requires that by 2025, Member States take measures to encourage the use of reusable packaging, such as: using DRS, setting qualitative or quantitative targets, the use of economic incentives, or setting a minimum percentage of reusable packaging placed on the market annually for each packaging stream.[176] Member States must further ensure that EPR schemes are created for all packaging types at the latest by 2024.

The 'SUP Directive' is also likely to impact the materials, products and packaging markets. The Directive requires that Member States take measures relating to different product groups, including for beverage and food containers, and for packets and wrappers. The consumption reduction measures, item bans and proposals for EPR schemes fees to cover also the costs of littering and awareness raising measures (already included in some EPR schemes), could stimulate the reuse market by creating opportunities for reusable packaging to commercialise and develop economies of scale. What is more, the SUP Directive sets a precedent and strong policy direction such that the scope of these requirements could be extended to other packaging formats.

On the other hand, as has already been seen across Europe, the product bans – instead of promoting reuse - could cause a shift to the use of alternative materials for disposable packaging, such as bamboo, composite materials, aluminium, paper, coated paper and glass.[177] Moreover, approximately 40% of the items covered by the Directive are packaging, and only those types most commonly found on European beaches. Thus, the scope of the Directive in relation to the packaging market is relatively small (the total weight of waste material generated in scope of the Directive in 2017 was around 3.6 million tonnes per annum, this compares with around 77.5 million tonnes of total packaging waste generation ~4.5%). The proportion of grocery packaging would be higher, but is not yet known.

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[174] European Parliament and the Council (2018) Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste

[175] European Commission (2018) *Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste*, accessed 2 June 2020, http://data.europa.eu/eli/dir/2018/851/oj/eng

[176] European Parliament and the Council (2018) Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste

[177] Deutsche Umwelthilfe (DUH) (2020) Policy recommendations to promote reusable packaging

At the national level, some Member States are taking action to encourage reuse, possibly as implementation of the legal requirements in the revised WFD and PPWD. For instance:

- In Portugal, the proposed amendment of Decree-Law No. 152-D/2017 stipulates that from January 2022, all distributors/traders who sell soft drinks, juices, beers, packaged waters and table wines (excluding those classified as regional wine and VQPRD) in non-reusable primary packaging, must also market the same category of products packaged in reusable primary packaging (up to 5 liters capacity);
- In Romania, from 1st January 2020, market operators who place packaged products on the market are required to sell a minimum of 5% of their goods in reusable packaging, and no less than the average percentage achieved between 2018 and 2019. Retailers will be required to provide the opportunity for consumers to choose reusable packaging and return it at the point of sale.[178] This excludes smaller retailers;
- In Germany, the German Packaging Act has a quantitative but not legally binding target for reusable beverage containers filled in Germany. One goal of the Packaging Act is that 70% of drinks covered by a deposit are filled in returnable bottles. Additionally, the Blue Angel label of the Federal Government can be used on reusable bottles and glasses, transport packaging and beverage cups. Currently, Germany has a mandatory deposit on one-way beverage containers and a voluntary deposit on reusable beverage containers;[179] and
- In Spain, Royal Decree 782/1998, which implements Law 11/1997 on Packaging and Packaging Waste, establishes the requirement to have a Company Prevention Plan (PEP) for waste for certain companies. The business plans for the prevention of packaging waste (developed by packers) must include an increase in the proportion of reusable packaging in relation to the amount of single-use packaging. The exception is when a life-cycle assessment can demonstrate that the environmental impact of the reuse of such packaging is greater than the impact of recycling or alternative recovery;
- In Ireland, Spain and the Slovak Republic, reusable packaging is a proposed component of Green Public Procurement (GPP). In the Slovak Republic for instance, the Waste Prevention Programme 2019-2015 proposes mandatory use of reusable beverage containers for all state administrative bodies (through the Act on Waste). The Programme also proposes to develop a methodological tool to support the implementation of package-free shops.
- In France, Law No. 2020-105 Regarding a Circular Economy and the Fight Against Waste, introduced in February 2020, focuses on the transition to a circular economy. The legislation includes several provisions to encourage reuse. The Law includes targets for 5% of packaging marketed in France to be reused in 2023, increasing to 10% in 2027. It also establishes a reuse observatory, to be created by January 2021. The observatory will be responsible for defining the national trajectory for increasing the share of reusable packaging placed on the market and to support organisations in achieving this objective. Additionally, under Article 58, guidelines for Green Public Procurement are set out, namely: by January 2021, the goods/services acquired by the State and local authorities must come

[178] Deutsche Umwelthilfe (DUH) (2020) Policy recommendations to promote reusable packaging

[179] European Parliament (2011) *A European Refunding Scheme for Drinks Containers*, accessed 16 September 2020, https://www.europarl.europa.eu/RegData/etudes/note/join/2011/457065/IPOL-AFET_NT(2011)457065_EN.pdf

from reuse, or incorporate recycled materials in proportions of 20% to 100% depending on the product. EPR schemes are also obligated to give at least 2% of their annual budget to supporting packaging reuse.[180]

Consultation with Member States showed mixed views regarding quantitative reuse target, although there was support overall. There were suggestions that targets should apply to certain sectors or packaging formats. Alternatively, some Member States respondents felt that targets should be voluntary.

Finally, in some Member States, reusable packaging is encouraged through exemptions from EPR obligations (for example Austria) or exemptions/reductions in EPR fees (Belgium, Germany, Ireland, Italy). Other initiatives include, for instance, the German Blue Angel label of the Federal Government, which indicates environmentally friendly products, and can be used on reusable bottles and glasses, transport packaging and beverage cups. The label enables consumers to distinguish between one-way and reusable beverage bottles and glasses.[181] Though according to DUH this is not the primary use of this label.[182]

Upscaling such labelling schemes raise important questions for harmonisation. Whilst an EU harmonised label for reusable primary packaging could stimulate and help upscale reuse systems by encouraging consumers, such labels if introduced at national level could also create a barrier to the internal market.

Furthermore, there was consensus from the responding Member States that certain packaging types are better suited to reuse. Packaging which is frequently used and partly standardised such as beverage bottles and transport packaging was identified as most viable for a reuse system. Generally, producer incentives, such as EPR fee modulation, were considered important, although it was also noted that EPR alone would not cause a significant shift to reuse. In addition, several Member State respondents were of the view that some form of standardisation at the EU level, or an EU level body for reuse would help address the challenges of packaging reuse in an open system. Information sharing and a common definition of a reuse system were considered important aspects of harmonisation in order to overcome barriers to reuse in the single-market.

1.2.3 Problem Evolution

In summary, data on packaging reuse across Europe is limited, but overall trends indicate a reduction in reusable primary packaging over the past two decades.

Notwithstanding, there have been recent signals, albeit on a small scale, that this decline of reusable primary packaging may be slowing in some areas and for some consumer packaging types. There is significant opportunity in this sector to build upon a rise in consumer awareness.

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[180] Legifrance (2020) *LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire*, accessed 16 September 2020, https://perma.cc/9YRB-SQGQ

[181] Blauer Engel *Umweltschonende Mehrwegflaschen und -gläser*, accessed 24 June 2020, https://www.blauer-engel.de/de/produktwelt/gewerbe-kommune/mehrwegflaschen-und-glaeser

[182] Blauer Engel is used to label very different products in the German market which fulfill certain standards in terms of eco-friendliness. It is very well-known when it comes to paper and toilet paper, but also for electric devices. It never really established itself as a label for reusable (beverage) packaging in Germany, partly because it was feared that consumers would not understand the link to other products carrying the label. Therefore, just a few companies actually use it for reusable packaging.

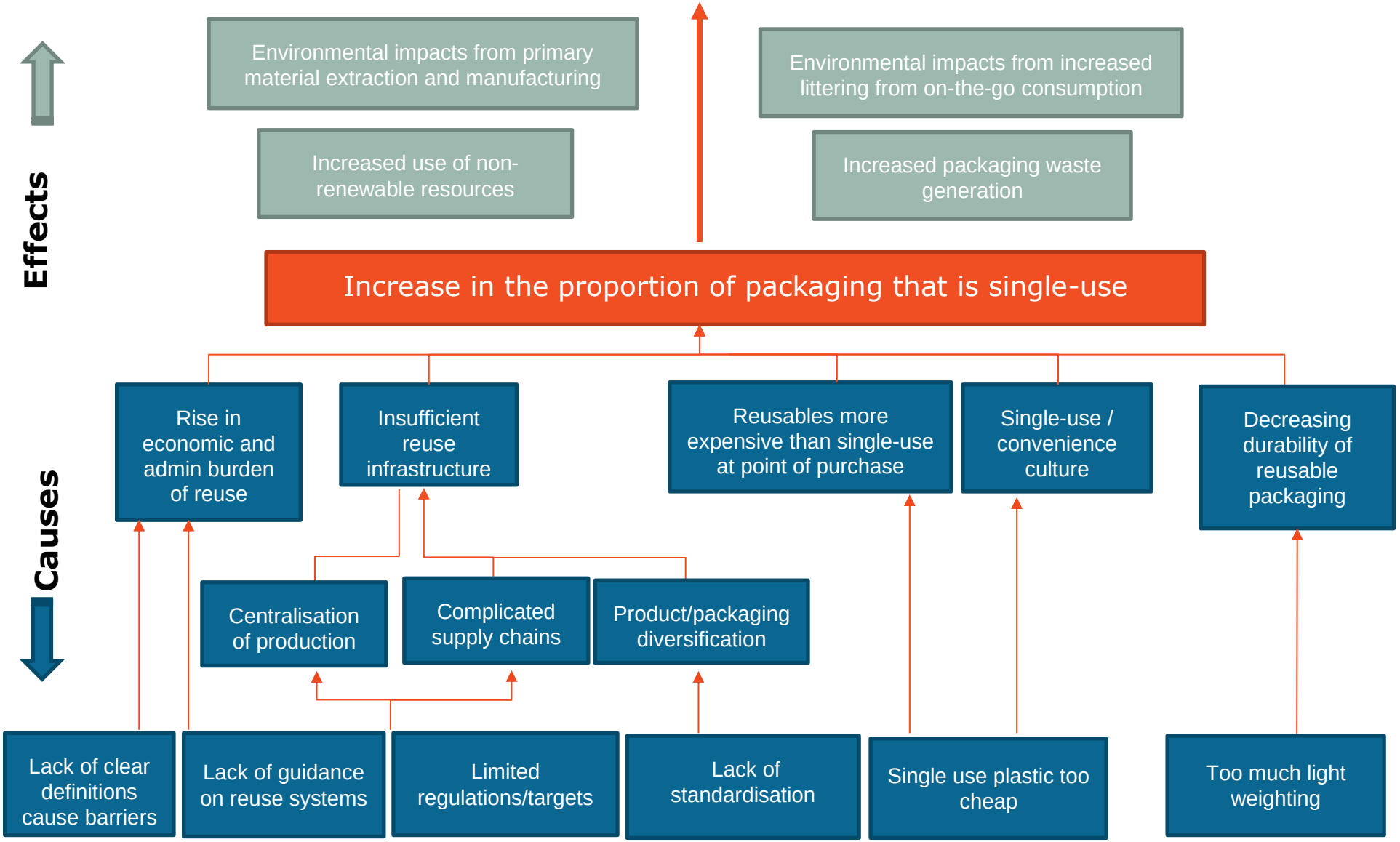
Reusable transport packaging has shown more stability, although there are some material and sector-specific challenges.

As products, materials and consumption have evolved, there has been a significant rise in the use of one-way packaging, especially single-use plastic primary and secondary packaging; a trend which looks set to continue. What is more, the evolving retail landscape, with larger distribution networks, produced and packed on high-speed packaging lines, have combined to exert a downward pressure on reuse.

The current and proposed legislation discussed in the previous section indicates a policy direction which is attempting to promote packaging reuse through a number of different mechanisms. The recent 2018 waste legislative packaging (WFD, PPWD), European Green Deal, Circular Economy Action Plan and the SUP Directive provide a regulatory framework and impetus for Member States to take action on packaging waste prevention and packaging reuse.

On the whole, however, many of the market and consumer shifts which have driven the decline in reusables are set to continue over the coming decade. Recent increase in consumer demand for reusables represents a relatively small-scale shift compared to the continued trends in on-the-go consumption, convenience and the overall growth of the packaging market. Indeed, a further evolution, strengthening and enforcement of the policy drivers would be required to significantly reverse the trend in declining packaging reuse. The continued fall in packaging reuse presents a critical problem if the resource efficiency principles and greenhouse gas mitigation targets of the EU Circular Economy Action Plan and Green New Deal are to be achieved.

1.2.4 Problem Tree


Effects
Environmental impacts from primary material extraction and manufacturing
Increased use of non-renewable resources
Environmental impacts from increased littering from on-the-go consumption
Increased packaging waste generation
Increase in the proportion of packaging that is single-use
Causes
Rise in economic and admin burden of reuse
Insufficient reuse infrastructure
Reusables more expensive than single-use at point of purchase
Single-use / convenience culture
Decreasing durability of reusable packaging
Centralisation of production
Complicated supply chains
Product/packaging diversification
Lack of clear definitions cause barriers
Lack of guidance on reuse systems
Limited regulations/targets
Lack of standardisation
Single use plastic too cheap
Too much light weighting

2.0 Barriers to packaging circularity

2.1 Increased use of packaging design features that inhibit recycling

2.1.1 Overview

2.1.1.1 Scale and Trends

Data from both Eurostat and market data reports were assessed, which showed increased use of packaging design characteristics that may inhibit, at present, reuse and recycling, and increasing these levels further in future. These packaging characteristics are further outlined below, and include, for example, flexible composite (or multi-material) packaging(e.g., which has increased in tonnage placed on the market by 16% over the 2003-2018 period.[183,184] In comparison, the quantity (tonnage) of rigid packaging placed on the European market increased by 13% over the same period.[185] This likely represents an even greater increase when resolved to number of units placed on the market given the low-weight of many flexible packages.

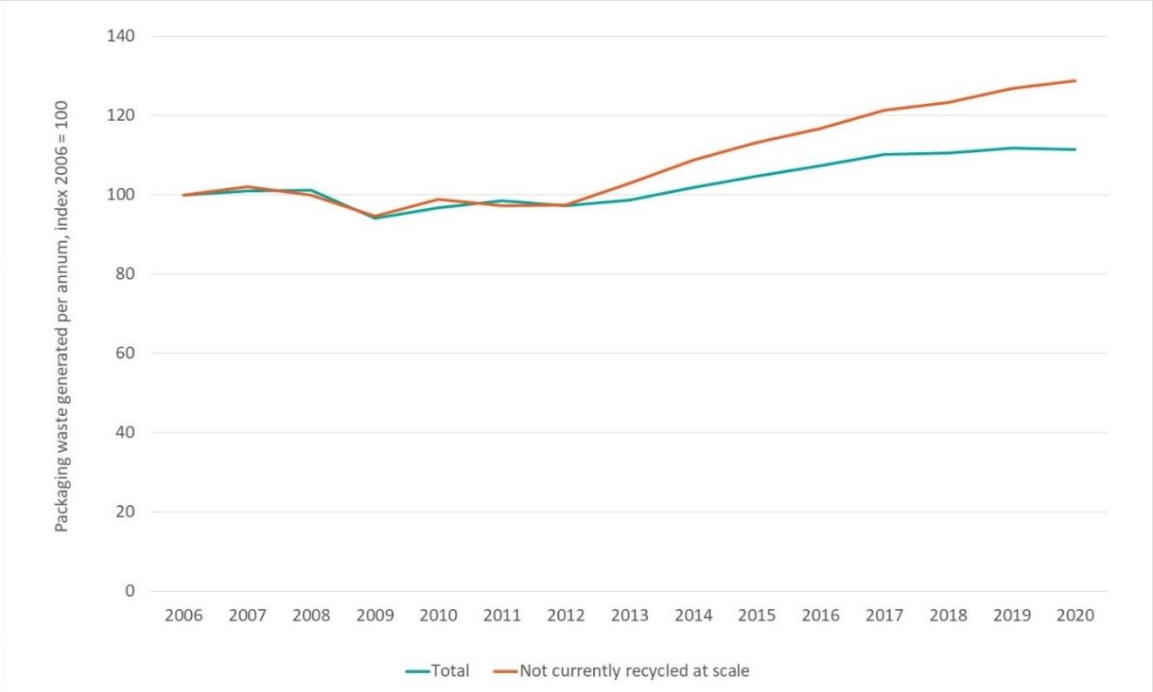
An estimate of the proportion of each packaging category in the baseline model (see Appendix B) that is deemed 'unrecyclable' because of characteristics that inhibit the collection and reprocessing of packaging was made. This is outlined in Figure 2-1, which shows that, for around the last decade, the amount of unrecyclable packaging has been increasing at a greater rate than total packaging waste generated, showing that the problem has been increasing.

[183] Classification covers FIBCs, bags, sacks, pouches, sachets, wraps and other flexible packages – not restricted to flexible plastic packaging.

[184] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[185] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

Figure 2-1 Change in total and 'unrecyclable' packaging, index 2006 = 100



Source: Eunomia baseline model

Materials that currently have a lower recycling rate, or packaging that represents challenges to collect/ sort and/ or recycle, are increasingly more common (in terms of market share and demand). Many of these packaging types are technically recyclable, though the processes associated with their collection and sorting (including washing and decontamination) can be costly and inefficient, associated with relatively low quality/ quantity of useful output and, historically, a lack of sufficient demand in end markets. At present, therefore, the increasing market share of packaging with characteristics that inhibit recycling poses a challenge to the attainment of higher recycling targets across the EU. The following packaging design characteristics that inhibit recycling or reuse (including collection and sorting) have been identified[186]:

- **The packaging is less likely to be collected by streams being subjected to sorting for recycling:**
  - Due to the package being especially small, flexible or lightweight, potentially causing the material to move around on the belt of the sorting equipment, get caught up in the air currents and be miss-sorted, create jams or clogs in the sorting equipment, etc. Or,
  - Due to the packaging being more likely to be highly contaminated with food (e.g. if the package is difficult to empty fully), or other residues (including inks, labels, etc.) that are difficult/ costly to remove relative to the quality/ quantity of material that can be recovered. Or,

[186] Eunomia et. Al for DG Environment of the European Commission (2020), *Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement*, available at https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

- As a result of the item being consumed on-the-go and the packaging being therefore less likely to enter into a recycling collection. Additionally, this could mean that the package is more likely to be littered. Or,
- Due to relying on consumer compliance/actions for the package to enter the recycling stream in the correct way – e.g. if there are many parts which need to be separated by the consumer prior to being placed in a recycling collection. Or,
- If a separate collection infrastructure does not exist or is not common for the item, due to a lack of final recycling options and end markets or insufficient volumes of waste material, which result in collections being economically unviable, e.g. for metallised plastic films such as those used in crisps packets and candy wrappers.

- **The packaging poses challenges to the majority of sorting systems, depending on the availability and quality of sorting infrastructure in the region or Member State in question:**
  - Packaging poses challenges to the majority of sorting systems if its parts are made from different materials which are not easily separable (either by hand or mechanically) or made from different polymers (e.g. composite packaging including multi-polymer plastic packaging, cardboard and aluminium laminates, etc.). Or,
  - If the use of one polymer, e.g. for labelling, is likely to lead to the packaging being mis-sorted into the wrong material stream and result in contamination. Or,
  - If colouring used in the packaging results in it not being "seen" by NIR sorting machinery.[187]

- **The packaging poses challenges to recycling operations**
  - If additives to the packaging result in the polymer (for plastic packaging) behaving differently in industry standard separation tests, such as the float-sink test. Or,
  - If the extent of other materials or other polymers included in the packaging is above the tolerable limit for the process. E.g. in paper reprocessing there is generally a tolerable limit of ~3-5% for non-pulpables entering the stream which if exceeded is detrimental to recycling process. An example of such a non-pulpable is the plastic windows in envelopes which are part of paper packaging. Or,
  - If the packaging is economically unfeasible to reprocess, for example, the item can technically be recycled but there is a lack of demand for it as secondary material/end markets are lacking. This could also be the case where the packaging item is particularly small and yield per item is decreased, because the share of the market for a packaging item is so small that it is not economically viable to set up recycling infrastructure. Or,
  - If it is difficult to incorporate secondary material into new packaging, due to certain technical and regulatory constraints e.g. use for food contact packaging. This is linked to the above as it is important to generate end markets for recycled packaging by creating demand for recycled materials in high quality applications.

All of the above are magnified when these packaging types (i.e. those that pose challenges to existing sorting and recycling operations) are increasing in market share relative to other more easily recyclable packaging.

[187] This is not an exhaustive list of factors which results in a package posing challenges to the majority of sorting systems, but is indicative of the sorts of considerations made.

Based on the above factors, characteristics of packaging that inhibit recycling have been identified through a review of guidelines, protocols and best practice documents developed by industry to promote improved packaging design in order to maximise recyclability, and through consideration of other sources, such as the 2016 Ellen MacArthur Foundation report[188] and previous work on beach/marine litter[189]. Interviews with industry stakeholders were also conducted to help inform the information below. Table 2-1 contains a list of some of the packaging characteristics that may inhibit recycling. For each of the examples in the table, the most common challenges posed to collection, sorting, and recycling operations are also identified. It is noted that the table is not comprehensive, but rather, provides an illustration of some of the key packaging types that pose challenges to the recycling process, and the nature of these challenges.

Sources used to inform this table were:

- Design of Rigid Plastic Packaging for Recycling (WRAP)[190]
- Plastic Packaging Recyclability by Design (ReCoup)[191]
- Refined methods and Guidance documents for the calculation of indices concerning Reusability / Recyclability / Recoverability, Recycled content, Use of Priority Resources, Use of Hazardous substances, Durability (JRC)[192]
- Recyclability of Paper Based Products (Eco Paper Loop / European Commission)[193]
- The Association of Plastics Recyclers Design Guide for Plastics Recyclability (APR)[194]
- Design Guidance: Best Practices for Recyclable Products and Packaging (Healthcare Plastics Recycling Council)[195]
- Confederation of Paper Industries (CPI) Guidelines – Paper and Board Packaging Recyclability Guidelines[196]

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[188] Ellen MacArthur Foundation (2016) *The New Plastics Economy: Rethinking the Future of Plastics*, March 2016, https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_15-3-16.pdf

[189] ICF and Eunomia for the European Commission (2018), *Plastics: Reuse, Recycling and Marine Litter*, 30 May 2018, https://op.europa.eu/en/publication-detail/-/publication/3cdca2d1-c5f2-11e8-9424-01aa75ed71a1/language-en

[190] Foster, S., Morgan, S., and East, P. (2013) *Design of Rigid Plastic Packaging for Recycling - Guidance Document*, 2013

[191] BTF and RECOUP (2017) *Recyclability by design*, 2017, http://www.recoup.org/p/130/recyclability-by-design

[192] Fulvio, A., Mathieux, F., European Commission, Joint Research Centre, and Institute for Environment and Sustainability(2012) *Integration of resource efficiency and waste management criteria in European product policies - second phase: refined methods and guidance documents for the calculation of indices concerning reusability Report n° 3. Report n° 3.*, Luxembourg: Publications Office

[193] EcoPaper Loop (2014) *Recyclability of Paper based Products - Guideline Document*, 2014

[194] Association of Plastic Recyclers (2018) *Full APR Design Guide: APR Design Guide for Plastic Recyclability*, 2018, https://plasticsrecycling.org/images/pdf/design-guide/Full_APR_Design_Guide.pdf

[195] *Design Guidance | HPRC*, accessed 19 February 2019, https://www.hprc.org/design-guidance

[196] Confederation of Paper Industries (CPI) (2019) *Paper and Board Packaging Recyclability Guidelines*, 2019, https://paper.org.uk/PDF/Public/Publications/Guidance%20Documents/CPI%20Recyclability%20Guidelines%20Final.pdf

- Ten Common Rules of Design for Recyclability (DfR) for Plastic Packaging[197]
- RecyClass Recyclability Tool for Plastic Packaging (Plastic Recyclers Europe)[198]

Table 2-1 Table of some of the key characteristics of packaging that may inhibit recycling

Packaging Type and Exemplar items	Reasoning
Multi-Material Packaging	
Metallised plastic films: - **Crisp Packets** - **Pet food pouches**	- **Less likely to be collected by streams being subjected to sorting for recycling**: On the go consumption may make this difficult for crisp packets. In many places there is no recycling collection for these items - **Poses challenges to recycling operations:** Multi-material composite where the constituent materials are difficult to separate.
Plastic coated, or metallised cardboard: - **Beverage cartons** - **Coffee cups**	- **Poses challenges to recycling operations**: Provides a challenge to separate the plastic and metal layers from the fibre, such that all materials can be fully recycled. Technically feasible in specialised plants, not all pulping plants across the EU have the necessary equipment. Reprocessing can be hampered by inks and adhesives, water soluble inks and adhesives and paper coating agents. This increases expense of the process. - CEPI guidance states: Two-sided laminates such as beverage cartons and hard to recycle coffee cups should be collected and reprocessed separately.
Small Multi-Material Packages: - **Yoghurt Pots** - **Blister Packs**	- **Less likely to be collected by streams being subjected to sorting for recycling**: Relies on consumers separating/sorting components E.g., for yoghurt pots there is a foil lid, paper/fibre label and rigid plastic pot. - **Poses challenges to the majority of sorting systems**: For blister packs, foil covering bound to plastic backing with adhesive. - **Poses challenges to recycling operations**: Small size, less efficient and economical to reprocess, so less revenue from recycling per item collected.
Plastic Packaging	

[197] Borealis, and MTM Plastics (2018) *Ten Common Rules of Design for Recyclability (DFR) for Plastic Packaging*, 2018

[198] RecyClass Design for Recycling Tool (accessed 18th December 2019), https://recyclass.eu/

Packaging Type and Exemplar items	Reasoning
Multi-Polymer flexible film packaging: › **PET/PE Laminate** › **PET/OPP/CPP Laminate** › **Snack pouches** › **Spouted pouches**	› **Less likely to be collected** by streams being subjected to sorting for recycling: Collections for this material are limited at present. › **Poses challenges to the majority of sorting systems**: Difficult to separate the constituent polymers (e.g., PE/PET). › **Poses challenges to recycling operations**: If PE is reprocessed with PET the lower melt point causes imperfections in the finished product which can result in rejections or lower quality output. › Increasing in market share
Black Plastic: › **(Also to a lesser extent, dark coloured plastic which isn't black)** › **Black plastic food trays**	› **Poses challenges to the majority of sorting systems**: Carbon black pigment prevents the pack being 'seen' by NIR technology. › **Poses challenges to recycling operations**: Non-carbon black dark pigments still have low value and limited end markets compared to clear or light coloured rigid plastics › (n.b. some end markets such as plant trays exist).
Biodegradable plastics: › **Biodegradable rigid plastic food container** › **Biodegradable films**	› **Less likely to be collected by streams being subjected to sorting for recycling:** Potential for consumers to place in the wrong collection containers if they are unsure whether a piece of packaging is biodegradable or not.[199] › **Poses challenges to recycling operations:** There is low tolerance for contamination with biodegradables. › Biodegradable plastics have an immediate effect when the plastic is melted as they melt faster and create black spots in the film. Longer term, if included in products such as thick construction film, they may biodegrade during use. › Recycling of a pure stream of some biodegradable plastics is technically feasible if correctly separated, but is not being practically implemented in Europe at a large scale at present (barring small scale PLA recycling in Belgium). › Increasing in market share.

[199] The likelihood of this issue does depend on the nature of the collection services and composting plants in a given Member States, for some this is not as significant a problem, however, stakeholder input suggests that this is an issue in the majority of Member States.

Packaging Type and Exemplar items	Reasoning
Plastic Packaging with PVC components and all-PVC packaging: › **PET packaging with PVC sleeve** › **PVC packaging**	› **Poses challenges to the majority of sorting systems:** Similar in appearance to PET and overlapping densities make separation difficult. › **Poses challenges to recycling operations:** If not separated PVC generates acidic compounds during reprocessing which cause problems – ester depolymerisation reactions. › Packaging which is all PVC is not widely recycled.
Shallow or flattened plastics: › **Items more two dimensional than three dimensional e.g. thin trays**	› **Poses challenges to the majority of sorting systems:** Very shallow or flattened plastics may be mis-sorted in automatic sorting facilities with paper/cardboard fractions, and subsequently never enter further plastic sorting/ recycling stages. › **Poses challenges to recycling operations:** If mis-sorted it can contaminate the paper fraction. Mis-sorting also reduces plastic reprocessing yield and economic efficiency of plants.
Additives which alter sorting: › **Foamers/Fillers/additives which change density** › **Sleeves with more than 60% coverage**	› **Poses challenges to the majority of sorting systems:** Plastic regrind is sorted in a float/sink test based on density. Additives which change density to the extent of opposite behaviour in the float/sink test will lead to mis-sorting, contamination of streams etc. › Sleeves with more than 60% coverage can lead to errors in identification of the material used for the container.
Plastics with optical brighteners	› **Poses challenges to recycling operations:** Optical brighteners are detrimental to recycling as they create an unacceptable fluorescence when reprocessed.
Additions to Plastic Bottles: › **Paper labels on plastic bottles (e.g. PET/PP/HDPE)** › **Metal Caps on plastic bottles**	› **Poses challenges to recycling operations:** Paper labels on PET bottles can pose challenges to recycling operations in some cases as paper becomes pulp in a caustic hot wash and is difficult to filter from the liquid. › Individual fibres which travel through will degrade the quality of recycled PET. › Metal caps and rings may not be easily separable and aluminium processed in a caustic wash will form aluminium hydroxide and contaminate the batch. In

Packaging Type and Exemplar items	Reasoning
	the case of PET this prevents use for food-grade applications.
Glass Packaging	
Glass bottles with additional parts made of different materials › **Perfume bottles**	› **Poses challenges to the majority of sorting systems:** Parts made from different materials may be difficult to separate. › **Poses challenges to recycling operations:** Small springs from sprays can become jammed in recycling machinery where these are used (this is also true for plastic spray bottles with trigger mechanisms).
Paper Packaging	
Paper products cured with UV varnish or varnish which breaks down into small or microplastic particles	› **Poses challenges to recycling operations:** Not readily removed by conventional de-inking process, and for those which break down into microplastics – can pollute waste water released.
Paper products with adhesives which plasticise	› **Poses challenges to recycling operations:** Some adhesives on tape/labels and in binding of packaging have potential to soften or plasticise in heat and form "stickies" which end up on the finished paper and spoil performance.
Waxed Papers	› **Poses challenges to recycling operations:** Wax cannot be removed by mill cleaning systems and passes onto the finished product. Silicone, greaseproof and glassine papers cannot be pulped and pass into the mill waste stream.
Metal Packaging	
Aluminium foils with high levels of food contamination such as post consumer food trays/ containers/ sheet foil	› **Poses challenges to the majority of sorting systems** High levels of organic contamination can be costly and difficult to clean, making recycling economically unattractive.
Wood Packaging	
Wood packaging with material/ chemical contaminants (e.g. medium density fibreboard with paint/	› **Poses challenges to recycling operations:** Wood fibres not readily separated from resins/ additives by conventional shredding process, with potential toxic dust release/ accumulation in recycled products.

Packaging Type and Exemplar items	Reasoning
plastic coating/ urea formaldehyde)	

2.1.1.2 Consequences

The impacts of the heightened use of packaging design features that inhibit recycling (including separate collection and sorting) are felt across the packaging value chain. While there are clear economic advantages for producers associated with the use of several of the design features described above (see the discussion regarding drivers below), their use makes the proper separation for disposal of such items at the end of life challenging for consumers and subsequent sorting and recycling costly for waste managers. In some cases, the switch to high barrier (e.g., multi-material films and pouches described in the table above, which are designed to extend the shelf life of products), lightweight, and low cost (see Section 2.3.2 below) packaging design can also result in an increase in the generation, distribution and persistence of litter in the natural environment. This is due to the fact that such packaging is both lightweight, and therefore easily transported as litter, as well as highly durable and non-biodegradable, resulting in its persistence as litter if not subsequently picked up. In addition, the fact that such packaging is often designed to allow products to be consumed on the go, and has little, or no value to consumers, means they may be more susceptible to being littered.

Increased generation of waste associated with such difficult to recycle packaging types also puts greater requirements on reprocessors, who must either increase their sorting and recycling capabilities, or, as is more likely in the short term, reject these types. In the latter case, driven by the lack of clarity in the Essential Requirements, this packaging waste is likely to be either incinerated, and result in the associated greenhouse gas emissions; or be exported abroad for reprocessing, where it is difficult to verify whether all of the material is actually reprocessed, incinerated, or mismanaged. The demand for, and use of, such difficult-to-recycle design features can therefore have a negative environmental impact by driving a switch to packaging that has higher greenhouse gas emissions (GHGs), is less easily recycled or is more likely to be littered through the course of its entire lifecycle.

In summary, this situation, particularly related to the increased use of packaging that, as noted above:

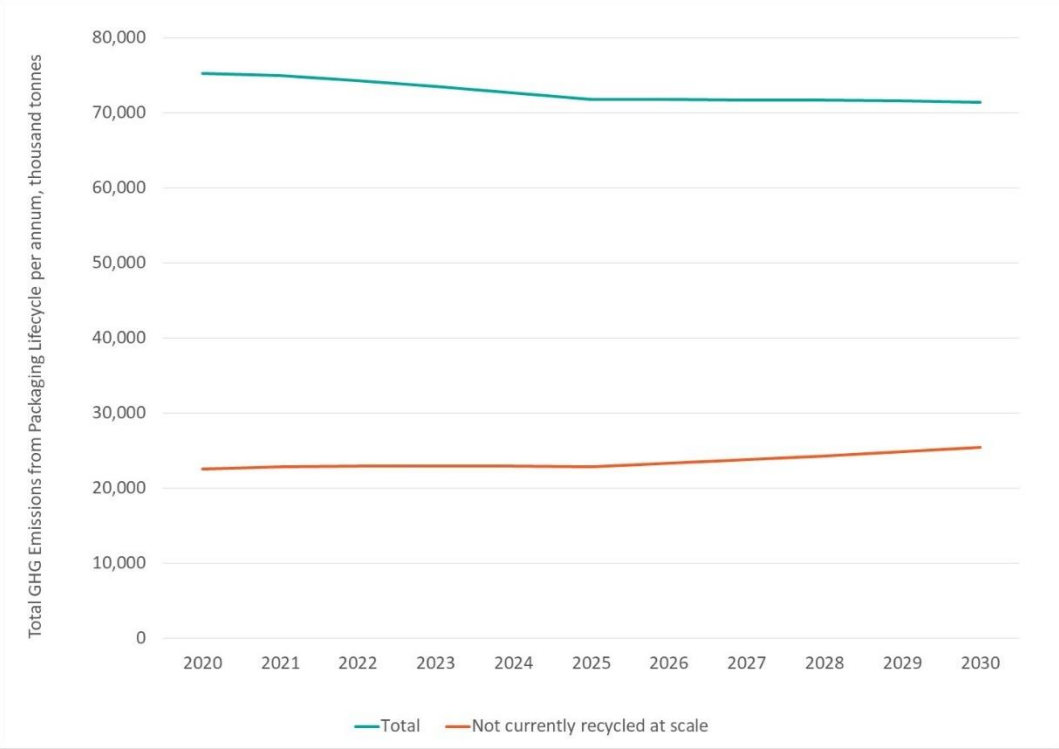
a. can lead to higher GHGs at the end of life,
b. is less easily recycled in an economically viable way, and/or
c. is more likely to be littered,

is contrary to the stated aims of the Commission's Green Deal (no net GHG emissions by 2050), and the supporting Circular Economy Action Plan as regards packaging (which aims to ensure that all packaging on the EU market is reusable or recyclable in an economically viable way by 2030).

The carbon impacts from the baseline model related to the estimated proportion of 'unrecyclable' packaging were calculated. This is shown below in Figure 2-2. What this indicates is that whilst overall GHG emissions start to fall by 2030, the contribution from 'unrecyclable' packaging is actually increasing, and the rate of increase grows. This highlights the nature of the problem. The reason is that a large proportion of unrecyclable packaging is plastic, and as

the management of residual waste shifts from landfill to thermal recovery plants, the GHG emissions from managing the plastic waste stream increase.

Figure 2-2 Estimate contribution of GHG emissions from unrecyclable packaging



Source: Eunomia baseline model

2.1.2 Problem Drivers

2.1.2.1 Market Drivers

Demand for lightweight, high barrier and composite packaging

Linked to the rise in flexible plastic (e.g., films, pouches, wrappings etc) and composite packaging, the packaging market has seen an increase in demand for high barrier materials (those that provide a high degree of barrier protection for gas, moisture and grease), driven by demand for food packaging which can increase the shelf life of products.[200]

Composite, or multilayer, flexible packages can offer such additional properties and be tailored to requirements as modified atmospheric packaging, through controlled release of packaged content, or other 'smart' packaging concepts which can be applied – increasing the functionality of the package beyond protecting and containing a product.[201] Materials used for flexible packaging can be integrated with other materials or additives to alter or enhance their barrier

[200] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[201] *Get Ready for Smart Packaging | CPI*, accessed 26 April 2019, https://www.uk-cpi.com/blog/get-ready-for-smart-packaging

properties, something which may be especially valuable in the packaging of food products.[202,203] For example, active food contact materials can be used to either absorb or release substances to extend shelf life, while intelligent food contact materials are used to monitor the condition of the packaged food – the use of both these in food contact packaging is regulated. In addition, some advanced packaging approaches for food contact materials such as modified atmospheric packaging (MAP) and vacuum skin packaging (VSP) are only possible with the use of high barrier films which maintain the modified gas ratio inside the package, or which prevent gas permeability. Vacuum skin packaging is popular for meat and seafood products, as well as for ready meals.[204,205]

As such, there is increasing demand for packaging materials and formats which enhance barrier properties, many of which currently pose challenges to sorting and recycling operations (e.g., composite packaging containing aluminium foil, Ethylene-vinyl alcohol (EVOH), or polyamide). Composite and multilayer materials can offer additional benefits such as good strength to weight ratio, and meet functional requirements which cannot be met with a single material.[206] The wide range of uses of flexible packaging therefore supports the expansion of the flexible packaging market with faster growth compared to the rigid packaging market.[207] However, these functional properties can come at a cost as they are posing challenges to the majority of sorting systems and reprocessing systems at the point of recycling. This is discussed further in Table 2-1 above.

Flexible packages such as pouches can be appealing to manufacturers, offering a higher filling and sealing speed when compared to rigid packaging. This can decrease the energy requirement at this stage of the process.[208]

Flexible packaging has additional benefits for transportation due to its low weight and can require 70% less material (by weight) when compared to rigid packaging for the same quantity of goods.[209] In addition, size and shape of the package can reduce shelf space and transit space requirement. Combined, this has the potential to reduce the number of transport units required for transport of packaged goods and reduce the total weight transported.[210]

As such, flexible packaging may offer manufacturers an economic advantage when compared with a rigid packaging alternative. Alongside these factors, it is noted that in general, the

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[202] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[203] *Flexible Packaging Applications | Pouch Partners*, accessed 26 April 2019, https://pouchpartners.com/flexible-packaging/applications/

[204] Stella, S., Bernardi, C., and Tirloni, E. (2018) *Influence of Skin Packaging on Raw Beef Quality: A Review*, accessed 26 April 2019, https://www.hindawi.com/journals/jfq/2018/7464578/

[205] *Vacuum Packaging - an overview | ScienceDirect Topics*, accessed 26 April 2019, https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/vacuum-packaging

[206] (2014) *Design Smart Material Guide - Composite Packaging*, 2014, http://www.helenlewisresearch.com.au/wp-content/uploads/2014/03/Composite-DSMG-082013.pdf

[207] Transparency Market Research (2019) *Europe Packaging Market: Industry, Size, Share, Growth, Trends and Forecast, 2003(A)–2018(E)*, 2019

[208] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[209] Ibid.

[210] University, H.-W. (2018) *Ban on plastics could increase damage to planet*, accessed 26 April 2019, https://www.hw.ac.uk/about/news/2018/a-plastic-ban-could-increase-damage-to.htm

Essential Requirements have added little in terms of design for recyclability precisely because they are not written to promote one form of recovery over another.

2.1.2.2 Regulatory Drivers

Lack of Effectiveness of EN 13430 (Requirements for packaging recoverable by material recycling)

Harmonised European Standards such as EN 13430 provide a presumption of conformity with certain aspects of the PPWD. With regards to flexible and composite packaging in particular, Annex II of the PPWD states that "*Packaging must be manufactured in such a way as to enable the recycling of a certain percentage by weight of the materials used into the manufacture of marketable products, in compliance with current standards in the Community. The establishment of this percentage may vary, depending on the type of material of which the packaging is composed*." However, the meaning of this requirement is unclear and has a number of possible interpretations: it could relate to the market as a whole and recycling targets for each material type, or it could refer to composite packaging and the percentage of components that are recyclable.

EN 13430 states that suppliers must declare the percentage by weight of the packaging unit that is suitable for recycling – recognising that it may comprise some components that are not recyclable. There is, however, no minimum percentage or guidance as to what this could be and there seem to be no requirements for the non-recyclable components. Nor is it clear to whom suppliers must make this declaration; there is a suggested compliance statement in Annex C of the Standard, but this is only advisory and it seems unlikely that suppliers have routinely been asked to submit such a declaration to the regulatory authorities.

The Standard also outlines the impact of each lifecycle phase on recyclability, with the design, manufacturing process, use, post-use collection and sorting affecting both the ability to recycle the packaging, and the packaging's impact on the recycling process. It sets out how the end user must be able to empty the packaging of the product. The design process must therefore "take into account" materials that are likely to create technical problems in the recycling process or in collecting and sorting, or to affect the quality of the recycled material, and whether components are separable. This does not, however, impose any conditions – strictly speaking, *considering* these impacts does not necessarily mean that the impacts *must be avoided*. Selected materials should not cause "significant problems in recycling technologies"; however, recycling facility operators are, arguably, best placed to judge this and interpretations of "significant problems" could vary.

The Standard does refer to another Standard CR 13688:2000 (Packaging – Material Recycling – Report on requirements for substances and materials to prevent a sustained impediment to recycling). CR 13688 provides guidance on materials and substances that may cause sustained impediment to the material recycling of the functional unit of packaging. Contamination of the packaging by contact with extraneous materials in the collection and sorting processes, or by residues of the packaging content, even after cleaning, are not considered as impediments to the material recycling. EN 13430 states that inter alia CR 13688:2000 is an indispensable for the application of this document, however this is out of date. Having been updated in 2008, it would not reflect the most up to date knowledge on recycling processes or more recent packaging innovations. It also adds to the possible bureaucracy and costs for producers, by requiring them to purchase and refer to another document. [The use of this standard and its status will be reviewed during the assessment phase of the study when new standards for defining what is not recyclable packaging will be assessed with industry stakeholders].

Further, EN 13430 recognises that the introduction of new materials and types of packaging to the market "may precede the introduction of appropriate recycling technologies", and that the "development and expansion of such recycling processes may take a period of time". The supplier consequently needs to be able to demonstrate that development is underway, and that there will be "industrial recycling capacity within a reasonable period of time" for their packaging to be classed as recyclable. The "reasonable period of time" is not defined so the interpretation of suppliers, Member States and the European Commission may vary. This could, for instance, apply to composite beverage packaging or to black plastic, which are theoretically recyclable, but for which the roll out of suitable recycling infrastructure in some Member States is limited. This does not indicate who is responsible for ensuring that this actually happens, and monitoring whether the planned capacity is ultimately delivered. It simply states that developments in relevant technology should be monitored and recorded, but it is not clear whose responsibility this is, or whether the absence of such technology for a given period should trigger some form of action (none is specified).

Essential Requirements Fail to Reflect the Waste Hierarchy

In terms of the trends identified at the start of this section, the increasing recycling rates are more likely to be linked to the explicit targets in the PPWD and the WFD rather than changes in design motivated by the Essential Requirements. The Essential Requirements have, however, arguably facilitated a situation in which plastic has the lowest recycling rate of the 4 material types, given that all plastic packaging – by virtue of its high calorific value – is classified as recoverable under the Essential Requirements. The decline in glass, meanwhile, indicates a decline in reusable packaging (although other packaging types are also reusable).

These trends are therefore the result of one of the most critical weaknesses of the Essential Requirements, being that, in pre-dating the WFD, the Essential Requirements fail to reflect the waste hierarchy. The 2018 amendment to Annex II– which added "in line with the waste hierarchy" to the section on reuse and recovery – could be interpreted to simply highlight that reuse and recovery should be prioritised over disposal; there is no recognition that reuse takes precedence over recovery, or that recycling is preferable to energy recovery. Although the 2018 amendment referred to above has not yet been operationalised, it is noted that the latter point regarding recovery is particularly relevant in view of the fact that the Essential Requirements specific to recoverable nature of packaging do not implement this hierarchy.

This is true of both Annex II and the Standards, with EN 13427 (Requirements for the use of European Standards in the field of packaging and packaging waste) simply requiring compliance with any one of the three Standards relating to recovery, implying that all forms of recovery are equal. In addition to allowing packaging to be designed so that it can be incinerated, EN 13431 (Requirements for packaging recoverable in the form of energy recovery, including specification of minimum inferior calorific value) does not reflect the classification of recovery operations in the WFD. Annex II of Directive 2008/98/EC (WFD) on Recovery Operations, specifies that incineration facilities dedicated to the processing of municipal waste must have an energy efficiency of at least 0.60 or 0.65 (depending on whether they were permitted before or after 31st December 2008). These WFD provisions mean that not all incineration is classed as energy recovery, but there is no reference to this in the Essential Requirements or in the Standard.

Further, underlining the pre-eminence of reuse and recycling, Article 8a of the WFD on extended producer responsibility refers to design for recyclability and publishing information on "the extent to which the product is re-usable or recyclable" – notably excluding other forms of recovery. These EPR provisions and promotion of modulated fees in the WFD reinforce the perspective that there are degrees of recyclability, in contrast to the Essential Requirements,

which present recyclability as a binary status – i.e. packaging (or a proportion of it) can either be theoretically recycled or not; there is nothing relating to whether it is cost-effective to recycle or would produce high quality recycled material, let alone a recognition that it is preferable to have a packaging unit that is 100% recyclable. Nor do the Essential Requirements reflect the changes to Article 6 of the PPWD, which no longer includes any targets for energy recovery, and sets more ambitious *recycling* targets for 2025 (a minimum of 65%) and 2030 (a minimum of 70%) compared to the situation when the Essential Requirements were first implemented. With regards to litter, despite the provisions of Article 9 of the Waste Framework Directive, the Plastics Strategy and the Single Use Plastics Directive (Directive (EU) 2019/904), the Essential Requirements more generally do not include any consideration of how packaging design could affect the ease with which the packaging (or specific parts thereof) is littered and could remain in the terrestrial/ marine environment.

Finally, within the Essential Requirements, there is little guidance over how to address potential conflicts and contradictions. For instance, some packaging that has been re-designed to be lighter weight is also less easily recycled, but there is no indication in the Essential Requirements as to which should take precedence when waste prevention and recycling are mutually exclusive. Similarly, reusable glass packaging needs to be thicker – and consequently heavier – than glass packaging designed for single use. While the wording of Annex II arguably implies that discretion is to be used in interpreting the "minimum adequate amount", the Essential Requirements and EN 13427 do not fully reflect the trade-off between weight and reusability/ recyclability.

In summary, by providing both weak and vague criteria to be classed as recyclable and implicitly allowing all plastic packaging to be designed for energy recovery, the Essential Requirements have arguably facilitated the situation described in the Plastics Strategy: "Today, producers of plastic articles and packaging have little or no incentive to take into account the needs of recycling or reuse when they design their products." As such, the Essential Requirements do nothing to support the transition to a circular economy and the Commission's commitments in the Plastics Strategy: for all plastic packaging placed on the market in the EU to be designed so it is "either reusable or can be recycled in a cost-effective manner" by 2030.[211]

Essential Requirements unenforceable in practice

In terms of effectiveness, the Essential Requirements are difficult to implement and enforce because they leave so much to interpretation. While the Essential Requirements in theory provide rules on what types of packaging can be placed on the market across the EU, their vague nature could potentially mean they pose a barrier to the functioning of the internal market, as interpretations could differ between Member States. There is, however, little evidence to suggest this is a problem because there is so little enforcement activity.

For example, while packaging is not always of the minimum volume and weight, the indeterminate caveats (such as allowing for "consumer acceptance" and "other issues") make it difficult to demonstrate that a packaging item could be non-compliant. Additionally, packaging that is not suitable for reuse, recycling, biodegrading or composting – predominantly plastics that cannot be recycled – will be suitable for energy recovery. This means that all packaging types arguably comply with the Essential Requirements or, perhaps more pertinently, cannot be proven to be non-compliant. This does not necessarily mean that the Essential Requirements

[211] European Commission (2018) *A European Strategy for Plastics in a Circular Economy*. 16th January 2018.

have been ineffective, but rather that the requirements have been formulated too imprecisely to be enforceable.

The presumption of conformity seems to have been interpreted differently in various Member States, with markedly more enforcement activity in a limited number of Member States than in most. The harmonised Standards do not seem to have been extensively relied upon by either producers or enforcers, and a review of their content indicates that they do not provide the necessary degree of clarity to support the Essential Requirements and make them more concrete, operational, implementable and enforceable.

By assigning responsibility for enforcement of the essential requirements to Member States in Article 9 (Essential Requirements) and with the presumption of conformity the responsibility for actual compliance with the standards is shared among the Member States and packaging producers, however there is no enforcement guidance for Member States and, along the supply chain, there is no explicit division of responsibility. Meanwhile, the role of other entities along the supply chain who are ultimately responsible for placing packaging on the market, such as food retailers – who may rely on disposable packaging – is largely overlooked.[212]

The limited compliance and reporting procedures associated with the Essential Requirements contrasts with Article 37 of the WFD and the amended Article 12 of the PPWD. These provisions detail Member States' reporting requirements, including annual reporting to the Commission on reuse and recycling. Additionally, Article 38 WFD promotes information exchange and the sharing of best practice. Although Article 12 and Annex III of the PPWD require reporting on implementation of requirements and attainment against targets, including monitoring of non-compliance (in terms of quantities of municipal/ packaging waste generated, reused, recovered and disposed of), neither the Essential Requirements nor the harmonised standards include any such reporting requirement on the implementation of their requirements or incidence of non-compliance. Instead, the Essential Requirements rely on the use of the harmonised standards, which should enable a "presumption of conformity" with the requirements which can subsequently be monitored and verified, although, in reality, the lack of clarity in and enforceability of the standards and the lack of clarity on the procedures and authorities responsible to enforce them, have rendered this ineffective. This, potentially, also hinders sharing of best practice, which has been identified in the past as an area that could be improved.[213]

Europen (an organisation representing the packaging industry) reported a decade ago that 77% of companies had implemented the CEN Standards in some form.[214] It seems, however, that this was often a more informal approach of reflecting the ethos of the Standards in their internal procedures, rather than strictly and explicitly following the letter of the Standards. Tellingly, it was noted that "often companies do not even realise they are complying with the Essential Requirements and the harmonised standards", indicating that Member States' promotion of the standards and compliance inspections were limited.[215] This would seem to suggest that any positive action from producers cannot be attributed to the Essential Requirements and harmonised standards. Indeed, at a workshop conducted for a 2018 study to inform the

[212] ICF & Eunomia (2018) *Plastics: Reuse, Recycling and Marine Litter.* Final Report for the European Commission. 30th May 2018.

[213] Arcadis (2009) *A Survey on Compliance with the Essential Requirements in the Member States*. Final Report for the European Commission.

[214] ibid.

[215] ibid.

Commission's Plastics Strategy, a packaging expert working in the packaging supply chain reported that they were not aware of the Essential Requirements.[216] This may indicate that little progress has been made in the last decade, and seems to suggest that the Essential Requirements risk being a misnomer. Member States responding to the survey for the Scoping Study commented that the Essential Requirements have had little influence on packaging design, with one respondent explaining that the Essential Requirements "are not so well known or used". While some stakeholders contacted during the preceding Scoping Study, particularly producers, perceived this as beneficial, Member States, such as Belgium, reported that the Standards have had no effect.[217]

Moreover, packaging recycling performance varies significantly between Member States, although this is attributed primarily to variations in waste collection and management systems as opposed to large differences in packaging design for recycling across Member States. However, the recycling performance will get more and more harmonised as the Member States implement recycling systems to meet the increasing recycling targets under the WFD and PPWD. The sortability of packaging plays a key role in the efficiency of their collection and recycling. Indeed, in theory, packaging design with respect to both sortability and recyclability is already harmonised across all Member States, which are responsible for ensuring compliance with the PPWD and the Essential Requirements (and associated Standards). However, as noted in the preceding section, the Essential Requirements and the associated Standards are not widely used in reality.

By 2009, only the UK, France, the Czech Republic and Bulgaria had developed enforcement procedures, but they did not have accompanying measures to monitor the effectiveness of these procedures.[218] Another study for the European Commission in 2011 concluded that "*No Member States have demonstrated that all packaging on their market is compliant with the Essential Requirements, and no Member States have been able to provide evidence that they do not need an enforcement mechanism*." It was, however, noted that industry had launched some voluntary initiatives, including integrating the Essential Requirements into product development.[219]

The 2019 survey responses received as part of the Scoping Study corroborated the impression that there is little by way of Member State enforcement. Many Member States either did not answer the question relating to enforcement, or replied that they have no enforcement mechanisms in place. The survey responses indicated that, generally, the Essential Requirements are accorded a low priority and have had little influence on packaging design. Sweden commented that the Essential Requirements "are not so well known or used" and "are hard to use because of their complexity". Finland has previously commented that evaluating compliance with the Essential Requirement is "challenging and sometimes also open to various

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[216] ICF & Eunomia (2018) *Plastics: Reuse, Recycling and Marine Litter.* Final Report for the European Commission. 30th May 2018.

[217] O-KOM (2019) Remuneration structure for ensuring compliance with the obligation to return and recover packaging waste through EKO-KOM, available at https://www.ekokom.cz/uploads/attachments/Klienti/Poplatky/EKOKOM_fees_valid_from_1_1_2019.pdf

[218] Arcadis (2009) *A Survey on Compliance with the Essential Requirements in the Member States*. Final Report for the European Commission.

[219] BIO IS (2011) *Awareness and Exchange of Best Practices on the Implementation and Enforcement of the Essential Requirements for Packaging and Packaging Waste.* Report for the European Commission. 3rd August 2011.

interpretations". Where enforcement does take place, this usually refers the concentration of hazardous materials in packaging, rather than the recyclability of packaging.

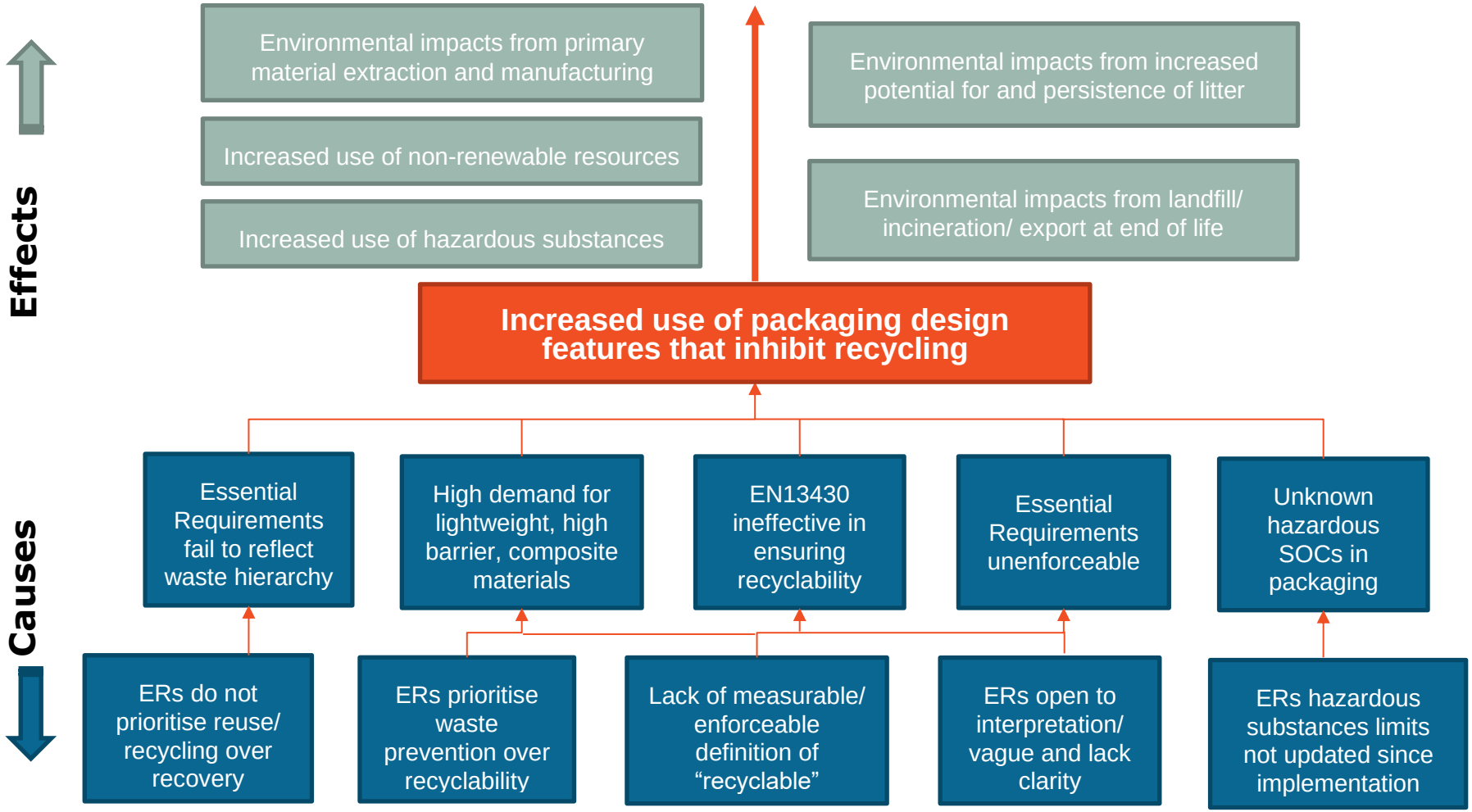
2.1.3 Problem Evolution

It is likely that the trend towards the use of design features that inhibit recycling will continue in the future in the absence of action. The packaging market (particularly for plastics) is a dynamic one, with new packaging formats, material combinations and recycling technologies continually arising. However, the pace at which new packaging formats are introduced exceeds that at which local recycling infrastructure is able to adapt to manage these new formats/ compositions, suggesting a need for active coordination. In addition, the significant economic advantage of adopting such design features to producers and retailers at present suggests that this trend will continue in the absence of clear drivers to the contrary.

It is noted also that while packaging recycling rates have steadily improved since the 1990s, this trend has historically been attributed to the targets established by the Waste Framework and Packaging Waste Directives. Moving forward, increasing targets, accompanied by a new recycling calculation methodology, is likely to make it more challenging for Member States to meet these requirements in the absence of further regulatory and economic incentives for producers to make packaging more recyclable.

The Commission's Plastics Strategy and the SUP Directive already provide the overall policy direction in support of limiting formats that inhibit recycling. In addition, the Commission's Green Deal and the Circular Economy Action Plan support the transition to a climate-neutral, resource-efficient, and therefore circular economy. However, there is an absence of binding measures to tackle these issues in the packaging sector, with the measures that are in place usually having a very narrow focus on specific items/ materials at present. There is therefore a need for additional action to support the implementation of these requirements, accompanied by clear guidance to assist in ensuring compliance. Improved clarity, consistency and enforceability in the Essential Requirements and harmonised standards will go a long way in providing this.

2.1.4 Problem Tree



2.2 Cross-contamination of conventional and compostable recycling streams

2.2.1 Overview

2.2.1.1 Scale and Trends

This application of compostable plastic materials alongside more conventional plastics in consumer packaging has led to confusion about the correct end of life management of such packaging, exacerbated by the fact that in most cases, the compostable plastic alternatives are, in appearance, very similar to their conventional counterparts.[220] Adding to the confusion, biodegradable and compostable packaging is also becoming increasingly widespread, although the current contribution of such materials to the total amount of packaging placed on the market remains relatively small. At present, labelling of such products is typically confusing for consumers, often not providing specific instructions for disposal or bearing messaging which is technically incorrect.

The fragmentation of the collection practices and treatment infrastructures in the Single Market, i.e. almost as many instructions for disposal as there are localities in charge of collection, also prevents economies of scale and greater efficiencies that would arise from simplified and more harmonised practices and infrastructures across the EU (including in terms of communication and awareness raising campaigns).

The demand for bio-based and compostable plastics has grown substantially over the past 15 years, a trend which is expected to continue going forwards as they are used in new applications, in many of which fossil-based plastics are already ubiquitous. In Europe, such packaging has grown from 48,700 tonnes placed on the market in 2003, to 283,000 tonnes in 2018.[221] This represents an almost five-fold increase over the fifteen-year period, although their total share of the plastic packaging market remains small at 1%. The increase is proportionally large given the relatively small quantity of these materials consumed in 2003. This growth is expected to continue with European Bioplastics forecasting that the *global* market for *all* bio-based and compostable plastics will grow by 20% over the next five years.[222] Packaging does however make up the largest field of application for these materials, representing 65% of the *global* market in 2018 (~1.2 million tonnes).[223] Bio-based, non-biodegradable plastics, including bio-based PE, PET and PA made up ~56% of total global bioplastics production in 2017. Going forwards, additional capacity is due to come online in Europe in the coming years and will

[220] Eunomia & Mepex (2018) Bio-Based and Biodegradable Plastics. An Assessment of the Value Chain for Bio-Based and Biodegradable Plastics in Norway. Report for the Norwegian Environment Agency. 30th November 2018. https://www.miljodirektoratet.no/Documents/publikasjoner/M1206/M1206.pdf

[221] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[222] Hoffmann, C. *Global market for bioplastics to grow by 20 percent*

[223] European Bioplastics *New market data: The positive trend for the bioplastics industry remains stable* https://www.european-bioplastics.org/new-market-data-the-positive-trend-for-the-bioplastics-industry-remains-stable/

increase production of bio-based PE.[224] Consumption of bio-based plastics have been driven recently by a few large users, notably, Coca-Cola using bio-PET in its Plant Bottle.[225]

This application of bio-based and compostable plastic materials alongside more conventional fossil plastics in consumer packaging has led to confusion about the correct end of disposal of such packaging, exacerbated by the fact that in most cases, the bio-based/ compostable plastic alternatives are, in appearance, very similar to their fossil-based counterparts.

At present, food packaging, disposable tableware and bags are the largest end use segment for such materials at present, and the major growth driver for biodegradable and compostable polymer consumption.[226] Some countries encourage the use of compostable single-use carrier bags and smaller bags used in shops for fruit and vegetables in bio-waste collections. The aim here is to reduce the amount of contamination in these collections that would otherwise arise from the inappropriate use of conventional plastic carrier bags. In this way, compostable plastics may also play a potential role in reducing contamination levels in bio-waste collection and treatment systems.

Case Study: Italy

Italy collects significantly more food waste than any other European country, with over 6 million tonnes collected in 2015 and amounts steadily rising since. The contamination of food waste by conventional plastic carrier bags was a significant problem. In response to this issue, Assobioplastica – the Italian Association of Bioplastics and Biodegradable and Compostable Materials – was set up in 2011, and it brought together the bioplastics sector with the entities responsible for managing bio-waste plant to consider industry-wide solutions. Alongside this, a ban on conventional plastic carrier bags was introduced in 2010, with retailers required to offer only compostable plastic carrier bags, or paper bags. More recently, a similar ban came into force for smaller fruit and vegetable bags made of plastic. These bans have not yet completely prevented the contamination of compost by conventional plastic carrier bags, as it has not been possible to fully enforce the ban at a national level. But quantities of conventional plastic contamination have been reducing annually in recent years, whilst the amount of compostable plastic has significantly increased – quantities of the latter entering composting plant tripled from between 2016 and 2019.

Compositional assays indicate that the compostable carrier bags are the items made of compostable polymer that are the most frequently used to collect food waste – these accounted for nearly 40% of the compostable plastic in 2019, more than double that of the caddy liners, and significantly more than the fruit and vegetable bags that have been more recently introduced.

[224] Rosenheim, H., De, I., and Hyvedemm, S. *Bioplastics market data 2017*, Report for European Bioplastics, https://docs.european-bioplastics.org/publications/market_data/2017/Report_Bioplastics_Market_Data_2017.pdf

[225] Coca-Cola's 100% Plant-Based Bottle | Packaging Gateway https://www.packaging-gateway.com/projects/coca-cola-plant-based-bottle/

[226] *Demand For Biodegradable Plastics Expected To Surge | CleanTechnica*, accessed 26 February 2019, https://cleantechnica.com/2018/07/31/demand-for-biodegradable-plastics-expected-to-surge/

The most recent data indicates that Italy is on track to meet its target of 50% of compostable plastic bags being treated via the biowaste collection system. Contamination levels of compostable plastic in conventional plastic remain relatively low, at an estimated 6,000 tonnes per annum in 2019.

Sources: https://www.polimerica.it/articolo.asp?id=24090; https://www.packagingnews.co.uk/news/italy-bans-plastic-carrier-bags-04-01-2011; http://www.assobioplastiche.org/index.html; CIC (2020) Food Waste Collection and Recycling in Italy, presentation to the BBIA, available from https://bbia.org.uk/wp-content/uploads/2020/06/RICCI-BBIA-FW-Collection-IT-Webinar-2020-0514.pdf

The further roll-out of food waste collection systems across Member States over the next few years suggests that the future role of such products could be important, as the operation of such collection systems becomes mandatory from 2023 onwards. However, alongside this, there is the potential for the co-existence of both conventional and compostable plastic products to increase consumer confusion, thereby leading to an increase in the quantity of conventional plastic bags contaminating bio-waste systems if such systems are not properly managed. Organic waste is the largest component of municipal solid waste; improvements in the separate collection of this material stream can therefore have a relatively significant impact on overall recycling rates.

2.2.1.2 Consequences

As mentioned above, increased use of bio-based plastics has resulted in an increase in contamination of both organic waste streams and recyclable plastic streams leading, in turn, to a reduction in the quality and quantity of recycled materials. This is due to the proliferation of compostable/ bio-based alternatives in applications in which conventional plastics are already ubiquitous. [227] In some cases, this has resulted in entire loads of recyclables being discarded, which further undermines consumer confidence in source segregation efforts and those perceived to be responsible for recycling.[228, 229] Though this is currently not a significant issue due to the relatively small proportion of such materials in use in the packaging sector, the strong growth projections for bio-based and compostable materials in packaging suggest that the problem may become a more significant barrier to recycling in the next 5-10 years. As noted in the Commission's Plastics Strategy: "in the absence of clear labelling or marking for consumers, and without adequate waste collection and treatment, [the increasing market shares of plastics with biodegradable properties] could aggravate plastics leakage and create problems for mechanical recycling".

Waste operators must ultimately bear the costs associated with additional sorting, washing and disposal requirements, as well as lower prices and fewer end markets for the resulting low quality of recyclate that results. Environmentally, this has negative consequences, since the landfilling/ incineration of recyclable materials not only results in increased GHG emissions, but

[227] Eunomia & Mepex (2018) Bio-Based and Biodegradable Plastics. An Assessment of the Value Chain for Bio-Based and Biodegradable Plastics in Norway. Report for the Norwegian Environment Agency. 30th November 2018. https://www.miljodirektoratet.no/Documents/publikasjoner/M1206/M1206.pdf

[228] Viridor (2018), *UK Recycling Index 2018*, https://www.viridor.co.uk/siteassets/document-repository/recycling-index/viridor-uk-recycling-index-2018.pdf

[229] European Commission (2018), *Behavioural Study on Consumers' Engagement in the Circular Economy*, October 2018, https://ec.europa.eu/info/sites/info/files/ec_circular_economy_final_report_0.pdf

also supports continued reliance on virgin materials rather than recycled ones. In the case of biodegradable packaging, the difficulty in sorting these materials has sometimes led to the misconception that such waste packaging can be discarded as litter – with long-lasting negative impacts on terrestrial and marine environments.[230]

Alongside of the above, bio-waste treatment system operators will also bear the costs of increased contamination from conventional plastic bags arising from the inappropriate use of these products in bio-waste collection systems.

2.2.2 Problem Drivers

Inconsistency and Shortcomings in Collection/ Sorting Infrastructure

While the range of packaging placed on the EU market is largely consistent across all Member States, the systems for packaging waste collection and treatment at the end of life differ widely. This is true of systems for the end of life management of compostable/ bio-based packaging as well, and includes not only the scope of targeted materials and the systems for their collection (kerbside, door-to-door, bring, etc.), but also the infrastructure and technology used for composting, including both home composting and industrial composting. These differences reflect a range of economic, geographic and regulatory considerations, exacerbated by the lack of standards for industrial composting processes/ home composting at present (as recognised in the previous amendments to the PPWD), which can result in the situation in which a particular item of compostable packaging may be correctly separated and subsequently composted in an industrial facility in one Member State, but identified as contamination and disposed of as a part of residual waste from composting in another.

In many cases, these variations in collection systems exist even within Member States, with different systems adopted in different municipalities or regions. It is also noted that given the rapid growth in this sector and the increasing number of applications to which bio-based/ compostable packaging are being applied, outdated/ insufficient collection/ sorting infrastructure or related funding underlies this problem – a situation which may be improved by EPR system requirements on one hand, and ongoing trials to introduce "smart" sorting infrastructure on the other (e.g. digital watermarking/ trackers/ tracers/ product passports, etc.).The latter, in particular, would support increased accuracy in the identification and subsequent separation of compostables in the plastic packaging stream, or vice versa, allowing for their removal in a more efficient manner to prevent contamination.

Shortcomings in approach to relying on presumption of conformity with a harmonised standard EN 13432

A key underlying issue that drives the inconsistency in labelling of bio-based/ compostable plastic packaging, and, in turn, the contamination of the composting/ plastic recycling stream, is the shortcomings in the harmonised standard EN13432. The standard is meant to satisfy the requirements set out in Annex II of the PPWD, that packaging intended for composting should be "*of such a biodegradable nature that it does not hinder the separate collection and the composting process*", while biodegradable packaging should be "*capable of undergoing physical, chemical, thermal or biological decomposition*", producing "*carbon dioxide, biomass and water*". The PPWD as revised in 2018 strengthened the language slightly by requiring that the

[230] https://op.europa.eu/en/publication-detail/-/publication/3fde3279-77af-11ea-a07e-01aa75ed71a1/language-en/format-PDF

compostable packaging "does not hinder" the separate collection and composting process rather than indicating that it "should not hinder" the process. The amendment also specified that oxo-degradable plastic does not count as biodegradable.

However, this has not been the case in reality. For example, despite stating that the packaging should not damage the composting process or affect the quality of the resulting compost, biodegradable bags that are currently compliant with EN 13432 can cause problems for biogas plants as they do not breakdown within the average treatment period. For this reason, and to avoid risk of confusion with conventional plastic bags, some plants automatically remove all types of bag from food waste – regardless of what they are made from and whether they are compostable – prior to treatment.[231] In this regard, the Standard is not proving effective and, arguably, it is not for the packaging supplier to determine in test conditions whether the packaging has "any observable negative effect on the [waste treatment] process", as the treatment facilities themselves may be better placed to judge this.

The essential shortcoming at the root of this is that Standard EN 13432 makes clear that it covers mainly only biodegradability in industrial treatment plants. This means that packaging is tested and certified as compostable in conditions that are not necessarily replicated in real-life conditions once it is placed on the market. As there are no standards for industrial composting processes, they will vary across plants and across Member States (as discussed in the section above). The Standards are also generous in allowing six months for full biodegradation. In reality, this will vary between Member States, but plants' active phases could be just 3-6 weeks, while the post-composting stabilisation phase may be 2-3 months.[232] In the case of anaerobic biodegradation, it is not guaranteed that there will be a second, aerobic, phase even though the Standard assumes there will be. EN 13432 therefore assumes certain conditions or practices as present in the laboratory testing will be used within the composting processes, but there are no accompanying standards for composting processes themselves, so there is no guarantee that these conditions will be met and the evidence is that these conditions are not replicated in actual composting facilities or AD plants. Eunomia has completed a separate study for the European Commission investigating the gaps between assumptions about composting in the Standards and practice in reality[233].

Additionally, in terms of biodegradability and composting for instance, EN 13432 does not apply to home-composting, despite Article 22 of the Waste Framework Directive requiring Member States to encourage home composting. This means that home composting is likely to become increasingly relevant but it is not necessarily clear to consumers (or indeed packaging manufacturers and retailers) that packaging designed to be composted in line with the requirements of EN 13432 and put on the market labelled as 'compostable' is not suitable for home composting. France has previously reported that "EN 13432 is insufficient"; it has consequently developed its own standards on domestic composting, and indicated support for

[231] Eunomia & Mepex (2018) Bio-Based and Biodegradable Plastics. An Assessment of the Value Chain for Bio-Based and Biodegradable Plastics in Norway. Report for the Norwegian Environment Agency. 30th November 2018. https://www.miljodirektoratet.no/Documents/publikasjoner/M1206/M1206.pdf

[232] Ibid.

[233] Eunomia for the European Commission (2020), *Relevance of Biodegradable and Compostable Consumer Plastic Products and Packaging in a Circular Economy*, March 2020, https://op.europa.eu/en/publication-detail/-/publication/3fde3279-77af-11ea-a07e-01aa75ed71a1/language-en?WT.mc_id=Searchresult&WT.ria_c=41957&WT.ria_f=5702&WT.ria_ev=search

the development of an equivalent European standard.[234] As the Standard only relates to test conditions, compostable or biodegradable packaging that is littered is not necessarily any different to all other packaging that is littered; as such, the Standard is meaningless for the proportion of packaging that ends in any marine or terrestrial environment, despite this being an increasing concern to EU citizens and Member States.

As the European Commission's Fitness Check of five Waste Stream Directives noted, Annex II of the PPWD (the Essential Requirements) could create confusion – for Member States, suppliers and consumers – by not clearly differentiating between compostability and biodegradability.[235]

Lack of requirement to demonstrate added value for bio-based/ compostable packaging

The increasing use of bio-based/ compostable plastic material use in the packaging sector, particularly in applications in which conventional plastics are already widely in use, is underpinned by the lack of a requirement for compostable/ bio-based plastics to prove the added value of such material use in these applications, relative to reuse, recycling and other recovery operations of their conventional counterparts. This would include any agronomic benefits associated with the use of compostable plastic in compost/ digestate, as well as any particular applications in which the use of compostable/ bio-based plastic materials improve the quality/ quantity of recycling/ reuse. A previous study by Eunomia for the Commission reviewed the case for compostables from this perspective, finding that "the evidence is weak in favour of any particular agronomic benefit associated with compostable plastic material in compost or digestate and therefore material choices for products and packaging should prioritise recyclability over compostability. Exceptions to this are where the use of compostable plastic have proven 'added benefits' such as increasing the collection of organic waste and its diversion from residual waste or reduction in plastic contamination of compost."[236] It is therefore very likely that the lack of such a requirement is enabling packaging made of compostable/ bio-based plastics to continue to be placed on the market with no clear benefit, and indeed, resulting in contamination of existing waste streams.

Confusing Labelling for Bio-based/ Compostable Packaging

Inconsistent labelling practices across the EU, and in many cases, within Member States, causes consumer confusion regarding the correct disposal options for compostable/ bio-based packaging waste at the end of life, making their correct sorting challenging, and increasing cross-contamination between packaging streams. This inconsistency in part reflects the lack of harmonised/ consistent collection practices between municipalities and across Member States, which is a result of variations in the available infrastructure and technology for such packaging waste sorting and recycling.

A recent study by the One Planet Network provides a global assessment of the potential problems with standards, labels and claims on plastic packaging that reduce the probability of their being correctly sorted and subsequently recycled – among these, bio-based and

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[234] Professional Management (2018) *Implementation of PPWD in Eleven Selected EU Countries.* Report for the Swedish EPA. 19th October 2018.

[235] http://ec.europa.eu/environment/waste/packaging/index_en.htm; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0209&from=EN

[236] https://op.europa.eu/en/publication-detail/-/publication/3fde3279-77af-11ea-a07e-01aa75ed71a1/language-en/format-PDF

compostable plastic packaging are both highlighted in the study as being problematic, as summarised in Table 2-4 below[237]:

Table 2-2: Overview of Findings from One Planet Network Claims Assessment

Claim	Key Findings
Biobased	› **Consumers may misinterpret as biodegradable.** › **Not all biobased sources are sustainable and responsible.**
Compostable and Biodegradable	› **Significant discrepancy between labelling and available composting infrastructure (industrial/ home composting)** › **Labels for marine, soil, or water biodegradability risk giving consumers the false impression that it is acceptable to dispose of plastic packaging in those environments**

The study concluded that:

"consumers generally do not understand the difference between biobased, biodegradable and compostable and the implications of these claims. It is therefore important that these claims include instructions on how to properly dispose of these types of plastic packaging. In a recent study of German consumers comparing correct disposal of recyclable fossil-fuel based plastics and biobased plastics, despite the perceived environmental benefit of biobased plastics, consumers were more likely to dispose of them incorrectly than fossil-fuel based plastic packages (Taufik 2019)".

Ultimately, packaging labelling is an important source of information for consumers and is a key component of recycling habits. This is true of compostable packaging as well, for which labelling intended to provide consumers with disposal information is often incorrect, or misleading. In order to understand the extent to which this labelling is misleading, Eunomia analysed such packaging across Europe.[238] The results found that the majority of labels assessed have certifications and state whether they are biodegradable/ compostable, however they often do not clearly distinguish between home and industrial composting. The majority of labels also do not clearly state which waste stream the product should go in, and, perhaps most worryingly, they do not define the environments they biodegrade in (if labelled as biodegradable). Further bad practice examples involved encouraging irresponsible behaviour such as littering, and mistranslation. Not only is the messaging around compostability complex, but this is compounded by the fact that the messaging is also likely to be very regionally specific which is problematic for products sold across Europe (e.g. translations from one language to another result in different interpretations, etc.).

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[237] One Planet Network (2020), *Can I Recycle This – A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging*, https://www.oneplanetnetwork.org/sites/default/files/unep_ci_2020_can_i_recycle_this.pdf

[238] Eunomia (2019) *Relevance of Biodegradable and Compostable Consumer Plastic Products and Packaging in a Circular Economy*, Draft Report to DG Environment of the European Commission

There are also issues with using the term 'biodegradable' on packaging when no further information about the environments they degrade in is provided. Given the relative infancy of biodegradable packaging in the market, there are a lack of consumer studies on the topic. Of the existing studies, the potential link between biodegradability labelling and littering tends to be highlighted, although there is a lack of conclusive empirical evidence that correlates the marketing of biodegradable plastics with an increase in the tendency to litter. This is because no such studies have been undertaken, rather than evidence being present to the contrary. Several studies do however point towards a perception amongst consumers that 'biodegradable' is a virtuous aspect of a product and that littering such an item would be less impactful.[239],[240]

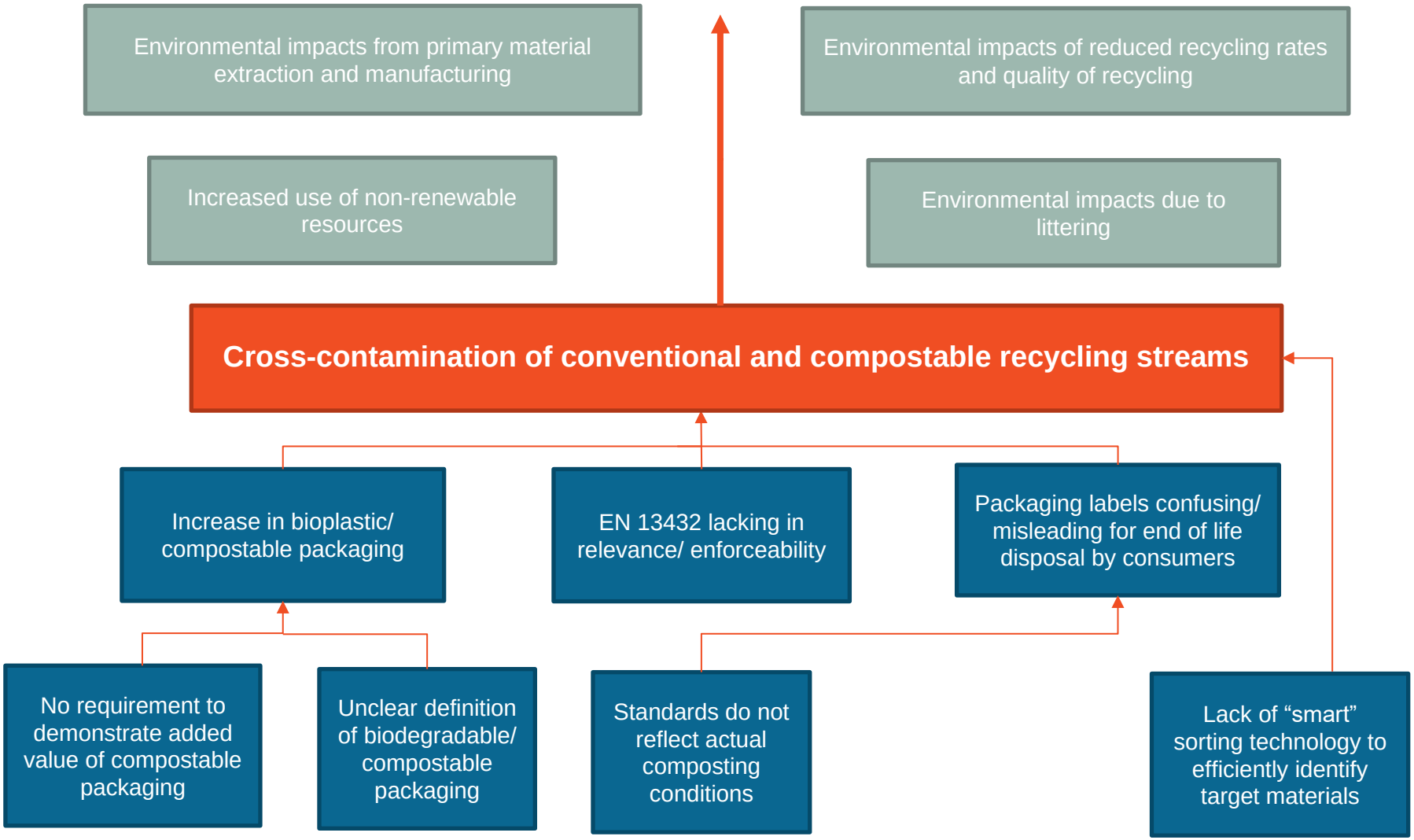
2.2.3 Problem Evolution

The problems associated with the reduced sortability of bio-based and compostable plastic packaging waste - and therefore the increased contamination of packaging waste streams with non-target materials - is likely to persist. Furthermore, issues of contamination in bio-waste collection systems are likely to worsen as European countries introduce more food waste collection systems. The issue may worsen in the absence of intervention, as a consequence of the dynamic nature of the plastic and compostable packaging industries. Both industries include a large and increasing number of constituent materials, formats, and applications for which adequate labelling is not in place to ensure consumer understanding of end of life disposal options. In addition, - in the event that current trends for the increase of bio-based plastics continue - waste operators will be increasingly unlikely to be able to continue to bear the added sorting and cleaning costs associated with such packaging. Increased use of these materials will ultimately increase the inefficiencies associated with operating recycling service and negatively impact recycling rates after a point, despite the role of EPR in shifting this cost burden to producers themselves. Various regulatory and industry-led initiatives have been launched to address these issues, including, among others, the Commission's Green Claims initiative (which includes a call for standardised methods for quantifying the environmental footprint of products). However, it is noted that while the green claims initiative may prevent "greenwashing" (inaccurate claims regarding a packaging item's environmental credentials), it will not necessarily tackle the root cause of the reduced sortability in bio-based and compostable packaging, i.e. inconsistent/ unclear labelling, underpinned by the limitations of Standard EN 13432, and a lack of consistent collection/ sorting/ treatment infrastructure for this material stream.

[239] Keep Scotland Beautiful (2007) Public attitudes to litter and littering in Scotland, *cited in* Brook Lyndhurst (2013) *Rapid Evidence Review of Littering Behaviour and Anti-Litter Policies*, Report for Zero Waste Scotland, 2013, http://www.zerowastescotland.org.uk/sites/files/zws/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf

[240] Brook Lyndhurst (2015) *Public Perceptions and Concerns around Litter*, Report for Zero Waste Scotland, 2015, http://www.zerowastescotland.org.uk/sites/files/zws/Litter%20Insights%20final%20web%20March%2015.pdf

2.2.4 Problem Tree



2.3 Lack of mechanism in essential requirements for addressing changes in use of chemicals in packaging

2.3.1.1 'Noxious materials'

The classification of certain hazardous chemicals (substances or mixtures) is harmonised to ensure adequate risk management throughout the EU. This applies to hazards of highest concern (carcinogenicity, mutagenicity, reproductive toxicity (CMR) and respiratory sensitisers) and to other substances on a case-by-case basis. Harmonised classifications are listed in Annex VI to the CLP Regulation.

Furthermore, substances could be targeted that are classified as persistent, bioaccumulative, and toxic (PBT), or very persistent, very bioaccumulative (vPvB), or endocrine disrupting chemical (EDC) under REACH.

From the Directive text, however, it is not clear whether the term 'noxious and other hazardous materials' has the same meaning as 'hazardous substance' or 'hazardous mixture' under the respective EU chemicals legislation. The Directive predates the CLP and REACH Regulations; therefore, no reference could be made to them in the original text.

2.3.1.2 Is it a problem?

There is little information on the use of hazardous substances in packaging and packaging components. A research project led by the Food Packaging Forum and the NGO ChemTrust attempted to establish a database of *Chemicals associated with Plastic Packaging* (CPPdb) based on publicly available sources. The results of the project, summarised in an article by Groh et al. (2019)[241] identified a significant lack of information on the use of chemicals in plastics manufacturing (i.e., which substances are used in which application and in what quantities, and at which level they are present in final products). The researchers identified the lack of publicly accessible comprehensive registries for chemicals used in plastic packaging as a major challenge hampering the identification of chemicals associated with plastic packaging. Annex I to Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food[242] provides a positive list of monomers and additives authorised for use in plastic food contact materials. This list is limited, however, as it focuses on intentionally added substances and therefore does not cover most non-intentionally added substances. In addition, no such list exists for non-food plastic packaging. Groh et al. (2019) also identified a lack of harmonised toxicological information, such as CLP hazard classifications, for over half of the chemicals included in the CPPdb. To overcome this hurdle it partially relied on advisory CLP classifications for human health hazards as assigned by the Danish Environmental Protection Agency. In relation to the identification of a substance as endocrine disrupting chemical (EDC), the authors used classifications provided under REACH but also other sources, e.g., a report by the United Nations Environment Programme (UNEP) on EDCs, and the Substitute It Now! (SIN) list maintained by the non-governmental organisation International Chemical Secretariat. Furthermore, the study design did not include any commercial, paid-for data sources, in order to ensure that the resulting

[241] Groh KJ, Backhaus T, Carney-Almroth B, Geueke B, Inostroza PA, Lennquist A, Maffini M, Leslie HA, Slunge D, Trasande L, Warhurst M, Muncke J. 2018. Chemicals associated with plastic packaging: Inventory and hazards. PeerJ Preprints

[242] Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food, OJ L 12, 15.1.2011, p. 1–89.

database of chemicals associated with plastic packaging could be made publicly available. It also stresses that "*numerous data gaps exist with regard to the use patterns and exposure, but also toxicity of plastic packaging-associated substances*".

Based on these limited sources, Groh et al. (2019) showed that the use of hazardous chemicals in plastic packaging is suspected to be extensive. The authors identified and included in the CPPdb 4 283 substances that are likely or possibly used during the manufacturing and/or present in the final products. Of the 906 chemicals identified as being likely to be associated with plastic packaging, 63 rank highest for human health hazards and 68 for environmental health hazards according to their harmonised hazard classifications under CLP. Examples include monomers such as bisphenols, acrylamide, melamine or formaldehyde, fire retardants, colorants, biocides, plasticisers like chlorinated paraffins or phthalates, solvents); seven substances are classified in the European Union (under the REACH Regulation) as persistent, bioaccumulative, and toxic (PBT), or very persistent, very bioaccumulative (vPvB) (e.g. some PFAS, or stabilizers such as Benzotriazol), and 15 as endocrine disrupting chemicals (EDC) (e.g. some phthalates, or BPA)[243]. Those figures relate to all plastic packaging, including packaging covered by the FCM legislation. However, non-food plastic packaging still represents a significant share of plastic packaging. According to Groh et al. (2019), around 60% of all plastic packaging is used for food and beverages, while 40% covers non-food applications, such as healthcare, cosmetics, consumer, household, apparel, and shipment packaging[244].

Overall, the study sheds light on three important issues, one being a lack of harmonised toxicological information on many substances used in plastic packaging, second an extensive use of hazardous substances in plastic packaging that may potentially constitute a risk for human health during manufacture, handling and recycling, as well as the environment mainly at the end-of-life, and thirdly a significant lack of information concerning the use of hazardous substances in plastic packaging.

A study by Wiesinger et al[245] identifies more than 2,400 substances of potential concern used in plastics including the caveat that the number may be a low estimation because it is only based on reported hazard classification. The authors agree with other studies pointing at a general lack of transparency regarding substances present in plastics[246]. In addition, they highlight the need to identify and understand the group of non-intentionally added substances (NIAS)[247].

The lack of adequate information on the chemical content of products has also been highlighted by the Commission in relation to the implementation of the circular economy package[248], and the "*significant uncertainties on hazard characteristic and on releases from plastic matrices*" of additives used in plastics has been a reason for ECHA to launch an initiative developing a method for comparing the release potential of different additives[249]. Additives are chemical compounds added to improve the performance, functionality and ageing properties of the

[243] Groh KJ, Backhaus T, Carney-Almroth B, Geueke B, Inostroza PA, Lennquist A, Maffini M, Leslie HA, Slunge D, Trasande L, Warhurst M, Muncke J., Overview of known plastic packaging – associated chemicals and their hazards, 2018.

[244] ibid.

[245] Wiesinger H., Wang Z., Hellweg S., Deep Dive ito Plastic Monomers, Additives, and Processing Aids, Environmental Science and Technology, 2021 55(13), 9339-9351.

[246] ibid. H.

[247] ibid. H.

[248] COM(2018) 32 final, Section 3.1.

[249] ECHA, Plastic additives initiative, 2016-2019.

polymer. Additives in plastics have also been in the focus of a study by COWI and DTI. The study highlights the fact that most hazardous substances used as additives for plastics are able to migrate to the surface of the plastic where they may come into contact with human skin[250]. Another study, authored by Hahladakis et al.[251], assesses on emission/leaching of 'potentially toxic substances'[252] (PoTSs) during recycling processes for all kinds of plastics. It stresses that several PoTSs could potentially be released during recycling and that some additives may have a direct impact on the recyclability of plastics or even might support the degradation of plastics[253]. Considering the potential negative impact on the environment and human health the authors conclude that some of the additives should be substituted with more 'green' and sustainable chemicals[254].

A study by Eriksen et al. found that waste plastic contains metals, including Al, As, Cd, Pb, Ti, and Zn in varying concentrations, in particular in plastic samples from household waste in elevated concentrations. The authors conclude that since some metals are potentially harmful and toxic and that a continuous increase in recycling rates may lead to even higher metal concentrations in the future[255].

The study by Groh et al. (2019) also briefly refers to findings in relation to imports in the US where most of the non-compliant packaging items identified appeared to be imported, often from China.

Similar research on the use of chemical substances in other types of packaging (metal, glass, cardboard, etc.) could not be identified which is a finding in itself: a lack of information on hazardous substances used during the manufacture of and/or contained in non-plastic packaging.

2.4 Inconsistent/ confusing labelling of recyclable packaging

2.4.1 Overview

2.4.1.1 Scale and Trends

Consumers play a key role in the effectiveness of any packaging recycling system in improving recycling rates and quality, by segregating recyclable waste at source. In order to maximise the efficiency of recycling, consumer engagement and understanding of the recycling system (and of what is recyclable) are crucial. Thus, it is important to identify the barriers to this that currently are reported to cause uncertainty or inhibit uptake of sorting systems designed to increase recycling. Central to such uncertainty is the recycling information provided on product packaging and labels. While recycling targets increase in ambition, recycling rates have grown

[250] COWI, DTI, Hazardous substances in plastic materials, TA 3017 (2013), p.5.

[251] Hahladakis J.N., Velis C.A., Weber R., Iacovidou E., Purnell P., An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling, Journal of Hazardous Materials 344(2018) 179-199.

[252] This term is considering that if a hazardous substance remains within the plastic is has a lower risk since it needs to be leached or released or emitted first, before any toxicity can have an impact.

[253] Hahladakis et al. p.195.

[254] ibid.

[255] Eriksen M.K., Pivnenko K, Olsson M.E., Astrup T.F., Contamination in plastic recycling: Influence of metals on the quality of reprocessed plastic, Waste Management 79 (2018), p. 595-606.

relatively sluggishly and a number of studies point to consumer confusion around labelling as a primary factor, as outlined in the previous Essential Requirements Scoping Study.

The issue of consumer confusion regarding the recyclable nature of packaging appears to be particularly pronounced for plastic packaging, given the wide range of polymers and components in such packaging, often with similar appearance. Indeed, in an international comparison study conducted by RECOUP, it was found that uncertainty about what types of plastics are accepted for recycling was the most commonly cited barrier to consumer engagement with efforts to increase source segregation for recycling in both Germany and the UK, and was also significant in Poland.[256]

Research by The Grocer in the UK for instance, showed that 42% of consumer respondents found on-pack recycling labels hard to understand, including 9% who said that it was 'very difficult', and only 11% who said it was 'very easy'.[257] A more recent study by the One Planet Network provides a global assessment of the potential problems with standards, labels and claims on plastic packaging that reduce the probability of their being correctly sorted and subsequently recycled – these are summarised in Table 2-4 below[258]:

Table 2-3: Overview of Findings from One Planet Network Claims Assessment

Claim	Key Findings
Made from Recycled Plastic	› **Different ways of calculating make comparability difficult.** › **Can be confused with recyclable.**
Made from Ocean Plastic	› **Lack of consistent use of terminology and definitions.** › **Brings awareness to the problem in a way that connects with consumers' concerns.** › **Emphasises a lower-priority solution.**
Recyclable	› **Use of universal recycling symbol is not regulated.** › **Actual recyclability relies on accessibility of infrastructure, which is not universal.**

Sources of confusion include both the number of labels, some of which look similar but do not mean the same thing, and symbols providing misleading information. Commonly highlighted points of confusion include:

[256] RECOUP (2017) *Plastics Recycling Consumer Insight Research, An International Comparison*, November 2017, http://www.recoup.org/p/275/publications

[257] Farrell, S. (2019) *Consumers confused over plastic recycling, research shows*, accessed 11 November 2019, https://www.thegrocer.co.uk/plastic/consumers-confused-over-plastic-recycling-research-shows/597987.article

[258] One Planet Network (2020), *Can I Recycle This – A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging*, https://www.oneplanetnetwork.org/sites/default/files/unep_ci_2020_can_i_recycle_this.pdf

- The Green Dot: RECOUP's 2019 study into consumer plastic recycling behaviour found that all respondents were misled by the Green Dot, incorrectly referring to the logo as meaning that the packaging was recyclable.[259] The Green Dot is used across Europe to show that producer has paid a tax towards recovering and recycling packaging. It is possible therefore for an item of packaging to be labelled as 'Not recyclable' but to also bear the Green Dot (because it's also sold in Germany for example).
- The Mobius Loop: an international icon which shows that at item can be recycled somewhere in the world but may not actually relate to the consumer's local area. The Mobius Loop however, can be confused with Resin Identification Codes for plastic packaging, which were designed for recycling centres, not consumers.[260] In a UK survey by the consumer group Which?, 26% of respondents did not know what to do with packaging bearing the Mobius Loop.[261]
- In 2015, the 'Triman' icon was also introduced in France in order to harmonise separate collection systems and show items which household packaging items are covered by an EPR recovery chain.[262] The logo consists of three parts: a human silhouette which represents the consumer; three arrows which symbolise sorting to allow for better waste treatment; circular background which symbolises recycling.
- The Tidyman logo: developed by Keep Britain Tidy, the logo encourages people to pick up litter, yet is often mistaken for a sign of recyclability. The symbol of a man putting a bottle in a bin surrounded by a triangle however, marks glass which should be recycled.[263]

[259] RECOUP (2019) *Research Study Into Consumer Plastic Recycling Behaviour*, accessed 11 November 2019, https://www.mrw.co.uk/download?ac=3153941

[260] Szaky, T. (2015) *Consumers are confused about recycling, and here's why*, accessed 11 November 2019, https://www.packagingdigest.com/sustainable-packaging/consumers-are-confused-about-recycling-and-heres-why150223

[261] Walsh, H. (2019) *The plastic people still recycle incorrectly – and does it really matter? – Which? News*, accessed 11 November 2019, https://www.which.co.uk/news/2019/09/the-plastic-people-still-recycle-incorrectly-does-it-matter/

[262] The Connexion (2015) *Do you know what this icon means?*, accessed 11 November 2019, https://www.connexionfrance.com/French-news/Do-you-know-what-this-icon-means

[263] Adams, C., and Knapton, S. (2019) *Bring in laws to force companies to make recycling labels simpler, MPs told*, accessed 11 November 2019, https://www.telegraph.co.uk/news/2019/07/03/bring-laws-force-companies-make-recycling-labels-simpler-mps/

Figure 2-3 Common symbols on plastic food and drink packaging

Symbol	Meaning
	The On-Pack Recycling Labels (OPRL) tell you whether you can recycle packaging in the UK. They are based on local councils' recycling collections and services.
	The Mobius Loop is an international symbol that simply tells you that somewhere in the world it is possible to recycle the packaging material. If there's a number in the centre this gives the recycled content of the packaging.
	The Green Dot is not a recycling symbol. It's used in some European countries to show that the producer has paid a tax towards recovering and recycling packaging.
	The 'Seedling' is a European-wide label which tells consumers that the material is a bio-plastic which can be composted by industrial processors.

Source: OPRL

Furthermore, 'Which?' (a consumer magazine) investigated recycling labels on 46 of the most popular own-brand items from 11 major supermarkets in the UK, found that 42% of the items was either not labelled or was labelled incorrectly, with all supermarkets making mistakes in how they had labelled products.[264] Ultimately, packaging labelling is an important source of information for consumers and is a key component of recycling habits. This is reflected in the findings of a UK survey of over 6000 people, in which 59% of respondents wanted 'clear and definitive labelling' on packaging.[265]

2.4.1.2 Consequences

Inconsistent labelling practices across the EU, and in many cases, within Member States, causes consumer confusion regarding the correct disposal options for packaging waste at the end of life, making their correct sorting challenging and increasing cross-contamination between packaging streams. This is exacerbated by the increase in packaging design features that inhibit recycling (Section 2.0), and the absence of a clear and consistent definition for packaging that is recyclable across the EU.

This can result in reduced capture of recyclable materials (if consumers wrongly dispose of recyclables in residual waste or as litter), as well as increased contamination of, and increased

[264] The Environment, Food and Rural Affairs Committee (2019) *Plastic food and drink packaging. Sixteenth Report of Session 2017–19*, September 2019, https://publications.parliament.uk/pa/cm201719/cmselect/cmenvfru/2080/2080.pdf

[265] WRAP (2019) *INCPEN & WRAP: UK survey 2019 on citizens' attitudes & behaviours relating to food waste, packaging and plastic packaging*, July 2019, http://www.wrap.org.uk/sites/files/wrap/Citizen-attitudes-survey-food-waste-and-packaging.pdf

costs, associated with the cleaning of recyclable materials that do get captured (if consumers wrongly dispose of materials that are not recyclable or not recyclable in another stream). In some cases, this has resulted in entire loads of recyclables being discarded, which further undermines consumer confidence in source segregation efforts and those perceived to be responsible for recycling.[266, 267]

Waste operators must ultimately bear the costs associated with additional sorting, washing and disposal requirements, as well as lower prices and fewer end markets for the resulting low quality of recyclates. Although the revised EPR rules in the WFD will reduce this cost burden on public authorities, environmentally, this still has negative consequences, since the landfilling/ incineration of recyclable materials not only results in increased GHG emissions, but also supports continued reliance on virgin materials rather than recycled ones. Additionally, the uptake of recycled materials is reliant on the availability of high quality recyclates, particularly in food contact packaging applications. High quality recyclates prevent downcycling and the potential loss of value in materials.

2.4.2 Problem Drivers

Inconsistency and Shortcomings in Collection/ Sorting Infrastructure

While the range of packaging placed on the EU market is largely consistent across all Member States, the systems for packaging waste collection and recycling at the end of life differ widely. This is true not only of the scope of targeted materials and the systems for their collection (kerbside, door-to-door, bring, etc.), but also the infrastructure and technology used for collection, sorting and recycling. These differences reflect a range of economic, geographic and regulatory considerations, and result in the situation in which a particular item of packaging may be separated and subsequently recycled in one Member State, but disposed of as a part of residual waste in another (e.g., household PE films). It is also noted that in some cases, outdated/ insufficient collection/ sorting infrastructure or funding relative to the fast-paced, dynamic nature of packaging product innovation underlies this problem – a situation which will be improved as Member States implement new recycling systems that will support the achievement of the 2025 and 2030 recycling targets under the PPWD and WFD.

The fragmentation of the collection practices and infrastructures in the Single Market, i.e. almost as many instructions for disposal as localities in charge of collection, also prevents economies of scale and greater efficiencies that would arise from simplified and more harmonised practices and infrastructures across the EU (including in terms of communication and awareness raising campaigns).

Lack of Clear/Harmonised Definition for Recyclable Packaging

The challenges associated with a clear, harmonised system for the labelling of packaging as recyclable (or not recyclable) have also stemmed from continued confusion and inconsistency in the definition of what is considered recyclable in the first place. In this regard, waste sorters and recyclers frequently complain that choices in the design and composition of packaging do not take account of the difficulties and costs of treatment as waste afterwards, and the

[266] Viridor (2018), *UK Recycling Index 2018*, https://www.viridor.co.uk/siteassets/document-repository/recycling-index/viridor-uk-recycling-index-2018.pdf

[267] European Commission (2018), *Behavioural Study on Consumers' Engagement in the Circular Economy*, October 2018, https://ec.europa.eu/info/sites/info/files/ec_circular_economy_final_report_0.pdf

consequences for the quality, purity and cost of recyclates (secondary raw materials). In terms of labelling, this has meant that labelling of what is recyclable to date has tended to focus on technical feasibility of recycling, as opposed to whether the packaging actually gets recycled or not in existing systems. A more enforceable definition for what is considered recyclable, which takes into account existing systems of waste management, and which can be applied consistently across Member States would therefore reduce some of the ambiguity in the labelling of such packaging.

Too much Information

A further driver for consumer confusion regarding the labelling of packaging as recyclable is the number of labels on packaging at present, several of which relate to the end of life management of packaging, but not all of which are relevant to consumers in terms of their ability to accurately sort their packaging for recycling. This includes several labels which look similar, but do not mean the same thing, as well as some symbols providing misleading information.

Altogether, this results in a situation in which consumers are confronted with a large amount of information on their packaging, some of which is targeted at non-consumers (e.g. production/ stock barcodes/ serial numbers), some of which relates to their consumption of the product in question (particularly around nutritional/ health and safety information), and some of which conveys information regarding recyclability, end of life disposal routes, EPR eligibility, and other environmental claims. This information can be confusing, and contradictory, especially in the absence of further guidance around the meaning of specific symbols and scope for verification of claims. The use of the OPRL labelling system in the UK has been identified as an improvement in some regards, providing greater clarity than visual symbols alone (though this can cause linguistic barriers in some cases). The use of QR codes to allow consumers to access additional information, and the development of smart technologies like digital watermarking may suggest the potential for further improvements in the streamlining of packaging labelling more widely.

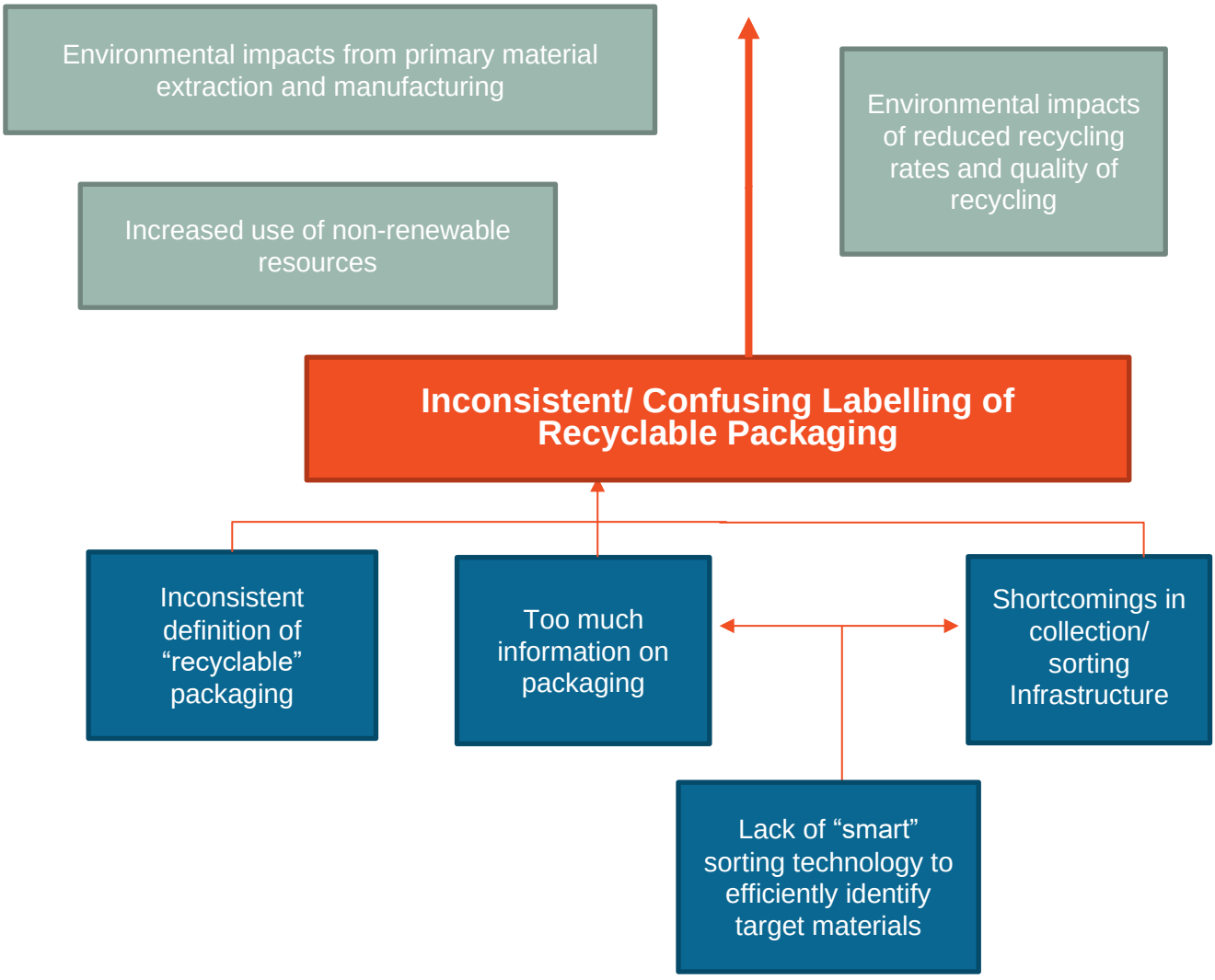
2.4.3 Problem Evolution

The problems associated with inconsistent/ confusing labelling on recyclable packaging are likely to persist, and possibly worsen in the absence of intervention. This is because of the dynamic nature of the packaging industry, which include a large and increasing number of constituent materials, formats, and applications for which adequate labelling is not in place to ensure consumer understanding of end of life disposal options in their MS/ local contexts. In addition, waste operators are unlikely to be able to continue to bear the added sorting and cleaning costs associated with such packaging, which will become inefficient and negatively impact recycling rates after a point.

Various regulatory and industry-led initiatives have been launched to address these issues, including, among others, the Commission's Green Claims initiative (which includes a call for standardised methods for quantifying the environmental footprint of products), and the revision of the food contact material regulations (to include considerations around consumer information on food contact materials). In addition, the scope of the revised EPR requirements, including the modulation of fees on the basis of whether packaging is recyclable or not, to address this issue is currently unclear. However, they are likely to have some impact in terms of removing some forms of unrecyclable packaging from the market, and reducing the cost burden on public authorities associated with sorting, cleaning and decontamination. Industry action via the Circular Plastics Alliance (CPA), includes the development of a range of polymer and packaging

format specific standards to improve collection, sorting, recycling and the uptake of recycled material. However, it is noted that while the green claims initiative may prevent "greenwashing" (inaccurate claims regarding a packaging item's environmental credentials), it will not necessarily tackle the proliferation of inconsistent/ unclear labelling and the underlying lack of consistent collections for recycling. In addition, while there is likely to be overlap between the objectives of the CPA to increase the share of recyclable packaging and the objectives of the proposed revisions to the PPWD and Essential Requirements to make all packaging placed on the market recyclable or reusable by 2030 (which would eliminate the confusion regarding packaging recyclability altogether), the former are voluntary, and are therefore unlikely to either be applied consistently across the EU market, or with the same level of ambition and scrutiny – the need for a legal backstop in order to ensure that the Commission's objectives are met therefore remains.

2.4.4 Problem Tree



3.0 Low levels of uptake of recycled content in packaging

3.1.1 Overview

This section presents the current state of play of recycled content uptake, and associated trends, across different packaging materials in the EU (plastic, paper and card, aluminium, steel, glass and wood).

Firstly, it should be noted that in general, there are significant challenges associated with measuring the amount of recycled content in packaging, and, at present, there is no recognised standard methodology for doing so. It is therefore likely that recycled content measurement methods vary between organisations and across products. When interpreting the (limited) recycled content data that exists, it is important to bear in mind that datapoints are unlikely to be directly comparable or entirely accurate, but they do still give an indication of current level of recycled content uptake in different packaging materials / formats.

The main challenges associated with measuring recycled content are as follows:

- There is no agreed definition of what constitutes recycled content in packaging. The material that can be included or excluded from calculations is therefore open to interpretation, though some international standards do suggest principles that should be followed. For example, ISO 14021 (Environmental labels and declarations) states that "reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it" should not be considered recycled content.[268] This avoids material produced from manufacturing process inefficiencies being masked as recycled content.

- It is not possible to analyse an item of packaging directly and determine the amount of recycled content present. This is a view backed up by the European Committee for Standardization (CEN) which states that "at present there are no reliable technologies for an analytical determination of the recycled content in a material or product".[269] Therefore, any approach to the measurement of recycled content is likely to rely on a chain of custody approach whereby materials are traced from at least the last point at which it is known that the content is from a secondary source to incorporation into final product. This has its challenges, as supply chains can be complex – particularly for plastics – as, for example in the case of plastics, polymer manufacturers tend to blend virgin and recycled material to meet certain specifications on a batch-by-batch basis, thereby leading to batch-wise variability, and complicating traceability.

[268] ISO 14021:2016 Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)

[269] EN 14343:2007, Plastics. Recycled plastics. Plastics recycling traceability and assessment of conformity and recycled content.

It should also be noted that as part of the implementation of the Single Use Plastics Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment (Article 6.5), the European Commission has committed to develop a method for calculating and verifying recycled content in SUP bottles by 1st January 2022. The availability of data relating to recycled content in packaging is likely to improve after this date.

Plastic packaging

According to the EU Plastics Strategy, the demand for recycled plastics accounts for only around 6% of total plastics demand in Europe.[270] The main application for plastics in Europe (EU 28 + Norway + Switzerland) in 2018 (the latest year of available data) was packaging (accounting for ~40% of total demand in that year) [271], so it can be inferred from this data that the uptake of recycled content in plastic packaging is low. The few specific datapoints that exist relate primarily to recycled content in PET bottles, and support this conclusion:

- European Plastic Converters (EUPC) estimate that the average recycled content of PET bottles in the EU is 11.7%.[272] There are exceptions to this, however, with some brands committing to a transition to PET bottles made from 100% recycled PET in the near future (e.g. Coca-Cola Great Britain GLACÉAU Smartwater bottles, Nestle water brand Valvert in Belgium), though whether or not these commitments are achieved, and maintained, remains to be seen.[273, 274]
- The UK Plastics Pact reported that 10% of Pact members' plastic packaging by weight was comprised of recycled content in 2018, though the data was not broken down further by polymer or pack format. [275]
- Analysis by ICIS suggests that the quantity of colourless rPET currently produced is only enough for European packaging and beverage firms to include ~16% rPET content as an average across the industry (and that is if the packaging industry has a 100% market share of the total European rPET market, which it does not).[276]

[270] European Commission (2018) *A European Strategy for Plastics in a Circular Economy*, January 2018, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

[271] Plastics Europe (2019) *Plastics- the Facts 2019*, accessed 2 October 2020, https://www.plasticseurope.org/application/files/9715/7129/9584/FINAL_web_version_Plastics_the_facts2019_14102019.pdf

[272] European Plastics Converters *Packaging Statistics*, accessed 6 October 2020, https://www.plasticsconverters.eu/project-1

[273] Coca-Cola *Coca-Cola Great Britain moves to 100% recycled plastic in all GLACÉAU smartwater bottles | Press and news centre | Coca-Cola GB*, accessed 20 October 2020, https://www.coca-cola.co.uk/our-business/media-centre/coca-cola-great-britain-continues-sustainable-packaging-drive-with-move-to-100-recycled-plastic-in-all-glac-au-smartwater-bottles

[274] https://www.hbmedia.info/petplanet/2019/07/11/first-100-rpet-bottle-launch-from-nestle-europe/

[275] WRAP (2019) *UK Plastics Pact Report 2018-19*, 2019, https://www.wrap.org.uk/sites/files/wrap/The-UK-Plastics-Pact-report-18-19.pdf

[276] Victory, M. *Europe R-PET content targets unrealistic*, accessed 20 October 2020, https://www.icis.com/explore/resources/news/2019/01/31/10313630/europe-r-pet-content-targets-unrealistic

- A recent study published by PRE estimated levels of recycled content in PE non-food films for packaging, with findings summarised in the figure below[277]

Figure 3-1 Estimated levels of recycled content in PE non-food films for packaging

	Flexible PE Films Demand 2018, kt, est.	Recyclates Used 2018, kt, est.	Recycled Content, 2018
Film and foil (non-food)	3,410,000	400,000	12%
Bags/sacks (refuse)	440,000	300,000	68%
Carrier bags	110,000	100,000	91%
Bags/sacks (others)	1,540,000	200,000	14%
Building film	180,000	100,000	56%
Agricultural film	536,000	118,800	22%
TOTAL NON-FOOD	**6,216,000**	**1,218,800**	**20%**

TABLE 1: Use of Recyclate in Key Flexible Film Products, EU28+2 in kt (source: Market Expert)

For plastic packaging, the uptake of recycled content tends to vary significantly by polymer, packaging type and application. For example, the British Plastics Federation (BPF) states that when food contact grade rHDPE is added to virgin HDPE at levels above 45%, the removal of volatiles and additives from the material mix during the final stages of the recycling process can cause degradation issues (therefore, the inclusion of recycled content is limited). In contrast, the same source states that PET packaging can incorporate up to 100% recycled content without any technical issues.[278] Regulatory restrictions related to food contact materials in the EU pose an additional challenge to increasing recycled content in food and drink packaging, which makes up around 40% of all plastic packaging placed on the market at present.[279] This is particularly true for polymers aside from PET.

Furthermore, there are geographical factors to consider. In some Member States, it has been noted that a significant portion of plastic packaging is produced in the country where it is sold (see Figure 3-2 which indicates that 70% of the PET bottles / preforms produced in Germany are used domestically), though the extent to which this is true across all Member States is unclear at present.[280] If this is the case, then, given the wide variations in waste collection and recycling processes between Member States, increasing uptake of recycled content in the packaging production process may be difficult for some producers who have limited access to the required recycled materials. Equally, producers in those Member States that have relatively advanced

[277] Eunomia for PRE (2020), Flexible Films Market In Europe: State Of Play, accessible at https://743c8380-22c6-4457-9895-11872f2a708a.filesusr.com/ugd/dda42a_a45684734c764933a2bc752e54e97212.pdf

[278] British Plastics Federation (2020) Recycled Content Used in Plastic Packaging Applications

[279] ING Economics Department (2019) *Plastic Packaging in the Food Sector*, accessed 20 October 2020, https://think.ing.com/uploads/reports/ING_-_The_plastic_puzzle_-_December_2019_(003).pdf

systems in place for plastic packaging collection and processing are more likely to find it feasible to increase recycled content uptake. For example, ten Member States have deposit refund schemes (DRS) for PET bottles in place, which boosts the recycling rate for PET and the quality of rPET available (the highest performing schemes achieve return rates >90%).[281,282] DRS schemes can provide a consistent supply of high quality food-grade rPET, since the returned beverage containers are not mixed with other types of plastic packaging (they are therefore responsible for a disproportionate share of bottle-to-bottle material). Evidence suggests that there is a higher proportion of recycled content in PET food and beverage packaging produced in Member States with a DRS. For example, analysis by GVM indicates that ~26% of PET used in the domestic production of PET bottles in Germany is rPET (see Figure 3-2), which is higher than the average 11.7% suggested by EUPC.[283,284] The existence of closed loop recycling systems via deposit refund systems for plastic beverage bottles has also been cited by Coca Cola as the one of the enabling factors underpinning their 100% rPET bottle commitments in Norway and the Netherlands.[285]

[281] Croatia, Denmark, Estonia, Finland, Germany, Iceland, Lithuania, Netherlands (bottles larger than 0.5L in volume only), Norway, Sweden

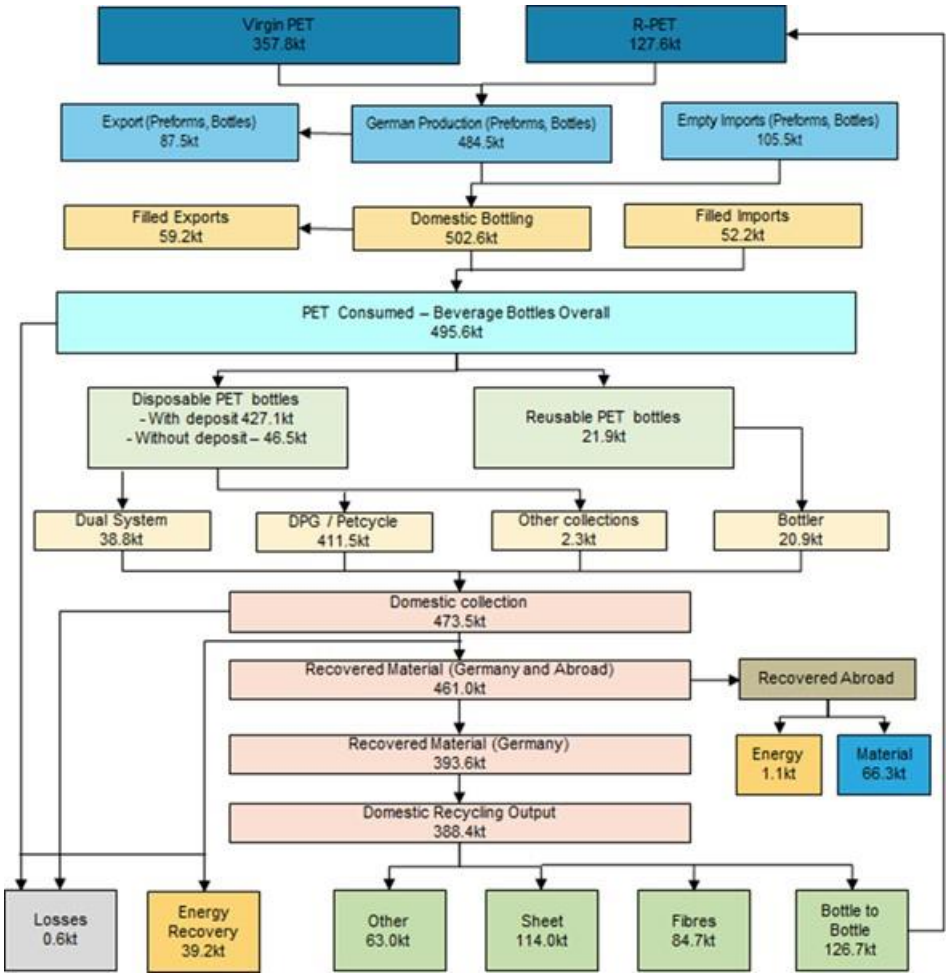
[282] CM Consulting & Reloop (2018) *Deposit Systems for One-Way Beverage Containers: Global Overview 2018*, 2018, https://www.reloopplatform.org/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

[283] GVM (2018) *Aufkommen und Verwertung von PETGetränkeflaschen in Deutschland 2017*, accessed 29 October 2020, https://www.forum-pet.de/rs/u/files/2018_09_19_Verwertung%20PET-Getr%c3%a4nkeflaschen%202017_Kurzfassung.pdf

[284] European Plastic Converters *Packaging Statistics* | *eupc*, accessed 20 October 2020, https://www.plasticsconverters.eu/project-1

[285] https://www.cocacolaep.com/media/news/2020/coca-cola-in-western-europe-transitions-to-100-recycled-plastic-rpet-bottles-in-two-more-markets/

Figure 3-2 PET Bottle - Material Flows (Germany, 2017)



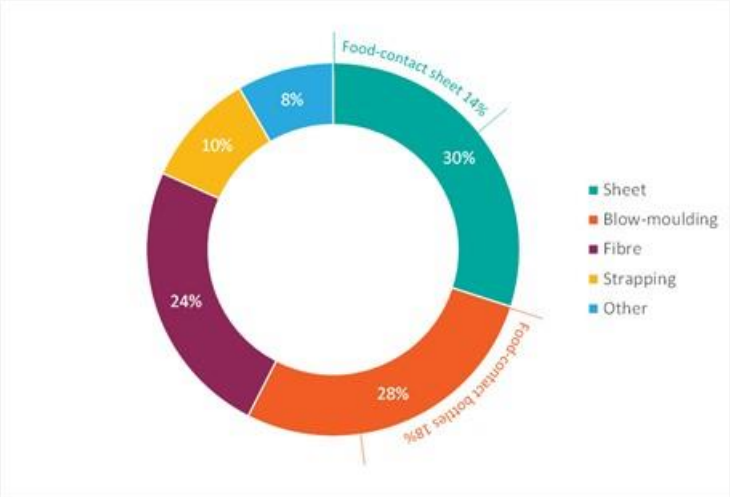
Source: GVM (2018)

A further consideration is that downcycling (i.e., recycling of waste in cases where the recycled material is of a lower quality and functionality than the original material) is relatively common with recycled plastic, and this sometimes limits the potential for it to be used again multiple times, resulting in a situation in which seemingly high recycling rates can mask the environmental benefits that recycling delivers. As the quantity of packaging placed on the market continues to increase, this indicates an ongoing reliance on virgin resources. The lack of uptake of (and therefore demand for) recycled content in applications that retain high material values additionally restricts growth in the recycling sector, prolonging our dependence on other waste management methods such as landfilling and incineration, and the negative environmental externalities these disposal routes entail relative to recycling. For example, PET bottles make up the majority of the input into Europe's PET reprocessing facilities, but less than a fifth rPET is used to manufacture new bottles; most rPET is used in other applications such as trays and sheets, fibre and strapping (see Figure 3-3).[286] These applications cannot always be recycled as effectively as PET bottles, if at all. For example, PET trays are more brittle than PET bottles, and

[286] EFBW, Petcore Europe and Plastics Recyclers Europe (2020) *PET Market in Europe - State of Play: Production, Collection and Recycling Data*, 2020

tend to fragment during the grinding and washing process, meaning that material loss rates in the recycling process can be very high. [287] When downcycling (i.e., where the recycled material is of a lower quality and functionality than the original material) occurs, it is therefore more likely that material is effectively being lost from the packaging system, and must be replaced with virgin resin. This limits the overall amount of recycled content that can be incorporated into plastic packaging.

Figure 3-3 End Markets for rPET (EU28+2) in 2018 based on PRE survey respondents



Source: EFBW, Petcore Europe and Plastics Recyclers Europe (2020)

To the best of our knowledge, there are no reliable data on trends in recycled content uptake in the EU plastic packaging market over time. However, trends in recycled content can be inferred from other, related datasets. These relate primarily to PET packaging, and are discussed below.

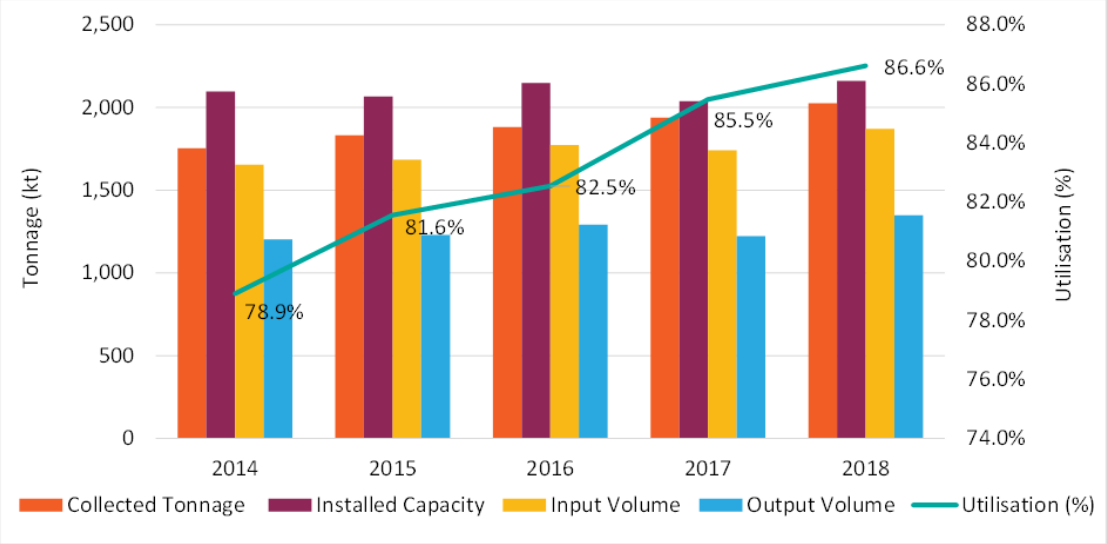
Since 2014, although there has been relatively little growth in reprocessing capacity for PET in Europe, there has been growth in input volumes, driven by increased collections, and a corresponding increase in utilisation and output volumes (see Figure 3-4).[288] The main end market for rPET is packaging, specifically bottles for food and drink (18% of rPET sold) and bottles for non-food (10%), as well as trays and sheets (14% food and 16% non-food).[289] Therefore, it could potentially be inferred that the use of rPET in the packaging sector has been increasing since at least 2014 (note though, that there is no guarantee that the increased rPET output has been going into the packaging sector). Furthermore, an increase in the use of rPET in the packaging sector does not necessarily mean there has been an increase in the recycled content within each packaging item; increased use of rPET could instead be a reflection of an increase in the plastic packaging volume overall.

[287] Hogg (2020) *PET and the hidden complexities of plastic recycling*, accessed 12 October 2020, https://www.isonomia.co.uk/pet-and-the-hidden-complexities-of-plastic-recycling/

[288] EFBW, Petcore Europe and Plastics Recyclers Europe (2020) *PET Market in Europe - State of Play: Production, Collection and Recycling Data*, 2020

[289] EFBW, Petcore Europe and Plastics Recyclers Europe (2020) *PET Market in Europe - State of Play: Production, Collection and Recycling Data*, 2020

Figure 3-4 Change in European (EU28+2) PET Reprocessing over time



Source: EFBW, Petcore Europe and Plastics Recyclers Europe (2020)

Recent trends in rPET prices also signify increased demand for recycled plastic content in packaging. As shown in Figure 3-5, the price of food-grade rPET pellets has been increasing since 2017, and continued to rise in late 2018 / early 2019 even when the price of virgin PET resin significantly declined (due to high virgin stocks and relatively weak demand).[290]

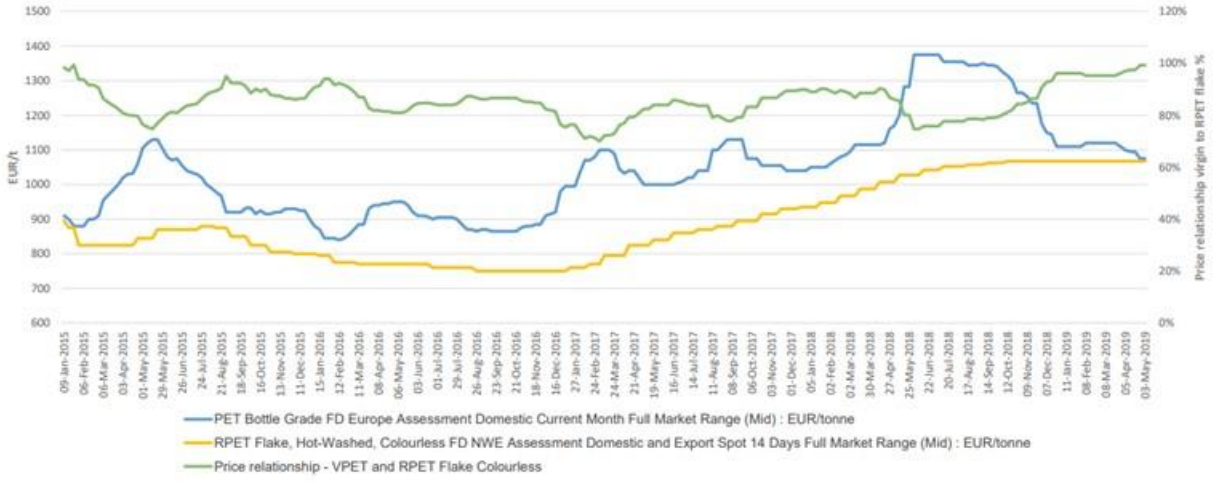
Similarly, Figure 3-6 shows that in the past, non-food grade rPET flake has tracked below the price of virgin PET, but in mid-2018/early 2019 remained stable, despite a sharp decline in the price of virgin PET. This indicates that demand for recycled plastic content is largely decoupled from the price of virgin resin, likely driven by consumer demand, linked to brand commitments to recycled content in packaging, as well as the need to meet future targets set in EU legislation (see Section 3.1.4 for more detail on drivers).

Tightening of waste export markets has also had an impact on the European plastic recycling market, and the availability of recycled materials therefrom. For example, China's "National Sword" policy, enacted in 2018, banned the import of most low-grade/ mixed plastics (and other materials such as mixed, unsorted paper), spurring a number of other traditional export markets to do the same. Prior to the Chinese ban, a significant portion of plastics collected in Europe had been exported to China. This has resulted in calls for more domestic plastic recycling capacity in Europe, and recognition of the need for end markets for the secondary materials that have been produced.

[290] S&P Global (2019) *Plastics Recycling: PET and Europe Lead the Way*, 2019, https://www.spglobal.com/platts/plattscontent/_assets/_files/en/specialreports/petrochemicals/plastic-recycling-pet-europe.pdf

Figure 3-5 Price relationship –vPET and food-grade rPET

Figure 3-6 Price relationship - vPET and colourless rPET flake



Source: ICIS, 2019

Paper and card packaging

Paper and card packaging generally contains a high proportion of recycled material, for example:

- The European Corrugated Packaging Association (FEFCO) estimated that the average recycled content used in corrugated cardboard packaging in 2018 was 89%.[291]
- The Confederation of European Paper Industries (CEPI) estimates that the average recycled content in cartonboard packaging at present is 50%.[292]

[291] Communication with FEFCO, May 2020

[292] Communication with CEPI Cartonboard, May 2020

The exception to this is beverage cartons, for which technical limitations means that current levels of recycled content are 0%.[293] Relatively high levels of recycled content uptake are possible in most other paper/ card packaging applications because recycling rates for paper and card packaging are high in the EU (84.6% in 2017), meaning there is a good supply of secondary material.[294]

In terms of demand for secondary paper/ card, it is noted that in most cases, it is technically possible to include a significant proportion of recycled content in paper and cardboard packaging, although, the recycling process does gradually shorten and weaken the fibres, and so for certain applications virgin fibres must also be used to achieve the performance requirements of the packaging. As a general estimate, fibres can be recycled between 4 and 7 times before they can no longer be used in the paper manufacturing process.[295]

There are health and safety considerations that must be considered if recycled paper or card is used in food packaging, which can limit the uptake of recycled content in certain applications. Depending on the source of the recycled fibre (i.e. whether it was originally used for food or non-food packaging), and the way it was prepared and treated, it is possible for recycled paper and cardboard to contain substances (e.g. residues from inks) at concentrations that are unsuitable in materials that come into contact with food.[296] This limitation can be overcome to some extent by the use of functional barriers such as polymer films or coatings, metallised polymers and / or aluminium foil which prevent the migration of substances, though these additions can pose challenges to the waste collection / sorting / recycling process at the end of life stage. [297]

As noted, levels of recycled content in paper and card packaging appear to already be relatively high (though, data is limited). Consumer demand for recycled content should continue to drive up levels of recycled content in the future, until a technical or supply side barrier is reached. Specific targets for recycled content in paper and card packaging are not in place at present.

Aluminium packaging

According to the European Aluminium Association, aluminium as a material is fully recyclable without loss of quality or change in properties – recycled aluminium cannot be distinguished from virgin material and so there are no technical or health and safety barriers to its incorporation in aluminium packaging.[298] In theory an aluminium packaging item could be made from 100% recycled content.

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[293] Valpak (2012) *PackFlow 2017*, March 2012

[294] EUROSTAT *Recycling rates for packaging waste*, accessed 20 October 2020, https://ec.europa.eu/eurostat/databrowser/view/ten00063/default/table?lang=en

[295] Australian Packaging Covenant *Design Smart Material Guide: Fibre-Based Packaging*, accessed 19 October 2020, https://www.australianpackagingassessment.com.au/wp-content/uploads/2017/11/2.-Fibre_DSMG.pdf

[296] FoodDrinkEurope (2016) *FoodDrinkEurope Guidelines on the safe use of paper and board made from recycled fibres for food contact use*, 2016, https://www.fooddrinkeurope.eu/uploads/publications_documents/FoodDrinkEurope_Guidelines_safe_use_of_paper_and_board_made_from_recycled_fibres.pdf

[297] The term "functional barrier" is defined in Commission Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food (See Article 3 (15)). Article 3, section 15 reads: "*"functional barrier" means a barrier consisting of one or more layers of any type of material which ensures that the final material or article complies with Article 3 of Regulation (EC) No 1935/2004 and with the provisions of this Regulation;"*

[298] European Aluminium Foil Association (2019) Aluminium Foil and Recycled Content - Explanatory Note

However, as outlined below, supply and demand dynamics associated with recycled aluminium act as a barrier to the uptake of recycled content in packaging.

There is an economic incentive to recycle as much aluminium as possible because the value of the secondary aluminium output is high enough to offset the costs of recycling it.[299] This is reflected in relatively high recycling rates for aluminium packaging. For example, the European Aluminium Foil Association (EAFA) reports that the estimated average recycling rate in Europe for packaging with a dominant aluminium component is ~65%.[300] This includes aluminium beverage cans, which are relatively simple to collect and recycle, and for which the average recycling rate is even higher at 75% (ranging from 99% in Germany to 30% in Malta).[301] Although this suggests that there is strong supply of recycled aluminium material from the packaging sector, it is noted that aluminium foils are made using different alloys, and can pose issues for collection and recycling due to their small, often highly contaminated nature. The proportion of post-consumer aluminium foil that is separately collected is therefore often too contaminated, too light and of too low value to attract viable end markets as new foil. Foil collected alongside cans, despite being of a different alloy, is often treated a form of contamination that is unlikely to affect can recycling and is therefore often smelted alongside cans, although this reduces the share of secondary aluminium foil on the market. In addition, many forms of aluminium foil packaging are sold in multi-layer formats, which are not recycled widely. Recycling of aluminium foil is therefore limited, with any recycled materials often used in the automotive industry rather than the packaging sector.

Despite high recycling rates in the packaging sector, it is noted that the available quantities of recycled aluminium do not meet the current demand across all sectors, limiting the uptake of recycled content in all applications, including packaging. Corresponding to this, there is therefore competing demand for recycled aluminium packaging across multiple end-markets (e.g. packaging, automotive, construction), all of which have experienced growth in recent years. As with plastics, the incorporation of secondary aluminium material in applications which cannot be easily recycled, or which have a much longer life-cycle than packaging (e.g. applications in the automotive / construction sectors), limits the amount of recycled content that can be incorporated in aluminium packaging, because the material that is lost (or locked up) in the system must be replaced with virgin material. The use of recycled aluminium from cans in engine blocks, for example, or other applications removes the potential for using secondary aluminium in closed loops since the aluminium in engine blocks is likely to remain 'in stocks' for a decade or so, whilst the production and consumption of cans has a much faster turnover. The specificity of aluminium alloys for particular purposes also means that the loss of can-based materials from the system requires the relevant alloying elements to be added to the feedstock. The same is true for recycled steel.

In terms of the uptake of secondary aluminium in the packaging sector, EAFA estimates that in Europe ~50% of the aluminium produced (both packaging and non-packaging) originates from recycled materials.[302] More specifically, it is estimated that the average recycled content in European aluminium beverage packaging is 47%, though the underlying data to support this is not publicly

[299] ibid.

[300] European Aluminium Foil Association *Recycling & Recovery*, accessed 19 October 2020, https://www.alufoil.org/en/sustainability/recycling-and-recovery.html

[301] Metal Packaging Europe *Aluminium beverage can recycling in Europe hits record 74.5% in 2017 | Metal Packaging Europe*, accessed 19 October 2020, https://www.metalpackagingeurope.org/article/aluminium-beverage-can-recycling-europe-hits-record-745-2017

[302] European Aluminium Foil Association (2019) Aluminium Foil and Recycled Content - Explanatory Note

available at present.[303] There is little information available about the average recycled content in other aluminium packaging applications such as foil trays, aerosols, bottle tops and wrapping foil (the EAFA does not report recycled content figures at a product level), though there are examples of specific products being marketed with high levels of recycled content. For example, Technocap introduced a portfolio of aerosols with 100% recycled content in early 2020.[304]

Steel Packaging

The situation for recycling and recycled content for steel packaging mirror those of aluminium packaging. Steel is fully recyclable without loss of quality or change in properties.[305] There are therefore no technical barriers to the incorporation of recycled steel content in packaging, with levels of up to 100% achievable.

As with aluminium, the high value of steel scrap means there is a strong economic incentive to recycle it, and its magnetic properties mean that once collected, it is relatively easy to recover from the waste stream. As a result, the recycling rate for steel packaging in Europe reached 82.5% in 2018, making it the most recycled packaging material.[306]

There is significant demand for recycled steel from multiple end-markets (e.g. packaging, automotive, construction), all of which have experienced growth in recent years; and as with aluminium, demand therefore currently outstrips supply. Currently, the Association of European Producers of Steel for Packaging (APEAL) reports that the average recycled content in the EU for steel packaging is 58% (based on data from 2017, and validated by the European Commission in 2020).[307] The discrepancy between the 82.5% recycling rate for steel packaging, and the estimated average recycled content of 58% suggests that some steel packaging recycled material is directed to non-packaging applications, which are potentially in use for much longer than an item of packaging. The packaging industry must therefore replaced this "lost" recycled material with virgin material.

In addition, existing infrastructure for steel processing in the EU includes long-life blast oxygen furnaces (BOF), the process for which places strict limits on the amount of scrap that can be included (~25%-30%) relative to electric arc furnace (EAF) technology. Despite advances in the applications for which EAF technology is now suitable, therefore, given that it is economically unviable to upgrade all BOF plants, the resulting continued reliance on BOF technology may limit the potential for RC uptake in steel in applications including packaging. Finally, the presence of contaminants in scrap steel also pose issues (explaining the controls placed on scrap steel levels in BOF plants). In the case of steel packaging, this includes post-consumer contamination including food, paint, chemicals, etc., but also contaminants from the steelmaking process itself, in the form of alloying elements, coatings, etc. which can be difficult to remove, and which tend to accumulate each time the scrap steel is recirculated. While this does not pose problems for some applications

[303] Geographical *Don't bottle it: why aluminium cans may be the answer to the world's plastic problem - Geographical Magazine*, accessed 19 October 2020, https://geographical.co.uk/people/development/item/3560-aluminium-cans

[304] Packaging Europe (2020) *Tecnocap introduces 100% recycled aluminium cans and bottles*, accessed 19 October 2020, https://packagingeurope.com/api/content/8463fcfa-4283-11ea-9933-1244d5f7c7c6/

[305] APEAL *STEEL PACKAGING RECYCLING IN EUROPE REACHES 79,5%*, accessed 22 October 2020, https://www.apeal.org/news/steel-packaging-recycling-in-europe-reaches-795/

[306] APEAL *The recycled content of steel for packaging?*, accessed 19 October 2020, https://www.apeal.org/news2/recycled-content-of-steel-for-packaging/

[307] Ibid.

(e.g. large structural shapes such as bars, beams, and columns, and other steel products that have more lenient residual element restrictions produced in EAF processes), for other small, light applications (including mainly flat products, such as rolled steel used to make automobile bodies and steel studs), contamination must be carefully controlled – this is likely to be the case for steel packaging as well.

Glass Packaging

As with metals, glass can technically be recycled in a closed loop without any loss of quality, and while remaining safe for food contact use. European packaging manufacturers use recycled glass due to the associated environmental benefits and lower production costs, with the French Packaging Council stating that cullet accounts for as much as 63% of material used in the glass industry.[308] However, there are a few factors which make 100% recycled content difficult to achieve:

- **Colour requirements:** Glass composition must be carefully controlled to ensure colour consistency within and between production runs. Colour sorting technology has improved significantly over time, but some contamination is inevitable. Usually some virgin material is required to achieve the desired colour results. Tolerance for colour contamination is very low for clear glass, while there is slightly more leeway for green glass. Amber glass requires the most careful control of the composition – any contamination from plastic or food can alter the chemical reaction which creates the amber colour.[309]
- **Defects from inclusions:** Cullet can contain contaminants in the form of non-container glass (e.g. ovenware, tableware), ceramics, and pyro-ceramics. These are difficult to remove from post-consumer waste streams, do not melt and therefore cause inclusions in finished products (i.e. bubbles, particles, foreign particles). Such products are usually identified in post-production quality checks, so do not impact customers, but do reduce the manufacturer's productivity. [310] It is worth noting that glass collected in mixed streams requires significantly more cleaning and processing until furnace ready cullet is produced than separately collected glass.
- **Supply of high quality cullet:** Glass manufacturers may not always be able to acquire cullet of the necessary quality at a cost that allows their selling price to remain competitive. Various factors influence the pricing and availability of glass cullet. For example, in some markets there can be a mismatch between the colours of glass collected and the colours required by glass manufacturers. In the UK, a large proportion of the glass packaging collected for recycling is green (imported wine and beer), yet a large proportion of the glass packaging produced is clear (e.g. spirits in clear bottles).[311]

Recent data on the average recycled content for glass packaging in Europe, by colour, is presented in Table 3-1. As would be expected, flint (i.e. no colour) has the lowest recycled content, while green has the highest, as manufacturers of green glass can tolerate more contaminated cullet.

Table 3-1: Glass Packaging - Average Recycled Content (Europe, 2019)

[308] French National Council (2019) *Recycled materials and packaging: State of play, Advantages, obstacles, issues and prospects*, February 2019, https://conseil-emballage.org/wp-content/uploads/2019/02/Recycled-materials-and-packaging.pdf

[309] British Glass (2019) *Recycled Content in Glass Packaging*, accessed 19 October 2020, https://www.britglass.org.uk/sites/default/files/00016-E2-2019_Recycled_content_in_glass_packaging_WEB.pdf

[310] Ibid.

[311] Ibid.

Colour	Average recycled content (%)
Unspecified colour	52%
Green glass	80%
Brown glass	50%
Flint glass	40%

Source: FEVE (European Container Glass Federation)

These average figures mask variation by Member State. It is likely that recycled content in glass packaging is higher in those Member States with a higher glass packaging recycling rate, due to a stronger supply of cullet (see Figure 3-7).

Figure 3-7 Glass packaging recycling rate, by Member State, 2016

Source: FEVE

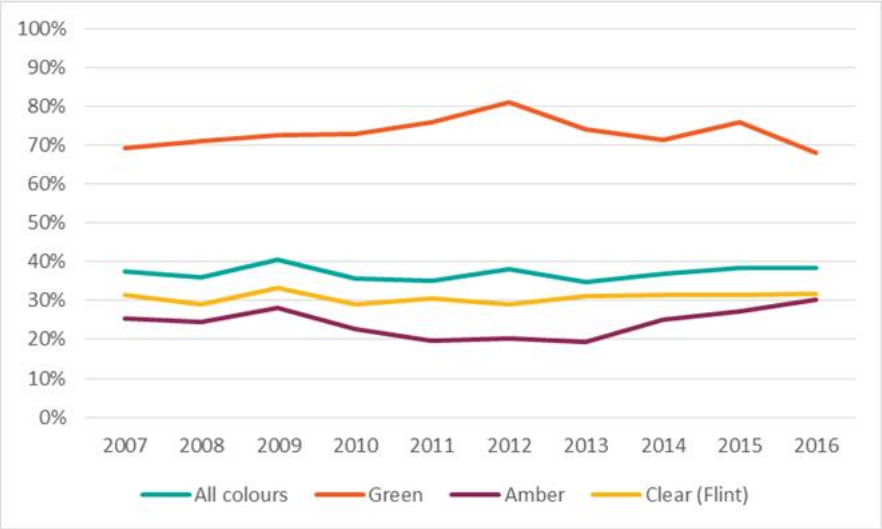
In terms of trends in recycled content uptake in glass packaging over time, British Glass (the British trade association for glass) publishes one such dataset which has been tracking the average recycled content in UK glass packaging since 2008, when a consistent method for measuring recycled content was agreed between UK glass container manufacturers. The materials counted towards recycled content under this method are:

- glass packaging waste e.g. bottles and jars from recycling collections (UK and imports);
- waste plate glass e.g. glazing, automotive; and
- calumite (a waste material from iron production).

Glass from internal process losses (eg test runs, rejects) is not included.

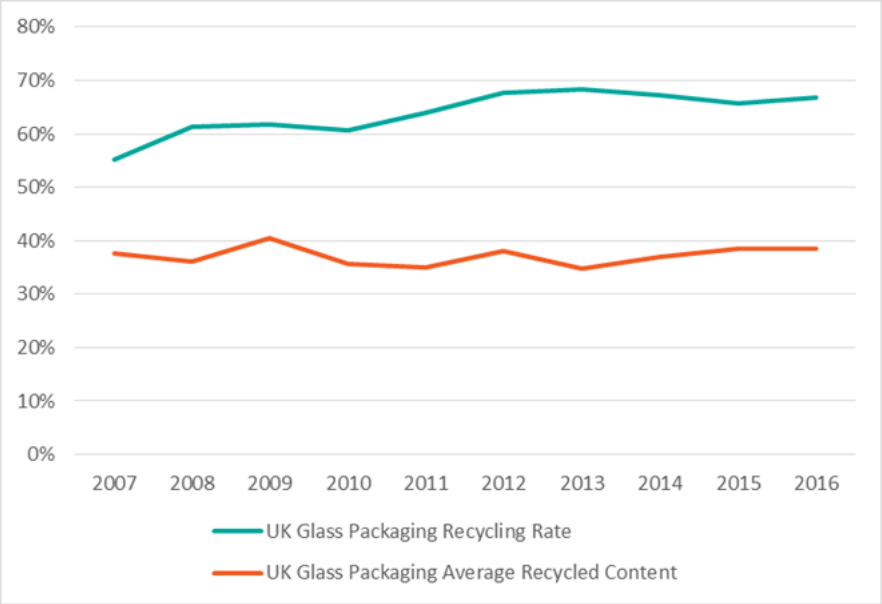
As shown in Figure 3-8, the recycled content in glass packaging remained fairly constant between 2007 and 2016 (albeit with some fluctuation), at an average of around ~40%.[312] In comparison, over the same time frame, the UK glass packaging recycling rate has increased from 55% to 67% (see Figure 3-9). This indicates that there may be some technical issues, or market failures, limiting the uptake of recycled content in glass packaging.

Figure 3-8 UK Glass Packaging - Average Recycled Content (British Glass)



Source: British Glass

Figure 3-9 UK Glass Packaging – Recycling Rate vs. Recycled Content



Source: British Glass; Eurostat

[312] British Glass (2017) *Recycled content – packaging*, September 2017, https://www.britglass.org.uk/sites/default/files/1709_0001-E1-17_Recycled%20content_0.pdf

Wood packaging

The main form of wooden packaging is non-consumer, wooden pallets, which are used to transport goods. Typically, they are constructed from virgin timber and do not contain any recycled content (though, as an exception, some may include compressed blocks of recycled wood in the corners).[313] Though there are targets for the recycling of wooden packaging in the Packaging and Packaging Waste Directive (25% by 2025 and 30% by 2030), wood tends to be downcycled for use as feedstock for the panel board industry, animal bedding, surfacing (e.g. equestrian, play areas, landscaping) and biomass fuel. Further investigation with pallet manufacturers is required to understand the desire and feasibility to make wooden pallets from recycled content (it may not be feasible from a strength / durability perspective). Note that a company called 'Pallite' is manufacturing pallets from recycled content, but they are paper based rather than wood based.[314]

Summary of Trends

The main trends in recycled content uptake across different packaging materials are as follows:

- The uptake of recycled content in plastic packaging is generally low, though there are exceptions, with some brands marketing 100% rPET bottles. Growing pressure from *inter alia* consumers and policy makers is driving brands to increase recycled content in their packaging (across all materials, though plastics are a particular focus for consumers at present). The SUP Directive also includes targets for increased recycled content in beverage containers by 2025/2030. As a result, in recent years, there has been sustained demand for recycled PET from manufacturers, even in periods when the price of virgin PET has fallen significantly.
- Average recycled content in paper and card packaging applications is higher than in plastics (especially for corrugated cardboard and carton board), due to a greater supply of recycled material and fewer technical limitations. However, after multiple life cycles, paper fibres tend to become shorter and less suited to incorporation in new products. Additionally, beverage carton packaging, for technical reasons, cannot include recycled content. Food contact safety considerations also apply to paper and card packaging.
- Aluminium and steel can be endlessly recycled without any loss in quality, or concerns about food safety, so in theory 100% recycled content in steel and aluminium packaging is feasible. The high value of recycled aluminium and steel means strong economic drivers to recycle it already exist, reflected in high recycling rates. However, demand for metal recyclate outstrips supply and limits the uptake of recycled content in packaging applications. Key trade associations argue that any recycled content targets for metal packaging would just divert recycled aluminium/steel from one application to another, rather than stimulate further recycling.
- Glass is also endlessly recyclable, though complications arising from how it is collected (mixed colours, non-glass contaminants) can limit the quality of cullet, and therefore its inclusion in glass packaging.

[313] RAJA UK (2019) *A Guide to Pallets | Understanding warehouse logistics*, accessed 20 October 2020, https://www.rajapack.co.uk/blog-uk/pallets-guide/

[314] PackagingNews (2019) *Pallite moves to use 100% recycled materials*, accessed 20 October 2020, https://www.packagingnews.co.uk/news/materials/paper/pallite-moves-use-100-recycled-materials-12-11-2019

3.1.2 Consequences

The uptake of recycled content in products – as well as recycling rates – varies significantly between different packaging materials, as shown in Table 3-2. Generally, it is observed that greater quantities of packaging material are sent for recycling than make it into new packaging products. For steel and glass, the amount of recycled content that is used in packaging products is equivalent to around three-quarters of the tonnage of material that is sent for recycling. The difference is much greater for PET bottles, however, for which recycled content use is equal to only 20% of the tonnage that is recycled. This suggests that steel and glass used in packaging displays much greater circularity than PET bottles. Where circularity is low, seemingly high recycling rates can mask the environmental benefits that recycling delivers if the secondary materials produced from recycling processes are either being downcycled, or are not being incorporated as recycled content in new products multiple times. As the quantity of packaging placed on the market continues to increase, this indicates an ongoing reliance on virgin resources. The lack of uptake of (and therefore demand for) recycled content additionally restricts growth in the recycling sector, prolonging our dependence on other waste management methods such as landfilling and incineration, and the negative environmental externalities these disposal routes entail relative to recycling. Even waste that has been sent for recycling might not be processed into secondary materials (especially when demand is low), being disposed of instead of becoming recycled content in new products. Therefore, where uptake of recycled content in the packaging sector is limited and displays low circularity, wide-ranging effects are felt on the environment, supply chain, and packaging and recycling markets, as discussed in this section.

Table 3-2 Comparison of Recycling Rate and Recycled Content by Packaging Material (Europe)

Packaging Material	Application	Recycling Rate - 2017	Average Recycled Content
Metals	**All metal packaging**	79.2% (Eurostat)	-
	Steel packaging	80.5% (APEAL)	58% (APEAL)
	Aluminium packaging	Aluminium cans: 74.5% (European Aluminium)	*No data*
Paper/ Cardboard	**All paper and cardboard packaging**	84.6% (Eurostat)	-
	Corrugated Cardboard	-	89% (FEFCO)
	Carton board		50% (CEPI)
Glass	**All glass packaging**	74.7% (Eurostat)	55.5% (average of all colours, FEVE)
Plastic	**All plastic packaging**	41.9% (Eurostat)	-
	PET	56.3% (Petcore)	*No data*
	PET beverage bottle	58.2% (EPBP)	11.7% (EuPC)

3.1.2.1 Continued Reliance on Virgin Resources for Production

Typically, the extraction of virgin resources such as aluminium, steel and glass, oil for the manufacture of plastics, and in the practice of forestry, are associated with a number of negative environmental externalities, including:

- noise;
- dust;
- air overpressure;
- emissions to air and water;
- congestion;
- changes in biodiversity;
- depletion of finite resources; and
- in the case of forestry, changes in carbon sequestration.

It is important to note that the production of recycled content is not without its own externalities, such as emissions generated through collection and re-processing. That being said, the total sum of externalities incurred through extraction and processing of virgin resources far outweighs that of the production and use of recycled content. In particular, the extraction of virgin resources is well-understood to have much greater energy requirements than the use of recycled content, and therefore higher associated GHG emissions.

These emissions contribute to the problem of climate change and low air quality, impacting human, animal and plant health and the environment. Other things being equal, ensuring that production processes make greater use of materials with a lower embodied energy content will support efforts to reduce emissions of GHGs. This is clearly demonstrated through the benefits of increasing the proportion of recycled content across a range of packaging types. Switching to recycled steel, for example, has been shown to reduce the impact on climate change by around 80%, and emissions of particulate matter by circa 70%; whilst CO_2 reductions for aluminium and PET are around 95% and 85%, respectively.[315] With regards to aluminium beverage cans, evidence suggests that the carbon intensity can be as low as 0.5 tonnes CO_2 equivalent per tonne of recycled aluminium, compared to up to 20 tonnes CO_2 equivalent per tonne of aluminium from coal-based production.[316] This is reflected in the process of recycling aluminium, which can be achieved with only five per cent of the energy required to manufacture primary aluminium. Closed-loop recycling also helps to lower GHG emissions more than it would to recycle material in an open loop by maintaining material quality to an extent that it can substitute virgin material, be used multiple times, and maintain its value as a resource. For some materials this can be done indefinitely without the material quality degrading. In open-loop recycling, where material is not re-used multiple times, value is lost from the cycle. One example is the use of recycled glass as aggregate for construction material; once used as aggregate, it can no longer be used in new glass packaging, known as 'down-cycling.' This increases the demand for virgin materials and is less efficient than closed-loop recycling, because of the loss of resources from the cycle. In a closed loop, all materials are used as far as possible to maximise efficiency, and therefore minimise GHG emissions. This is demonstrated in the recycling of

[315] European Commission (2020) *Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement : final report and appendices.*, accessed 16 September 2020, http://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[316] European Aluminium (2020) *Circular Aluminium Action Plan*, 2020, https://www.european-aluminium.eu/media/2931/2020-05-13_european-aluminium_circular-aluminium-action-plan_executive-summary.pdf

aluminium cans, for example, where the reduction in energy requirement is achieved partly through the use of the coatings as fuel for the melting of the material.

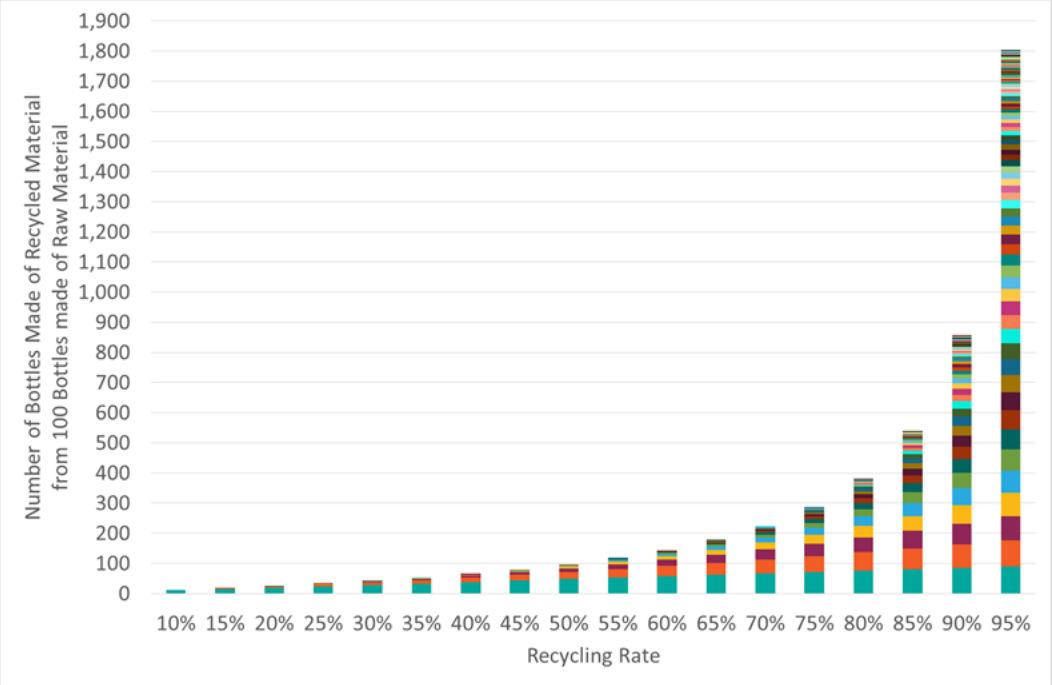
This demonstrates that recycling material in a closed loop maximises resource efficiency by keeping it in use for longer, and therefore higher levels of recycled content will help to reduce GHG emissions further by reducing the need for further primary resource extraction.

Figure 3-10 shows the cumulative impact of higher recycling rates on resource efficiency. The logic behind the chart is as follows:

- At a 10% recycling rate, 100 PET bottles would produce enough rPET to make 10 more PET bottles with the first round of recycling. Once those 10 bottles are recycled, they produce enough rPET to make 1 more PET bottle. In total, the 100 bottles worth of raw material created 11 bottles made of rPET.
- At a 90% recycling rate, 100 PET bottles would provide enough recycled plastic material for 90 bottles more PET bottles with the first round of recycling. Once those 90 bottles are recycled, they produce enough rPET to make 81 more PET bottles, and so on. The dramatic cumulative effects of such a higher recycling rate, over numerous rounds of recycling, on overall material efficiency is shown in this figure.

This demonstrates that recycling material in a closed loop maximises resource efficiency by keeping it in use for longer, and therefore higher levels of recycled content will help to reduce GHG emissions further by reducing the need for further primary resource extraction.

Figure 3-10 Impact of Circularity Through Recycling (95% Yield)



Note: Each colour block represents the number of recycled bottles created from the previous round of recycling

Source: Eunomia

Low uptake of recycled plastic content, however, is preventing these impacts from being felt. Globally, it is estimated that ~1.5% of global oil production is used in the production of plastic packaging, but only 2% of plastic packaging is recycled in a closed loop, while 40% is landfilled and 32% is leaked to the environment.[317]

Furthermore, use of higher amounts of recycled content has a disproportionately large impact on the emissions for plastics packaging. A study in Ireland, for example, showed that increasing recycled content of PET trays from 85% to 100% reduced the overall GHG emissions by 24%.[318] Such significant cumulative impacts are only felt where levels of recycled content are higher; when the combined impacts of both resource efficiency to reduce embodied carbon and the energy savings from the extraction of virgin resources are much greater.

The European Commission has identified increasing the use of recycled content as a key element in the delivery of the Circular Economy Action Plan's goal of designing sustainable products, which will play a significant role in reducing the harmful emissions associated with extraction of virgin

[317] Ellen MacArthur Foundation (2016) *The New Plastics Economy: Rethinking the Future of Plastics*, March 2016, https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_15-3-16.pdf

[318] Dormer, A., Finn, D.P., Ward, P., and Cullen, J. (2013) *Carbon Footprint Analysis in Plastics Manufacturing*, July 2013, https://doi.org/10.1016/j.jclepro.2013.01.014

resources.[319] In order to deliver these benefits, however, there will need to be much greater cooperation along the supply chain to trace and verify the amount of recycled material in products, as well as sourcing the material in the first place. The plastics economy in particular is highly fragmented, which has led to the development of many different materials, formats, labelling, collection schemes, and sorting and reprocessing systems being used. Extensive coordination along the recycling supply chain will be required to enable the plastics economy to supply the right material in order to maximise use of recycled content.

Increasing demand for recycled content would be accompanied by a greater burden on municipalities who will need to make investments into improving recycling collections, potentially requiring increases in fees for those in receipt of such collections. However, this would be mitigated by revenues from an increase in end markets available for the materials processed. In addition, bearing in mind the requirement for EPR schemes for packaging to be in place by 2024 (and by 5th January 2023 for Member States where schemes were established before 4th July 2018), and for these schemes to contribute to the net costs of such waste management improvements, municipalities alone are unlikely to bear these costs. Indeed, waste managers and operators are likely to have to bear these to a certain extent, as new advanced technologies for sorting and processing materials are costly, and not necessarily compatible with existing infrastructure in the short term. However, greater demand for recycled materials would help to drive innovation in such sorting and reprocessing technologies in a commercially viable way in order to allow supply to grow, thereby creating opportunity for investment.

3.1.2.2 Barrier to Increasing Recycling Rates

The low demand for recycled content in the packaging sector hinders the improvement of recycling rates, since there is a lack of end markets to which recycled materials can be sold, making investment in recycling beyond a certain point, and/or for particular materials, economically unviable. This is particularly relevant given the challenges posed by increased packaging waste recycling targets and the revised measurement method for proving attainment against those targets. By measuring recycling rates at the point at which materials are input into the final part of the recycling process, rather than any earlier stage, such as at the point of collection, or just after preliminary sorting (after which points there may be further losses prior to recycling), attainment of these targets will only be achieved if more material is actually recycled.

In Europe, packaging waste that is not re-used or recycled will be disposed of – if properly handled – in one of two ways: energy recovery through incineration, or disposal (landfill). Incineration of waste for energy and heat is an efficient process on which many European countries rely, but does lead to associated GHG emissions through the burning of fossil carbon present in waste. Much of this fossil carbon is found in plastic, which has been shown to emit 55% more GHG emissions when incinerated as opposed to recycled,[320] and for which the uptake of recycled content is the lowest of all packaging materials. Waste can also be exported for energy recovery, transport for which carries associated emissions. Landfills must be carefully managed to prevent leachate – which is formed through the breakdown of waste – escaping into the surrounding water and ground. Illegal incineration operations and dumpsites still exist in some Member States where the environmental consequences

[319] European Commission (2020) *Circular Economy Action Plan: For a Cleaner and More Competitive Europe*, 2020, https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

[320] Hillman, K., Nordisk Ministerråd, and Nordisk Råd(2015) *Climate Benefits of Material Recycling: Inventory af Average Greenhouse Gas Emissions for Denmark, Norway and Sweden*, Kbh.: Nordisk Ministerråd : Nordisk Råd : [Eksp.] www.norden.org/order

of these are not properly managed, and whose associated emissions are higher due to the lack of mitigation efforts. For some packaging types, particularly single-use packaging, problems with littering are also common, with packaging constituting around half of all marine litter items found on European beaches, including food containers, beverage cups and containers, and packets and wrappers. Littered plastics are a particular concern in marine environments, where they can degrade and break down to form microplastics, which re-enter the food chain in marine animals, and are known to build up in humans who consume these, potentially leading to health complications. Landfilling, incineration, littering and waste crime, and their associated emissions and negative externalities, could therefore be reduced if the uptake of recycled content were greater.

Additionally, recycling follows circular economy principles by keeping material at a higher value for longer. If waste is not recycled, and is instead littered landfilled or incinerated, this value is essentially lost from the market, resulting in a continued dependence on virgin materials that is incompatible with the Commission's circular economy aspirations. A lack of uptake of recycled content in packaging therefore constrains demand and the availability of end markets for recyclate, in turn preventing the development of the recycling sector, including increased collections, improved sorting technologies, and so on. A 'chicken-and-egg' scenario therefore exists wherein demand for recycled content is insufficient to drive supply of higher quantities and quality of recycled materials, while the quantity and quality of secondary materials available are inadequate to ensure steady, and increasing, demand.

3.1.3 Problem Summary

Without a recognised method or reliable technologies to measure recycled content in a product, nor any agreed definition as to what can be counted, the uptake of recycled content in packaging is framed by a considerable lack of data. Where data are available, rates of uptake of recycled content in packaging are shown to vary significantly across different materials, with broader categories of paper and cardboard, aluminium, steel, and glass generally showing higher levels of uptake than for plastics and wooden packaging. Within these categories, however, rates of uptake vary further still depending on the packaging application; in the paper and cardboard category, for example, the average level of recycled content in corrugated cardboard is 89%, whilst for beverage cartons it is 0%.

Where there is insufficient supply or demand for recycled materials in a closed loop, the demand for packaging materials must be met through extraction of virgin resources, the environmental impacts for which – including GHG emissions – are much greater than using secondary materials. Furthermore, failure to incorporate higher levels of recycled content into some packaging materials due to low demand actively prevents recycling rates from increasing. This waste is instead treated through incineration for energy recovery and landfill, which further contributes to environmental problems of GHG emissions and pollution, whilst the value of the waste is also lost. Additionally, waste that is not recycled frequently ends up in marine environments, causing pollution which has been shown to cause harm to marine life, and but with as yet unknown effects on species higher up the food chain, including humans.[321] increasing recycling rates to displace waste from incineration and landfill will require investment from municipalities in terms of collection capacity (the burden of which will be shared by producers as per the revised EPR requirements), but it will play an important role alongside improving industry's uptake of recycled content by ensuring a more steady supply of

[321] Akhbarizadeh, R., Moore, F., and Keshavarzi, B. (2018) *Investigating a probable relationship between microplastics and potentially toxic elements in fish muscles from northeast of Persian Gulf*, January 2018, https://doi.org/10.1016/j.envpol.2017.09.028

quality material. This will be particularly important for those materials in which it has been suggested there is currently sufficient demand for recycled materials (such as metals and glass). Addressing these issues with waste will therefore play a key role in achieving the Commission's 2050 climate neutrality objectives, as well as those of the Green Deal in minimising resource use. This will, however, also require a shift in industry to embrace the differences between the secondary and virgin material supply chain, and how to effectively incorporate these materials into their products.

3.1.4 Problem drivers

3.1.4.1 Market Drivers

Much like other markets, recycling post-consumer material to be incorporated into new products is underpinned by steady supply and demand. Where demand for secondary materials for use as recycled content is low, it is much more difficult to achieve higher recycling rates, such as those laid out in the Circular Economy Action Plan; the economics of recycling simply do not work as there is a lack of financial incentive for recyclers. Greater demand must come from an end market to which to sell recycled material, increasing the incentive to collect, sort, and reprocess recyclate of a consistent quality. However, stimulating this demand depends upon a range of factors, including competition with virgin material. Compared to the use of virgin materials, recycled content is associated with greater risk, reduced quality, and inconsistent supply, in addition to higher costs, which act as barriers to its uptake in new products. The term 'packaging,' however, is broad and these barriers apply across different materials to varying degrees. Further detail on these barriers is provided in the sections below.

Insufficient Internalisation of Externalities

Prices for both virgin and recycled materials, including – but not limited to – plastics, at present do not factor in the externalities that will lead to the environmental and social consequences discussed in Section 3.1.2. Instead of being priced into the market, the correction of environmental damage is often a burden for the taxpayer to bear, or simply left to cause harm if unaddressed. By failing to internalise these costs there is a lack of financial incentive to incorporate greater amounts of recycled content into those packaging materials which rely primarily on virgin resources. In principle, full internalisation would reduce demand for materials overall, but to the extent that the externalities of recycled content production are lower than virgin materials, then full internalisation would have the effect of inserting a price wedge between the secondary and primary materials, effectively reducing the price of recycled content relative to primary resources.

Even when uptake of recycled content is high, such as in aluminium packaging products, the extraction of virgin material to meet demand still fails to fully incorporate and address externalities, although accounting for these in the price of virgin materials would not necessarily divert demand towards secondary materials recycled content. Different materials each have different influencing factors affecting uptake of recycled content, which may be affected differently by an increase in costs for virgin materials if externalities were accounted for. The mining of Bauxite, from which aluminium is produced, is heavily associated with polluting emissions to both air and water, the costs of which are not incorporated into production of aluminium. Unlike other raw materials used for packaging, however, bauxite has been recognised on the European Commission's Critical Raw

Materials list,[322] reflecting the dwindling virgin stocks that remain. Recognition that reserves of bauxite are limited has forced the recycling market for aluminium to develop to ensure that material stocks are sufficient to meet growing demand, and it is thought that around 75% of the aluminium ever produced is still in use.[323] Recycled content in aluminium packaging applications is therefore unlikely to be bolstered by an increase in costs for virgin materials, and instead this is more likely to have the effect of increasing the cost for aluminium packaging products overall. For other materials, such as glass and cardboard, the externalities are associated with emissions to air and water, as well as energy use, but the methods of extraction and impacts on stocks are very different. The wood that is used to produce cardboard is a readily available renewable material, but is associated with polluting activities. The recycling of cardboard is fairly straightforward, and already demonstrates high levels of uptake of recycled content, but relies upon the inclusion of virgin material to ensure product quality – recycled cardboard degrades after each cycle. For glass, meanwhile, although the uptake of recycled content is already high, it is thought to be higher in some European countries than in others, since improvements have been made in the collection and sorting phases of recycling (see Section 3.1.1) that could be driven to improve further with a greater financial incentive to use recycled material.

Although it is important to consider the externalities of extraction of virgin materials, for some packaging materials the uptake of recycled content is already relatively high. Accordingly, sufficient internalisation of externalities to insert a price wedge between virgin and recycled materials is more of a driver for the uptake of recycled plastic than for other materials, such as aluminium, for which quality standards and demand for recycled content already exist, but for which supply is insufficient. For these materials, ensuring effective collection, sorting and processing will help to meet a greater demand through maximising the supply and quality of material.

Price Volatility for Virgin Materials

Prices for recycled plastic content factor in a variety of costs that are relatively unchanging, including those associated with collection, sorting, processing, and search and transaction, in addition to the underlying costs of virgin plastics. The price of virgin plastic materials, on the other hand, largely track those of oil and natural gas, since petrochemicals are important feedstocks for plastic production. Although primary commodities markets display a degree of inelasticity in supply responses (i.e. lags in increases or decreases in production as a response to changing prices), the responsiveness of supply to market prices is virtually non-existent in secondary materials markets, making the problem of inelasticity far worse. This is because the nature of the waste collection service is not such that it can be turned on or off, and it also reflects the fact that where recycling is concerned, there is little or no possibility of authorities requesting that participants stop, and then re-start, recycling when prices are low and high respectively. Large fluctuations in oil prices have therefore historically been responsible for volatility in virgin plastics prices, which have, at times, dipped below the point at which the recycling of plastics of a sufficient quality – and the associated price competitiveness of plastic recycled content – is economically viable. In recent years, falling oil prices have led to the cost of producing virgin plastic resin being much lower relative to that of

[322] European Commission (2020) *Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability*, 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN

[323] European Aluminium (2016) *"Recycled Content" vs. "End-of-Life Recycling Rate"*, 2016, https://www.european-aluminium.eu/media/1644/recycled-content-vs-end-of-life-recycling-rate-may-2016.pdf

recycled plastic resins. This has been exacerbated by the impacts of the COVID-19 pandemic, in which demand for oil fell to the extent that it was priced at a negative value in some instances.[324] Costs for producing recycled plastic resin simply do not have the flexibility to compete with virgin resin prices in such instances, and it is expected that it will be at least two years (i.e., 2022) before oil prices recover, and for recycled plastics to be in a more competitive position.[325]

Consumer Demand

Consumer demand for improvements in the environmental impacts of packaging has been growing, and given the direction of policy as set out in the Commission's Plastics Strategy and the more recent Circular Economy Action Plan, brands and producers are starting to respond accordingly. A recent study by WRAP demonstrated that 78% of British consumers "*said that they would feel more positive about a product or manufacturer whose packs contained recycled plastic*,"[326] whilst Veolia found that over half (57%) of the respondents surveyed in the UK believe that plastic bottles are already made from at least 50% recycled content. According to the European Consumer Packaging Perceptions Study, 75% of Europeans admit that the environmental impact of a product's packaging affects their purchasing decision,[327] although it does not specifically address recycled content. Publicising the use of recycled content in packaging used by large FMCG companies such as Coca-Cola[328] and Danone[329], however, suggests that the use of recycled content appeals to the consumer. With increasing awareness of the negative environmental impacts of not recycling, this suggests that consumers might be willing to embrace small increases in packaging costs to account for these impacts, which could partially mitigate the increase in costs associated with switching to recycled plastics in the current market.

Quality Risk Associated with Recycled Content Use

Where virgin materials are readily available, not significantly more expensive than secondary materials, relatively cost-effective, and of guaranteed quality, incorporating recycled content into packaging materials can be considered somewhat risky. For some packaging materials, such as plastics and some paper applications, the perception that quality of packaging material produced from recycled content is poor is considered a key factor in the lack of demand in the sector. In meeting the required standards, a certain proportion of losses from the conversion process is expected. However, beyond a certain threshold, loss rates can make the process inefficient and economically unviable. There are therefore potential risks associated with loss rates from using

[324] Stuab, Colin (2020) *Low virgin plastics pricing pinches recycling market further*, accessed 22 October 2020, https://resource-recycling.com/plastics/2020/05/06/low-virgin-plastics-pricing-pinches-recycling-market-further/

[325] *Ibid*

[326] WRAP (2007) *Using Recycled Content in Plastic Packaging: the Benefits*, https://www.wrap.org.uk/sites/files/wrap/Using%20recycled%20content%20in%20plastic%20packaging%20the%20benefits.pdf

[327] PROCARTON (2018) *European Consumer Packaging Perceptions Study*, 2018, https://www.procarton.com/wp-content/uploads/2018/10/European-Consumer-Packaging-Perceptions-study-October-2018.pdf

[328] The Coca Cola Company (2020) *Sustainable Packaging*, accessed 10 November 2020, https://www.coca-colacompany.com/sustainable-business/packaging-sustainability

[329] Danone (2019) *Circular economy model - Danone*, accessed 10 November 2020, https://www.danone.com/impact/planet/packaging-positive-circular-economy.html

recycled material in packaging for multiple players along the supply chain, including packaging converters and manufacturers/ brands.

For example, contamination is possible if recyclable materials are mixed with non-recyclable materials, potentially preventing an entire batch from being recycled. Undetected contamination could thus compromise the quality of the output. A small amount of PVC in a PET stream, for example, degrades recycled PET resin because PET is melted and processed at a higher temperature than PVC, producing harmful hydrochloric acid gas. This potential for contamination therefore impacts supply of materials of a sufficient quality, and is something which manufacturers using recycled content must be confident will not be affected. Furthermore, recyclate must be washed and cleaned to remove any contaminants such as grease or hazardous chemicals. In order to mitigate such risks, reprocessors often incur additional costs for decontamination, adding to the overall cost of recycled content. These costs are associated with extra mechanical technology (for sorting and cleaning), cleaning agents, energy, water consumption, and the subsequent treatment of contaminated wastewater. New cleaning technologies are emerging, however, that require less energy, water and chemicals to decontaminate homogenous batches, instead employing methods such as supercritical carbon dioxide (sc-CO_2) extraction, which uses carbon dioxide collected from industrial processes and keeps it in a closed-loop cycle to decontaminate plastics.[330] This process is more effective for decontamination of hazardous materials than washing and drying, and produces recycled plastics of a quality that is compliant with REACH regulations for both consumer products and children's articles. That being said, despite better quality output and lower processing costs, these emerging technologies come with high investment costs, which mean they have yet to take hold in the recycling market, and acting as a barrier to quality recycled content reaching the market.

Conversely, the use of virgin materials is more likely to guarantee quality of packaging and ensure that the contents are adequately protected. Virgin material is less likely to be contaminated than recycled content, and has gone through less processing, which degrades the material. Although recycled content can be used in the production of good-quality products, virgin material has a better guarantee and a broader range of uses than recycled content at present. In the case of cardboard packaging, although recycling rates and incorporation of recycled content is high, virgin material is often added to fortify fibres. Like plastic, recycled cardboard is a material that is prone to contamination, often with oil or grease from food which renders it unrecyclable. Additionally, material degrades after being reprocessed four to five times.

Information Failure

The potential for use of recycled content in different applications, and the associated perception of risk described above, is, in some cases, compounded by the lack of clear and accurate information regarding quality. Would-be users of recycled content may be risk-averse and might not be in possession of all the facts regarding the quality of, and hence the potential to make use of, recycled content. As a result, they may also be unaware of the extent to which they could integrate recycled content into their production processes, or need to invest in costly sampling/ testing/ pre-processing strategies to mitigate against this risk. For some of the more complex and less mature materials recycling markets, notably plastics, there remains a role for credible provision of information to lubricate the demand for more recycled content. Wider use of standards would instil greater

[330] Alassali, A. et al. (2020) *Assessment of Supercritical CO2 Extraction as a Method for Plastic Waste Decontamination*, June 2020, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7362185/

confidence in manufacturers and in some markets, there are already relatively well-accepted systems of grading for recycled content (e.g. paper). Such standards, whether industry-led or mandated, fall under the field of regulation, and will play an important role in incentivising the use of recycled content over virgin materials.

High Transaction and Search Costs

In some material markets, the suppliers of virgin materials are well known. Indeed, there may be global exchanges which allow for widespread trading of primary materials. Although there are some exchanges in which recycled content is traded, they are less well-known, and the companies involved may also be relatively poorly known.

The supply chain for recycled content is not as well established as for virgin materials, and costs are therefore incurred in buying or selling material. There must be significant cooperation and transparency between players to eliminate transaction costs, such as broker fees, which can affect buyers and sellers of recycled material. These transactions must be further underpinned by quality checks to ensure supply meets demand, further increasing overall costs. 'Search costs' are often grouped together with transaction costs, as would-be participants might not be known to each other, and therefore incurs the cost of trying to find either a buyer or seller of recycled material. These costs are likely to reduce if the market for recycled material is able to operate on an economy of scale, as for virgin materials.

Unreliable Supply of some Packaging Materials

The supply of recycled content of sufficient quality across all materials and packaging types cannot yet be guaranteed, reflecting – in part – the limitations of processes further up in the supply chain, in which materials are collected, sorted, and re-processed. Recycling rates have increased since 2006 at similar rates across all packaging types, but glass, paper and cardboard, and metallic packaging recycling rates are far greater than those for plastic and wooden packaging (see Table 3-2). Using 100% recycled content in metallic packaging is theoretically relatively straightforward compared to other packaging types, due to material purity and lack of degradation. These materials are more likely to be affected by issues of supply of recycled content, as opposed to quality. Paper and cardboard recycling, on the other hand, is susceptible to issues with quality, which can be for such reasons as oil contamination on food packaging, preventing some material from being recycled despite higher collection rates. Consistently high recycling rates ensure that there is a reliable supply of material, even with some level of contamination, reducing the risk that supply contracts might not be able to be fulfilled by providers of recycled content.

Recycling rates for plastic and wooden packaging, meanwhile, are lower than those of other packaging materials, limiting the availability of recycled packaging material for uptake, and accordingly the lower rates of recycled content in plastic and wooden packaging. Regarding wooden packaging in particular, the data shows fluctuations in recycling rates, although revisions to the targets and associated measurement method for recycling rates in the PPWD should ensure that the reuse and repair of wooden pallets and packaging, as well as the disposal of wood packaging will be included in the calculation of recycling rates more clearly in the future.

Lack of Investment in Research and Development

Firms are reluctant to invest in research and development in areas such as reprocessing technologies and market research, as there is a lack of confidence within the market that the demand for recycled content will be raised sufficiently to make such investments worthwhile. This is particularly true for plastic packaging, for which the quality that the market requires cannot be attained without these investments. Many leading companies involved in sorting technologies are based in Europe, and therefore the development of these technologies should be seen as an opportunity to stimulate

innovation, research and investment in the EU. Without a guarantee of recouping profits, however, lack of innovation is hindering the plastics recycling market.

Despite reluctance from the market to invest in infrastructure for mechanical recycling, the European Commission is funding large-scale research projects in non-mechanical recycling technologies (which are mainly applicable to plastics), such as iCAREPLAST and PUReSmart. These projects investigating the potential for processes such as pyrolysis, where plastic is separated into its basic polymer, additives, and other substances, potentially enabling the removal of undesirable substances such as Substances of Very High Concern (SHVCs), as well as enabling greater circularity. Whilst these technologies are still emerging and are not yet widespread, their potential to work alongside mechanical recycling to improve availability and quality of recycled material is expected to encourage greater uptake of recycled content.

3.1.4.2 Regulatory Drivers

Recycling policy in the EU has historically been focused largely on supply, setting EU-wide targets for Member States that have helped to increase the amount of packaging waste collected for recycling. However, an efficient recycling market that is able to maximise use of this recycled material to an extent that will sufficiently displace virgin resource extraction has yet to fully emerge. Until recently, targets for the uptake of recycled content in packaging to stimulate demand have been lacking, alongside the framework of a measurement method and standards to make such targets feasible. For plastics in particular, market failures discussed above have meant that the use of virgin materials is not disincentivised to such an extent to favour recycled materials, although this is in contrast to some other packaging materials, such as corrugated paper, glass and steel, which already incorporate high levels of recycled content. For those packaging materials which have, until now, been less successful in incorporating recycled content, there is opportunity to develop regulation that can help to stimulate demand in the market across the EU.

Historic lack of recycled content measures in the EU's waste acquis

Until recently there has been a notable gap in European regulation addressing the incorporation of recycled content into new products. In particular, the Essential Requirements, although seeking to minimise the volume of weight of packaging that is used, do not refer to the use of recycled material, and any consideration of recycled content is consequently left out of the accompanying Standards. In neglecting recycled content, setting a very low bar to be classed as recyclable and allowing all plastics to be incinerated, the Essential Requirements and accompanying Standards neither stimulate the demand or supply of recycled material, and, at worst, undermine the whole purpose of the Commission's Circular Economy vision for the packaging sector. They are, therefore, inadequate in the broader policy landscape on recycled content.

Further regulatory gaps have been identified as not sufficiently disincentivising extraction of virgin materials in favour of secondary materials for packaging articles in which incorporation of recycled content is particularly lacking. Considering that the motivation for uptake of recycled content is partly framed against the externalities associated with the extraction of virgin resources, there is an opportunity for regulation disincentivising the extraction of these materials in the form of taxes, tradeable credits or fee-rebate schemes. Whilst the externalities, as described in Section 3.1.2, could be addressed through regulation to ensure the cost for abatement is included across all material extraction, for those materials for which recycled content uptake is already high, it is likely to increase the overall cost of these types of packaging where the recycling market for these materials is already operating efficiently, due to lower potential for increasing the proportion of recycled content used.

Recognising these gaps, more recently, Article 8 of the revised WFD states that "*Member States may take appropriate measures to encourage the design of products*"... "*that contain recycled materials*", mirrored by Article 4 in the PPWD, stating that "*Member States shall, where appropriate, encourage the use of materials obtained from recycled packaging waste for the manufacturing of packaging and other products by: (a) improving market conditions for such materials; (b) reviewing existing regulations preventing the use of those materials*". The SUP Directive subsequently introduced targets for minimum 25% recycled content for single-use PET beverage containers by 2025, and 30% recycled content in all plastic beverage bottles by 2030. In the future, further targets for recycled content can be expected, as set out in the new CEAP, which states that the "*Commission will propose mandatory requirements for recycled content and waste reduction measures for key products such as packaging, construction materials and vehicles, also taking into account the activities of the Circular Plastics Alliance*".

Whilst considered appropriate for certain plastics, where inclusion of recycled content is particularly low, it is noted that there is concern that minimum requirements for other materials or packaging applications would not be effective. The aluminium industry, for example, for which there is insufficient supply of recycled material to meet demand, notes that setting minimum standards for specific products could "simply take recycled aluminium from other products without a minimum threshold."[331] For different plastic products, minimum targets need to consider the circularity of different types of plastic, being careful to avoid the potentially adverse effect of producing low-quality packaging materials which are more difficult to recycle (i.e., down-cycling). Regulation must therefore be appropriately tailored to different packaging materials, as well as considering how the market will respond; including meeting the demand for all recycled materials through improvements in collection, sorting and reprocessing to ensure the quality and quantity in supply.

Legal Restrictions on Recycled Content Use in Packaging (particularly for plastics)

Another consideration is the legal restrictions that can affect the use of recycled content, particularly in packaging used for food, cosmetics and toys. Materials used for food packaging, for example, are subject to strict regulation that prevents the contamination of food items with harmful substances. Food safety regulations limit the possibilities to include secondary material and there is a limited supply of food-grade material due to the nature of the existing sorting systems. It has been suggested that more clarity in the European Union rules under food contact legislation on functional barriers would help. Whilst using recycled content is common in food packaging, it is more difficult to reach the standards required of plastic packaging than it is with other materials such as glass and paper. According to Article 4c of Commission Regulation (EC) No 282/2008:

> *(i) either the plastic input must originate from a product loop which is in a closed and controlled chain ensuring that only materials and articles which have been intended for food contact are used and any contamination can be ruled out; or*
>
> *(ii) it must be demonstrated in a challenge test, or by other appropriate scientific evidence that the process is able to reduce any contamination of the plastic input to a concentration that does not pose a risk to human health.*

[331] Michalopoulou, S. (2019) *Aluminium Windows Contribute to the Circular Economy*, 2019, https://www.european-aluminium.eu/media/2687/aluminium-windows-contribute-to-the-circular-economy_march_2019.pdf

Manufacturers therefore require certainty that recycled content in plastic food and drink packaging is free of contamination, but there are risks associated with using recycled content. This could be due to contamination in the recyclate, and therefore could discourage manufacturers from using recycled content in their products, with the exception of PET packaging. It may also be that industry standards need to be reviewed to allow more scope for recycled content. The new Circular Economy Action Plan recognises this need, suggesting that, on the one hand that *"EU companies should benefit from a robust and integrated single market for secondary raw materials and by-products. This requires deeper cooperation across value chains, as in the case of the Circular Plastics Alliance"*, and, on the other, that the *"Commission will consider legal requirements to boost the market of secondary raw materials with mandatory recycled content (for instance for packaging, vehicles, construction materials and batteries). Commission will also establish rules for the safe recycling into food contact materials of plastic materials other than PET"*. An evaluation of, and subsequent revisions to the food contact regulations are, at the time of writing, ongoing.

It is noted that whilst EU food contact legislation exists for plastics, there is no such harmonised legislation for packaging for other packaging materials used in food contact applications, such as paper, cardboard and glass, with regulations instead enforced at Member State level.[332] Despite no legislation, Framework Regulation (EC) No 1935/2004 sets out the general requirements for food contact materials as follows:

Materials and articles, including active and intelligent materials and articles, shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could:

(a) endanger human health; or

(b) bring about an unacceptable change in the composition of the food; or

(c) bring about a deterioration in the organoleptic characteristics thereof.

Therefore, although there is no harmonised legislation for non-plastic food-contact packaging materials, similar principles apply that mitigate the risk of potentially harmful substances, although to a less prescriptive extent. Recognising the potential issues that might be raised from some other food-contact packaging materials, some Member States are known to have put in place their own legislation. Belgium and the Netherlands, for example, have set a total migration limit for regulated substances commonly found in recycled paper and board fibres, whereas restrictions for the total dry residue in hot and/or cold-water extracts for paper and fibres have been set by others, including Czech Republic, Germany, France and Slovakia. The only legislation requiring producers to declare compliance with migration levels from paper/board fibres is in Italy.[333] For glass packaging, whilst generally considered safe to recycle, there is also a risk that contamination through the recycling process can lead to potentially harmful substances in recycled material. Regulations that apply to glass packaging are generally in line with the regulations that apply to ceramics. Member States regulate substances used for treatment of the external surfaces of glass, particularly lead and

[332] FoodDrinkEurope (2016) *FoodDrinkEurope Guidelines on the safe use of paper and board made from recycled fibres for food contact use*, 2016, https://www.fooddrinkeurope.eu/uploads/publications_documents/FoodDrinkEurope_Guidelines_safe_use_of_paper_and_board_made_from_recycled_fibres.pdf

[333] Joint Research Centre. (2016) *Non-Harmonised Food Contact Materials in the EU: Regulatory and Market Situation, Baseline Study: Final Report.*, Report for LU, 2016, https://data.europa.eu/doi/10.2788/234276

cadmium, as well as other metals,[334] that are often present in glass light bulbs, and which can contaminate recycling.

Whilst regulations for other packaging materials are not as stringent as those for plastics recycling (potentially allowing industry to make greater use of recycled materials), where there is a lack of harmonised legislation, such divergence between Member States could affect confidence among manufacturers as to whether recycled materials can be effectively used in packaging without risking contamination of food or drink contents. Furthermore, where packaging is used across multiple Member States, it would have to comply with the strictest regulations, potentially discouraging industry from using recycled paper/board fibres or glass if it does not comply.

Lack of Standards for Measurement/ Quality of Recycled Content

The packaging market is not well-supplied with accurate and clear information regarding the quality of recycled content, and the potential for its use. For some of the more complex and less mature markets, notably plastics, there remains a role for credible provision of information to lubricate the demand for more recycled content. The European committee for Standardization (CEN) states that: "*at present there are no reliable technologies for an analytical determination of the recycled content in a material or product*." To tackle this, a CEN Standard which sets out a mandatory process to be followed to assess the potential to include recycled content could provide manufacturers with greater confidence to include these materials in their products. However, clear standards of a regulatory nature are not always easy to develop. For example, an attempt was made to define an 'end-of-waste' standard for plastics at the European level, but this proved to be extremely challenging.

Mandated standards for traceability of recycled content would help to guarantee that materials are safe for use in food contact packaging, by certifying that there are no harmful substances present in the recycled content used. There are points in the supply chain in which the recycled content of material is known to a relatively high degree of accuracy, but at present this is not tracked. Traceability of the input material will play a key role as it will enable an accurate tracking of the source and characteristic of incoming material, as well as minimising fraud along the value chain.

For many materials, once they have been prepared to be manufactured into a product (e.g. plastic flakes, metal sheets), distinguishing the proportion of the material derived from recycled materials, or primary ones, becomes difficult, if not impossible. At present, however, there is no agreed point at which to measure recycled content in new products, whether this might be at the point when recyclate has first been transformed to be used in the manufacture of a new product, or whether at the point it *becomes* a new product.

3.1.5 Problem evolution

To some extent, the EU has already sought to stimulate the market for recycled content through policy. For example, Article 8 of the WFD states that "Member States may take appropriate measures to encourage the design of products" [...] "that contain recycled materials". This, however, does not require Member States to take any action, and therefore it is reasonable to assume that, given the market failures described in Section 1.2.1 above, its future impact on the uptake of recycled content will continue to be minimal.

More directly, the Single Use Plastic Directive (SUP Directive) includes a target of 25% recycled content for PET beverage containers by 2025, and 30% for all beverage bottles by 2030. The vast majority of beverage containers are made from PET, meaning the 30% target can be met through

[334] ibid.

increasing recycled content in PET bottles alone. This target is therefore unlikely to stimulate the development of recycling markets outside of rPET (e.g,. rHDPE), for which the market is already relatively well-developed compared to some other plastics. Another factor to be aware of is that recycled content targets set for specific packaging types, such as PET bottles, may have the effect of simply diverting recycled material from one application to another, rather than stimulating an overall increase in the uptake of recycled content across all PET packaging. This is an argument put forward by the EAFA in the context of recycled content targets for aluminium packaging. The EAFA suggests that the aluminium recycled content market is supply constrained, but that there are already sufficient economic drivers in place to ensure aluminium is recycled. It argues that *"calling for high aluminium recycled content in specific applications"* will not stimulate further aluminium recycling and instead would just divert recycled aluminium from one application to another.[335]

The SUP Directive also includes a target to collect 77% of single use plastic bottles by 2025, and 90% by 2029. In response, several Member States are at varying stages of planning and implementing a DRS for beverage containers (Malta, Poland, Portugal, Romania, Slovakia, and the UK[336]). Though the main aim of a DRS is to boost collection rates for single use plastic bottles, such systems also provide a clean and consistent stream of food-grade rPET. There is some evidence to suggest that the current supply of rPET is insufficient to support high levels of recycled content[337], and therefore any additional supply of rPET is likely to be beneficial in terms of boosting recycled content uptake in PET packaging. However, there are also number of demand side drivers which limit uptake of rPET (see Section 3.1.4). Therefore, it is reasonable to conclude that improving the supply of rPET alone will not be sufficient to significantly increase recycled content uptake across plastic packaging.

Finally, the EU has confirmed that non-recycled plastic packaging waste will form the basis of a new Member State budgetary contribution from 1 January 2021. This is set at a rate of €0.80 per kg of non-recycled plastic packaging, introduced alongside a mechanism to prevent regressionary impacts. It is unclear whether, or how Member States will use this to incentivise the plastic packaging industry to ensure plastic packaging is recyclable and incorporates recycled content (e.g. by passing on the burden of the contribution via a tax on packaging producers using virgin materials). In the best-case scenario, the mechanism does have the potential to drive a price wedge between virgin plastic for packaging and recycled plastic, thereby making the latter more competitive, and potentially encouraging its uptake. Equally, however, given the current price difference between virgin PET and rPET, the cost of using virgin plastic ***and*** paying the tax may still be less than using rPET. For example, in March 2020, the spread between food grade rPET and virgin PET was €650/tonne (>€450/tonne tax).[338] Therefore, the EU level tax on non-recycled plastics may not stimulate the uptake of recycled content because a) individual Member States may choose not to pass the burden onto industry, and b) even if Member States do introduce a tax for industry it may not be a strong enough economic driver to disincentivise the use of virgin plastic. Additionally, in the absence of supply-side stimulus to the market, a tax on virgin plastic could simply serve to increase

[335] European Aluminium Foil Association (2019) Aluminium Foil and Recycled Content - Explanatory Note

[336] The UK withdrew from the European Union on 31st January 2020

[337] Victory, M. *Europe R-PET content targets unrealistic*, accessed 20 October 2020, https://www.icis.com/explore/resources/news/2019/01/31/10313630/europe-r-pet-content-targets-unrealistic

[338] Tudball, M. *Italy's postponed virgin plastic tax to be implemented in January 2021*, accessed 20 October 2020, https://www.icis.com/explore/resources/news/2020/05/15/10508256/italy-s-postponed-virgin-plastic-tax-to-be-implemented-in-january-2021

demand and competition for limited materials, thereby driving up the price for materials without any real market impact in terms of material use.

Additionally to these more prescriptive measures, in its Plastics Strategy the European Commission called on industry to submit voluntary pledges to ensure that by 2025 10 million tonnes of recycled plastics are used in new products (compared to <4 million tonnes in 2016).[339] In order to facilitate this, the Commission launched the Circular Plastics Alliance in December 2018. Other voluntary initiatives include the European Plastics Pact, a public-private coalition of companies, organisations and governments focused on solving issues around single use plastics products and packaging. A key objective of the pact is to increase the use of recycled plastics in new products and packaging by 2025, with plastics user companies achieving an average of at least 30% recycled plastics (by weight) in their product and packaging range. As of September 2021, there were 149 signatories from 21 countries in Europe.[340]

Further analysis would be required to estimate the proportion of packaging that is placed on the European Market by a company that has made a voluntary pledge, but most major FMCG companies have made some sort of commitment, for example:

- Coca-Cola: 50% recycled content in all packaging by 2030 (western European business has pledged to meet this target by 2025).[341]
- Colgate-Palmolive: 50% recycled content across all packaging in 2020 and 25% recycled content in plastic packaging by 2025.[342]
- Danone: average of 25% recycled material for all its plastic packaging by 2025. Average of 50% recycled material for water and beverage bottles.[343]
- Pepsico: 25% of recycled content in global plastic packaging by 2025 and 30% rPET in bottles[344]

It remains to be seen whether global brands will adhere to the goals they have set themselves (whether they do or not is likely to be linked to the economics of doing so).

Finally, in the future, new technologies such as chemical recycling may enable plastic packaging that is currently difficult to recycle mechanically (e.g. multi-layer, contaminated) to be recycled, increasing the supply of secondary material (albeit in the form of monomers) for uptake in packaging, overcoming the quality/ health and safety issues currently associated with mechanically recycled secondary plastics. Concerning packaging materials other than plastics, the development of blockchain technology to enable the tracking and tracing of recycled content in products may provide a solution to the issues associated with verifying recycled content claims made by producers. Digital watermarking, chemical marking and other tracking and tracing technologies may allow not only better identification and sorting of packaging materials to improve the quality of secondary materials available, but may also support improved consumer awareness of the environmental claims made by

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[339] European Commission (2018) *A European Strategy for Plastics in a Circular Economy*, January 2018, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

[340] *European Plastics Pact*, accessed 8 October 2021, https://europeanplasticspact.org/

[341] Ellen MacArthur Foundation (2019) *New Plastics Economy Global Commitment: June 2019 Report*, 2019, https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf

[342] ibid.

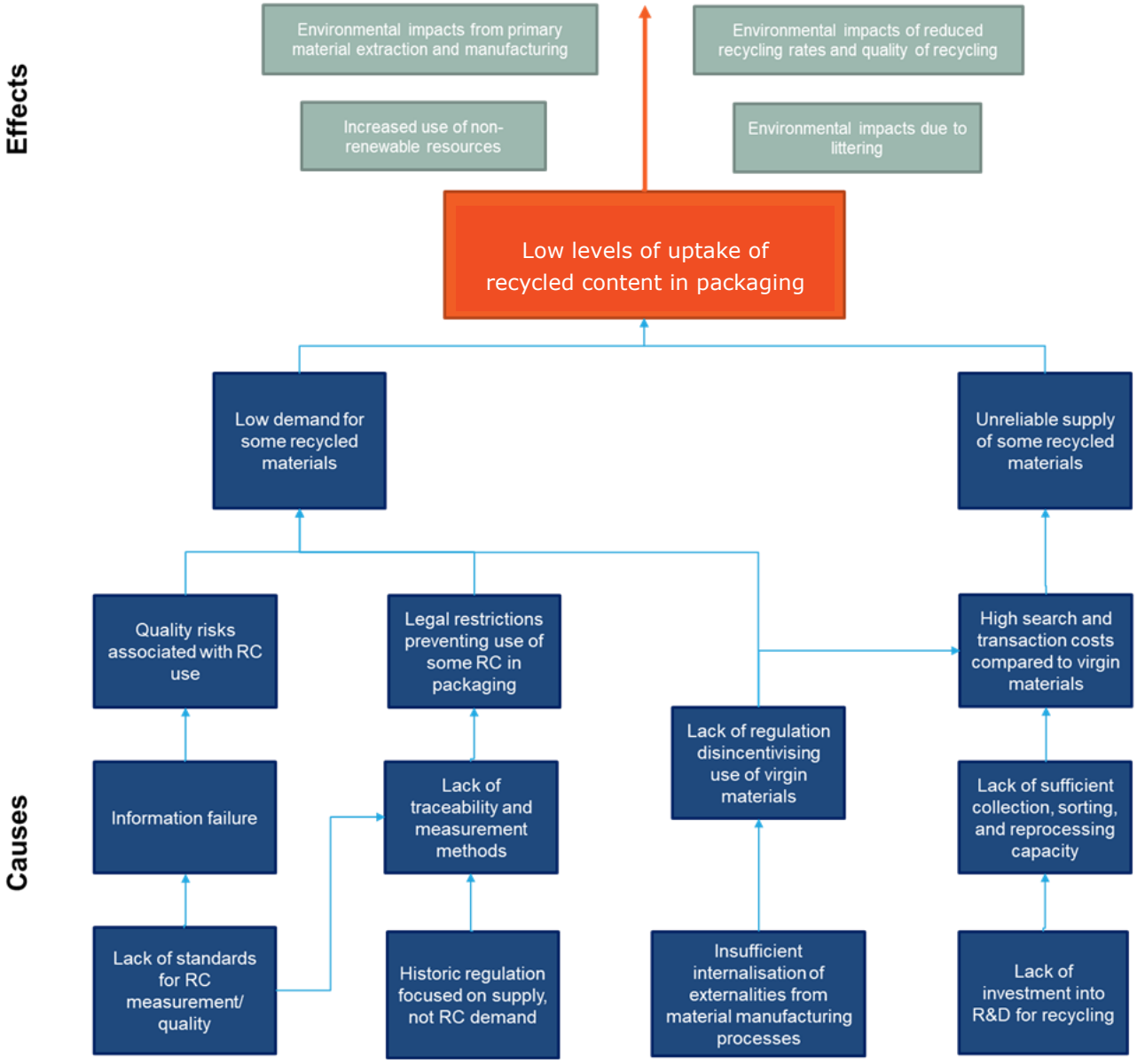
[343] ibid.

[344] AIM European Brands Association (2020) *Brands for a Clean & Circular Economy- Drivers of Sustainability – through Eco-Design* https://www.aim.be/wp-content/themes/aim/pdfs/AIM%20Eco%20Design%202020_for%20website_FINAL3.pdf?_t=1588680215

packaging producers. However, the commercial viability and success of these technologies are still uncertain and unreliable.

In summary, though the European Commission has introduced legislation specifically related to recycled content in packaging (i.e. the SUP beverage container targets), it is unlikely to stimulate an increase in recycled content uptake across packaging beyond PET bottles. It is also important to note that all legislation related to recycled content focuses on plastics. This is unsurprising given the low levels of current uptake in plastic packaging (see Section 3.0) and the attention that the environmental impacts of plastic packaging has received in recent years. However, it does mean that there is a clear absence of legislative drivers to increase the uptake of recycled content in non-plastic packaging materials, as well as in non-PET plastic packaging applications. In addition, the lack of sufficient economic incentives and persistence of market failures to increase uptake of recycled materials relative to virgin materials in packaging suggests that there is a role for further intervention to correct the market failures.

3.1.6 Problem Tree



APPENDIX B - BASELINE METHODOLOGY

The baseline provides an overview of packaging waste consumption, waste generation and management for EU27 Member States. It includes both historic trends based on existing data and future projections out to 2050. The baseline is essentially a "no policy change" scenario, i.e. modelling of future trends include all relevant EU-level and national policies and measures which are assumed to continue in force, in addition to any legislative proposal by the Commission that are not yet adopted. Future trends also include the modelled impact of socio-economic developments (population growth, GDP growth etc.).

The preparation of a baseline of historic and projected packaging flows in Europe required the design of an appropriate method to compile and cross-compare data from existing datasets on packaging consumption, waste generation and management. The methodology is described across the following sections:

- An overview of the baseline taxonomy, i.e. the types of packaging included and how they are categorised (Section 1.0);
- Details of the data sources used for modelling packaging waste generation / consumption (Section 2.0);
- The methodology for modelling historic packaging waste generation / consumption (Section 3.0);
- The approach taken to future projections of waste generation / consumption (Section 4.0);
- The methodology used to model recycling rates at the material and packaging type level, both historic and future projections based on recycling rate targets (Section 5.0);
- A description of how residual treatment destinations and litter are modelled (Section 6.0).

Section 5.0 of the main report, which sets out the scope of the baseline and key terms, should be read prior to viewing this appendix. The approach taken to the modelling of environmental impacts is described in the impact modelling methodology (Appendix D).

The reader should note that detailed statistical reporting of much of the data required for this study is relatively undeveloped. Essentially, the key challenge in designing the methodology for the baseline was to devise sensible methods to combine, merge, cross-compare and corroborate

existing data to reach the desired goal of a full analysis of European packaging flows. Furthermore, where data simply does not exist this has necessitated the use of carefully considered estimates and assumptions for some inputs and modelling parameters. These are noted throughout this report, and wherever possible have been evidenced in reference to known data points.

The baseline is designed to dynamically recalibrate based on the input data. In other words, the input of one data point will affect others, for example, if better known or more accurate data can be obtained for a specific packaging category then causes the model to recalculate tonnages for other packaging types in an appropriate manner. In this way, the addition of a few more reliable data sources increases the overall robustness of the model. Furthermore, given the relatively large number of unknowns in data inputs and parameters, some outputs will have limited accuracy, and inevitably some may differ significantly from the 'real-world'. Any such inaccuracies we hope to improve on through the course of this study if further data can be obtained from relevant stakeholders. However, we believe the methodology presented here provides the best-possible representation of packaging in Europe within the constraints of the data available to this study.

1.0 Baseline Taxonomy

The model taxonomy sets out the categorisation of different packaging types in the model. The form of this taxonomy required a balance between, on the one hand, a sufficient range of categories to enable impacts on specific packaging types to be properly assessed and, on the other, not so many categories that: a) the level of disaggregation outweighs the resolution of available data; or b) the modelling exercise becomes unduly complex and detracts from the ability to derive clear results and interpretations from the data.

In practise, the design of the taxonomy was conducted alongside the data collection and modelling of historic packaging flows (Section 2.0 and 3.0). The design process itself was somewhat of a chicken and egg situation, that is, the structure set out in the taxonomy guided the data collection, whilst the type and quality of reviewed data in turn set certain constraints on the taxonomy. The final taxonomy used is presented in Table 1-1.

Table 1-1: Baseline Data Taxonomy [SU = single-use; MU = multi-use]

Tier	Material	System	Packaging Type
Primary / consumer	Glass	SU	Beverage containers
		MU	Beverage containers
		SU	Non-beverage food
		SU	Other (non-food, non-beverage)
	Steel	SU	Beverage containers
		SU	Non-beverage food e.g. food cans
		SU	Other (non-food, non-beverage) e.g. paint tins
		MU	Food refill scheme boxes e.g. Loop
	Aluminium	SU	Beverage containers
		SU	Other rigids e.g. aerosol sprays, food cans
		SU	Semi rigids e.g. food trays
		SU	Flexibles e.g. foils
	Paper / board	SU	Carton board e.g. cereal boxes etc
		SU	Beverage cartons
		SU	Non-beverage liquid packaging board e.g. soups
		SU	Other paper / board
	Plastic	SU	PET bottles (beverage containers)

Tier	Material	System	Packaging Type
		SU	Non PET (beverage containers)
		MU	Beverage containers
		SU	Bottles (all non-beverage)
		MU	Bottles (all non-beverage)
		SU	Rigid food e.g. pots, tubs and trays
		MU	Food refill scheme boxes e.g. Loop
		SU	Other rigids (non beverage, non-food) e.g. blister packs
		SU	Mono-polymer stand-up pouches
		SU	Multi-polymer/material stand-up pouches
		SU	Other mono/multi polymer/layer flexibles (excl. film)
		SU	Films
		SU	Compostable Rigids
		SU	Compostable Films
	Other	SU	Miscellaneous (not included elsewhere)
Primary / consumer (incl. secondary)	Paper / board	SU	Corrugated and other board boxes
Tertiary / transport	Steel	MU	Drums
	Aluminium	MU	Kegs, tanks etc.
	Paper / board	SU	Corrugated and other board boxes - e-commerce
	Plastic	SU	Film and bubble pouches - e-commerce
		SU	Wrapping and strapping
		SU	Crates, boxes etc.
		MU	Boxes and pouches - e-commerce
		MU	Wrapping and strapping
		MU	Crates, boxes etc.
		MU	Drums

Tier	Material	System	Packaging Type
	Wood	SU	Pallets
		MU	Pallets

It is helpful to mention a few points in regard to this taxonomy. Firstly, whilst some packaging types are very narrow in their scope (e.g. PET bottles), others include a range of sub-packaging types. This is particularly true for tertiary / transport packaging types for which there is, on the whole, less available data, and hence any further disaggregation of packaging type categories would be challenging, and, in our opinion, not sensible to model. Any attempt to do so, given constraints in the resolution of input data, would require a further layer of estimates and assumptions, leading to a less robust model.

Secondly, it was not possible to clearly delineate secondary packaging from tertiary packaging. Secondary packaging, whilst clearly delineated in terms of its definition (see Section *[Reference to synthesis report]*) is not separated out from primary and/or tertiary packaging in any dataset we have reviewed. The vast majority of secondary packaging consists of card (both carton board and corrugated cardboard), and therefore, for the purposes of modelling, we have assumed it exists within the data for primary packaging.

Lastly, for some tertiary packaging types, such as wooden pallets, there is (in general terms) no material difference between single-use and multi-use packaging – the packaging is the same in both cases, it is only the number of uses prior to disposal that varies. These packaging types are differentiated in the model for the purpose of applying targets for reuse in the impact assessment; this is done based on the best available estimates of the type of usage.

2.0 Packaging Waste Data

Prior to any modelling, a full literature review was conducted for packaging waste generation, consumption and other supporting data required to produce a baseline of historic packaging flows. Data sources reviewed include EU and national level statistics, consultancy reports, and data from industry associations. This data was supplemented with additional information obtained from interviews with selected stakeholders in the packaging sector.

2.1 Packaging Consumption and Waste Generation Data

Packaging consumption and waste generation data was sourced mainly from three main datasets. Eurostat data provided the foundation for our material flow analysis. As described in Section 3.0, historic waste generation and treatment destinations by material were set to equal Eurostat tonnage after modifying with appropriate loss rates, with other data used to disaggregate further within the bounds of these high-level values. The dataset is available back to 1997 for EU14 Member States, with a more complete dataset from 2004 onwards (with the exception of countries that joined in later phases of enlargement – Bulgaria, Romania and Croatia). Most Member States have now reported 2018 data, although some have only reported up to 2017.[345] The UK was not included in our model, and excluded from any historic datasets used for the derivation of modelling assumptions.

Most publicly available data (such as Eurostat) in the EU is relatively high-level, and does not, for example, provide breakdowns by type of packaging, or provide detailed data on composition for composite packaging types. It was therefore necessary to also include paid-for data from market research companies to ensure sufficient data granularity. Two market data reports were used, from Transparency Market Research (TMR) and GlobalData, outlined in Table 2-1.[346,347]

Table 2-1 Market data reports

Dataset	Time range[348]	Geographical Scope	Tier	Detail
GlobalData	2006 - 2018	Data by Member State. Excludes Croatia, Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta and Slovenia	Primary packaging only	Large number of packaging types / data categories
Transparency Market Research	2003 - 2017	Europe (no dissagregation by Member State). Includes all European countries (i.e. EU27, UK, Norway, Russia etc.)	All packaging waste	Smaller number of data categories

These datasets were supplemented with additional data from stakeholders for a selection of packaging types. This additional data was used in place of data derived instead of data derived

[345] Eurostat (2020) *Packaging waste by waste management operations and waste flow, Accessed 30th May 2020,* https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_waspac&lang=en

[346] Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

[347] GlobalData (2019) *Europe Packaging Data*

[348] Earliest year to latest year of actual data

from GlobalData and TMR (following the methodology described in Section 3.0), either because it is more reliable, or because no data was available in these market datasets for a given packaging type. The methodology used by GlobalData and TMR to derive their data is somewhat opaque, although we understand that both these datasets rely on secondary research, covering annual reports, trade data and association data, supplemented with interviews conducted with those in the purchase and supply sides of the packaging sector. Hence, we focused on improving on this data where alternative data was available. The additional data used in this study for consumption/waste generation is detailed in Table 2-2 below.

Table 2-2 Additional Consumption and Waste Generation Data Sources

Packaging Type in Model	Time Range	Geographical Scope	Source
Aluminium - Beverage Containers	2017	Czech Republic	Communication with EKO-KOM, 2018
	2017	Ireland	Communication with Repak, 2015
	2013 -2017	Romania	Eunomia (2019) Deposit System for Beverage Containers in Romania
Steel - Beverage Containers	2017	Czech Republic	Communication with EKO-KOM, 2018
	2013 -2017	Romania	Eunomia (2019) Deposit System for Beverage Containers in Romania
Steel - Drums	2005 -2018	Various, based on SEFA Member Countries (e.g. 9 MS + UK + Turkey in 2018)	SEFA (2019) SEFA at a glance. Presentation at EIPA 12th Annual Meeting, Berlin.
Glass - beverage containers - reusable	2006 to 2017	EU27 by Member State	Reloop (forthcoming) Global data on refillable beverage containers, 1999-2018.
Plastic - beverage containers - reusable	2006 to 2017	EU27 by Member State	Reloop (forthcoming) Global data on refillable beverage containers, 1999-2018.
Plastic PET bottles (beverage containers)	2016 to 2017	EU27 by Member State	ICIS (2017), ICIS and Petcore Europe Annual Survey on the European PET Recycle Industry 2017
Plastic - compostables	2017-2018 (and future projections to 2024)	Europe incl. non EU countries	European Bioplastics (2019), Bioplastics Market Data 2019[349].
Plastic - compostables	2009	Europe incl. non EU countries	N. Farmer (2013) Present status and trends in innovations in packaging for food, beverages and other fast-moving consumer goods,

[349] European Bioplastics (2019), Bioplastics Market Data 2019. Available at: https://docs.european-bioplastics.org/publications/market_data/Report_Bioplastics_Market_Data_2019.pdf

Packaging Type in Model	Time Range	Geographical Scope	Source
			Report in Trends in Packaging of Food, Beverages and Other Fast-Moving Consumer Goods (FMCG)[350].
Other mono/multi polymer/layer flexibles (excluding films)	2017	Europe	FIACE 2017 - Mapping Flexible Packaging in a Circular Economy[351]
Wrapping films	2017	Europe	Eunomia (2020), Flexible Films Market in Europe: State of Play[352].
Paper/board - corrugated and other board boxes – Carton board	2002 to 2018	Europe	Communication with CEPI Cartonboard, May 2020
Paper/board - corrugated and other board boxes - e-commerce	1996, 2013, 2016, 2017	Germany	Deutsche Umwelthilfe (DUH), 2019, Aufkommen und Verwertung von Verpackungsabfällen in Deutschland im Jahr 2017[353].

The data sources listed above are only those that are directly used in the model. A selection of further data sources were used when sense checking for specific data points or to audit the overall schema of results, these include:

- A compositional breakdown of flexible plastic packaging from the REFLEX project.[354]
- Consumption data for flexible plastic packaging from Flexible Packaging Europe.[355]
- Consumption data for rigid polyolefin packaging from Eunomia (2020), HDPE & PP Market in Europe: State of Play 356

[350] N. Farmer (2013) Present status and trends in innovations in packaging for food, beverages and other fast-moving consumer goods, Report in Trends in Packaging of Food, Beverages and Other Fast-Moving Consumer Goods (FMCG)https://www.elsevier.com/books/trends-in-packaging-of-food-beverages-and-other-fast-moving-consumer-goods-fmcg/farmer/978-0-85709-503-9

[351] FIACE 2017 - Mapping Flexible Packaging in a Circular Economy: https://sustainablepackaging.org/flexible-packaging-circular-economy-fiace/

[352] Eunomia (2020), Flexible Films Market in Europe: State of Play www.eunomia.co.uk/reports-tools/flexible-films-market-in-europe

[353] Deutsche Umwelthilfe (DUH), 2019, Aufkommen und Verwertung von Verpackungsabfällen in Deutschland im Jahr 2017 https://www.umweltbundesamt.de/publikationen/aufkommen-verwertung-von-verpackungsabfaellen-in-12

[354] Axion Consulting (2016) REFLEX Project, November 2016

[355] Communication with Flexible Packaging Europe, May 2020

[356] available from https://www.plasticsrecyclers.eu/plastics-recyclers-publications

- Beverage carton placed on market data in the EU27+3.[357]
- Corrugated cardboard production data for select Member States.[358]

2.2 Unit Weights

The data regarding unit weights of different single- and multi-use packaging formats were sourced from a variety of locations. Sources include market data and internet searches for product specifications, as well as correspondence with stakeholders, and measurements of specific types of packaging from shops. References include the following:

- PET Bottles[359]
- Film[360]
- Plastic tubes[361]
- Pallets[362]
- Aluminium foil[363]
- LDPE Film[364]
- Cardboard boxes[365]
- Steel Strapping[366]
- Reusable food and drink containers[367]
- Aluminium sheets[368]

[357] Communication with ACE, May 2020

[358] Communication with FEFCO, May 2020

[359] ALPHA (2020) ALPLA and KHS present innovative reusable PET bottle. Available at https://blog.alpla.com/en/blog/products-innovation/alpla-and-khs-present-innovative-reusable-pet-bottle/03-20

[360] BrentR (2016) Stretch film usage calculations. Available at: https://packagingblog.org/2016/08/31/stretch-film-usage-calculations/

[361] Clear Tec Packaging (2020) Sealed Bottom Clear Plastic Round Tubes. Available at https://cleartecpackaging.co.uk/plastic-tubes.html

[362] Elephant box (2020) Products. Available at https://elephantbox.co.uk/products/elephant-box EPAL (2020) EPAL EURO PALLET (EPAL 1). Available at:https://www.epal-pallets.org/eu-en/load-carriers/epal-euro-pallet/

[363] European Aluminium Foil Association (2020) Aluminium Foil: Characteristics and Properties. Available at: https://www.alufoil.org/en/about-alufoil/properties.html

[364] Goodfellow (2020) Polyethylene: Low Density (LDPE) Film Material information. Available at: http://www.goodfellow.com/E/Polyethylene-Low-Density-Film.html

[365] MMK Digita. Product Search. Available at: https://digi.mm-karton.com/products/productCategory/FBB?0&quality=GC1

[366] PAC Strapping Products, Inc (2007). Available at https://strapsolutions.com/wp-content/uploads/2015/06/SteelStrapping.pdf

[367] Refill (2019) Reusable solutions: How governments can help stop single-use plastic pollution. Available at https://refill.org.uk/wp-content/uploads/2019/11/bffp_rpa_reusable_solutions_report.pdf

[368] Sanghvi Overseas Incorporation (2017) Aluminium sheet weight calculation chart. Available at https://www.sanghvioverseasinc.com/blog/aluminum-sheet-weight-calculation-chart/

› Packaging Market trends and growth[369]

The modelled change in unit weights over time, between 1990 and 2017, are presented in Table 2-3 below. The unit weights are approximate. For instance, estimates for some packaging types are based on more than one 'type' of packaging or more than one size, weighted according to the estimated distribution of sub-types/sizes within that packaging type. Where specific data for the change in weight over time were not available, the trends are assumptions based on similar packaging types for which data were available.

As noted in the main report, since the introduction of the PPWD in 1994 there has been a general increase in material efficiency of packaging and a process of light-weighting. According to 2018 TMR data, a decrease in unit weight has been observed across all packaging types between 1990 and 2015, with an average unit weight reduction of 26%.[370] Beverage containers have seen the greatest decrease in unit weight as a group. This lightweighting has been accompanied by material shifts in some product categories, such as the displacement of heavier packaging materials like glass and metal, with plastic and paper.

From 2017 onwards, unit weights are fixed. Whilst this is an approximation, this is based on the reasonable assumption that there are limits to material efficiency improvements. The primary functions of packaging remain product protection, safety, hygiene, shelf life and labelling. Continued efficiency improvements at the detriment of these functions would be counterproductive, and as such, light-weighting trends are unlikely to continue indefinitely.

Table 2-3 Unit Weights of Different Packaging Types, 1990-2018 (grams) [SU = single-use; MU = multi-use]

Material	System	Packaging Unit(s)	1990	2000	2008	2018
			Primary / consumer packaging			
Glass	SU	Beverage containers	388	320	295	242
Glass	MU	Beverage containers	263	263	263	263
Glass	SU	Non-beverage food	175	175	175	175
Glass	SU	Other (non-food, non-beverage)	55	55	55	55
Steel	SU	Beverage containers	35	30	28	24
Steel	SU	Non-beverage food e.g. food cans	67	57	53	46
Steel	SU	Other (non-food, non-beverage) e.g. paint tins	175	175	175	175
Steel	MU	Food refill scheme boxes e.g. Loop	450	450	450	450
Aluminium	SU	Beverage containers	19	17	15	13

[369] Transparency Market Research (2018) Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026, December 2018

[370] Transparency Market Research (2018) *Packaging Market - Europe Industry Analysis, Size, Share, Growth, Trends and Forecast, 2018 – 2026*, December 2018

Material	System	Packaging Unit(s)	1990	2000	2008	2018
Aluminium	SU	Other rigids e.g. aerosol sprays, food cans	73	63	58	50
Aluminium	SU	Semi rigids e.g. food trays	114	98	90	78
Aluminium	SU	Flexibles e.g. foils	8	7	6	6
Paper / board	SU	Carton board e.g. cereal boxes etc	17	17	16	15
Paper / board	SU	Beverage cartons	24	23	23	21
Paper / board	SU	Non-beverage liquid packaging board e.g. soups	25	24	23	22
Paper / board	SU	Other paper / board	35	33	32	30
Plastic	SU	PET bottles (beverage containers)	58	50	42	28
Plastic	SU	Non PET (beverage containers)	68	59	51	45
Plastic	MU	Beverage containers	55	55	55	55
Plastic	SU	Bottles (all non-beverage)	70	61	50	34
Plastic	MU	Bottles (all non-beverage)	55	55	55	55
Plastic	SU	Rigid food e.g. pots, tubs and trays	24	22	19	14
Plastic	MU	Food refill scheme boxes e.g. Loop	160	160	160	160
Plastic	SU	Other rigids (non beverage, non-food) e.g. blister packs	34	31	28	24
Plastic	SU	Mono-polymer stand-up pouches	18	17	15	12
Plastic	SU	Multi-polymer/material stand-up pouches	19	17	16	15
Plastic	SU	Other mono/multi polymer/layer flexibles (excl. film)	7	6	6	5
Plastic	SU	Films	5	4	4	4
Plastic	SU	Compostable Rigids	24	22	19	14
Plastic	SU	Compostable Films	5	4	4	4
Other	SU	Miscellaneous (not included elsewhere)	1	1	1	1
			Primary / consumer (incl. secondary)			
Paper / board	SU	Corrugated and other board boxes	165	162	157	149

Material	System	Packaging Unit(s)	1990	2000	2008	2018
						Tertiary / transport
Steel	MU	Drums	18,877	17,590	17,200	16,720
Aluminium	MU	Kegs, tanks etc.	10,440	9,728	9,513	9,194
Paper / board	SU	Corrugated and other board boxes - e-commerce	165	162	157	149
Plastic	SU	Film and bubble pouches - e-commerce	28	28	28	28
Plastic	SU	Wrapping and strapping	546	524	495	429
Plastic	SU	Crates, boxes etc.	3,850	3,300	3,000	2,415
Plastic	MU	Boxes and pouches - e-commerce	165	162	157	149
Plastic	MU	Wrapping and strapping	8	7	7	6
Plastic	MU	Crates, boxes etc.	3,850	3,300	3,000	2,415
Plastic	MU	Drums	12,200	11,600	10,000	8,781
Wood	SU	Pallets	25,000	25,000	25,000	25,000
Wood	MU	Pallets	25,000	25,000	25,000	25,000

2.3 Assumptions for Disaggregation of 'Metal' Packaging

The Packaging and Packaging Waste Directive sets separate targets for aluminium and steel packaging, and therefore these materials (and packaging types) are differentiated in the model. Separate reporting of aluminium and steel packaging waste data is still voluntary: Member States are not obliged to differentiate these until the 2020 reporting year, and can currently opt to report the aggregated values for metal packaging only.

In their latest reporting year (2018 for most Member States), 14 Member States reported separate tonnages for aluminium and steel packaging waste generation, with the remaining 13 reporting only generation of 'metal' packaging waste.[371] Therefore assumptions for the overall aluminium and steel proportion of metal waste generated were required for these 13 Member States to estimate aluminium and steel packaging waste tonnages.

These estimates were based on the average proportions of steel vs. aluminium in Eurostat data for the 14 Member States reporting these separate tonnages. These were adjusted down based as a further approximate method to account for probable over-reporting of steel industrial packaging, by also using the raw tonnages from TMR data (this dataset was used as it covers

[371] These 9 Member States a re Croatia, Cyprus, Czech Republic, France, Germany, Greece, Hungary, Italy, and Sweden.

the full packaging market, and GlobalData only covers only primary packaging). This was done by taking averaging the overall proportions from Eurostat and TMR data. The final estimates, which were applied to all metal tonnages to disaggregate into aluminium and steel, were 55% steel and 45% aluminium.

For individual packaging types, further assumptions were used to estimate the proportion of steel vs aluminium, the results of which are in Table 2-4 below. The proportions were calculated using several different sources. Firstly, for beverage cans, internal data sourced from a number of Deposit Return Scheme projects Eunomia are currently working on were used to calculate the breakdown. The proportion of food cans, aerosols, and other types of packaging that were aluminium and steel was calculated using Local Authority waste composition data in the UK. For a number of special cases, either the Global Data Packaging Definitions, or taking direct sample data from retailers was used to confirm whether any particular packaging types would likely be dominated by either aluminium or steel. An example of this was 'can – metal paint', where after directly sampling the items available in shops, all those tested were steel.

Table 2-4 Aluminium vs Steel by Packaging Type

Packaging Type	*Beverage Container*	*Food*	*% Aluminium*	*% Steel*
Bottle - Metal	TRUE	FALSE	*25%*	*75%*
Can - Metal Beverage	TRUE	FALSE	*81%*	*19%*
Can - Food	TRUE	FALSE	*7%*	*93%*
Cup - Metal	TRUE	FALSE	*25%*	*75%*
Keg/Drum - Metal	TRUE	FALSE	*25%*	*75%*
Pod - Aluminum	TRUE	FALSE	*100%*	*0%*
Specialty Container - Metal	TRUE	FALSE	*25%*	*75%*
Tank - Metal	TRUE	FALSE	*25%*	*75%*
Tub - Metal	TRUE	FALSE	*25%*	*75%*
Foil - Aluminium	FALSE	FALSE	*100%*	*0%*
Tube - Flexible Aluminium	FALSE	FALSE	*100%*	*0%*
Aerosol - Metal	FALSE	FALSE	*48%*	*52%*
Bottle - Metal	FALSE	FALSE	*25%*	*75%*
Can - Metal Paint	FALSE	FALSE	*0%*	*100%*
Specialty Container - Metal	FALSE	FALSE	*0%*	*100%*
Tray - Aluminium	FALSE	FALSE	*100%*	*0%*

Packaging Type	*Beverage Container*	*Food*	*% Aluminium*	*% Steel*
Tray - Other Metal	FALSE	FALSE	*0%*	*100%*
Tub - Metal	FALSE	FALSE	*25%*	*75%*
Foil - Aluminium	FALSE	TRUE	*100%*	*0%*
Tube - Flexible Aluminium	FALSE	TRUE	*100%*	*0%*
Aerosol - Metal	FALSE	TRUE	*48%*	*52%*
Bottle - Metal	FALSE	TRUE	*0%*	*100%*
Can - Food	FALSE	TRUE	*7%*	*93%*
Can - Metal	FALSE	TRUE	*81%*	*19%*
Other Rigid Metal Pack Types - All Sub-types	FALSE	TRUE	*25%*	*75%*
Specialty Container - Metal	FALSE	TRUE	*0%*	*100%*
Tray - Aluminium	FALSE	TRUE	*100%*	*0%*

2.4 Multi-Use Packaging Parameters

Further parameters were required for multi-use packaging (Table 2-5). Specific data required were: 1) the number of uses before waste and 2) whether reuse schemes are open-loop or closed loop (see discussion in Section 3.0). These data were taken from various sources including data provided by Reloop and SERRED, and a report from the Danish Ministry of Environment and Food.[372,373,374]

Table 2-5 Multi Use Parameters

Type	Material	System	Packaging Unit(s)	Number of Uses before Waste
Primary / consumer packaging	Glass	MU	Beverage containers	50
	Steel	MU	Food refill scheme boxes e.g. Loop	150
	Plastic	MU	Beverage containers	25
		MU	Bottles (all non-beverage)	30

[372] Communication with Reloop, 25th May 2020

[373] Communication with SERRED, 25th May 2020

[374] Danish Ministry of Environment and Food (2019) *Statistik for emballageforsyning og indsamling af emballageaffald 2017*, https://www2.mst.dk/Udgiv/publikationer/2019/10/978-87-7038-121-5.pdf

Type	Material	System	Packaging Unit(s)	Number of Uses before Waste
		MU	Food refill scheme boxes e.g. Loop	200
Tertiary / transport	Steel	MU	Drums	45
	Aluminium	MU	Kegs, tanks etc.	30
	Plastic	MU	Boxes and pouches - e-commerce	30
		MU	Wrapping and strapping	100
		MU	Crates, boxes etc.	100
		MU	Drums	20
	Wood	MU	Pallets	30

2.5 Recycled Content

Assumptions for recycled content in the baseline were primarily based on data from BKV, and adjusted for an EU-wide context.[375,376]

This data was used to understand the approximate split of polymer types (PET, polyolefins (PO) and other) for each packaging type. Recycled content assumptions as presented in Table 2-6 were assigned to each to estimate the total recycled content by packaging type:

Table 2-6 Recycled Content (RC) Assumptions by Packaging Type / Polymer

Packaging Type / Polymer	RC Assumptions
PET bottles (both beverage and non-beverage)	12%
PO bottles (both beverage and non-beverage)	10%
PET pots, tubs and trays	15%
PO pots, tubs and trays	5%
PET and PO (other rigids, flexibles and films)	5%
PET and PO (tertiary / transport films)	30%

[375] BKV GmbH (2020) *Potential for the Use of Recycled Plastics in the Production of Plastics Packaging*, https://www.bkv-gmbh.de/studies/potential-for-the-use-of-recycled-plastics-in-the-production-of-plastics-packaging-in-germany-gvm.html

[376] BKV GmbH (2020) *Material Flow Analysis for Plastics in Germany 2019*, https://www.bkv-gmbh.de/studies/material-flow-analysis-for-plastics-in-germany-2019.html

Packaging Type / Polymer	RC Assumptions
PET and PO (tertiary / transport boxes, crates, pallets, drums etc.)	20%
Other (not PET or PO)	2%

Data from the same source was then used to estimate the % of food contact vs non-food contact packaging for each packaging type.

Table 2-7 Assumptions for Proportion of Food Contact vs Non-Food Contact Packaging by Weight

System	Packaging Unit(s)	% Food Contact	% Non-Food Contact
SU	PET bottles (beverage containers)	100%	0%
SU	Non PET (beverage containers)	100%	0%
MU	Beverage containers	100%	0%
SU	Bottles (all non-beverage)	0%	100%
MU	Bottles (all non-beverage)	0%	100%
SU	Rigid food e.g. pots, tubs and trays	100%	0%
MU	Food refill scheme boxes e.g. Loop	100%	0%
SU	Other rigids (non beverage, non-food) e.g. blister packs	18%	82%
SU	Mono-polymer stand-up pouches	52%	48%
SU	Multi-polymer/material stand-up pouches	52%	48%
SU	Other mono/multi polymer/layer flexibles (excl. film)	52%	48%
SU	Films	52%	48%
SU	Film and bubble pouches - e-commerce	0%	100%
SU	Wrapping and strapping	5%	95%
SU	Crates, boxes etc.	29%	71%
MU	Boxes and pouches - e-commerce	0%	100%
MU	Wrapping and strapping	5%	95%
MU	Crates, boxes etc.	29%	71%
MU	Drums	29%	71%

Recycled content assumptions for the food and non-food components of each packaging type were then estimated, using a goalseek approach to compare with the total recycled content %s calculated using the polymer-based approach described above. Various industry data were then

used to triangulate these assumptions and estimate the final recycled content assumptions used in the model for food contact and non-food contact components. These are shown in Table 2-8.

Table 2-8 Assumptions for % of Recycled Content by Type

System	Packaging Unit(s)	Food Contact	Non Food Contact	Overall
SU	PET bottles (beverage containers)	12.0%	-	12.0%
SU	Non PET (beverage containers)	9.8%	-	9.8%
MU	Beverage containers	12.0%	-	12.0%
SU	Bottles (all non-beverage)	-	9.8%	9.8%
MU	Bottles (all non-beverage)	-	9.8%	9.8%
SU	Rigid food e.g. pots, tubs and trays	7.3%	-	7.3%
MU	Food refill scheme boxes e.g. Loop	7.3%	-	7.3%
SU	Other rigids (non beverage, non-food) e.g. blister packs	2.0%	2.0%	2.0%
SU	Mono-polymer stand-up pouches	4.2%	4.2%	4.2%
SU	Multi-polymer/material stand-up pouches	4.2%	4.2%	4.2%
SU	Other mono/multi polymer/layer flexibles (excl. film)	4.2%	4.2%	4.2%
SU	Films	4.2%	4.2%	4.2%
SU	Film and bubble pouches - e-commerce	-	4.7%	4.7%
SU	Wrapping and strapping	6.9%	28.6%	27.5%
SU	Crates, boxes etc.	5.0%	26.1%	20.0%
MU	Boxes and pouches - e-commerce	-	4.7%	4.7%
MU	Wrapping and strapping	6.9%	28.6%	27.5%
MU	Crates, boxes etc.	5.0%	26.1%	20.0%
MU	Drums	5.0%	25.9%	19.8%

3.0 Methodology for Historic Consumption / Waste Generation Flow Analysis

The methodology for compiling historic mass flows for all materials and packaging types is described here.

Prior to compiling the final set of mass flows, it was necessary to perform prior data manipulation of the GlobalData and TMR datasets, which are used as the basis (in addition to Eurostat) for the baseline packaging flows. For both datasets the packaging categories used in the raw data were matched with the categories used in this model.

The geographical scope of both datasets also differed from that required by the model (i.e. data for the EU27 by Member State). For GlobalData, the data provided for the suite of Member States included in that dataset was pro-rated based on material-level (plastic, glass etc.) packaging waste generation tonnages reported to Eurostat to provide an estimate of tonnages for the remaining Member States.

A similar approach was applied for TMR, which provides only aggregated data for Europe (the scope of which includes non-EU countries, see Table 2-1). Initially an estimate for the EU27 was derived by assuming similar per capita waste generation in all (EU27 and other) countries. Tonnages were then apportioned between Member States based on the relative splits observed in material-level packaging waste generation tonnages reported to Eurostat.

Finally, the raw GlobalData is provided in terms of number of units (not tonnage). Unit weights (as calculated/sourced using the methods described in Section 2.2) were therefore applied to estimate the tonnage of material prior to input into the model.

Eurostat data provides the foundation for our material flow analysis. At the material level (e.g. plastic, glass etc.) the historic waste generation and treatment tonnages in the model are set to the figures reported in Eurostat. Eurostat data is not infallible, and there are numerous issues around reporting which deserve further scrutiny. These range from issues around the measurement/calculation point for recycling data (see Section 5.0) to obvious flaws in reported data such as the sum of reported tonnages for treatment destinations (recycling, incineration and landfill) being higher than the tonnage of waste generated (fortunately this is not a frequent occurrence in the data).

In regards to the calculation points for recycling tonnages, new calculation rules will become mandatory for the 2020 reporting year (which Member States will report on in 2022) onwards.

This is pursuant to the requirements laid down in Commission Decision 2005/270/EC as amended by Implementing Decision (EU) 2019/665 establishing the formats relating to the database system pursuant to European Parliament and Council Directive 94/62/EC on packaging and packaging waste.[377] It is likely that these changes will, in many cases, lead to lower recycling tonnages than would have been reported under the old calculation rules, due to a range of more stringent requirements for calculating the weight of material recycled at the calculation point, including, for example, rules on applying average loss rates. Whilst some decrease in recycling tonnages is therefore likely (relative to tonnages reported under the old calculation rules), we have not adjusted or otherwise modified Eurostat recycling data in our

[377] For the consolidated version see https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583325017136&uri=CELEX:02005D0270-20190426

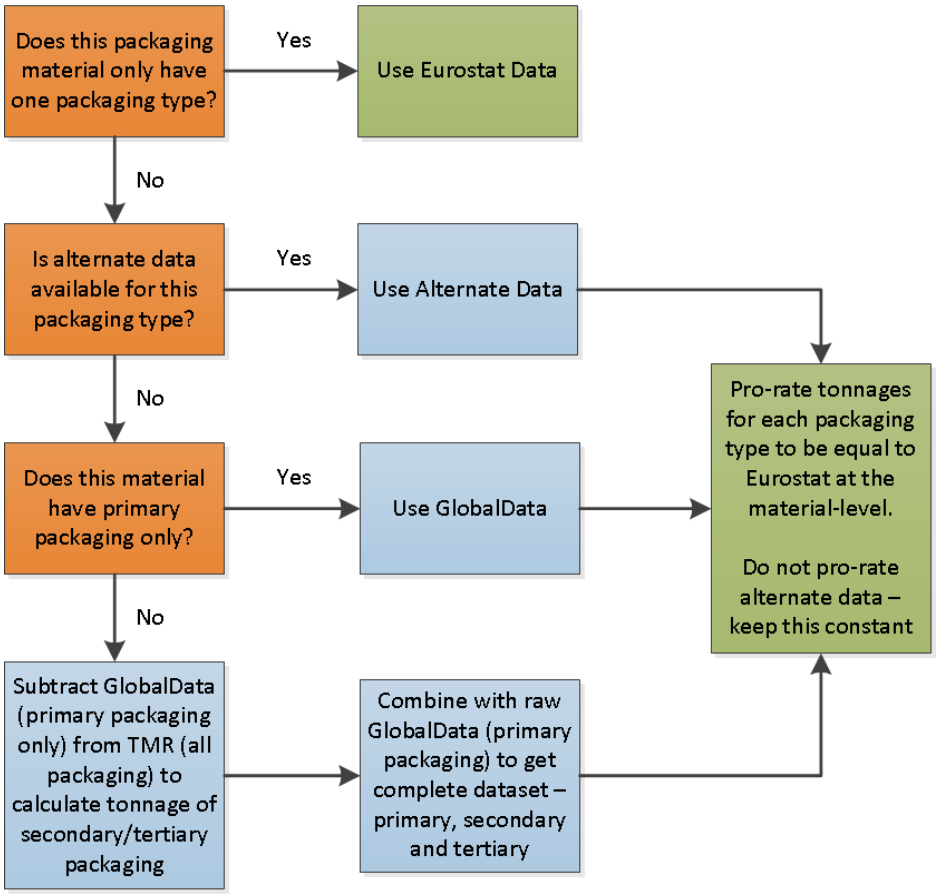
model to reflect these potential changes, given that the magnitudes of any changes that may occur are fundamentally unknown.

Despite the reporting issues discussed, and potential changes in recycling tonnages/rates following the application of the new calculation rules, we have based our modelled tonnages on Eurostat data. Eurostat is the only publicly available and regularly updated dataset for packaging waste for all Member States. Furthermore, it is sensible to use Eurostat data given that progress towards recycling targets laid out in the Packaging and Packaging Waste Directive is measured based on Eurostat data, and the model incorporates these targets.

A consistent method, making best use of the available data was designed to compile a dataset of historic waste generation data. This follows a dynamic method whereby the baseline flows recalibrate based on the input data to calculate the suite of tonnages across all packaging types.

The methodology is illustrated in Figure 3-1. Please note the terminology used here: *material* refers to e.g. plastic, glass etc., whilst *packaging type* refers to the specific packaging types within that material e.g. *glass beverage bottles* etc.

Figure 3-1: Illustration of Methodology for Compiling Historic Waste Generation Flows



For each packaging type the model will start in the top left and go through the calculation stages shown in the diagram:

- The model starts by determining whether the packaging material has one packaging type only. If it does then no pro-rating or data manipulation is required, and Eurostat data can be used as is.

- If alternate data, such as well-evidenced tonnage data from e.g. stakeholders or national reporting, is available for a specific packaging type then this is used.
- If the material only has primary packaging types (e.g. glass) then tonnages from GlobalData are used. This dataset has a much greater level of detail than TMR data, and contains primary packaging only.
- If the material has other tiers of packaging data also (secondary/tertiary), then the model estimates the tonnages of secondary/tertiary data by subtracting GlobalData tonanges (primary only) from TMR tonnages (all packaging). Raw TMR tonnages are not differentiated according to tier, hence making this process necessary.
- Primary/seconday packaging tonnages (from Global Data), and calculated tertiary tonnages (from the process described above) for each packaging type are then pro-rated so that the sum of tonnages for each packaging type in that material (the total calculated tonnage of that material) are equal to Eurostat tonnage data. Effectively, the model uses the calculated compositional splits of packaging data from GlobalData and TMR and applies these to Eurostat.
- At this stage any alternate data is not pro-rated – the tonnages are used in their raw-form, and any calculated tonnages from GlobalData and TMR are recalculated accordingly to keep the totals for each material consistent with Eurostat data.

We believe that this method as described makes the best possible use of the available data to estimate tonnages of packaging waste. It has the benefit that if a few more accurate/reliable data points can be added to the input data (alternate data), then the model will recalculate tonnages for other packaging types in that material. In doing so, the 'alternate data' provides anchor points which improves the overall accuracy and robustness of all data within that material.

Thus far we have discussed the preparation of waste generation tonnages, which, as discussed in the main report, can be approximated as equal to the tonnage of packaging placed on the market/consumed for single-use packaging. Alternative methods are required for multi-use packaging whereby a single unit of packaging can be consumed/placed on the market multiple times before becoming waste. Most of the raw data for this work is in the form of placed on the market/sales data. The relationship between the amount of waste generated and placed on market/sales is determined by the number of uses that the packaging in question is used before becoming waste. For example, our modelling assumes an average of 25 uses before becoming waste for a reusable glass bottle i.e. 25 cycles of collection for reuse, washing, and subsequent re-sale of the reusable bottle. It is therefore reasonable to assume that in this case for every 25 units sold (or 25 tonnes sold), 1 unit (or 1 tonne) will become waste. This assumption is applied in the model for all reusable packaging types.

4.0 Future Projections of Waste Generation / Consumption

Our approach to future projections of waste generation / consumption is based on identifying consistent historic trends via regression analysis and projecting these forward to 2050 (or 2035 in the case of waste compositions). With a few minor exceptions (e.g. compostable packaging), no additional modification of market trends has been performed. Our rationale for this decision is that, firstly, there are range of reports with market projections in the literature, many of which when compared present contrasting views on, for example, the growth of the packaging market for one material vs. another. We do not view it as our place in this study to make decisions as to whether, for example, the views of reports presented by one industry association are more reliable than another. Following this rationale ensures a degree of 'fair treatment' between producers of different packaging materials/types, as future trends are based on objective analysis of historic behaviour, rather than our (or anyone else's) opinion.

Secondly, in the vast majority of cases, there is not compelling evidence that existing trends in changes on consumption will significantly change in the future, certainly not to the extent where there is a clear rationale for adjusting the modelling projections. Under a 'no change' policy scenario, we suggest that significant deviations from past trends in consumption are likely only for a limited range of packaging types. Overall, we believe this methodology provides a well-reasoned and conservative approach to projections of consumption / waste generation, and is the most sensible methodology to apply given the highly speculative nature of future predictions.

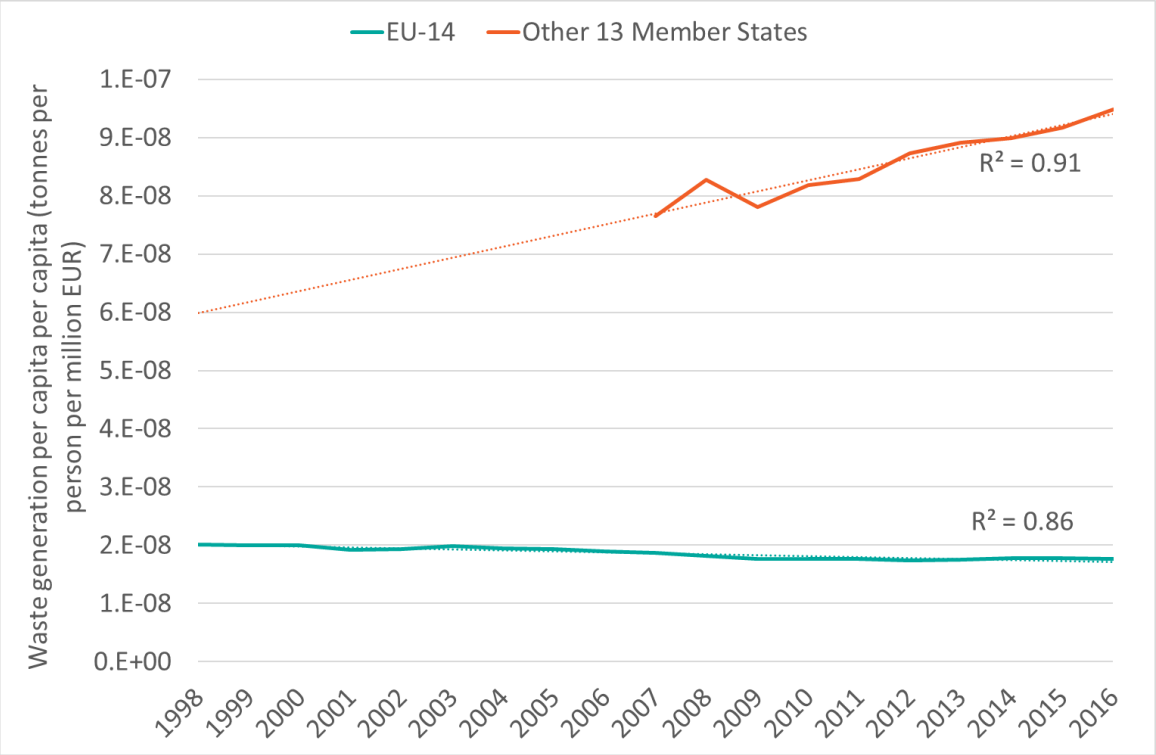
Firstly we discuss the approach to modelling trends in the overall amount of waste generation, followed by modelling of trends at the material and packaging type level, and finally discussing adjustments made to account for historic lightweighting trends.

4.1 Overall Waste Generation Trends

As discussed in the main report, there are clear correlations between packaging waste generation, change in GDP, and population growth. That is packaging waste tends to increase with population and GDP, with the member states with the highest population and GDP producing the highest levels of packaging waste.

Analysis of data by Member State demonstrates two historic trends of particular interest, one for the EU14 and one for the remaining 13 Member States. These are illustrated in Figure 4-1. The timescales reflect the period over which complete or near-complete datasets are available for Member States. The remaining 13 Member States joined in various periods of enlargement to the EU after the initial EU15 (now EU14), hence the time period begins at a later date (2007).

Figure 4-1 Waste generation per capita split between EU-14 + other 13 Member States [R^2 is the coefficient of determination]



Both sets of Member States show a clear trend in the change in waste generation per GDP per capita over time. For the EU14, as discussed in the main report, we observe a decoupling of waste generation from GDP growth, demonstrated in the downward trend over time. However, it is not the case that absolute waste generation tonnages have reduced over time, or even remain constant. What is demonstrated here is that over time the amount of waste generated per person has increased, but at a lower rate than the rate of increase of economic activity (GDP). Of course, over time the aim is to lower this relative rate further, with the ultimate goal to fully decouple growth in waste generation from GDP growth. This decoupling has not yet occurred for the remaining 13 Member States, which are, on the whole less economically advanced than the EU14. For these Member States we see an increase in the amount of packaging waste generated per capita relative to economic growth. Importantly this identifies that while there are general trends between packaging waste, GDP and population, to accurately model overall waste generation trends out towards 2050, we need a model that can account for individual country level differences in the relationship between packaging waste, GDP and population.

Therefore, future packaging waste can be determined by modelling the historical relationship between waste generation, GDP and population applying these trends to future projections of population GDP growth. The Winter 2021 Economic Forecast provides projected GDP growth for

2020, 2021 and 2022.[378] For 2023 onwards we used a 10-year moving average of growth rates to predict GDP into the future. Population data was by country was obtained from Eurostat.[379]

We used a linear mixed effects model[380] to predict future waste generation up to 2050 using data on GDP and population based on the assumptions described above. It was necessary to use a mixed model over a simple regression analysis for each country as country level regressions produced intractable predictions for some countries due to extrapolation beyond the range of the data available for each country. For example, fitting a regression analysis for waste generation for Slovakia based only on historical trends in population and GDP predicted that waste generation for Slovakia in 2050 would be 0 tonnes. In contrast, the power of a mixed model allows all countries relationships between waste generation, population and GDP to be used to predict future waste generation. Importantly, this pooling of data is one reason why mixed models are capable of making more reliable predictions. In fitting this model, we assume that population and GDP have an impact on waste generation, that these two variables might interact (e.g., by decoupling as described above) and that individual countries might have different relationships between population, GDP and waste generation.[381]

Before being used in the model, these trends are further adjusted to properly account for the impact of lightweighting on waste generation trends (this is discussed further below).

4.2 Future Changes in Packaging Waste Composition

After determining the trend in the total tonnage in packaging waste, adjustments are made for the projected change in composition of packaging waste at the material and packaging type level. As discussed in Section *[Reference to synthesis report/relevant tech appendix]*, there are clear trends in the evolution of the composition of packaging waste over time at the material level (i.e. plastic, glass etc.). These are reproduced in Figure 4-2. This analysis is based only on the EU-14 as this allow for a much greater range of time-series data (back to 1997), and these countries make up the majority of waste generation tonnages.

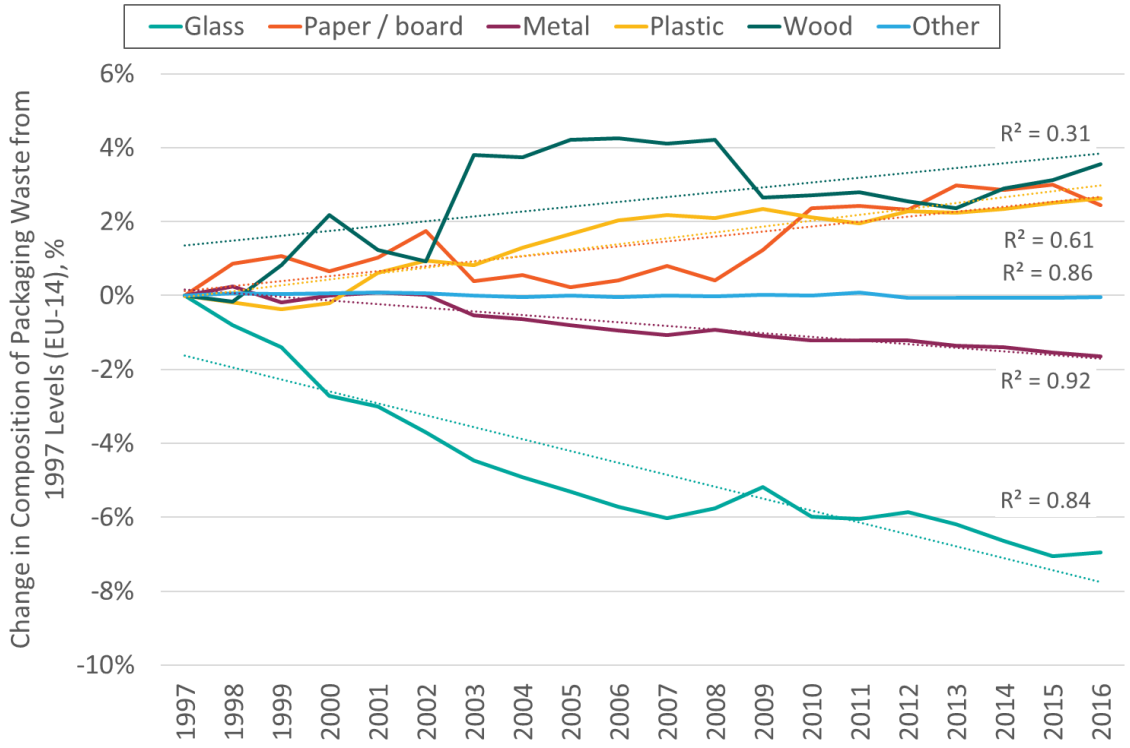
[378] Winter Economic Forecast *2021*: https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-forecasts/winter-2021-economic-forecast-challenging-winter-light-end-tunnel_en

[379] Population projections Eurostat *2019*: https://ec.europa.eu/eurostat/data/database?node_code=proj

[380] In R, using the R package LME4. https://cran.r-project.org/web/packages/lme4/lme4.pdf

[381] Specifically, fixed effects were population and gdp, and were assumed to interact, random effects were country level intercepts: $\log(packaging\ waste) \sim log(population) * log(gdp) + (1|Country)$

Figure 4-2 % Change in Packaging Waste Composition over Time from 1997 Levels (EU-14) [R^2 is the coefficient of determination]



The average % changes year on year in the composition of packaging waste (i.e. the trendlines shown in this chart) are projected forward. Therefore, a future decrease in the proportion of metal and glass in the packaging waste stream is modelled, and an increase in the proportion of plastic, paper/board and wood.

A similar approach is taken to packaging waste compositions at the level of each packaging type. The average trends in change in composition from 2006 (i.e. the first year of market data in the TMR and GlobalData datasets) to 2018 are projected forward and adjustments made within the material-level compositional trends already established.

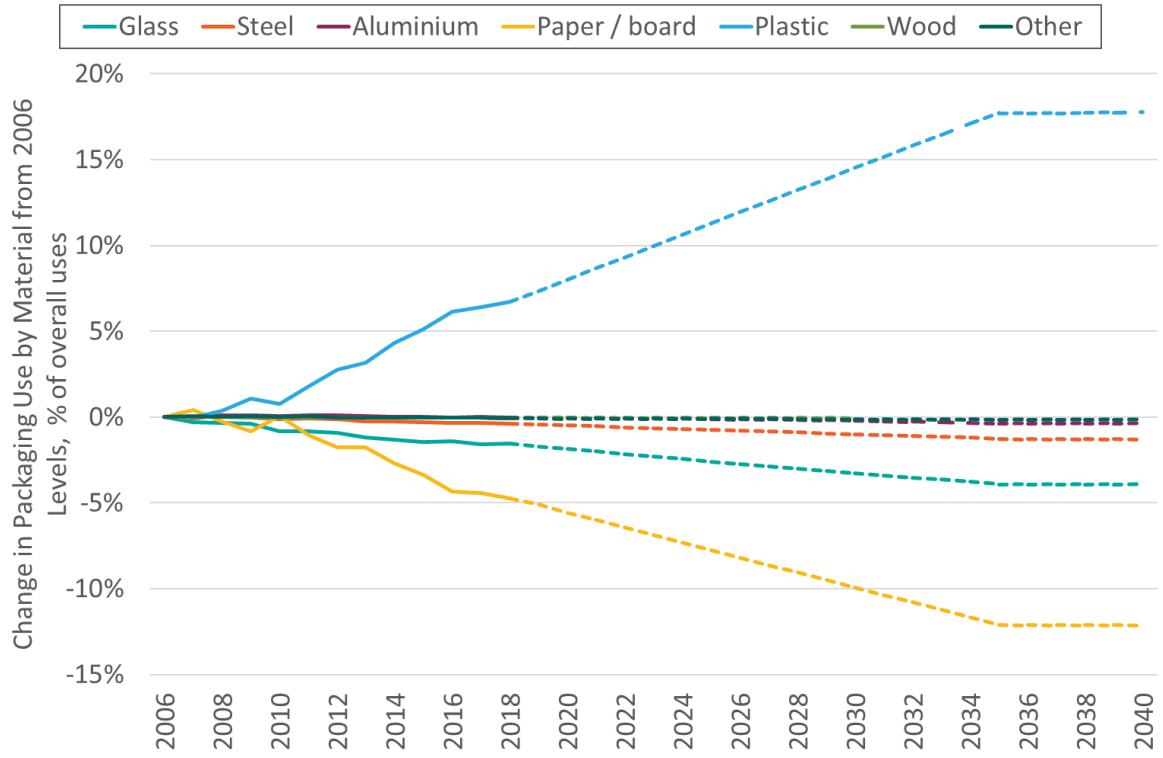
For both material-level and packaging-level compositional trends, the continuation of historical trends is projected forward only to 2035. Any trends in packaging markets and therefore packaging compositions beyond this date cannot be reliably known at this stage (as they are so far into the future). Therefore, as a conservative assumption, we have assumed that compositional trends remain flat - i.e. there is no change year on year in composition - from 2035 onwards.

As discussed, historic trends in the type of packaging waste used are assumed to continue in nearly all cases. The exception to this is compostable plastic packaging (rigids and films). For this packaging type future consumption trends are based on market projections by European

Bioplastics.[382] They project a 2.4% increase in compostable packaging placed on the market out to 2024, and this trend is continued in our modelling out to 2030. The reason for this exception is that compostables are a relatively new packaging type, with only a few years of historic data (not enough to project future trends with), and likely to grow relatively quickly as a sector. To keep the overall tonnages at a material level in line with compositional trends as describe we have assumed that this growth in compostable packaging will be due to switches from the use of conventional plastic packaging.

The modelled change up to 2040 in the overall proportion of packaging used relative to the 2006 composition is shown in Figure 4-3.[383]

Figure 4-3 Change in Packaging Use by Material from 2006 Levels, %



4.3 Accounting for Lightweighting in Future Waste Generation Projections

Past waste generation trends occur over a period in which lightweighting has occurred for many materials (see main report). As packaging becomes lighter over time, the number of units of packaging in a given tonne of packaging waste will increase. Therefore, whilst increases in tonnes of waste generated shown in historic trends may be modest, there is a steeper increase

[382] European Bioplastics (2019) Bioplastics Market Data 2019, *https://docs.european-bioplastics.org/publications/market_data/Report_Bioplastics_Market_Data_2019.pdf*

[383] Projections from 2040 to 2050 are not included in this chart – these are a continuation of the 'flat' trends from 2035 to 2040.

in the total consumption of packaging when measured in terms of number of units of packaging consumed.

As historic waste generation trends implicitly include this trend in lightweighting, any future forecasts based on these trends will contain the implicit assumption that lightweighting trends will continue. As discussed in Section 2.2, this is unlikely to be the case, and our general assumption for modelling is that current unit weights for packaging will not change in the future. To account for this, the future waste generation projections, as calculated using the methodology discussed thus far, are used to calculate future consumption of packaging (in number of units) based on the assumption that lightweighting trends will continue. Waste generation trends are then re-calculated by applying our projected unit weights (constant unit weight over time) to these consumption trends. In doing so forward projections for waste generation are no longer based solely on historic waste generation trends, but rather on the assumption that the observed rate of change in consumption (in number of units of each packaging type) will continue into the future. This method when applied provides a much more accurate picture of future waste generation trends, it goes to say that if historic lightweighting trends in packaging are to slow or cease (as we have modelled), then, as the rate of change in consumption (number of unit) is assumed to stay constant, we can therefore expect the tonnage of waste produced in the future to rise more steeply than it has in the past.

4.4 Further Discussion of Rationale for Future Projections

Eunomia acknowledges that there are some plausible reasons to assume that future waste generation may decouple from GDP and population growth further (i.e. a smaller increase than in the projections described above) and there is certainly the possibility that the future use of material might diverge from historic trends. For example, for plastics in particular, increased consumer awareness in conjunction with brand commitments are resulting in a move away from plastic and towards paper/card packaging for products such as confectionary, and towards aluminium and glass for beverages. However, one outcome of this particular movement is that it will increase the unit weights of the packaging and it will actually drive packaging waste quantities up.

Future trends may not continue as they have in the past, however, for the purposes of our modelling, there is not sufficient data or robust evidence to include this in our future projections. Ultimately, we have to base our modelling on policies that are in place now and in the near future that will have a definite, measurable impact. Policies that we have taken into account include the Single Use Plastics Directive (SUPD), the Plastic Bags Directive and the Circular Economy Action Plan.

The SUPD requires Member States to "achieve an ambitious and sustained reduction in the consumption of single-use plastics" and targets cups for beverages (including their covers and lids) and food containers. Although the directive does prohibit Member States from placing a range of single-use plastics on the market, the only single-use plastic that is related to packaging is polystyrene containers for takeaway food and beverages – which makes up a fraction of the overall market for plastic packaging. Furthermore, there are no specific quantitative targets provided in the directive, thus making it difficult to disaggregate this data and the overall scope is still only limited to takeaway containers.

The Plastic Bags Directive similarly requires Member States to "achieve a sustained reduction in the consumption of lightweight plastic carrier bags" which is again aimed at only a small portion of the packaging market and does not mention any targets or figures which can be incorporated into our model. It is also important to note that there are reports that this Directive has led, in some areas, to a switch to "bags for life", which are heavier than normal bags and so, if only used a small number of times (as is often the case), can even lead to an increase in waste generation. This demonstrates that it can be difficult to quantify the impacts of these policies.

The SUPD and Plastic Bags Directive will certainly have an impact on specific plastic products and having the Circular Economy Action Plan alongside that will help to promote waste minimisation. Nonetheless, it can be difficult to quantitatively determine these impacts and considering that these policies cover such a small proportion of packaging waste in Europe, the impacts are fairly small and concentrated. This is subsequently reflected in our modelling which, as discussed, applies a conservative approach assumes bases future waste generation / composition on historical trends only (with the exception of compostables, see Section 4.3).

4.5 Recycled Content Projections

Future projections for recycled content follow the standard approach for a business as usual scenario i.e. the potential impacts of adopted and agreed policy measures were taken into account for the projections. Only mandatory and legally binding existing recycled content targets were included when designing the model assumptions. Voluntary commitments and similar policy measures or views from stakeholders on the potential for future change in recycled content are not considered, as these do not provide sufficient certainty of future change to be included in a business as usual scenario.

Following this approach, recycled content projections are therefore kept at baseline levels, with the exception of beverage containers, which are assumed to meet the specific targets laid down in the Single-use Plastics Directive, these are:

- 25% of recycled plastic in PET beverage bottles from 2025; and
- 30% in all plastic beverage bottles from 2030

The 30% target for all plastic beverage bottles is split in the model across PET and non PET beverage containers, with the former modelled with a higher rate (30.3%) compared to the latter (20%) in 2030. In combination these serve to meet the 30% overall target for all beverage bottles.

5.0 Recycling Rates

Our approach to modelling historic and projected recycling rates is described in this section. Firstly, the main drivers (policy and otherwise) for any future changes in recycling rates under the baseline (business as usual) scenario are described. We then set out our method for modelling recycling rates at the material-level, followed by an overview of the methodology used for assigning recycling rates to specific packaging types. Finally, we discuss the approach taken to dissaggregate recycling rates reported for metal packaging into distinct rates for aluminium and steel.

5.1 Drivers for Changes in Recycling Rates

This section provides a detailed review of the drivers affecting the recycling rate of packaging. A systematic approach is taken to firstly consider the likely high and low impacts for each individual driver. The scenario (low or high) on which the baseline modelling is based is listed, along with the rationale for choosing this scenario.

Table 5-1 Recycling Rate - High/Low by Instrument and chosen scenario for the baseline

Flow	Instrument	Scenario – Low	Scenario - High	Baseline	Rationale
Recycling Rate	PPWD Targets	Assume the recycling targets are not met, given the challenges posed by the revised measurement method as suggested by the European Court of Auditors.	Assume the recycling targets are met.	High	The targets in already implemented policies are assumed to be met.
Recycling Rate	Waste Framework Directive	As compostables are such a small percentage of the market, we would not expect this to contribute significantly to an increase in the recycling rate.	The market for bioplastics increases significantly, with some forecasts expecting the market to grow by 20% over the next five years,[384] with packaging being the largest application. This growth, along with the impact of separate collection of organic waste, could see recycling rates increase by 1-2%	High	There is a significant possibility that the market for bioplastics will increase in future years
Recycling Rate	Waste Framework Directive	By 2030, the recyclable fraction that is currently ending up in incineration should be sorted out before incineration. However, as this proportion is already insignificant, little impact.	By 2030, the recyclable fraction that is currently ending up in incineration should be sorted out before incineration. This would result in a small increase in the recycling rate.	N/A	These changes are not defined in the model – as the model is calibrated based on the overall assumption of meeting recycling targets.
Recycling Rate	Landfill Directive	By 2030, the recyclable fraction that is currently ending up in landfill should be sorted out before landfill. However, as this proportion is already insignificant, little impact.	By 2030, the recyclable fraction that is currently ending up in landfill should be sorted out before landfill. This would result in a small increase in the recycling rate.	N/A	These changes are not defined in the model – as the model is calibrated based on the overall assumption of meeting recycling targets.

384 Hoffmann, C. *Global market for bioplastics to grow by 20 percent*

Flow	Instrument	Scenario – Low	Scenario - High	Baseline	Rationale
Recycling Rate	Single Use Plastics Directive	Within the SUPD, Member States are required to achieve a 77% collection target for plastic bottles by 2025 and 90% by 2029. Additionally, the sale of polystyrene food containers, beverage containers and cups will not be allowed. This will reduce the quantity of non-recyclable packaging placed on the market, and subsequently increase the amount of recyclable containers available for recycling, though for a very small proportion of packaging.	Within the SUPD, Member States are required to achieve a 77% collection target for plastic bottles by 2025 and 90% by 2029. Additionally, the sale of polystyrene food containers, beverage containers and cups will not be allowed. In addition to reducing the quantity of non-recyclable packaging placed on the market, consumers may alternatively switch to reusable alternatives, and as such could reduce packaging POM, and thereby increase recycling rates.	Low	The method that Member States will choose to achieve these targets is not yet clear, and so it is not yet apparent whether this will drive switches to reusable alternatives.
Recycling Rate	Modulation	Modulated fees are brought in across the EU, however the level of the fees/ differential rates are not significant to drive producers to make the use of non-recyclable packaging uneconomic. The impact on the levels of recycling assist in the attainment of the recycling target, though they do not take recycling further.	Modulated EPR fees for packaging are introduced across the EU with a high enough fee per tonne placed on the market to incentivise producers to phase out significant amounts of non-recyclable packaging.	Low	Modulated fees are still in their infancy in most Member States. Given that the relative fees applied/that will be applied to packaging types on the basis of recyclability are not yet known for most Member States, we have made the conservative assumption in the baseline that significant switches between packaging types will not occur.
Recycling Rate	Green Claims	Most recyclable packaging is already labelled as such, so the requirement that packaging be labelled correctly is unlikely to be especially beneficial in increasing recycling rates, as this depends more on influencing consumer behaviour and improving provision of source segregation in Member States. Will have no impact on recycling rates.	Clearer, consistent labelling leads to less contamination in recycling streams allowing a marginal increase in recycling rates due to lower losses.	N/A	These changes are not defined in the model – as the model is calibrated based on the overall assumption of meeting recycling targets.

Flow	Instrument	Scenario – Low	Scenario - High	Baseline	Rationale
Recycling Rate	Food Contact Materials Rules (FCMR)	Rules are being established for the safe recycling into food contact materials of plastic materials other than PET (Q4 2020/ 2021) however this has no impact on recycling rates in the absence of RC measures.	Rules are being established for the safe recycling into food contact materials of plastic materials other than PET (Q4 2020/ 2021) which will provide a marginal boost to recycling rates, indirectly, by opening up an important end market/ stimulating demand for recycled content.	N/A	These changes are not defined in the model – as the model is calibrated based on the overall assumption of meeting recycling targets.
Recycling Rate	EU Budget contribution	Member States do not choose to share the burden of the contribution with industry through taxation on virgin materials/ unrecycled packaging, or choose to do so, but to a limited extent that is insufficient to incentivise switches to recyclable packaging design/ types – minimal impact on recycling rates	Member States fully transfer the burden of the contribution to industry, driving a price wedge between virgin and secondary materials and increasing the costs associated with unrecycled packaging sufficiently to incentivise the removal of such packaging from the market – this drives recycling rates above the targets	Low	See above, it is assumed that the recycling rate targets are met but not exceeded. It is possible that these changes could contribute towards the meeting of targets.
Recycling Rate	Tech developments	New technologies like chemical recycling and digital watermarking do not achieve the required levels of commercialisation and uptake needed to drive significant improvements in the recycling rate.	Chemical recycling and digital watermarking both achieve commercial viability and uptake within the period of interest and have a significant effect on recycling rates, pushing them beyond the targets.	Low	See above, it is assumed that the recycling rate targets are met but not exceeded. It is possible that these technologies could contribute towards the meeting of targets.
Recycling Rate	Circular Plastics Alliance	Unlikely to have a significant impact on recycling rates. Close to 10 million tonnes of plastic is already being recycled in the EU, and given that it is a voluntary commitment, no firm commitment on recycled content is made/ sustained in the packaging sector in particular. No impact on recycling rates.	Although the 10 million tonnes of recycled plastic, committed in the CPA is not enough in and of itself to significantly raise levels of recycling, however the activities surrounding this may help achieve the recycling targets.	N/A	These changes are not defined in the model – as the model is calibrated based on the overall assumption of meeting recycling targets.

Flow	Instrument	Scenario – Low	Scenario - High	Baseline	Rationale
Recycling Rate	Deposit Refund Schemes	A small number of additional Member States implement DRS for a small number of items (cans, bottles). Whilst the impact on recycling rates in those Member States will be significant, the overall increase across the EU will be minor.	A large number of additional Member States implement DRS for a larger number of items (cans, bottles, cups) and as such this will drive the recycling of bottles up in those Member States to as much as 85-90% - this will help achieve the targets.	Low	We have assumed that DRS schemes are implemented for plastic bottes only, driven by the collection targets set out in the SUPD. Whilst, in reality, other materials are likely to be included in any DRSs implemented, there is no explicit policy driver for this to take place.

5.2 Material-Level Recycling Rates

5.2.1 Background to Recycling rates

Packaging waste and recycling tonnages by material are reported to Eurostat under Member State reporting obligations under the Packaging and Packaging Waste Directive (PPWD). In terms of the tonnages of material recycled used to calculate the recycling rate, Eurostat metadata states that for the packaging recycling rate,

> *"'Recycling rate' means the total quantity of recycled packaging waste, divided by the total quantity of generated packaging waste."*
> *"The weight of recovered or recycled packaging waste shall be the input of packaging waste to an effective recovery or recycling process. If the output of a sorting plant is sent to effective recycling or recovery processes without significant losses, it is acceptable to consider this output to be the weight of recovered or recycled packaging waste."*

For the data set on waste generation and treatment in all sectors, the Waste Framework Directive is referred to, which states

> *"'Recovery' means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function"*

From this it is understood that the tonnage, and hence the recycling rate, should be a 'real recycling rate' rather than the percentage collected for recycling. However, in practice, loss rates are not usually monitored and even more rarely reported. Therefore, it is not generally possible for a Member State to verify that their data satisfies these requirements under the current calculation rules.

5.2.2 Rationale for correcting recycling rates

The PPWD[385] stipulates that Member States must meet recycling rate targets for packaging waste in 2025 and 2030, as shown in Table 5-2.

Table 5-2: EU Packaging Waste Recycling Targets from the PPWD

	2025	2030
Glass	70%	75%
Steel	70%	80%
Aluminium	50%	60%
Paper / board	75%	85%
Plastic	50%	55%

[385] Official Journal of the European Union (2018) DIRECTIVE (EU) 2018/852 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste, 14th June 2018, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0852&from=EN

	2025	2030
Wood	25%	30%

The 2018 Eurostat release of packaging waste by waste management operations suggests that 15 countries have already met their 2025 packaging waste recycling obligations. However, as discussed in Section 3.0, once Member States are obliged to report under the new calculation rules (for the 2020 reporting year onwards), this is likely to lead to a negative correction in recycling rates relative to those reported to date (under the old calculation rules).

Most Member States have not assessed how the imminent rule change will impact their recycling rates, but member states that have undertaken an assessment have concluded that reported recycling rates will reduce. In part, this is because the new rules will explicitly prevent material that is collected for recycling, but then subsequently lost during sorting and/or reprocessing, being reported as material actually recycled. This will ensure that loss rates of materials in the recycling process are correctly accounted for in the calculation of Member States' recycling rates, and result in a reduction in reported rates. The effect of the introduction of these new rules will be particularly significant for plastic, which has high loss rates due to contamination of recyclate. In addition, it is known that packaging waste placed on market (POM) tonnages are often underreported, due to free-riding, online sales, private imports and de minimis thresholds. Some member states provide corrections for this, but others do not, and underreporting of placed on market tonnages also contributes to inflated recycling rates.

After accounting for new rules, loss rates and overreporting of PoM, there is a significant risk that some member states will not meet the 2025/30 packaging waste targets set out under the Packaging Waste Directive. Indeed, preliminary results from an EEA assessment identified 13 out of 19 assessed countries at medium or high risk of not meeting 2025 recycling targets for plastic packaging.

Given these risk assessments, it may be unrealistic to assume that member states will meet corresponding 2025/30 packaging waste recycling targets in the baseline model. In response, we have developed a methodology that adjusts when member states meet recycling targets to increase the accuracy of the tonnages predicted in the baseline model.

5.2.3 Modelling Methodology for Adjustment to Projected 2025/30 Packaging Waste Recycling Rates

The methodology used to estimate actual member states recycling rates in 2025 and 2030 is described below:

- Initially the model applies average loss rates by material to the reported Eurostat recycling rates.
    - Although in the baseline there is no adjustment to the 2018 reported recycling rates, the model projects forward from modified 2018 recycling rates where estimated average loss rates have been applied to attempt to provide some correction for under-reporting of PoM tonnes and over-reporting of recycling tonnages.
- Then, for each Member States, the model checks whether or not recycling targets are already met for 2025/2030, and then does the following:
    - If the country has already exceeded its recycling target for the packaging type in 2018, then that recycling rate is maintained;

- If the country has not met the recycling target then the country grows linearly to meet the recycling targets in 2025/30 or misses the target by a specified number of years depending on a quantified risk level described below (not at risk, medium risk, clear risk).

- Risk level is used to estimate by how many years a given country will miss it's recycling target. Within the model 'not at risk' countries meet the target in the target year, 'medium risk' countries miss the target by 3 years and 'clear risk' countries miss the target by 5 years.
  - Risk is assigned from the European Commission's initial work on the distance to 2025 targets (unpublished), or, for countries not included in this study, based on calculated distance to target assumptions.
  - Distance to target is calculated by first applying a weighted average of loss rates by material stream to the overall packaging waste stream in 2018 and then calculating the distance from the 70% packaging waste recycling target.
  - Risk is then assigned based on the country's distance in 2018 to the 70% packaging waste recycling target. The bands as defined by the model user, by default these are:
    - <10% Not at risk
    - <10% and <20% Medium risk
    - >20% Clear risk
  - The final 'risk' categories calculated via this approach are shown in Table 5-3.

Table 5-3 Modelled Risk Categories by Member State

Member State	Modelled risk of not achieving PPWD 2025/30 targets
Austria	not at risk
Belgium	not at risk
Bulgaria	clear risk
Croatia	medium risk
Cyprus	medium risk
Czech Republic	medium risk
Denmark	not at risk
Estonia	medium risk
Finland	medium risk
France	medium risk
Germany	not at risk
Greece	medium risk
Hungary	medium risk
Ireland	medium risk

Member State	Modelled risk of not achieving PPWD 2025/30 targets
Italy	medium risk
Latvia	medium risk
Lithuania	medium risk
Luxembourg	not at risk
Malta	clear risk
Netherlands	not at risk
Poland	medium risk
Portugal	medium risk
Romania	clear risk
Slovakia	medium risk
Slovenia	not at risk
Spain	not at risk
Sweden	medium risk

Projections are then created and the modelled 2025/2030 recycling rates achieved by Member States are presented in

Table 5-4 and

Table 5-5. These recycling rates are the rates for 2025 and 2030 that are used for projections in the baseline model of packaging waste.

Table 5-4: Modelled 2025 Packaging Waste Recycling Rates by Material

	Paper and cardboard packaging	Plastic packaging	Wooden packaging	Aluminium packaging	Steel packaging	Glass packaging	Other packaging
Austria	80%	50%	25%	76%	91%	80%	21%
Belgium	91%	50%	86%	68%	70%	95%	7%
Bulgaria	67%	39%	23%	70%	89%	74%	30%
Croatia	84%	39%	19%	36%	59%	66%	1%
Cyprus	78%	42%	19%	42%	135%	62%	1%

	Paper and cardboard packaging	Plastic packaging	Wooden packaging	Aluminium packaging	Steel packaging	Glass packaging	Other packaging
Czech Republic	73%	42%	43%	43%	70%	71%	15%
Denmark	87%	50%	26%	70%	89%	80%	1%
Estonia	77%	43%	23%	68%	88%	68%	
Finland	93%	42%	20%	84%	94%	94%	
France	83%	41%	30%	56%	82%	72%	1%
Germany	82%	50%	25%	90%	92%	79%	1%
Greece	80%	40%	23%	44%	75%	59%	1%
Hungary	69%	40%	23%	52%	80%	59%	1%
Ireland	71%	42%	52%	43%	66%	78%	1%
Italy	76%	44%	46%	78%	77%	70%	
Latvia	75%	41%	26%	57%	83%	69%	
Lithuania	73%	43%	24%	60%	84%	66%	1%
Luxembourg	76%	50%	30%	84%	84%	88%	1%
Malta	64%	35%	15%	37%	66%	52%	1%
Netherlands	83%	50%	69%	63%	70%	82%	1%
Poland	84%	41%	28%	53%	89%	67%	
Portugal	72%	41%	54%	41%	67%	64%	
Romania	73%	36%	27%	38%	69%	65%	1%
Slovakia	73%	41%	51%	58%	83%	69%	24%
Slovenia	75%	50%	31%	51%	75%	89%	53%
Spain	75%	50%	64%	50%	86%	70%	1%
Sweden	74%	43%	48%	65%	83%	83%	1%

Table 5-5: Modelled 2030 Packaging Waste Recycling Rates by Material

	Paper and cardboard packaging	Plastic packaging	Wooden packaging	Aluminium packaging	Steel packaging	Glass packaging	Other packaging
Austria	85%	55%	30%	76%	91%	80%	21%
Belgium	91%	55%	86%	68%	80%	95%	7%
Bulgaria	77%	46%	27%	70%	89%	75%	30%
Croatia	85%	47%	25%	48%	71%	72%	1%
Cyprus	84%	48%	25%	52%	135%	69%	1%
Czech Republic	82%	49%	43%	53%	78%	74%	15%
Denmark	87%	55%	30%	70%	89%	80%	1%
Estonia	83%	49%	28%	68%	88%	72%	
Finland	93%	48%	26%	84%	94%	94%	
France	85%	48%	30%	59%	82%	74%	1%
Germany	85%	55%	30%	90%	92%	79%	1%
Greece	84%	47%	28%	54%	79%	66%	1%
Hungary	79%	47%	27%	58%	80%	67%	1%
Ireland	81%	48%	52%	53%	75%	78%	1%
Italy	83%	50%	46%	78%	79%	74%	
Latvia	83%	48%	29%	59%	83%	73%	
Lithuania	82%	50%	29%	60%	84%	71%	1%
Luxembourg	85%	55%	30%	84%	84%	88%	1%
Malta	74%	43%	21%	48%	74%	61%	1%
Netherlands	85%	55%	69%	63%	80%	82%	1%
Poland	85%	48%	30%	59%	89%	72%	
Portugal	81%	48%	54%	52%	76%	70%	
Romania	81%	44%	29%	48%	76%	70%	1%
Slovakia	82%	48%	51%	60%	83%	73%	24%

	Paper and cardboard packaging	Plastic packaging	Wooden packaging	Aluminium packaging	Steel packaging	Glass packaging	Other packaging
Slovenia	85%	55%	31%	60%	80%	89%	53%
Spain	85%	55%	64%	60%	86%	75%	1%
Sweden	83%	50%	48%	65%	83%	83%	1%

5.2.4 Impact of recycling rates assumptions on baseline model

The baseline model uses official reported Eurostat figures in 2018. If a member state has already met the 2030 packaging waste recycling target then this recycling rate is maintained throughout the model. If not, then the country grows by arithmetic progression towards the PPWD target, potentially missing the target by up to 5 years if the member's state quantified risk of not meeting the target is high. Final plastic packaging recycling rates used in the baseline model are presented in Table 5-6.

Table 5-6: Plastic Recycling Rates used in the Baseline Model

	2018	*2025*	*2030*
Austria	32%	50%	55%
Belgium	42%	50%	55%
Bulgaria	59%	59%	59%
Croatia	37%	40%	47%
Cyprus	54%	54%	54%
Czech Republic	57%	57%	57%
Denmark	32%	50%	55%
Estonia	38%	43%	49%
Finland	31%	42%	48%
France	27%	41%	48%
Germany	47%	51%	55%
Greece	42%	41%	47%
Hungary	30%	40%	47%
Ireland	31%	42%	48%
Italy	44%	45%	50%

	2018	2025	2030
Latvia	36%	41%	48%
Lithuania	69%	70%	70%
Luxembourg	32%	50%	55%
Malta	21%	35%	43%
Netherlands	50%	53%	55%
Poland	36%	41%	48%
Portugal	34%	41%	48%
Romania	43%	43%	46%
Slovakia	51%	52%	52%
Slovenia	61%	60%	60%
Spain	51%	51%	55%
Sweden	50%	50%	50%

In practice, this means that if a member state has underreported packaging POM and/or did not properly account for loss rates in reported recycling tonnages, then their recycling rates would be overestimated in the model for 2018, and this rate is then maintained in future years.

Despite Austria having the most advanced waste collection system of the countries in the table, the reported plastic packaging recycling rates are up to two times higher in the other countries. For Bulgaria and Lithuania, this means that both the 2025 and 2030 plastic packaging targets are met in 2018 and they maintain a plastic packaging recycling rate of 59% and 69% respectively from 2018 to 2030. Whereas for the Netherlands, this means that the 2025 plastic packaging target has already been met in 2018. In contrast, Austria grows linearly from a plastic packaging recycling rate of 34% in 2018, to 50% in 2025 and 55% in 2030.

If actual plastic packaging rates are lower than reported recycling rates, then assuming that some countries have already met recycling targets will cause plastic packaging recycling rates to be overestimated in the model. If this is the case, then downstream environmental impacts will also be underestimated.

Table 5-7: Baseline Recycling Rates for Plastic Packaging Waste (Selected Member States)

Year→ Country↓	Reported	Projected Rates (based on assumed risk)		Final Baseline Rates	
Austria	34%	50%	55%	50%	55%
Bulgaria	59%	39%	46%	59%	59%
Lithuania	69%	43%	50%	69%	69%

Year→ Country↓	Reported	Projected Rates (based on assumed risk)		Final Baseline Rates	
Netherlands	50%	50%	55%	50%	55%

5.3 Recycling Rates at the Packaging Type Level

Reporting of recycling rates at the level of specific packaging types is extremely limited throughout the EU27.

A methodology was designed to make best use of the available data by applying a dynamic scaling function to a set of 'synthetic' recycling rates to estimate recycling rates for each packaging type, based on any overall target rate at the material-level (as discussed above).

The first stage in this process was to compile a full set of recycling rates for all packaging types based on the data from one particular region. In other words a single set of packaging recycling rates that is internally consistent and illustrates the general stratification of recycling rates by packaging type. This set of recycling rates is obviously associated with overall recycling rates at the material level, although as we will describe further, the overall recycling rate associated with this dataset is of no great importance. The methodology discussed here enables the individual recycling rates to be appropriately scaled to the rates required for any target recycling rate at the material level, and can be applied to any packaging waste composition.

The compiled 'synthetic' set of recycling rates is based on a detailed review and analysis of UK packaging waste compositions and recycling tonnages recently conducted by Eunomia, which provides the most comprehensive set of packaging waste recycling rate data we are aware of for any European country.[386] The approach taken to compiling this set can be summarised as follows:

- Waste composition data provides a breakdown of total waste arisings, and the split of residual and recycling tonnages in this total, which enables capture rates (collected recycling rates) to be calculated.[387]
- The categories used in the waste composition data were mapped to modelled packaging types. The level of granularity in waste composition data is, in most cases, less than the granularity of the modelled packaging types. Similar recycling rates are therefore used, in many cases, for more than one packaging type (for example, all flexible films are specified with the same recycling rate). Where more detail is available, for example, distinct capture rates can be calculated for different polymer types in plastic bottles, this has been included.
- Appropriate estimates are made for commercial waste capture rates based on the higher-resolution household waste recycling rates and adjusted based on detailed commercial waste compositions.
- These capture rates are then applied to POM tonnages for the UK (compiled from WRAP Flow reports and other sources) to estimate the tonnage of final recycling, and therefore final recycling rate, for each packaging type. This approach implicitly accounts for, and

[386] Derived by Eunomia from the most recent synthesis of waste composition data available

[387] Figures were used from the most recent synthesis of UK composition data available.

excludes any contamination from food and drink, as capture rates are applied to POM tonnages (dry material) rather than waste arisings (contaminated with food and drink).

- Additional calculations are made for some specified packaging types. These include accounting for recycling of metals from incineration bottom ash, and to estimate the relative recycling rates of glass bottles vs. glass jars.[388,389] Discussions with industry enabled the estimates of the recycling rates of less easily recycled plastic packaging, such as films and pouches to be made, and similarly for compostable plastics, for which we are not aware of any published data. Finally, recycling rates for most reusable transport packaging were set at 99% as discussions with industry indicate that virtually all reusable packaging is recycled at end-of-life.

The final set of 'synthetic' recycling rates, compiled based on this approach, is shown in Table 5-8.

Table 5-8 'Synthetic' Recycling Rate Dataset used for Modelling

Material	System	Packaging Unit(s)	Recycling Rate
			Primary / consumer packaging
Glass	SU	Beverage containers	78.4%
	SU	Non-beverage food	75.4%
	SU	Other (non-food, non-beverage)	75.4%
Steel	SU	Beverage containers	65.3%
	SU	Non-beverage food e.g. food cans	78.7%
	SU	Other (non-food, non-beverage) e.g. paint tins	23.0%
Aluminium	SU	Beverage containers	70.4%
	SU	Other rigids e.g. aerosol sprays, food cans	24.9%
	SU	Semi rigids e.g. food trays	12.3%
	SU	Flexibles e.g. foils	12.3%
Paper / board	SU	Carton board e.g. cereal boxes etc	69.0%
	SU	Beverage cartons	34.8%
	SU	Non-beverage liquid packaging board e.g. soups	34.8%

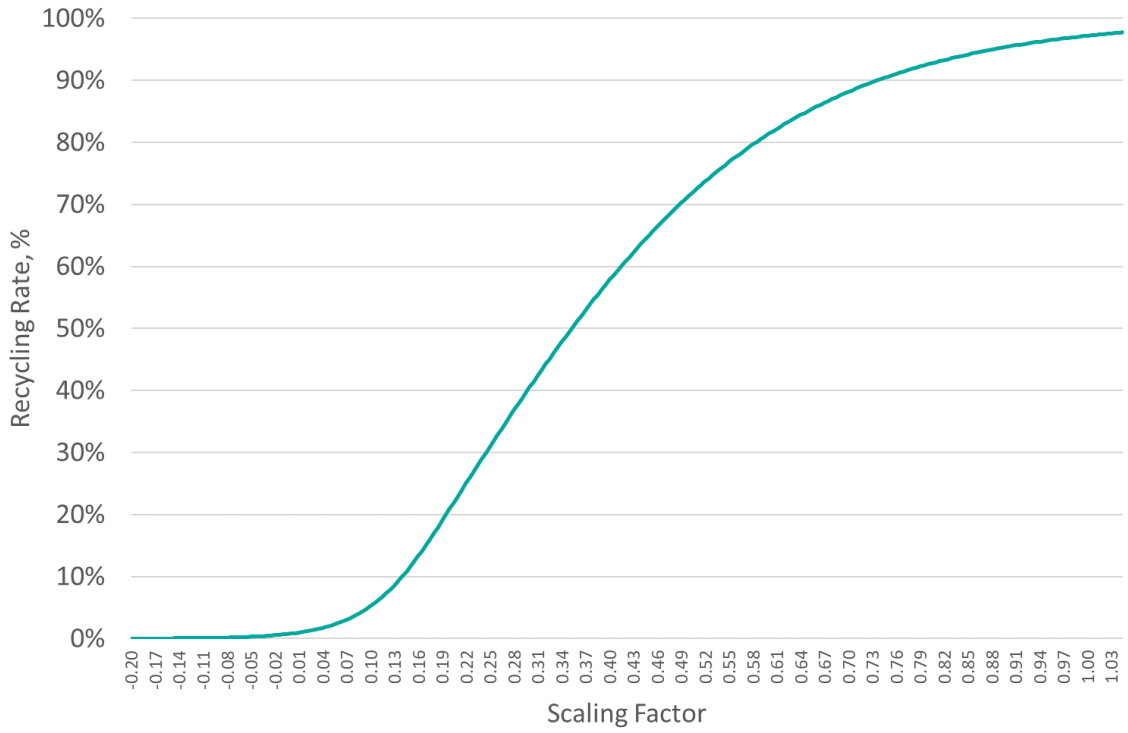
[388] Grosso M, Biganzoli L and Rigamonti L (2011*) A quantitative estimate of potential aluminium recovery from incineration bottom ashes*, Resources, Conservation and Recycling, 55, pp1178-

[389] Resource Futures (2012) *Updated compositional estimates for local authority collected waste and recycling in England, 2010/11 - EV0801*, Report for Defra, http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18237

Material	System	Packaging Unit(s)	Recycling Rate
	SU	Other paper / board	74.5%
	SU	PET bottles (beverage containers)	59.1%
	SU	Non PET (beverage containers)	55.0%
	SU	Bottles (all non-beverage)	55.0%
	SU	Rigid food e.g. pots, tubs and trays	19.0%
	SU	Other rigids (non beverage, non-food) e.g. blister packs	0.1%
Plastic	SU	Mono-polymer stand-up pouches	0.1%
	SU	Multi-polymer/material stand-up pouches	0.1%
	SU	Other mono/multi polymer/layer flexibles (excl. film)	0.1%
	SU	Films	5.3%
	SU	Compostable Rigids	12.0%
	SU	Compostable Films	8.0%
Other	SU	Miscellaneous (not included elsewhere)	0.1%
			Secondary / Tertiary
Paper / board	SU	Corrugated and other board boxes	64.9%
			Tertiary / transport
Paper / board	SU	Corrugated and other board boxes - e-commerce	64.9%
	SU	Film and bubble pouches - e-commerce	0.1%
Plastic	SU	Wrapping and strapping	40.0%
	SU	Crates, boxes etc.	19.0%
Wood	SU	Pallets	74.3%

These recycling rates were then scaled to estimated recycling rates for each packaging type for every required data point in the model i.e. for all Member States, for all the model years (2006 to 2030). The process relied on using goalseek method within a VBA macro to scale recycling rates based on a pre-defined function. This function approximates the generalised way in which recycling rates for specific packaging types are observed to change as the overall rate of recycling goes up or down, and is presented graphically in Figure 5-1.

Figure 5-1 Recycling Rate Scaling Function



Note: when moving further left or right along the x-axis, the function continues to flatten as it moves towards but never meets a 0/100% recycling rate.

The function calculates recycling rates from a 'scaling factor' or vice versa, and has the following generic form:

$$Recycling\ Rate = J + \left(\frac{K}{1 + e^{A+B.Scaling\ Factor}}\right)$$

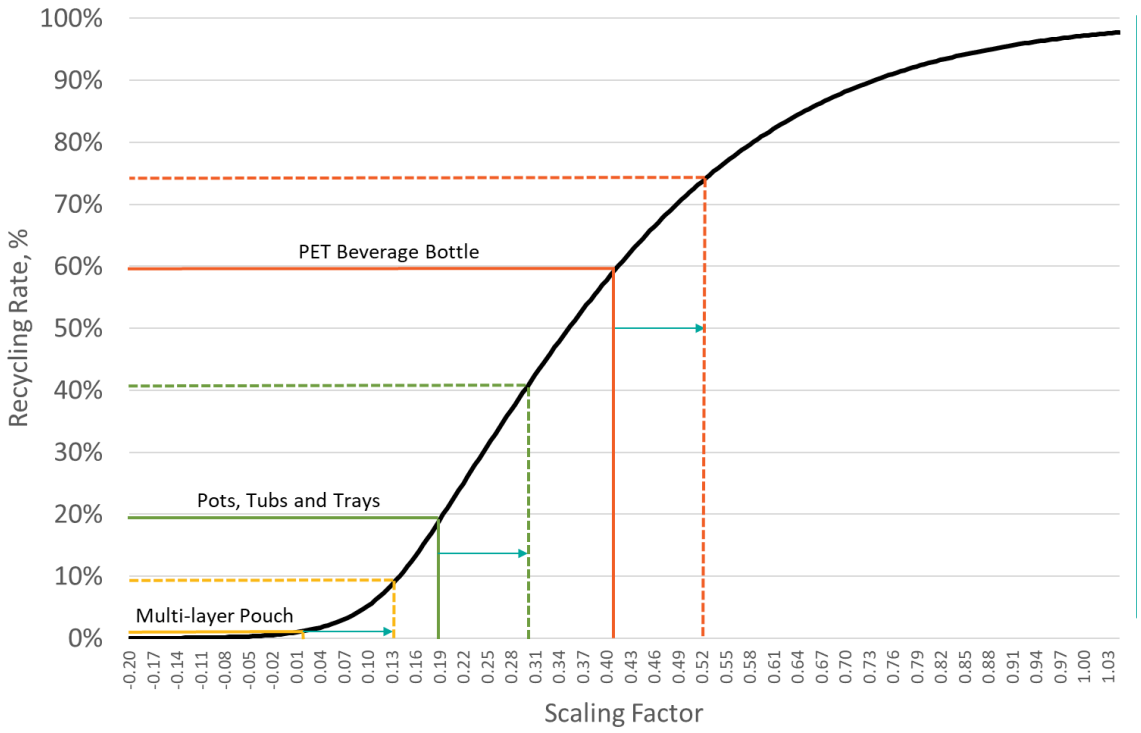
J, K, A, and B are constants and are set to the values set out in Table 5-9. As shown, the different constant are applied above and below a recycling rate of 20%.

Table 5-9 Values of Constants for Recycling Rate Function

	< Scaling Factor of 0.2 / Recycling Rate of 20%	> Factor of 0.2 / Recycling Rate of 20%
J	0.4	1.6
K	4.0	1.0
A	-20.0	-5.0
B	0.4	1.6

The application of this function in our model can be illustrated through an example, shown in Figure 5-2.

Figure 5-2 Recycling Rate Scaling Function Example Application



For the purpose of this example we have focused on three plastic packaging types used in the model: 1. PET bottles (beverage containers); 2. Rigid food e.g. pots, tubs and trays; and 3. Multi-polymer/material stand-up pouches. The VBA macro containing this function is run once per material, so in actual use all other plastic packaging types should be shown in this example, however, we have focused on these three as a simplification to more easily demonstrate the functionality.

The macro first takes recycling rates for each packaging type within the material in focus (in this example, plastic) from the bank of 'synthetic' rates for that material (Table 5-8) and calculates a 'scaling factor' for each material (solid lines in Figure 5-2). The overall recycling rate is calculated at this point in the model, based on the relative proportion of each packaging type in the overall waste stream. For the purpose of our example the recycling rate for all plastic may be around 40%, assuming roughly similar amount of bottles (recycling rate of 59.1%), pots, tubs and trays (recycling rate of 19%), and a minor component of pouches (recycling rate of 1.8%).

A goalseek is then performed which changes the calculated scaling factors by a fixed amount, which could be up or down. In the illustrated example, the scaling factors are increased, all by a similar amount, as shown by the blue arrows. As the goalseek is running, the function calculates new recycling rates for each material, based on the intersection of the new scaling factors with the curve (dotted lines in Figure 5-2). These new recycling rates are, in turn, used to recalculate a new material-level recycling rate. The goalseek continue until the material-level recycling rate calculated matches the target material-level recycling rate (in this example we are perhaps modelling an overall rate of 55% for plastic). As previously outlined, for historic rates this target rate is based on Eurostat reporting, and for future projections it is defined based on trajectories which meet the recycling rates set out in the Packaging and Packaging Waste Directive.

The shape of the curve defines the magnitude of the modelled change in individual recycling rates relative to their starting value (based on the 'bank' of synthetic recycling rates described). It does so in such a way that seeks to mimic what is observed in real-world recycling collection systems. As illustrated in this example, we would expect to see the following changes in recycling rates for a given increase in the overall recycling rate:

- At very high recycling rates (e.g. 80-90% +), little further gains are possible as generally a high rate is indicative that collection/management systems are already fully optimised. Thus the incline on the curve gradually reduces, trending towards but never quite reaching 100% recycling. In other words, for a given increase in the overall recycling rate (which is proportionate to a given increase – moving right along the x axis – in the scaling factor), the specific recycling rate for this packaging type will increase only marginally.
- Recycling rates for packaging types in the region of 50 to 80% will increase more as the overall recycling rate increases (e.g. the PET bottle in our example) with gradually less additional gain possible in recycling rate for starting recycling rates at the higher end of this range.
- Recycling rates in the region of approx. 15% to 50% will increase the most (e.g. pots, tubs and trays in our example). Materials with recycling rates in this range are often those that are technically 'recyclable' with current technologies, but require further development in collection and sorting systems to do so – they commonly have the most potential gains in recycling rates. Then model is 'tuned' around a recycling rate of 20% i.e. it is at a 20% starting recycling rate that the most gains are possible (this is the inflection point in the curve).
- Packaging types with very low recycling rates (e.g. multi-layer pouches in our example) are commonly those that are not recyclable, or only using very specialised technologies, such as certain types of chemical recycling. It is often the case that even with advances in investment in recycling technologies that recycling of such packaging remains very niche, given economic and technological constraints. Thus, packaging types with very low recycling rates are likely to see a lower increase in recycling rate relative to the overall change.

The function can also be used to adjust the starting rates down (if the target rate is lower than the original calculated material recycling rate). This function is a flexible, automated and dynamic method to calculate sensible recycling rates for individual packaging types, based on specific material-level recycling rate trajectories. We are aware that the rationale described in the bullets above will not hold true for all packaging types. For example, there will be instances where the reason for a very low current recycling rate for a packaging type is not because it is difficult to recycle (whether for technological and/or economic constraints), but because the collection systems in that country are still fairly rudimentary and the material the packaging material is not targeted. However, with appropriate improvements to waste management infrastructure the rate could increase quickly (i.e. at a much greater rate than specified in the function). Moreover, for all packaging types this method will of course only provide approximations – it is a 'model' of the real-world. It is designed to calculate the necessary recycling rates for the impact assessment in such a way that the relative stratification and overall schema of modelled recycling rates are robust and calculated based on sound principles.

Finally, it is useful to briefly discuss the interaction of the estimated % of packaging waste littered and left in the environment. The theoretical maximum recycling rate for a given packaging type (assuming that all collected waste is recycled with no losses) is equal to 100% minus the % of that packaging type left in the environment – the % littered and left in the

environment is an explicit assumption in the model. This limitation is accounted during the goalseek process – i.e that the maximum recycling rate that can be calculated (i.e. the recycling rates on the y-axis in Figure 5-2) is constrained to be no higher than this defined limit.

5.4 Recycling Rates for Member States with DRS

Where a country has a deposit refund scheme in place for beverage container packaging, return rates for beverage containers included in the scheme are higher than in countries without deposit collections, and data on return rates of those beverage containers included in the scheme are often available.

For countries with deposit schemes, specific baseline (2018) recycling rate assumptions have been applied for the four beverage container packaging types identified in the model (aluminium beverage containers, steel beverage containers, PET beverage containers, and glass beverage containers) in a similar manner to 'alternate data' for waste generation tonnages

The primary source for these recycling rates is Reloop, which compile reported statistics from different scheme operators. Two adjustments are made to the numbers compiled by Reloop to estimate a recycling rate for beverage containers in these countries.

Firstly, a downward adjustment is made to the recycling rates for each material on a country-specific basis, to account for the portion of beverage containers by weight that are excluded from the reported Reloop return rate data.

The return rate applies only to containers included in the deposit scheme. The scope of beverage containers included in the deposit scheme differs between countries, the major differences being:

- The exclusion of dairy products (no adjustment has been made in this case, as dairy containers are not included in the 'beverage containers' packaging group in the model);
- The exclusion of juices, typically affecting a portion of PET beverage containers and a smaller portion of glass beverage containers; and
- The exclusion of wines and spirits, typically affecting a large quantity of glass beverage containers

The portion of material not accounted for in the return rate reported by Reloop is added on (at a lower separate collection assumption) to reduce the overall return rate. The portion of containers which are juices, wines, etc of different types are estimated from the Global Data dataset.

Secondly, the recycling rate is adjusted to take account of losses of material prior to the calculation point for recycling under the PPWD measurement method. Specifically, PET return rates are adjusted for losses in the reprocessing of collected deposit-sourced PET to PET flake.

Typical yields of flake from deposit-sourced PET are understood to be in the region of 85%. However, this is 85% of total input material including (albeit very small) levels of non-target material (for instance cans) and moisture. Assuming a 4% average moisture content in deposit PET based on data reported by, the yield from the PET beverage bottles excluding moisture can be estimated therefore at 85% / (100%-4%) = 89%. This factor is applied to the adjusted return rate to reach a recycling rate estimate in line with the PPWD recycling rate measurement.

Recycling rates for material in scope of a DRS were not included in a small number of cases (glass beverage containers in Croatia and Lithuania) where doing so would unavoidably push

the material-level recycling rates in the model above the official rates published in Eurostat. It is useful to note that this issue is representative of the many challenges of triangulating data from different sources (derived using divergent methodologies) within a single mass flow model, as this study aims to do.

5.5 Aluminium / Steel Rates

As discussed in Section 2.3, many Member States do not report separate generation or treatment tonnages for aluminium and steel – instead reporting under a single 'metal' category. Therefore, as for waste generation tonnages (see Section 2.3) it was necessary to disaggregate the tonnage of metal packaging reported as recycling into estimated tonnages for aluminium and steel recycling. This was done prior at the same time as the work described in Section 5.1, and prior to the calculation of recycling rates at the packaging type level (Section 5.3).

To estimate recycling rates/tonnages for aluminium and steel, a similar methodology as described for the packaging-level recycling rates was applied. In this instance, instead of the 'bank' of pre-defined recycling rates described previously, the starting recycling rates for aluminium and steel were based on the weighted average of steel and aluminium recycling rates (in each year) provided by those Member States reporting these separately. The rationale for this is that the weighted average rate provides a good enough generalisation of the relative position of aluminium recycling rates compared to steel.

These rates were then used as the starting recycling rates for the calculation process described in Section 5.3. The goalseek function adjusts these starting recycling rates (following the functional curve shown in Figure 5-2) until the sum of the calculated aluminium and steel tonnages is equal to the overall target tonnage for metal, i.e. as reported by the Member State (for historic data) or calculated based on the forward projections described in 5.1.

6.0 Other Waste Treatment Destinations

6.1 Residual Treatment Destinations

Residual waste destinations in the model are based on Eurostat data. The proportion of residual waste sent to incineration vs. landfill is calculated at the material-level for each Member State for each year of the historic time-period based on data reported to Eurostat. In historic data (2006 to 2018) these treatment splits are then applied, for each packaging type within a given material, to the residual waste fraction – i.e. the remaining waste after recycling and litter left in the environment are taken into account.

For future projections, we have assumed that the Landfill Directive (as amended) target of no more than 10% of the total amount of municipal waste sent to landfill by 2035 will be met.[390] Whilst, in practise, this will likely be achieved by the combined effect of reductions in landfill to rates below this target for some materials, and above the target for other waste streams, for the purposes of this model we have applied trajectories based on a 10% target to all packaging waste materials. The model assumes, similarly to overall recycling rate projections, equal progress in terms of a fixed % change (an arithmetic progression) in landfill rate towards the 2035 target.

The remaining waste fraction (after explicit assumptions are made for recycling, landfill and litter left in the environment rates) is modelled as sent to incineration. If landfill rates are already below 10% for a given material then the proportion of incineration vs. landfill in the latest year of Eurostat data (2017 or 2018) will remain fixed. Reductions in the amount of waste landfilled in future projections to meet the landfill targets will therefore mean that the proportion of waste sent to incineration may increase if recycling rates are not increased at an equally steep rate.

6.2 Litter

The approach to estimating litter tonnages follows the approach set out in the report for the Commission on the assessment of measures for single use plastics.[391] This approach estimates the tonnage of litter based on studies deemed of reasonably certain scope – i.e., where the study reports the amount of litter dropped and collected, rather than bin litter. Only the data points for (formerly) EU-28 countries were included. This generated a figure of 3.76kg per capita per year. For the purpose of this study, we have assumed this as an overall average for the EU-28, although it will, clearly, vary by Member State.

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[390] Official Journal of the European Union (2018) *DIRECTIVE (EU) 2018/850 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste*, 14th June 2018, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0850&from=EN

[391] ICF and Eunomia Research and Consulting Ltd (2018) *Assessment of Measures to Reduce Marine Litter from Single Use Plastics*, May 2018, https://ec.europa.eu/environment/waste/pdf/Study_sups.pdf

We have further assumed that around 5% of total items littered make their way into the freshwater and, subsequently, the marine environment; this figure being supported by the studies summarised in the single use plastics report for the Commission. We assume that the same proportion of items remain littered on land. This gives a total littering rate of 4.18 kg per capita up to 2018, future littering rates will be considered in the cost benefit analysis.

The composition of litter in terms of percentage by weight was determined for the packaging types in this study based on the few data points available. For the purposes of this study, a Resource Futures study was used as the primary data source, with other supporting data used where required.[392] It is very important to bear in mind that owing to the paucity of data, these figures cannot be taken to represent an accurate picture of the true situation, but we believe they are as reasonable an estimate as can be made without significant further effort. Litter composition can be expected to vary considerably between places and seasons, whereas these estimates are made based on mainly one or two datapoints. By applying the litter rates to composition we calculate the tonnage of each packaging type littered and accordingly the litter rate i.e. the % of waste generated which is littered.

[392] Resource Futures (2018) *Waste composition analysis of litter in Wales*, Report for WRAP, http://www.wrapcymru.org.uk/sites/files/wrap/Litter%20composition%20FINAL%20technical%20report%20WRAP%20Cymru%2020180607.pdf

APPENDIX C - LONG LIST OF MEASURES

The table below sets out the long list of measures that were developed through the early stages of the project, including through consultation with stakeholders and Member States. Each measure was screened against a set of criteria:

- Criterion A: The measure cannot be phrased as 'a measure' and/or at EU level;
- Criterion B: The measure does not treat Member States of different types / income levels fairly
- Criterion C: The measure does not treat different packaging materials fairly
- Criterion D: The measure constrains the potential for innovation
- Criterion E: The measure may lead to a further fragmentation of packaging across the single market
- Criterion F: The measure is unfeasible to monitor and enforce
- Criterion G: The measure does not relate specifically to waste prevention and/or is already implemented

If the measure was defined by any of these tests an "X" was included in the relevant column, and it was screened out. A shortlist was developed (shown in the main report, section 6.0) - some measures were combined or rephrased for the final options shortlisting.

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Bans	Bans on certain single-use plastics			x					No
Bans	Ban of plastic packaging for fruit & vegetables			x					No
Bans	NEW (CEAP) "Restrictions of single use/disposable [e.g. plastic] packaging where reusable products or systems are possible"								Yes
Bans	Bans on specific packaging formats (for example, some single-use packaging items (not only plastic packaging))								Yes
Bans	NEW (CEAP) targeted measure re: "Restricting use of packaging where consumer goods can be handled safely without packaging"								Yes
Bans	EU wide restrictions / bans on specific packaging types where alternatives are available (e.g. compostable) or where the packaging is considered unnecessary								Yes
Bans	Member States implement either 1) restrictions / bans on specific packaging types OR 2) 'no giving away free / minimum pricing' measures where alternatives are available or where the packaging is considered unnecessary	x							No
Bans	Mandatory reusable tertiary packaging								Yes
Bans	Landfill bans		x		x		x	x	No
Bans	Restriction of hazardous substances in packaging								Yes

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Harmonisation	Harmonisation of waste prevention strategies across Member States	x							No
Harmonisation	Harmonisation of EPR reporting across EU								Yes
Harmonisation	Create a single market for reusable packaging								Yes
Standards	Standardisation for reusable packaging on EU level								Yes
Standards	Definition and standards for a reuse system (in terms of logistics, required documentation etc)								Yes
Standards	Commission Communication on harmonisation of reuse systems (e.g. as per on DRS to avoid fragmentation of the single market)								Yes
Standards	Updating the essential requirements for packaging to better align them with the waste hierarchy								Yes
Standards	More strictly and explicitly defining the requirements for packaging, with fewer exceptions								Yes
Standards	Setting product:packaging ratios								Yes
Standards	Setting best-in-class weight limits								Yes
Standards	Measurable standards for packaging types	x							No

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Standards	Packaging design should minimize the possibility of becoming litter						x	x	No
Standards	Dimension limits for e-commerce packaging i.e. reduction of unnecessary void space								Yes
Standards	Limit complexity of packaging (number & type of materials)								Yes
Standards	Eco-design requirements	x							No
Standards	Defining recyclable packaging and high quality recycling								Yes
Standards	Restrict unrecyclable packaging materials, formats and additives							x	No
Standards	Guidelines for food content packaging with recycled materials							x	No
Standards	Harmonisation of end-of-waste criteria for reusable packaging								Yes
Standards	Guidance on effective reuse systems developed through reference to a European Standard.								Yes
Standards	Harmonised definition and measurement method for recycled content in packaging								Yes
Standards	Packaging criteria in GPP								Yes

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Standards	Environmental award criteria in GPP								Yes
Standards	Alignment of the definition of 'hazardousness'								Yes
Standards	Clarification on the terms 'biodegradable' and 'compostable'								Yes
Targets	Targets for eliminating unnecessary single-use packaging and packaging waste reduction	x							No
Targets	Indicators by which the development of plastic waste prevention can be measured and distance to target can be assessed	x							No
Targets	EU wide overall packaging waste reduction target or waste generation limit		x	x					No
Targets	EU wide target to ensure zero or lower growth in packaging waste per GDP / capita over previous 5 years		X						No
Targets	EU wide material-specific packaging waste reduction targets or waste generation limit		X						No
Targets	EU wide packaging type specific reduction targets e.g. proportion of product sold loose as % of total		x						No
Targets	Member State packaging type specific reduction targets OR packaging tax / charge implemented								Yes
Targets	Packaging placed on market reduction targets							x	No

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Targets	Per capita packaging consumption targets on number of units								Yes
Targets	MS level packaging waste reduction target(s) taking into account per capita GDP and waste generation levels.								Yes
Targets	Consumption reduction targets or limits targeting specific packaging types or applications		x						No
Targets	Plastic waste prevention targets e.g: targets for specific waste materials, reduction targets in relation to economic indicators, reduction target combined with quantitative target, quantitative target for reuse.				x				No
Targets	Measures and targets on reusable packaging e.g. refill quotas								Yes
Targets	Targets for reuse within supply chains								Yes
Targets	Mandate reuse for some transport packaging								Yes
Targets	Sector based targets for packaging reuse, rather than material based e.g. food boxes, beverages etc.								Yes
Targets	Specific packaging type collection/recycling targets								Yes
Targets	Measuring and reporting on packaging reuse								Yes

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Targets	Proportion of on-the-go market delivered through reuse systems								Yes
Targets	Recycled content targets for packaging								Yes
Targets	Polymer substitution quotas								Yes
Obligation	DRS obligation for single-use beverage packaging							x	No
Obligation	Re-use and return scheme for e-commerce							x	No
EPR	EPR fee reduction. The current system includes, inter alia, a bonus of 8 % on the licence fee if the producer can prove an overall volume reduction, for example due to product concentration or deployment of refills.	x							No
EPR	Harmonisation of EPR modulation criteria								Yes
EPR	EPR modulation for recycled content								Yes
EPR	Incentives for refillable / reusable packaging under modulation of fees under the EPR schemes for packaging								Yes
EPR	EPR fees modulation to incentivise lightweighting								Yes

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Incentives	Reusable packaging exempt from licensing obligations/EPR fees								Yes
Incentives	Incentives for reusable models								Yes
Incentives	Reduced government-imposed fees to reward proven waste prevention or reuse systems	x							No
Packaging levies	Pay-as-you-throw fees							x	No
Packaging levies	Levies / taxes on packaging applied at the Member State level to meet EU level packaging waste reduction targets		X						No
Packaging levies	Carrier bag levies							x	No
Packaging levies	Levies on packaging for specific formats (for example, single-use cups, plastic or otherwise)							x	No
Packaging levies	Hypothecating a percentage of fees for promotion of waste prevention projects, such as water fountains to reduce the consumption of packaged drinks	x							No
Packaging taxes	Green taxes on packaging e.g. potential to adjust Own Resources Budgetary allocation based upon unrecycled plastic packaging waste.	X							No
Packaging taxes	Reduced VAT on refillable / reusable items								Yes

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
R&D	Provision of funding for research and development e.g. collecting data on reuse and conducting LCA of different types of reusable packaging.								Yes
Actions	Digital solution to allow whole supply traceability	x					x		No
Actions	Made to measure, design to order products, could reduce production of unwanted items	x					x		No
Actions	Requirement for Member States to include sectoral waste prevention plans from industry in national Waste Prevention Programmes (required by WFD)							x	No
Actions	Member States to implement requirement for obligatory corporate packaging prevention plans							x	No
Actions	Requirement on producers to introduce and update sectoral packaging waste prevention plans							x	No
Actions	Member States to report on their enforcement activities								Yes
Actions	Member States to reinforce market surveillance authorities								Yes
Actions	Assessment of hazardous substances in packaging								Yes
Commitments	Supermarket commitments to allowing consumers to bring their own reusable boxes when buying meat or cheese at fresh produce counters	x							No

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Commitments	Voluntary agreements for the use of reusable commercial packaging in HORECA channel	x							No
Commitments	Voluntary industry commitments (e.g. European Plastics Pact) or alliances	x		x					No
Commitments	Voluntary agreements with restaurants and refreshment outlets in shopping centres, cafes or fast-food shops to make sure that customers have the opportunity to return their plastic dishes	x							No
Promotions	Promotion of reusable beverage cups e.g. for coffee and beer/soft drinks	x							No
Awards	Competitions encouraging alternative re-use	x							No
Awards	Prevention awards, to producers who have redesigned packaging to have lower environmental impact	x							No
Eco-design	Waste consultancy training in the packaging sector, through the packaging coordination centre	x							No
Eco-design	Circular economy skills development in eco-design to reduce the quantity of materials used and in extending lifespans of packaging	x							No
Eco-design	Development of benchmarking tools allowing comparative evaluation	x							No
Eco-design	Online bespoke guidelines on eco-design features	x							No

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Eco-design	Certified waste prevention training course	x							No
Eco-design	PRO providing free packaging optimisation services to producers	x							No
Forum	Guidance on best practise for refill stores	x							No
Forum	Open forum between producers to streamline packaging design guidelines	x							No
Forum	System by which consumers can communicate examples of overpackaging								Yes
Forum	Database dedicated to products, packaging and waste management to enable monitoring of waste prevention								Yes
Forum	Implementation of a national business advisory body for reusable products and packaging								Yes
Information campaign	Requirement on anyone selling or giving away plastic bags to provide information about how plastic bags affect the environment and how consumers can reduce their consumption							x	No
Information campaign	Financial support for waste prevention projects[393]	x							No

[393] E.g. the Austrian collection and recycling systems for packaging make 0.5 % of the fees collected available for the promotion of waste prevention projects.

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Information campaign	Promotion of marketability of re-used products	x							No
Information campaign	Awareness raising campaigns on impacts of packaging waste generation for items not covered by SUP Directive								Yes
Information campaign	Information campaigns, including on environmental benefits of reuse and how to reduce packaging consumption								Yes
Information campaign	Customer awareness messaging on specific problem packaging (e.g. compostable)								Yes
Information campaign	Guiding packaging principles for e-commerce	x							No
Information campaign	Requirement to promote points of sale for loose/bulk products in all stores over Xm2	x							No
Information campaign	Consumer awareness & education programmes for the reduced use of lightweight plastic bags							x	No
Labelling requirements	Reduced labelling requirements to allow smaller print surface							x	No

Sub type	Measure Name	Criteria							Initial short-listing
		A	B	C	D	E	F	G	
Labelling requirements	Reuse labels								Yes
Labelling requirements	When charges and levies are applied on particular packaging types these should be fully advertised fully on the packaging	x							No
Labelling requirements	Harmonised standards for labelling of recycled content								Yes
Labelling requirements	Harmonised standards for labelling of recyclability								Yes
Local initiative	Public water fountains to reduce plastic water bottle use							x	No

APPENDIX D - IMPACT MODELLING METHODOLOGY

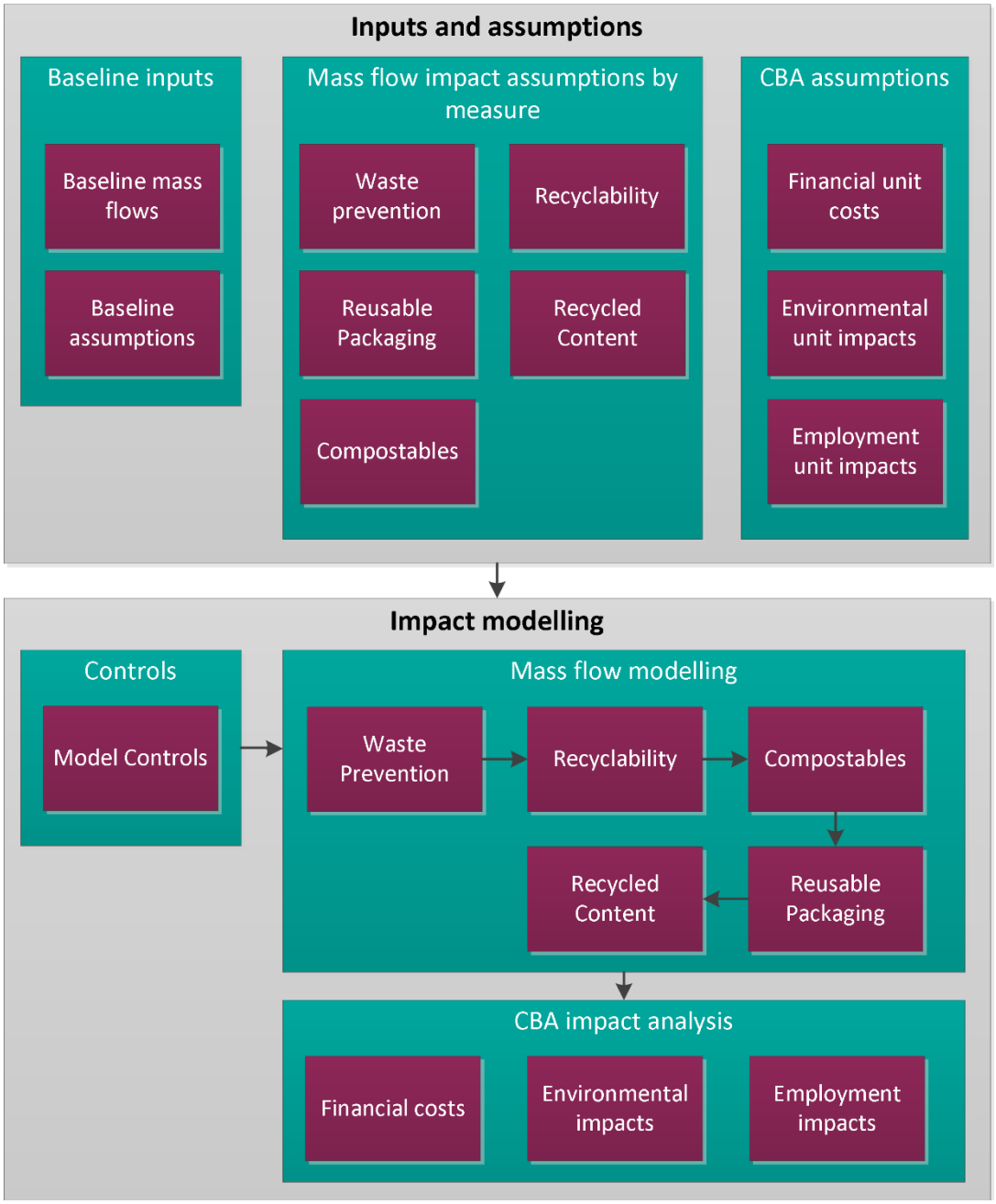
In this appendix we describe the overall methodology used to model the impacts of the proposed measures. Firstly, a general overview of the modelling approach and the structure of the model itself is described in Section 1.0. The following sections then outline the detailed assumptions and methodology used to model the change in mass flows, financial costs, environmental impacts and social (employment) impacts, respectively.

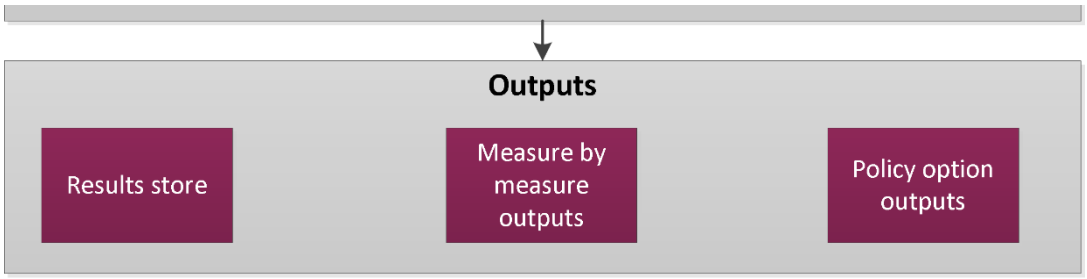
1.0 Overview of Methodology

Modelling of quantitative impacts was undertaken using a CBA model designed for this purpose. The model was built in Excel, making use of VBA macros where necessary to perform calculation loops (including goalseeks) and to 'run' the model and generate results. A relatively complex model was required, given the broad array of measures and the range of different mechanisms/pathways by which these impact on the mass flows, and therefore financial and environmental impacts.

The main components of the model are presented in, and described further in the sections below. Both the model infrastructure (in terms of the typology of worksheets, and their functions) and the overall flow and function of the model are described in Figure 1-1.

Figure 1-1 Model diagram





1.1 Data Inputs

Data inputs to the model consist of links to the baseline mass flows (e.g. placed on market tonnages, waste destinations, recycled content etc.). These also include all relevant raw data for financial and environmental impact modelling e.g. unit environmental impacts, unit financial costs etc. Further description of this data is provided where relevant in Sections 2.0 to 4.0.

1.2 Assumptions

The assumptions worksheets are used to define model parameters which are used in calculations to model the impacts of the measures on mass flows. These include all parameters related to the modelling of the mass flows e.g. the target level of reuse targets, or the change in recycling rate driven by recyclability measures etc.

1.3 Controls

The model controls are used to set up and run the model. The full set of proposed measures are listed in this worksheet, and for each run the model chooses the relevant measure or combination of measures (when modelling an 'option' i.e. a selection of measures in combination) to run. Various other controls which allow for troubleshooting and debugging of the model are located on this sheet.

1.4 Mass Flow Model

The mass flow sheets are where the impacts of the measures on mass flows are modelled. These include a range of impacts, for example, switches from one packaging type to another, changes in recycling rate, uplift in recycled content etc.

The model is set up so that measures can be modelled in isolation ('measure by measure') and also in combination, for the purpose of modelling policy 'options'. In this (latter) mode, the cumulative impact of the measures can be assessed.

There is significant crossover in terms of the impacts of the measures. In other words, when multiple measures are modelled simultaneously, the impact of any one measure will not be the same as when this measure is modelled in isolation. For example, consider a scenario in which a reduction in unit weights is modelled as a waste prevention measure in conjunction with a recyclability measure which includes switches from one (less recyclable) packaging type to another (more recyclable) packaging type. In this scenario, the impacts of the recyclability measure will not be equal, when modelled in conjunction with the waste prevention measure, to

a situation in which the recyclability measure is modelled in isolation. This is because, in the above example, the waste prevention measure reduces the unit weight, which means that tonnage of packaging switched (by the recyclability measure) is reduced (even though the number of units of packaging switched remains the same).

This is just one example of these 'crossover' impacts, of which there are many more, which highlights the importance of considering measures in combination, and how a 'measure by measure' analysis does not (and cannot) give a full picture of the impacts of proposed policy options which include multiple measures.

When designing the model, it was therefore necessary to 'daisy chain' the mass flow calculation modules for each intervention area in a sensible order. Any outputs from calculation modules applied earlier in this calculation chain become inputs for those modules later in the chain. A 'logical' ordering became clear. The order of calculation modules, from the first measures applied in the calculation 'chain' to the last, are as follows:

- Waste Prevention
- Recyclability
- Compostable Packaging
- Reusable Packaging
- Recycled Content

This ordering ensures that various implicit modelling 'requirements' are met. For example, reuse targets (e.g. a specific % of product sales/trips for a particular product type) are met exactly by the model. Therefore these impacts must be modelled after any mass flow changes which would affect this reuse target (such as changes in unit weight, switches from one packaging type to another etc).

Modelling in this way therefore ensures that modelling of policy options is not just done by summing the impacts of individual measures, but through precise consideration of the overlaps and crossover of measures with one another, and implications thereof. This (more sophisticated) methodology means that the outputs of the model reflect better what would happen 'in reality' when a package of measures are implemented together.

1.5 Financial, Environmental and Social Impacts

The outputs of the mass flow model are then used in these modules to calculate the financial, environmental and social impacts. Firstly, the mass flow after modelling the impacts of the measures is compared to the baseline mass flow, to understand the marginal change attributed to the measure(s). The change in mass flows (e.g. change in recycling tonnage etc.) is then multiplied by unit impact data (e.g. GHGs emitted per tonne of packaging, costs per unit of packaging etc.) to calculate impacts.

1.6 Results

As the model is run, it cycles through each measure and any policy options (combinations of measures) and records the results for each run separately. These results then feed through to results sheets, which order, summarise and cross-compare the raw results data to produce relevant tables and charts to display the outputs of the modelling.

2.0 Mass Flow Model

In this section we describe the various methodologies used to model the change in mass flows resulting from the implementation of the measures quantified in this study. Only those measures for which specific quantitative modelling was undertaken in the CBA model are described.

2.1 Waste Prevention

2.1.1 Measure 2. Mandatory Member State reduction targets

Cross-sectoral targets are defined in different terms to the sector by sector targets for reuse and for other waste prevention measures.

Rather than (in the former case) explicitly defining a % of sales, whereby reusable consumption must account for a minimum proportion of total consumption, or for example (for waste prevention measures), a specific void space limit, 'top down' targets are defined in terms of an absolute reduction in waste generation per capita relative to 2018 levels – i.e. the latest year of published Eurostat packaging waste generation data for most Member States.

Table 2-1 sets out the general specification of this measure, and the 'measures' modelled to achieve reduction targets. As can be seen, it is assumed that each intervention area – waste prevention and reuse – provides an equal (50/50) contribution to achieve the targets.

Table 2-1: Modelling Specification for Measure 2

	Waste Prevention	Reuse
Overall reduction target (waste generation per capita by 2030 as a % of 2018 levels)	Measure 2b – 5% Measure 2c – 10%	
Contribution from each intervention area to meeting target	50%	50%
'Measures' modelled to achieve reduction targets	Measure 7 – phase out of unavoidable unnecessary packaging (and subsequent switch to reuse Measure 5 – Void space limit thresholds Also includes more general reductions in unit weight	Assumes the distribution of increases in reusable packaging is similar to that determined by Measure 8 (reuse targets)

The MS level reduction targets are primarily achieved by the significant reduction in waste generation achieved through switching to reusable packaging. Whilst one unit of consumption of single use packaging will lead to one unit of waste, the amount of waste produced by one unit of

consumption of multi-use packaging is equivalent to the inverse of the total number of uses of the multi-use packaging before waste. For example, if multi-use packaging is used an average of 50 times before it becomes waste, then the total waste produced per unit consumption is approximately 1/50th of the waste produced by consumption of single use packaging (albeit the magnitude of this differential is decreased, but rarely cancelled out, if the multi-use packaging is significantly heavier than its single user counterpart(s)). Switches to reusable packaging occur as a consequence of phasing out of unavoidable unnecessary packaging (Measure 7, which falls under the 'waste prevention' IA).

Switches to reuse (under the reuse intervention area) are modelled using a similar approach as described for the sector by sector targets (see Section 2.2.1). A set of goalseek values i.e. predetermined magnitudes of switches from single-use to multi-use packaging / product types is sourced from calculations performed previously for the sector by sector targets. These values are then modified by a factor which is chosen based on a similar goalseek methodology. By doing this the model recalculates the degree of switching required to increase the number of consumption activities that use multi-use (rather than single use) packaging, and therefore, lead to a net reduction in waste generation equivalent to the cross-sectoral targets as defined. The model therefore assumes that the types of changes that will take place (i.e. which packaging / product types are switched to reusable alternatives more) are broadly similar for both the sector by sector (M8) and cross-sectoral (M9) targets. The two types of targets are therefore differentiated based on the overarching mechanism that drives change, and not so much by the general schema of impacts expected (which are assumed to be similar – albeit with varying levels of overall ambition).

The modelling also assumes that void space limit thresholds will be employed, explicitly (i.e. stipulated by MS in policy) or implicitly, to achieve MS reduction targets. Furthermore, general unit weight reductions are modelled to take place across all packaging items. The relative reductions in unit weight modelled are as follows:

- 7.0% for glass and plastic;
- 5.0% for paper / board;
- 1.0% for steel, aluminium and wood; and
- 0.0% for other.

These reductions are factored up and down (i.e. all reduction parameters could be e.g. doubled or halved etc.) as required using a goalseek mechanism, until the required contribution from waste prevention measures is achieved in the modelling.

As discussed in the appendix "Impact Assessment for Reuse measures", the target is set at two different levels for modelling purposes:

- a 5% reduction (kg per person per year of packaging waste generation relative to 2018 levels) is modelled in Measure 9b, and
- a 10% reduction in Measure 9c.

As these targets are specified relative to 2018 levels, the 'actual' level of impact relative to the counterfactual (i.e. the estimated waste generation per capita in 2030 under a business as usual scenario) is generally greater. This is because, as described in Appendix B – Baseline Methodology, overarching waste generation trends are based on regressions of previous changes in waste generation relative to changes in GDP and population. As GDP is assumed to increase (to a greater or lesser degree) for all Member States in the future, this means that kg per capita waste generation is also likely to increase under a business as usual (baseline) scenario i.e. based on current and agreed policies in place in the EU.

This situation is elaborated further in Appendix B – Baseline Methodology. The modelled waste growth in the baseline scenario i.e. the % increase in kg per capita waste generation from 2018 to 2030 is presented. The next columns then shown the 'actual' reduction (or 'effort) required to meet the reuse targets i.e. the % reduction in waste generation required relative to business as usual. For example, for Austria, a 5% reduction in kg per capita waste generation by 2030 relative to 2018 levels can be viewed to an 'actual' reduction of 14% relative to where Austria 'would' have been in 2030 – i.e. under the baseline scenario. We write this in order to contextualise the ambition of the scenario, which is somewhat greater than could potentially be surmised based on a cursory reading of the 5%/10% reduction targets as presented.

Table 2-2: Waste Generation Assumptions in Baseline and Equivalent 'Actual' Reduction in Waste as Determined by 'Top Down' Reuse Targets

	Projected growth in waste generation (kg per capita) from 2018 to 2030 under Baseline Scenario, %	Absolute reduction in waste generated per capita under 5% reduction target in 2030 relative to 2030 baseline, %	Absolute reduction in waste generated per capita under 10% reduction target in 2030 relative to 2030 baseline, %
Austria	10.4%	-14%	-18%
Belgium	20.4%	-21%	-25%
Bulgaria	15.1%	-17%	-22%
Croatia	11.4%	-15%	-19%
Cyprus	42.0%	-33%	-37%
Czech Republic	9.0%	-13%	-17%
Denmark	26.6%	-25%	-29%
Estonia	37.2%	-31%	-34%
Finland	12.6%	-16%	-20%
France	22.5%	-22%	-27%
Germany	11.7%	-15%	-19%
Greece	21.3%	-22%	-26%
Hungary	13.8%	-17%	-21%
Ireland	51.4%	-37%	-41%
Italy	2.3%	-7%	-12%
Latvia	39.1%	-32%	-35%
Lithuania	39.1%	-32%	-35%
Luxembourg	14.8%	-17%	-22%

	Projected growth in waste generation (kg per capita) from 2018 to 2030 under Baseline Scenario, %	Absolute reduction in waste generated per capita under 5% reduction target in 2030 relative to 2030 baseline, %	Absolute reduction in waste generated per capita under 10% reduction target in 2030 relative to 2030 baseline, %
Malta	15.1%	-17%	-22%
Netherlands	17.9%	-19%	-24%
Poland	39.0%	-32%	-35%
Portugal	10.2%	-14%	-18%
Romania	29.7%	-27%	-31%
Slovakia	14.4%	-17%	-21%
Slovenia	22.0%	-22%	-26%
Spain	24.9%	-24%	-28%
Sweden	23.2%	-23%	-27%

2.1.2 Measure 3. Best-in-Class weight limits

As described in the appendix Impact Assessment for Waste Prevention measures, a Best-in-Class weight limit would set a maximum weight by packaging type and ban packaging that was over this weight limit. To estimate the impact of Best-in-Class weight limits, we need to estimate the proportion of packaging that is currently overweight and therefore would be impacted by Best-in-Class weight limits, as well as the average reduction in weight per unit of overweight packaging. Glass and plastic beverage containers were identified as the packaging types with the best available data due to the relatively standardised bottle sizes (e.g. 250ml, 330ml etc.) and the existence of estimates for the proportion for the scale of the weight reduction potential.[394]

2.1.3 Measure 5. Void space limit threshold

As described in the appendix Impact assessment for Waste Prevention measures, this measure would impose limits on the volume of void space in packaging. Compared with Best-in-Class weight limits, this measure was more difficult to model given the lack of readily available data on void volume size. Estimates of the potential for void space reduction potential by packaging type were collated from a variety of sources including industry reports[395, 396] and cross checked

[394] Estimates are collated from a variety of sources. These include GTS benchmark data, the OI and similar container catalogues, a Finnish retailer, industry led seminars on lightweighting and Eunomia's own sampled bottled weight data. See also: Citeo's feedback to the EU Inception Impact Assessment on the initiative "Review of the requirements for packaging and other measures to prevent packaging waste"

[395] Citeo's feedback to the EU Inception Impact Assessment on the initiative "Review of the requirements for packaging and other measures to prevent packaging waste"

[396] DHS "The Empty Space Economy" available at: https://blog.dssmith.com/download-whitepaper-the-empty-space-economy

with Eunomia led webinars where a strong majority (61%) felt that the modelled limits were feasible in comparison with only 29% who thought they were too tight. The impacts of void space limits were estimated based on the estimated material cost saving associated with the void space reduction obtained from these reports.

Void space limits for E-commerce cardboard packaging were modelled separately given the unique scale and interest in the problem. We assumed that ~50% of the volume of the baseline e-commerce package is void space, and the limit would impose a 30% void space limit on all e-commerce packaging. Then we used data on ~100 Amazon box sizes to estimate how much material would be saved by imposing this reduction. To calculate the estimate material saving, we calculated the volume of each of these Amazon boxes, and then calculated the new dimensions, assuming that the volume savings were made by reducing the length of the longest side of the box. By comparing the surface area of the box before and after imposing the void space limit, we could calculate the median material saving across all boxes from void space limits. Assuming that ~50% of the volume of an e-commerce package is void space, then a 30% void space limit would represent approximately a 16% reduction in tonnage of e-commerce packaging.

2.1.4 Measure 7. Phase out of Avoidable / Unnecessary Packaging

Measure 7 assumes that specific types of avoidable / unnecessary packaging are phased out (i.e. banned). The specific packaging types impacted by this measure are described in the appendix Impact Assessment for Waste Prevention measures.

The model assumes that consumption of these 'phased out' packaging types will switch instead to reusable packaging alternatives, with similar switches assumed as for the reuse targets (see Section 2.2). Effectively then, this measure is equivalent to mandatory reuse for packaging types in specific sectors.

2.2 Reuse

The methodology used to model the impacts of the two reusable measures modelled – 'bottom up' and 'top down' reuse targets – is described below.

2.2.1 Measure 8: MS level sector by sector reuse targets

As described in the appendix "Impact Assessment for Reuse measures", three sets of sector by sector reuse targets were modelled. These targets are specified in terms of the % of product sales/trips in reusable packaging, and comprise the following:

- Measure 8a: Voluntary reuse targets;
- Measure 8b: Mandatory reuse targets, MS level – low; and
- Measure 8c: Mandatory reuse targets, MS level – high.

The breakdown of these targets by product/packaging type, as modelled, is also detailed in technical appendix. As can be seen, the product/packaging types differ from the primary taxonomy used in the packaging waste model (see main report, section 5.0). Thus, it was necessary to map from the model taxonomy to the taxonomy as defined by the reuse targets. This was done by reference to, primarily, detailed market reports such as the GlobalData dataset, supplemented with a literature review of relevant industry and consultancy reports. Where necessary, reasoned assumptions were made based on these datasets. This mapping

process, once completed, enabled the mass flows in the packaging waste model, particularly the number of uses of each packaging type which is used when modelling the changes required to meet the targets, to be defined in terms of the product/packaging type specified for the reuse targets.

Also prior to modelling the reuse targets, it was necessary to define the types of switches from single use to multi use packaging types that the model would take place in order to meet the reuse targets (see below for a more detailed description of this process). These switches are outlined in Table 2-3 below.

Table 2-3: Assumptions for Packaging Type Switches

Type	Material	System	Packaging Unit(s)	Reduction in number of uses (to be switched), %	Switched to	Reduction in number of uses (to be switched), %	Switched to
Primary / consumer packaging	Glass	SU	Beverage containers	75%	Glass - MU - Beverage containers	25%	Plastic - MU - Beverage containers
	Glass	SU	Non-beverage food	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Steel - MU - Food refill scheme boxes e.g. Loop
	Glass	SU	Other (non-food, non-beverage)	100%	Plastic - MU - Food refill scheme boxes e.g. Loop		
	Steel	SU	Beverage containers	50%	Glass - MU - Beverage containers	50%	Plastic - MU - Beverage containers
	Steel	SU	Non-beverage food e.g. food cans	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Plastic - MU - Bottles (all non-beverage)
	Aluminium	SU	Beverage containers	100%	Glass - MU - Beverage containers		
	Aluminium	SU	Other rigids e.g. aerosol sprays, food cans	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Plastic - MU - Bottles (all non-beverage)
	Aluminium	SU	Semi rigids e.g. food trays	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Steel - MU - Food refill scheme boxes e.g. Loop
	Paper / board	SU	Carton board e.g. cereal boxes etc	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Steel - MU - Food refill scheme boxes e.g. Loop
	Paper / board	SU	Beverage cartons	50%	Glass - MU - Beverage containers	50%	Plastic - MU - Beverage containers

Type	Material	System	Packaging Unit(s)	Reduction in number of uses (to be switched), %	Switched to	Reduction in number of uses (to be switched), %	Switched to
	Paper / board	SU	Non-beverage liquid packaging board e.g. soups	50%	Steel - MU - Food refill scheme boxes e.g. Loop	50%	Plastic - MU - Food refill scheme boxes e.g. Loop
	Plastic	SU	PET bottles (beverage containers)	90%	Plastic - MU - Beverage containers	10%	Glass - MU - Beverage containers
	Plastic	SU	Non-PET (beverage containers)	50%	Glass - MU - Beverage containers	50%	Plastic - MU - Beverage containers
	Plastic	SU	Bottles (all non-beverage)	50%	Plastic - MU - Bottles (all non-beverage)	50%	Plastic - MU - Food refill scheme boxes e.g. Loop
	Plastic	SU	Rigid food e.g. pots, tubs and trays	50%	Plastic - MU - Food refill scheme boxes e.g. Loop	50%	Steel - MU - Food refill scheme boxes e.g. Loop
	Plastic	SU	Other mono/multi polymer/layer flexibles (excl. film)	100%	Plastic - MU - Food refill scheme boxes e.g. Loop		
	Plastic	SU	Films	100%	Plastic - MU - Food refill scheme boxes e.g. Loop		
Secondary / Tertiary	Paper / board	SU	Corrugated and other board boxes	100%	Tertiary / transport - Plastic - MU - Crates, boxes etc.		
Tertiary / transport	Paper / board	SU	Corrugated and other board boxes - e-commerce	100%	Plastic - MU - Boxes and pouches - e-commerce		

Type	Material	System	Packaging Unit(s)	Reduction in number of uses (to be switched), %	Switched to	Reduction in number of uses (to be switched), %	Switched to
	Plastic	SU	Film and bubble pouches - e-commerce	100%	Plastic - MU - Boxes and pouches - e-commerce		
	Plastic	SU	Wrapping and strapping	100%	Plastic - MU - Wrapping and strapping		
	Plastic	SU	Crates, boxes etc.	100%	Plastic - MU - Crates, boxes etc.		
	Wood	SU	Pallets	100%	Wood - MU - Pallets		
Note: Only those packaging types for which switches are defined are shown							

Based on the assumptions described above, the model then proceeds to calculate the degree of switching, from single-use to multi-use items, that must take place to meet the sector by sector targets as defined for each product/packaging type. This takes place using a goalseek methodology, whereby switches are defined as set out above, and a factor applied to these switches for which the input value is iterated until the sum of the outputs from all packaging types leads to a result which matches the % of sales as defined in the relevant reuse target.

2.2.2 Measure 9: MS level overarching cross-sectoral reduction targets

This measure is included in and discussed under Measure 2 – see section 2.1.1.

2.3 Recyclability

The methodology designed to model the impacts of the 'recyclability' measures is described below. In sections 2.3.1 and 2.3.2 we describe the general methodology used to derive model assumptions relating to changes in recycling rates and switches to new packaging types, which are modelled to occur as a result of implementing these measures. In Section 2.3.6 the way in which these assumptions are applied in the model for the measures (and variants) modelled.

2.3.1 Overview of Methodology to Derive Model Assumptions

An initial review was conducted to determine, for each packaging type, the extent to which:

- The packaging is currently recycled at scale; and
- The packaging could be recycled at scale in the future using existing recycling technology

The first of these criteria aims to define the recyclability of packaging in terms of the qualitative statements put forward by a range of stakeholders. These definitions focus on the ability for a package to be collected, sorted, and recycled, in practise and at scale. Recycling 'at scale' implicitly requires a significant quantity (or proportion) of material placed on the market to be recycled, to meet these criteria.

For items that are not currently recycled at scale, the second of these criteria assesses the degree to which recycling at scale would be possible in the future using existing recycling technology. For example, LDPE plastic bags are not currently recycled at scale, due primarily to lack of collection infrastructure and economic barriers to recycling. Existing technology is sufficient to collect, sort and reprocess this material, and recycling rates could be improved without any further technological advancement – i.e. through better implementation of existing 'good practise' waste management. Such item types are therefore 'recyclable' only from a DfR perspective (i.e. the design is sufficient for recycling), but are not yet defined as recyclable when compared to qualitative definitions ('at scale'), or where recyclability is defined quantitatively, by the use of a recycling rate threshold – such as 20% recycling.

Other products, such as multilaminate plastic pouches (which can contain two or more different polymer types, as well as a thin aluminium layer), could not be recycled at scale using existing recycling technology. Further advances in recycling technology, such as chemical recycling, would be required to achieve higher recycling rates.

The 'low hanging fruit' therefore, in terms or improving recycling rates, are products that are not currently recycled at scale, but could be, if existing 'good practice' waste management practises were implemented more widely – no design changes are required. Increased recycling

of these types of packaging, as well as improvement in recycling of packaging types which are already widely recycled, are an essential step towards achieving 55% recycling of plastic packaging waste by 2030 – each packaging type must make the necessary contribution to meeting targets. Our general assumption therefore, is that in the baseline, these packaging types will be recycled at scale and recycling rates will increase, along a trajectory as defined by the recycling rate curve 'function' (see Appendix B – Baseline methodology).

This outcome is driven not only by the overarching recycling targets from the PPWD, but by supporting policies such as:

- The Circular Plastics Alliance (CPA) – this includes the development of a range of polymer and packaging format specific standards to improve collection, sorting, recycling and the uptake of recycled material;
- Own Resources - levies are charged to MSs by EU per gram of unrecyclable plastic; and
- The Plastics Strategy - all packaging must be recyclable by 2030.
- EPR - The requirement to establish producer responsibility schemes a means of ensuring that the "polluter pays" principle is applied to waste management.

Advancements in chemical recycling and increased commercial use of this technology also likely over the next decade or so, and will also support Member States to improve recycling rates. These will enable more recycling of packaging types which, as discussed, cannot be recycled at scale in the future using existing recycling technology.

The achievement of both the overarching aim of 'recyclability', as defined by the Plastics Strategy, and the PPWD recycling rate targets, will also require switching from 'unrecyclable' to 'recyclable' materials. For example, multi-layer pouches could be replaced with mono-layer pouches or with more traditional packaging, such as aluminium cans or plastic bottles.

Modulated EPR is the primary 'bottom-up' policy measure driving these switches. Where fees are modulated based on recyclability criteria, this creates an economic driver for producers to switch to more 'recyclable' packaging types (and/or to improve collection, sorting, and recycling systems to increase recycling). The SUP Directive also sets out specific measures which will, by their design, drive switches from one packaging type to another (both non-plastic single use and reusable alternatives), these are:

- The requirement for a significant reduction in the consumption of SUP products (by 2026 relative to 2022 consumption), specifically: beverage cups (including covers / lids) and 'takeaway' food containers (used for fast food or other meals ready for immediate consumption); and
- Bans on food containers made of expanded polystyrene.
- There is already a requirement to establish EPR schemes for packaging under PPWD, and additional requirements for the schemes are placed under the SUP Directive for SUP packaging items: food containers, flexible packaging for food, beverage containers (up to 3L), beverage cups, and lightweight carrier bags.

All legally binding targets are assumed to be met in our modelling. However, it is assumed that, under the baseline (with existing policies), some packaging which is not 'recyclable' will still be placed on the market in 2030. The Plastics Strategy, which sets out the requirement for recyclability, is not legally binding, and whilst EPR and other policy drivers will drive switching away from 'unrecyclable' packaging types, it remains that, even with the economic incentives to

switch (again, primarily through EPR fees) there will likely remain some producers who persist in using packaging which is not 'recyclable'.

To achieve the goals of increased recyclability driven by the proposed measures in this study, our impact modelling focuses on items types which, referring back to the beginning of this section, are those which cannot be recycled using current technology. As discussed, our general assumption is that, in the baseline, improvement in waste management practises has already enabled (by 2030, mainly driven by PPWD recycling rate targets) recycling at scale of packaging types where this is currently not the case, but where this is not due to a technological barrier (the 'low hanging fruit').

Therefore, to meet the requirements for packaging to be recyclable, the focus of our impact modelling is primarily on the remaining packaging types – those identified in our initial review as not recyclable and where this is not possible with existing technology. To achieve 'recyclability' will require redesign/switching to more 'recyclable' packaging types and/or improvement in recycling technology – primarily chemical recycling as well as other innovative technologies.

This modelling methodology, including the implicit logic modelled for the baseline, is set out in Table 2-4 below.

Table 2-4 'Recyclability' Modelling Methodology

	Baseline	Scenario
Improved recycling collection / treatment based on existing waste management practises	Achieves recycling at scale (and therefore meets recyclability criteria) for packaging types that can be recycled using existing technology.	
Redesign – Including switches to more recyclable packaging types	Increases overall recycling rate sufficient to achieve 55% recycling by 2030	Further switching above and beyond the baseline, driven by requirement for 'recyclability'
Chemical recycling + other advanced recycling technologies	Some rollout, supports attainment of recycling rate targets	Further rollout to improve recycling rates of packaging and meet recycling rate threshold for quantitative definition of recyclability

2.3.2 Detailed Methodology by Packaging Type

Our initial review, based on a general appraisal of various data from stakeholders in industry, enabled us to sort the packaging types as defined by the model taxonomy into the following three groups:

- Those that are currently recycled at scale (100% in column 1);
- Those that are not currently recycled at scale but could be in the future using existing technology (<100% in column 1, 100% in column 2); and
- Those that are not currently recycled at scale and require technological advancement to do so (<100% in both columns).

The specific modelling approach for each of these types is described in the sections below. This includes an appraisal of the implicit approach taken in the baseline modelling.

2.3.3 Packaging Currently Recycled at Scale

For packaging that is currently recycled at scale, no switches are assumed, and recycling rates are calculated for the baseline to increase in line with the expected contribution of each packaging type towards overarching material-level recycling rates targets as specified in the PPWD (based on the recycling 'curve function'). These assumptions are kept constant for the scenarios.

2.3.4 Packaging not Currently Recycled at Scale but could be in the Future using Existing Technology

The following packaging types include packaging that is not currently recycled at scale:

- Aluminium (Primary / consumer packaging)
  - Semi rigids e.g. food trays
- Plastic (Primary / consumer packaging)
  - Bottles (all non-beverage)
  - Mono-polymer stand-up pouches
- Plastic (Tertiary / transport)
  - Wrapping and strapping

As discussed in Section 2.3.1, it is assumed that, in the baseline, these types of packaging will be recycled at scale by 2030, with an associated increase in recycling rate (based on the recycling 'curve function'). Whilst some redesign of these packaging types to improve recyclability is also likely to occur (in the baseline and scenarios), it is expected, based on discussions with stakeholders, that redesign will generally remain 'within' each packaging type as per the categories listed above. For example, the design of a particular type of semi-rigid aluminium packaging may be improved, however, switches to a completely different packaging type are less likely – the packaging will remain semi-rigid aluminium packaging. Thus, no switches of consumption from these to other packaging types are modelled for these packaging types.

2.3.5 Packaging not Currently Recycled at Scale and Requires Technological Advancement to do so

As shown, there are eight packaging types[397] which, to a greater or lesser degree, could not be recycled at scale with existing technology, these are:

- Aluminium (Primary / consumer)
  - Flexibles e.g. foils
- Paper / board (Primary / consumer)
  - Beverage cartons
  - Non-beverage liquid packaging board e.g. soups
  - Other paper / board
- Plastic (Primary / consumer)
  - Rigid food e.g. pots, tubs and trays
  - Other rigids (non-beverage, non-food) e.g. blister packs
  - Multi-polymer/material stand-up pouches

[397] As per the baseline taxonomy, see Appendix B

    - Other mono/multi polymer/layer flexibles (excl. film)
    - Films
- Other (Primary / consumer)
    - Miscellaneous (not included elsewhere)
- Plastic (Tertiary / transport)
    - Film and bubble pouches - e-commerce

As discussed in Section 2.3.1, these packaging types are the focus of our impact modelling. A case study approach was adopted, whereby the potential for the development of advanced recycling technologies, chemical recycling or redesign of this packaging ('within' the category and/or switching to a new type) were assessed. The case studies focused on specific packaging which are representational of the packaging type category, and which make up a significant quantity of the packaging type. These were then used as a proxy for the broader packaging type category. The case studies chosen are shown in Table 2-5.

Whilst not all packaging types were assessed in this study, case studies were chosen based on the relative expected impact, i.e. both the magnitude of change possible and the quantity of packaging affected were considered when choosing case studies.

Table 2-5 Case studies

Material	Type based on Model Taxonomy	Representative Case Study
Paper / board	Beverage cartons	Emerging technologies for recycling of aluminium/PE layers
Plastic	Rigid food e.g. pots, tubs and trays	Rigid food PET thermoforms
Plastic	Multi-polymer/material stand-up pouches	Mono-layer pouches
Plastic	Films	Post-consumer films

The conclusions of these case-studies were used to derive the assumptions for the mass flow modelling of recyclability measures i.e. the magnitude of further gains in recycling rate and switches to more recyclable packaging.

2.3.6 Impact Modelling

The final model assumptions derived from the case studies are shown in Table 2-6. This table shows assumptions for 100% 'relative impact' (see description below).

Table 2-6 Recyclability Model Assumptions

Material1	Packaging Type	Reduction in number of uses2		Packaging type switched to		Recycling Rate Assumptions, 2030		
		Switch 1	Switch 2	Switch 1	Switch 2	% increase (relative to baseline)3	Baseline4	after Measure Applied
Paper / board	Beverage cartons	5%	-	Plastic - Non PET (beverage containers)	-	19.7%	56.8%	76.5%
Plastic	Rigid food e.g. pots, tubs and trays	-	-	-	-	21.6%	46.3%	67.9%
Plastic	Mono-polymer stand-up pouches	2.5%	2.5%	Steel - Beverage containers	Aluminium - Beverage containers	28.5%	17.3%	45.8%
Plastic	Multi-polymer/material stand-up pouches	2.5%	2.5%	Steel - Beverage containers	Aluminium - Beverage containers	41.8%	3.8%	45.6%
Plastic	Other mono/multi polymer/layer flexibles (excl. film)	5.0%	-	Paper / board - Other paper / board	-	50.1%	12.3%	37.9%
Plastic	Films	5.0%		Paper / board - Other paper / board		50.1%	28.8%	21.3%

Notes:

All packaging type listed are primary packaging and single-use

Relative to the baseline

This could be any year by which the policy has had the full impact - 2030 is chosen for the purposes of reporting

Note that this these rates reflect the increases required in the baseline to meet 2030 recycling targets (see Appendix B – Baseline methodology)

Within the model, a factor is applied to these assumptions to account for the expected relative strength of one recyclability measure (or variant of a measure) compared to others. For example, is expected that Measure 22c, which defines recyclable packaging based on a minimum recycling rate threshold, will lead to a greater impact than Measure 22a, which defines a qualitative definition of recyclability in the PPWD text.

The assumptions shown in Table 2-6 are for an 100% relative impact. If a 50% relative impact is assumed, then both the magnitude of switching and the increase in recycling rate will be halved relative to these impacts (and doubled if a 200% relative impact is assumed). The 'relative impacts' of each measure can also be summed up as appropriate if two or more measures are modelled together for the options.

The relative impact assumptions used in modelling are shown in Table 2-7. This table also includes the assumed implementation year for each measure and the year by which the policy has a full impact. The impact of the policy is assumed to ramp up throughout this period with a fixed increase in the magnitude of impacts year on year (an arithmetic progression).

Table 2-7: Relative Impact Assumptions of Recyclability Measures

Measure	Variant	Relative Impact	Implementation Year	Year by which Policy has Full Impact
Measure 21: Updates to the Essential Requirements	Measure 21a: All packaging shall be reusable or recyclable by 2030	10%	2023	2030
	Measure 21b: All reusable packaging must be recyclable, unless there is a robust demonstrable case for exemption	5%	2030	2035
Measure 22: Defining recyclable packaging	Measure 22a: Qualitative definition in PPWD text	15%	2023	2030
	Measure 22b: Recyclable packaging defined by use of design for recycling methodologies	50%	2025	2030
	Measure 22c: Allowance for recyclable packaging to be defined as any packaging that exceeds a minimum recycling rate threshold	75%	2030	2040
Measure 23: Harmonisation of EPR Fee Modulation Criteria		15%	2025	2030

2.4 Recycled Content

Quantitative modelling was conducted for Measure 35: Mandatory recycled content targets.

As discussed in [reference to assessment of impacts appendix for recyclability], this measure would establish recycled content targets for plastic packaging to be met by brands placing packaging on the EU market by the year 2030. The levels of the targets have been set lower than what is considered achievable for some packaging types to avoid the need for exemptions. The two variants which were assessed in the CBA model are:

- Measure 35a: A top-down average target for recycled plastic to be met across all plastic packaging set at the level of
  - 25% (low ambition/ potentially only counting post-consumer waste towards the attainment of the targets);
  - 30% (medium ambition);
  - 40% (high ambition/ potentially allowing pre-consumer waste to count towards the targets).
  - The target would apply at the level of individual brands placing packaged products on the EU market, not at Member State level
- Measure 35b: Bottom-up targets for recycled plastic to be met as averages across five specific plastic packaging categories as shown in the table below:

Table 2-8 Proposed 2030 targets per packaging group

Packaging group	Proposed 2030 target
Plastic bottles, flasks, carboys and similar articles (<5L in capacity) including their caps and lids	55%
Plastic pots, jars, tubs, trays, punnets and similar articles	15%
Plastic films used in primary packaging applications including pouches, bags, liners, peel-off lids, wraps, etc.	25%
Plastic films used in secondary packaging applications including stretch and shrink wrap, liners, sacks, bubble packing, envelopes, etc.	70%
Plastic crates, pallets, boxes and bulk storage containers and similar articles	70%

The approach taken to modelling the change in mass flows as a result of these measures is described in the sections below.

2.4.1 Measure 35a: Top-down targets

For the top-down targets, a methodology was designed to estimate the contribution from each packaging type required to meet the low, medium and high recycled content targets. This is based on the principle that some types of packaging (defined by polymer and/or food/non-food contact amongst other factors) are more feasible to include a higher proportion of recycled content than others.

There are various factors which limit the % of recycled content that can be included in food contact packaging. Thus, for each of the measure variants (low, medium and high targets), an

assumption was made on the feasible ('realistic') upper limit for the level of recycled content in food contact packaging which could be achieved. These are shown in Table 2-9. It can be seen that with a minimum rate of 35% for PET this measure therefore leads to greater ambition than the 30% target for beverage bottles (primarily PET) defined in the SUP Directive.

Table 2-9 Model Assumptions for Maximum Recycled Content in Food Contact Packaging in 2030, %

	Recycled Content Target, % (for reference)	Maximum RC in Food Contact, %	
		PET	PO / Other
Low	25%	35%	7%
Medium	30%	43%	8%
High	40%	60%	10%

After applying these assumptions in the model, the model then calculates the % of non-food contact packaging (applied to all packaging types) that is required in order to meet the overall targets. This is calculated using similar assumptions as for the baseline (see Appendix B – Baseline Methodology) for the proportion of food contact vs. non-food contact packaging.

A divergent approach is applied to transport/tertiary packaging, for which there is generally a much higher % of recycled content for non-food contact packaging in the baseline scenario compared to primary packaging. For these types, a similar approach of specifying a maximum % of recycled content in food contact applications. Additionally, an additional contribution from non-food contact packaging is assumed in the model, based on an assessment of the maximum recycled content that could potentially be achieved. This information was gathered through discussions with relevant stakeholders and reflects the generally higher potential for inclusion of recycled content in tertiary packaging. These assumptions are shown in Table 2-10.

Table 2-10 Model Assumptions for Maximum Recycled Content in Non-Food Contact Packaging (Tertiary / Transport Only) in 2030, %

	Films	Crates, Boxes, Drums Etc.
Low	40%	33%
Medium	50%	38%
High	64%	55%

2.4.2 Measure 35b: Bottom-up targets

The bottom-up targets were modelled by first mapping the target categories to the most relevant packaging type(s) in the model, as shown in Table 2-11.

Table 2-11 Mapping of Bottom-up Targets to Model Categories (TRUE = match)

System	Packaging Unit(s)	Non beverage bottles, flasks, etc. (<5L)	Primary films (low to account for food contact proportion)	Secondary films	PTTs – 10%	Secondary/ tertiary rigid plastic boxes, crates and pallets
SU	PET bottles (beverage containers)	TRUE				
SU	Non-PET (beverage containers)	TRUE				
MU	Beverage containers	TRUE				
SU	Bottles (all non-beverage)	TRUE				
SU	Rigid food e.g. pots, tubs and trays				TRUE	
MU	Food refill scheme boxes e.g. Loop					
SU	Other rigids (non-beverage, non-food) e.g. blister packs					
SU	Mono-polymer stand-up pouches					
SU	Multi-polymer/material stand-up pouches					
SU	Other mono/multi polymer/layer flexibles (excl. film)		TRUE			
SU	Films		TRUE			
SU	Film and bubble pouches - e-commerce					
SU	Wrapping and strapping			TRUE		
SU	Crates, boxes etc.					TRUE
MU	Boxes and pouches - e-commerce					

System	Packaging Unit(s)	Non beverage bottles, flasks, etc. (<5L)	Primary films (low to account for food contact proportion)	Secondary films	PTTs – 10%	Secondary/ tertiary rigid plastic boxes, crates and pallets
MU	Wrapping and strapping					
MU	Crates, boxes, etc.					TRUE
MU	Drums					

After completing this mapping exercise, the recycled content targets could then be modelled. The appropriate recycled content target rates were applied to each of the relevant plastic packaging types in 2030, and recycled content rates increased by an equal % year on year from the assumed implementation of the policy (in 2023) to 2030 to meet these targets.

2.5 Compostable Packaging

The Impact Assessment considered the proportion of material that would be switched from conventional packaging to compostable packaging under Measure 29 – the impacts of which were assessed quantitatively.

It is assumed in the baseline that there is a further uptake of compostable plastics even without any changes being made to the Directive. In the absence of any policy intervention, it is assumed that there would be a 2.4% increase in compostable packaging per annum between 2019 and 2024, based on data published by the European Bioplastics Association. The model assumes a further increase of the same magnitude between 2024 and 2030.

The table below confirms the mass flow categories which are anticipated to be affected by the switch to compostable packaging items. The project team used a mixture of stakeholder input / interviews and market data to develop assumptions on the proportion of each category that would be affected by the measure.

Table 2-12: Compostable packaging mass flow categories

Packaging Unit category	Compostable packaging type
Other mono/multi polymer/layer flexibles (excl. film)	Carrier bags
	Fruit / veg bags
	Tea bags
	Fruit labels
	Plastic film for perishables
Rigid food e.g. pots, tubs and trays	Fast food trays unsuitable for re-use
	Coffee capsules / pods
Films	Films for food trays
Other paper / board	Trays for fruit

Measure 29 requires consideration of the amount of food waste that is removed from food waste treatment systems by virtue of this being removed along with plastic contamination. Data from Italy is used to model the uplift factor, i.e., the amount of food pulled across as contamination

when the plastic is removed.[398] The same source was also used as a basis for estimating contamination levels for conventional / compostable plastics in food waste systems.

The food waste and the compostable plastics were assumed to be treated by a mix of composting and AD facilities, the proportion of which varies across Member States. The starting point for developing these assumptions was the EU Reference Model on Waste which sought data from MS on their future waste treatment infrastructure; proportions were updated based on more recent knowledge of the market (tested with stakeholders) where appropriate.[399]

A key factor driving scenario impacts in the model is the level of contamination in food waste, measured as a percentage of the amount of plastic in the collected food waste. Assumptions in this respect are shown in Table 2-13.

Table 2-13: Conventional Plastic contamination of food waste

	Business as Usual	Mandate Compostable	Ban Compostable	Both Allowed	Partial Mandate Compostable
Carrier bags	3.50%	0.20%	7.00%	2.80%	0.20%
Fruit / veg bags	0.70%	0.10%	1.00%	0.56%	0.10%
Fast food trays unsuitable for re-use	0.10%		0.10%	0.08%	0.08%
Tea bags			0.00%	0.00%	0.00%
Fruit labels	0.01%		0.01%	0.01%	0.00%
Coffee capsules / pods	0.10%		0.10%	0.08%	0.08%
Plastic film for perishables	0.20%	0.20%	0.20%	0.16%	0.16%
Films for food trays	0.20%	0.20%	0.20%	0.16%	0.16%
Trays for fruit	0.20%	0.20%	0.20%	0.16%	0.16%

[398] CIC (2020) Ottimizzazione del riciclo dei rifiuti organici: Sintesi dei risultati del programma di monitoraggio CIC – COREPLA (2019-2020)

[399] Eunomia / CRI (2014) Development of a modelling tool on waste generation and management: Appendix 6 Environmental Modelling, Report for DG Environment

3.0 Financial Cost Model

In this section we present the approach used to quantify financial costs and benefits. For the cost-benefit analysis (CBA) the outputs from this analysis, along with monetised environmental impacts (see Section 4.0), are used to understand the overall costs and benefits of the proposed policy measures.

Financial costs and benefit are, by their nature, concentrated on a specific and defined group of stakeholders. Furthermore, additional costs to one actor can often result in a benefit to other, related stakeholders (e.g. buyers and sellers). Specificity in regard to which stakeholder(s) costs and benefits are borne by is therefore an important consideration in policy making and is discussed throughout this section.

Many of the policy measures proposed by this study have the potential for far-reaching and relatively complex impacts (e.g. across thousands of different packaging types). Due to this and other considerations, for example the commercially confidential nature of much of the cost data required for modelling, and the lack of cost data on emerging technologies, only some of the potential costs and benefits from the proposed measures are modelled.

Costs have been quantified in this study only where there is data available to do so and a suitable methodology can be designed which is consistent with a 'proportionate evaluation'.[400] Where necessary, gaps in data have necessitated the use of carefully considered estimates and assumptions for some data inputs and modelling parameters. These are noted throughout this report, and wherever possible have been evidenced in reference to known data points. Any costs not quantified are discussed in the relevant sections of this report in qualitative terms.

The below sections describe the schema of costs which we have aimed to quantify, the raw data used, and the methodologies employed for this purpose.

3.1 Waste Management Costs

Changes in overall waste management costs were calculated by combining separate costs for recycling and residual waste management. Residual waste management costs for incineration and landfill were obtained from the European Reference Model on Waste Management.[401]

For recycling, we assumed that the most realistic costs were likely to be those from an existing well-functioning EPR scheme. Recycling waste management costs were calculated based on the operating costs of a real EPR scheme, in this case, Fostplus in Belgium[402]. Costs were scaled to per tonne values and mapped onto the relevant categories used for modelling here. Per tonne recycling costs are presented in Table 3-1.

[400] See Better Regulation Toolbox #45: https://ec.europa.eu/info/sites/default/files/file_import/better-regulation-toolbox-45_en_0.pdf

[401] Eunomia Research & Consulting (2015) *Further Development of the European Reference Model on Waste Generation and Management,* Report for European Commission Directorate-General for the Environment, May 2015, https://publications.europa.eu/en/publication-detail/-/publication/d188ce6e-9cac-11e5-b792-01aa75ed71a1/language-en

[402] https://www.fostplus.be/en/enterprises/your-declaration/rates

Table 3-1 Recycling costs per tonne (based on Fostplus costs) [SU = single use, MU = multiple use]

Tier	Material	System	Packaging Type	Rate (EUR per tonne) - current
Primary / consumer	Glass	SU	Beverage containers	50
		MU	Beverage containers	50
		SU	Non-beverage food	50
		SU	Other (non-food, non-beverage)	50
	Steel	SU	Beverage containers	211
		SU	Non-beverage food e.g. food cans	211
		SU	Other (non-food, non-beverage) e.g. paint tins	211
		MU	Food refill scheme boxes e.g. Loop	211
	Aluminium	SU	Beverage containers	46
		SU	Other rigids e.g. aerosol sprays, food cans	46
		SU	Semi rigids e.g. food trays	46
		SU	Flexibles e.g. foils	46
	Paper / board	SU	Carton board e.g. cereal boxes etc	119
		SU	Beverage cartons	168
		SU	Non-beverage liquid packaging board e.g. soups	168
		SU	Other paper / board	119
	Plastic	SU	PET bottles (beverage containers)	290
		SU	Non-PET (beverage containers)	390
		MU	Beverage containers	309
		SU	Bottles (all non-beverage)	354
		MU	Bottles (all non-beverage)	309

Tier	Material	System	Packaging Type	Rate (EUR per tonne) - current
		SU	Rigid food e.g. pots, tubs and trays	666
		MU	Food refill scheme boxes e.g. Loop	475
		SU	Other rigids (non-beverage, non-food) e.g. blister packs	874
		SU	Mono-polymer stand-up pouches	765
		SU	Multi-polymer/material stand-up pouches	765
		SU	Other mono/multi polymer/layer flexibles (excl. film)	765
		SU	Films	726
		SU	Compostable Rigids	N/A
		SU	Compostable Films	N/A
	Other	SU	Miscellaneous (not included elsewhere)	1152
Primary / consumer (incl. secondary)	Paper / board	SU	Corrugated and other board boxes	119
Tertiary / transport	Steel	MU	Drums	211
	Aluminium	MU	Kegs, tanks etc.	46
	Paper / board	SU	Corrugated and other board boxes - e-commerce	119
	Plastic	SU	Film and bubble pouches - e-commerce	910
		SU	Wrapping and strapping	910
		SU	Crates, boxes etc.	438
		MU	Boxes and pouches - e-commerce	438
		MU	Wrapping and strapping	438
		MU	Crates, boxes etc.	438
		MU	Drums	438

Tier	Material	System	Packaging Type	Rate (EUR per tonne) - current
	Wood	SU	Pallets	1152
		MU	Pallets	1152

For the recyclability measures, downward adjustments were made to waste management costs as recyclability measures are progressively implemented over time.

Packaging that is not optimised in terms of recyclability generally costs more to manage when disposed of, due to the greater costs of sorting and reprocessing. Improvements to recyclability, for example, through reduction in the use of multi-materials, simplified body design, ease of emptying, reduced metallisation of laminate layers etc., will likewise reduce the cost of waste management.

To model this, the current 'uplift' in EPR fee occurring for packaging in current EPR schemes as a consequence of lower than optimum recyclability was estimated. This uplift is measured relative to the theoretical maximum recyclability that could be achieved from changing the design of packaging. These cost estimates were based on various data gathered from industry sources. During our modelling, this uplift was reduced using by a magnitude calculated based on the relative impact of the measure(s), as detailed in Section 2.3.6. In doing so, the potential reduction in cost achieved through increased recyclability is included in the modelling.

3.2 Production *and* Sales Costs

3.2.1 Producer Turnover

The change in producer turnover was calculated to understand the costs / benefits for producers and buyers of packaging from proposed policy changes.

This cost specifically relates to the change in turnover (i.e. revenue from sales of packaging) for producers. These changes occur as a result from switches from one packaging type to another (with a different price) and/or a reduction in the number of units of packaging sold (e.g. as a result of switching to reusable packaging). Whilst at a high-level these changes result in a net change in turnover for producers, when observed at the material or packaging type level there will be winners and losers depending on which packaging types are switched from/to.

Buyers of packaging (e.g. retailers, wholesalers and fillers etc.) will experience an equal and opposite impact to producers. For example, a net reduction in sales / turnover by producers (an avoided benefit i.e. a cost) is also an avoided cost (i.e. a benefit) for those purchasing packaging. Ultimately this change in costs is passed on to consumers, and the net impact for consumers is greater due to the mark up by wholesalers/retailers etc to cover their own costs and generate margin.

To model producer turnover, costs for each packaging type in the model were sourced. To do this, a representative type was selected for each packaging type (i.e. one type of packaging – e.g. a 500ml PET bottle - that is prevalent within the packaging type as defined in the model taxonomy) and this was used as a proxy for the whole packaging type. Costs for these representative types were then sourced through internet searches, and the vast majority of costs sourced from wholesalers (i.e. the retail price(s) for packaging sold by wholesalers). The

sales cost for producers was then estimated by factoring down these prices based on the approximate markup made by wholesalers, which is assumed to be 50% based on typical markups. The final costs used in modelling are presented in Table 3-2.

Table 3-2: Assumption for Sales Cost per Unit of Packaging Sold by Producers, €

Tier	Material	System	Packaging Type	Producer Sales Cost, €
Primary / consumer	Glass	SU	Beverage containers	0.20
		MU	Beverage containers	1.33
		SU	Non-beverage food	0.20
		SU	Other (non-food, non-beverage)	0.37
	Steel	SU	Beverage containers	0.09
		SU	Non-beverage food e.g. food cans	0.09
		SU	Other (non-food, non-beverage) e.g. paint tins	0.09
		MU	Food refill scheme boxes e.g. Loop	2.94
	Aluminium	SU	Beverage containers	0.05
		SU	Other rigids e.g. aerosol sprays, food cans	0.30
		SU	Semi rigids e.g. food trays	0.05
		SU	Flexibles e.g. foils	0.0000005
	Paper / board	SU	Carton board e.g. cereal boxes etc	0.15
		SU	Beverage cartons	0.10
		SU	Non-beverage liquid packaging board e.g. soups	0.05
		SU	Other paper / board	0.05
	Plastic	SU	PET bottles (beverage containers)	0.15
		SU	Non-PET (beverage containers)	0.15
		MU	Beverage containers	1.68
		SU	Bottles (all non-beverage)	0.55
		MU	Bottles (all non-beverage)	0.79
		SU	Rigid food e.g. pots, tubs and trays	0.04
		MU	Food refill scheme boxes e.g. Loop	1.67

Tier	Material	System	Packaging Type	Producer Sales Cost, €
		SU	Other rigids (non-beverage, non-food) e.g. blister packs	0.002
		SU	Mono-polymer stand-up pouches	0.0004
		SU	Multi-polymer/material stand-up pouches	0.0004
		SU	Other mono/multi polymer/layer flexibles (excl. film)	0.006
		SU	Films	0.006
		SU	Compostable Rigids	0.001
		SU	Compostable Films	0.02
	Other	SU	Miscellaneous (not included elsewhere)	0.00
Primary / consumer (incl. secondary)	Paper / board	SU	Corrugated and other board boxes	0.88
Tertiary / transport	Steel	MU	Drums	5.83
	Aluminium	MU	Kegs, tanks etc.	47.72
	Paper / board	SU	Corrugated and other board boxes - e-commerce	0.88
	Plastic	SU	Film and bubble pouches - e-commerce	0.33
		SU	Wrapping and strapping	0.005
		SU	Crates, boxes etc.	14.67
		MU	Boxes and pouches - e-commerce	2.07
		MU	Wrapping and strapping	0.029
		MU	Crates, boxes etc.	14.42
		MU	Drums	12.57
	Wood	SU	Pallets	14.03
		MU	Pallets	14.03

3.2.2 Material Cost Savings

The waste prevention measures modelled would also result in a change in the weight per unit of packaging. Changes in material costs to producers were also calculated to estimate financial

savings to producers as a result of changes in mass flows. Material costs were calculated using per tonne pulp prices for paper/cardboard and virgin PET and PP prices for plastics. Material costs are presented in Table 3-3.

Table 3-3 Material costs

Material		Cost (EUR / tonne)	Notes
Paper/Card	**Corrugated Cardboard**	€ 500	Cheaper than carton board as made up of multiple types of cheaper paper
	Carton board	€ 1,000	Kraft pulp ~1000 per tonne
Plastic	**PET**	€ 1,050	
	PP	€ 1,050	

3.3 Costs Specific to Waste Prevention Intervention Area

The E-commerce packaging void space limits were also expected to have additional specific costs associated with the introduction of the measure unique to the sector. Specifically, we expected that the introduction of void space limits would also entail an efficiency cost as a result of the increased number and variety of boxes required to comply with the measure. We expected that this efficiency cost would result in reduced packing speed at e-commerce fulfilment centres. Internet testimonials of amazon workers suggest that 150 items are packed per worker per hour.[403] If we assume a 10% efficiency cost of the measure, this reduces to 135 items packed per hour. Assuming 1-2 items per box, we estimated a financial cost by estimating the additional labour hours to pack the same number of boxes per country estimated from the mass flows. To calculate the cost of these additional hours, we assumed that each worker at fulfilment centres were being paid the corresponding countries minimum wage. [404] Where countries did not have a minimum wage, we used data on a similarly developed EU country.

3.4 Costs Specific to Reuse Intervention Area

3.4.1 Costs of Reuse Schemes

There are a wide variety of reuse schemes which could contribute towards meeting reuse targets. These range from large, national or trans-national schemes (such as DRSs), to markets where a multitude of schemes operated by private companies exist to reuse, for example, transport packaging such as pallets. For the purposes of this study, the range of potential reuse schemes were categorised into five major types, as shown in Table 3-4. Each of the reusable packaging types within the model were then, for the purposes of cost modelling (and employment – see Section 5.2), mapped to each of these five major reuse scheme types, as shown in Table 3-5 (next page).

Table 3-4: Types of Reuse Schemes

[403] https://www.youtube.com/watch?v=3LS0r8Ex0B0

[404] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Minimum_wage_statistics

Reuse system type	Case study product/ packaging group	Description
Business to Business (B2B)	Secondary/tertiary packaging- boxes, crates, straps etc	Secondary[405] display packaging/tertiary packaging is reused within a supply chain. Pallets, crates, boxes, wrapping and straps designed for multiple trips within a company or between co-operating companies.
Business to Consumer (B2C): Return on the go	Grocery: Alcoholic and non-alcoholic beverages [excl. wine and spirits, incl. milk]	Users return empty glass or plastic bottles either at a store or drop-off points to be collected, cleaned and refilled by the retailer or producer. Such necessitate DRS.
Business to Consumer (B2C): Consumer led refill/refill on the go	HORECA: takeaway beverages and food	Customers use their own cups and food containers, or a brand's refillable packaging in hotels, restaurants and cafes. The packaging is filled by the HORECA/fast food establishment and washed by the customer.
Business to Consumer (B2C): Refill at home	Grocery non-food: cleaning and detergents	Users refill parent packaging at home such as through pouring the product into the parent packaging, placing a container inside the parent packaging, or diluting a concentrated product in water inside the parent packaging.
Business to Consumer (B2C): Return from home	E-commerce: non-food	A product is delivered to the user and picked up empty by a logistics company or posted back to vendor/owner.
	E-commerce: food	Users subscribe to a service in which a product is delivered in packaging to the user and picked up empty by a logistics company for instance.

[405] Note that secondary packaging here exclusively refers to B2B and not B2C packaging for display or multipacks that is taken home by the consumer.

Table 3-5 Mapping of Reusable Packaging Types to Reuse Schemes

		Packaging type	B2B	B2C: Return on the go	B2C: Consumer led refill/refill on the go	B2C: Refill at home	B2C: Return from home
Primary / consumer	Glass	Beverage containers	0%	50%	50%	0%	0%
	Steel	Food refill scheme boxes e.g. Loop	0%	40%	60%	0%	0%
	Plastic	Beverage containers	0%	50%	0%	50%	0%
	Plastic	Bottles (all non-beverage)	0%	50%	50%	0%	0%
	Plastic	Food refill scheme boxes e.g. Loop	0%	0%	50%	50%	0%
Tertiary / transport	Steel	Drums	100%	0%	0%	0%	0%
	Aluminium	Kegs, tanks etc.	100%	0%	0%	0%	0%
	Plastic	Boxes and pouches - e-commerce	0%	0%	0%	0%	100%
	Plastic	Wrapping and strapping	100%	0%	0%	0%	0%
	Plastic	Crates, boxes etc.	100%	0%	0%	0%	0%
	Plastic	Drums	100%	0%	0%	0%	0%
	Wood	Pallets	100%	0%	0%	0%	0%

For each of these five reuse schemes, a methodology was designed to estimate the annualised capital and operational costs of reuse schemes, with cost assumptions derived on a per use basis. These cost assumptions were derived from available data for each of the five reuse scheme types by considering representative case studies (see Table 3-4).

To do this, firstly a literature review was conducted to better understand the operations of each scheme, and to identify any relevant cost data. In general, with the exception of DRS, for which there are a significant number of schemes operating at scale with fairly well determined costs, available cost data is very sparse. Discussions with key stakeholders in the reuse industry were also conducted, however, as would be expected, much of the cost data for privately run schemes is commercially confidential.

Due to the sparse nature of available data, cost assumptions were derived based on high-level sector by sector up modelling for each scheme type. Specifically, a model was designed which included modules for the following cost categories:

- Handling fees (B2C: Return on the Go – modelled as a DRS – only)
- Transport / Collection costs
- Handling, washing and refurbishment costs
- Administrative costs

These models were designed to emulate the simplified operations of each reuse scheme, i.e. the number of trips required by trucks, time spent on refurbishment, central administrative costs etc, based on the best available EU data. Modelling to derive job assumptions (see Section 5.2) proceeded concurrently with 'cost' modelling, as estimates of staff requirements were required to derive cost assumptions. As with most of other economic models, it is essential to consider by whom the cost is (at least initially) borne by. These assumptions are presented in Table 3-6.

Table 3-6: Description of Actors Costs are Accrued to for Reuse Schemes

Reuse system type	Cost borne by	Notes
Business to Business (B2B)	Business	Costs passed on to other business – schemes operated as for-profit operations
B2C: Return on the go	Producers	The most common DRS schemes require any costs (i.e. shortfall in revenue after material revenues and unclaimed deposits are taken into account) to be paid by producers, who operate the scheme as a consortium
B2C: Consumer led refill/refill on the go	Consumer	Costs are minimal and borne by consumers – not explicitly modelled.
B2C: Refill at home		
B2C: Return from home	Retailer	Costs paid for by retailers, and likely to be passed on to consumers by a variety of mechanisms, most likely in a higher sales price.

Based on the above methodology, the final cost assumptions derived are presented in Table 3-7.

Table 3-7: Unit Costs of Reuse Schemes per Packaging Use, EUR

Reuse system type	Handling Fees (retailers)	Transport/ Collection	Handling / Washing / Refurbishment	Administration	Total
B2B	-	0.01	0.06	0.0016	**0.074**
B2C: Return on the go	0.01	0.03	0.01	0.0004	**0.045**
B2C: Return from home	-	0.01	0.04	0.0008	**0.045**

3.4.2 Avoided Costs of Deposit Return Schemes (DRS)

Reuse targets (both sector by sector and cross-sectoral) lead to a switching of consumption away from single use containers. For beverage containers this means there is a decrease in the quantity of (single use) packaging which can be returned through a (single use) DRS. Reusable beverage containers may instead be returned through a 'reuse' return scheme, as outlined in Section 3.4.1.

The SUP Directive (Article 9) requires the separate collection for recycling 77% of single-use plastic beverage bottles by 2025, and 90% by 2029. There are two potential mechanisms to meet this target, as set out in the Directive: 1) to *establish deposit-refund schemes*; 2) to *establish separate collection targets for relevant extended producer responsibility schemes*. Given the growing proliferation of DRSs in Europe and the potential economic, environmental and social benefits of these schemes relative to 'conventional' waste management via EPR (i.e. high return rates of high quality recycling, significant job creation etc.), it is assumed that DRS will become the primary mechanism by which these targets are achieved. Thus, under our business as usual scenario, it is assumed that countries which do not have already have DRS schemes in place will implement these by 2025. Furthermore, although the Directive does not set targets for other material types (i.e. metal and glass beverage containers), it is assumed that these material types will also be included in the DRS schemes implemented, as is commonly the case when specifying the DRS (as the inclusion of these material types also, in most cases, leads to net benefits to society, as described above).

We assume that, with shifts to reusable packaging, DRSs (for single user beverage containers) will still be implemented, however, the quantity of beverage containers within the scope of the schemed will be reduced relative to the business as usual scenario. Reusable containers will bear their own costs for takeback, reconditioning and onward sale (as detailed in 3.4.1), and thus there is a shift in costs from DRSs to reusable packaging takeback schemes. This will result in either a net / increase or decrease in the overall cost to producers (for DRS schemes, as well as other potential actors for proposed reusable packaging schemes), depending on the cost differential between DRS and reusable packaging schemes.

After the implementation of reuse targets, consideration will need to be made to the design of reusable packaging schemes, and (of most relevance here) any potential for cost efficiencies through integration with existing or planned DRSs. Although, as discussed in Section 3.4.1, for

the purposes of this CBA we have assumed that the two packaging types (single and multi-use) are taken back through schemes operating independently.

The reduction in costs resulting from a reduction in single use beverage containers placed on the market and taken back through DRS schemes is modelled based on an assessment of the average 'producer fees' for each material. This is assuming that DRS schemes are set up by producers, who pay a producer fee (per packaging unit placed on the market) to balance the net deficit of the scheme which remains after the costs of setup/operation and any revenues to the scheme are accounted for. This is by far the most common model of DRS observed in Europe, and the most likely to be implemented in the future.

Producer fees are based on an assessment of average fees from current schemes and are as such as likely average value which could be observed in future schemes (of course, in practise these fees will vary by Member State due to a variety of country specific and design factors). The fees used in modelling are:

- 5.00 € cents for glass;
- 2.25 € cents for steel; and
- 1.25 € cents for plastic.

No producer fee is assumed for aluminium as is commonly the case, mainly due to the high material revenues for this material.

3.5 Costs Specific to Compostables Intervention Area

Data on the relative costs of compostable polymers compared to conventional was obtained from a Dutch dataset.[406] It should be noted, however, that the costs of these polymers should be expected to decrease over time as the market matures – particularly in the case where conventional plastics are banned for priority products, which will result in greater prevalence of prioritised products.

The cost of composting and AD treatment systems for the different countries were taken from EU Reference Model on Waste.[407] Data presented by the Renewable Energy Association in the UK to government regarding the costs of extracting the plastics contamination from organic treatment facilities suggests removal costs of €11 per tonne.[408] Additional costs associated with managing this contamination include the cost of residual waste treatment associated with treating the removed contaminants.

R&D costs were considered based on stakeholder discussions and on data relating to industry investment needs from the literature.[409]

[406] Food and Biobased Research Wageningen (u.d.) Bio-based and biodegradable plastics - Facts and Figures: Focus on Food Packaging in the Netherlands

[407] Eunomia / CRI (2014) Development of a modelling tool on waste generation and management: Appendix 6 Environmental Modelling, Report for DG Environment

[408] Renewable Energy Association (2018) REA Response to HM Treasury's call for evidence on Tackling the plastic problem: using the tax system or charges to address single-use plastic

[409] Circular Plastics Alliance (2021) Circular Plastics Alliance – Roadmap to 10 Mt recycled content by 2025

4.0 Environmental Model

This section sets out the assumptions and sources used to calculate the environmental impacts (GHG emissions and water consumption) and damage costs (from GHG and air quality, AQ, pollutant emissions) of:

- Primary manufacturing;
- Recycling;
- Residual waste treatment i.e. incineration and landfill;
- Transport and washing of reusable items.

The section is structured as follows:

- Section 4.1 covers the methodology, assumptions and sources used to calculate GHG emissions (in terms of tonnes of CO2-equivalent; CO2e);
- Section 4.2 provides the key assumptions relating to the air quality pollutant emissions (which are not provided as results but are subsequently used to calculate damage costs);
- Section 4.3 provides the damage costs of GHG and AQ emissions on a per-year, Member State basis;
- Section 4.4 covers the assumptions and sources used to calculate water consumption;
- Section 4.5 covers the methodology, assumptions and sources used to calculate GHG emissions and damage costs of transporting and washing reusable items;
- Section 4.6 discusses considerations made for compostable packaging; and
- Section 4.7 presents an overview of other environmental impacts

Table 4-1 and Table 4-2 respectively show the environmental impacts and externalities included in the modelling.

Table 4-1 Scope of the Environmental Impacts Included in the Modelling

Process	Environmental Impacts Included
Primary Manufacturing	Direct GHG emissions from manufacturing processes
	GHG emissions from energy used during manufacturing processes
	Water consumption
Recycling	Direct GHG emissions from recycling process
	GHG emissions from energy used during recycling process
	Avoided GHG emissions through reduced use of raw materials
	Process water consumption
Incineration	Direct GHG emissions from incineration process
	GHG emissions from energy used during incineration process
	GHG emissions avoided through energy generation (depends on the mix of energy sources in each Member State's grid)
	Process water consumption

Process	Environmental Impacts Included
Landfill	Direct GHG emissions from landfill process
	GHG emissions from energy used during landfill process
	GHG emissions avoided through energy generation (depends on the mix of energy sources in each Member State's grid)
	Process water consumption
Transport	GHG emissions of transport from manufacture to retailer, and from waste collection depot to final waste destinations
Collection	GHG emissions of transport from waste collection activities
Sorting	GHG emissions produced by mixed waste sorting processes
Reuse	Washing GHG emissions
	Transport GHG emissions

Table 4-2 The Scope of the External Impacts Included in the Modelling

Process	External Impacts Included in Calculation of Damage Costs
Primary Manufacturing	Direct GHG and AQ emissions from manufacturing processes
	GHG and AQ emissions from energy used during manufacturing processes
Recycling	GHG and AQ emissions from energy used during recycling process
	Avoided GHG and AQ emissions through reduced use of raw materials
Incineration	Direct GHG and AQ emissions from incineration process
	GHG emissions from energy used during incineration process
	GHG emissions avoided through energy generation (depends on the mix of energy sources in each Member State's grid)
Landfill	Direct GHG and AQ emissions from landfill process
	GHG emissions from energy used during landfill process
Reuse	Washing GHG emissions
	Transport GHG and AQ emissions

4.1 Greenhouse Gas Emissions

This section details the methods, assumptions and sources used to calculate the GHG emissions of primary manufacturing, recycling and residual waste treatment.

4.1.1 Manufacturing

Greenhouse gas impacts of manufacturing comprise both primary energy-related emissions (e.g. from natural gas use) and electricity-related GHG emissions. Greenhouse gas emissions per unit electricity consumption for each Member State were forecast out to 2050 using the EU Reference Scenario[410], which forecasts the contribution to electricity production from each major generation type. The emissions intensities of electricity generation from nuclear, coal, oil, natural gas, hydropower, wind and solar were taken from the IPCC[411].

The emissions intensities of other energy sources (tonnes CO2e/MJ) were taken from UK Department for Business, Energy and Industrial Strategy conversion factors[412].

Energy (electricity and non-electricity) consumption in manufacturing were taken from a variety of sources, shown in Table 4-3.

Table 4-3 Energy consumption sources for primary manufacturing

Material	Source	Notes
Aluminium	World Aluminium (2017)[413]	
Steel	Ecoinvent 3.7	Steel production, converter, unalloyed = primary Related process: pig iron production Related process: sinter iron
Glass	Ecoinvent 3.7	
Paper	Ecoinvent 3.7	Newsprint, Virgin, RER
Card	FEFCO (2018)[414]	
HDPE	Plastics Europe (2016)[415]	

[410] Publications Office of the European Union (2016) *EU reference scenario 2016 : energy, transport and GHG emissions : trends to 2050.*, August 2016, http://op.europa.eu/en/publication-detail/-/publication/aed45f8e-63e3-47fb-9440-a0a14370f243/language-en/format-PDF

[411] Edenhofer, O., Pichs-Madruga, R., Sokona, Y., et al. (2011) IPCC special report on renewable energy sources and climate change mitigation - Annex II, *Prepared By Working Group III of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK*

[412] Department for Business, Energy & Industrial Strategy (2019) *Greenhouse gas reporting: conversion factors 2019*, accessed 18 September 2019, https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

[413] World Aluminium (2017) *Life Cycle Inventory Data and Environmental Metrics for the Primary Aluminium Industry - Appendix A Life Cycle Inventory Data*, June 2017, https://www.world-aluminium.org/publications/

[414] FEFCO (2018) *European Database for Corrugated Board Life Cycle Studies - Appendix A - Life cycle inventory GLOBAL*, 2018, https://www.fefco.org/lca/data

[415] Plastics Europe (2016) *Eco-Profiles*, 2016, https://www.plasticseurope.org/en/resources/eco-profiles

Material	Source	Notes
LDPE	Plastics Europe (2016)	
PE	-	Estimated from HDPE
PET	Plastics Europe (2016) and Association of Plastic Recyclers and Franklin Associates (2018)[416]	
PP	Plastics Europe (2016)	
PS	Plastics Europe (2016)	
PVC	Plastics Europe (2016)	
Wood	Ecoinvent 3.7	Sawn wood production, hardwood, dried (u=10%)

4.1.2 Recycling

The GHG emissions of reprocessing waste material into secondary products are a function of the primary energy demand and electricity demand of the processes. The primary energy demand (in terms of diesel, coal, natural gas, heavy and light fuel oils), as well as the electricity consumption, of the processes were taken from the sources in Table 4-4. Because electricity emissions are a function of both the Member State and year in question, the overall reprocessing emissions vary with these values.

The benefits of material recycling were calculated by subtracting the GHG emissions of primary production (described in Section 4.1.1) from those of reprocessing.

Table 4-4 Sources Used to Determine Primary Energy Demand from Recycling Processes

Material	Source	Notes
Aluminium	Turner et al. (2015)[417]	
Steel	Ecoinvent 3.7	Secondary steel alloy production process
Glass	Turner et al. (2015)	
Paper	Ecoinvent 3.7	Newsprint, Recycled, EU ex CH
Card	FEFCO (2018)[418]	

[416] Association of Plastic Recyclers and Franklin Associates (2018) *Life Cycle Impacts for Postconsumer Recycled Resins: PET, HDPE, and PP*, 2018, https://plasticsrecycling.org/images/library/2018-APR-LCI-report.pdf

[417] Turner, D.A., Williams, I.D., and Kemp, S. (2015) Greenhouse gas emission factors for recycling of source-segregated waste materials, *Resources, Conservation and Recycling*, Vol.105, pp.186–197

[418] FEFCO (2018) *European Database for Corrugated Board Life Cycle Studies - Appendix A - Life cycle inventory GLOBAL*, 2018, https://www.fefco.org/lca/data

Material	Source	Notes
HDPE	Association of Plastic Recyclers and Franklin Associates (2018)419 and Chen (2019)[420]	
LDPE	-	Estimated from HDPE
PE	-	Estimated from HDPE
PET	Chen (2019)[421]	
PP	Association of Plastic Recyclers and Franklin Associates (2018) and Chen (2019)	
PS	Chen (2019)	
PVC	Chen (2019)	

4.1.3 Waste Treatment (Incineration and Landfill)

The GHG emissions resulting from the incineration and landfilling of the materials in question were modelled using Eunomia's in-house waste treatment models. These models are also the source of the data used to develop the European Reference Model on waste, which was used in the impact assessment of the Circular Economy Package for DG Environment.[422] The methodology is therefore described in Annexes published alongside the documentation for the model; the following is a high-level description of the model functionality.

Each material has a set of characteristics associated with it. Key amongst these are the moisture content in the waste, the energy content and the carbon content (both 'fossil' and 'biogenic' carbon).

The model determines the mass balance through the treatment processes. For incineration, this is the conversion of material into gases (or incinerator bottom ash) via combustion. In a landfill, this is the degradation of organic material into carbon dioxide and methane ('landfill gas'), as well as un-degraded material left in the site at the end of the time period.

Alongside these mass balances are other outputs which are calculated using physical relationships, with further assumptions taken from the literature. For example, the model calculates the total amount of energy generated in the combustion process, which is a function of the energy content of each material.

To generate overall GHG impacts, a further set of (changeable) contextual assumptions is required. For incineration, these include the energy generation efficiency (assumed to be 29%, a reflection of the European incineration fleet), operating mode (assumed here to be electricity-

[419] Association of Plastic Recyclers and Franklin Associates (2018) *Life Cycle Impacts for Postconsumer Recycled Resins: PET, HDPE, and PP*, 2018, https://plasticsrecycling.org/images/library/2018-APR-LCI-report.pdf

[420] Chen, Y., Cui, Z., Cui, X., Liu, W., Wang, X., Li, X., and Li, S. (2019) Life cycle assessment of end-of-life treatments of waste plastics in China, *Resources, Conservation and Recycling*, Vol.146, pp.348–357

[421] Chen, Y., Cui, Z., Cui, X., Liu, W., Wang, X., Li, X., and Li, S. (2019) Life cycle assessment of end-of-life treatments of waste plastics in China, *Resources, Conservation and Recycling*, Vol.146, pp.348–357

[422] Eunomia / CRI (2014) *Development of a Modelling Tool on Waste Generation and Management*, Appendix 6 Environmental Modelling, Report for DG Environment

only), the carbon intensity of marginal energy generation being displaced, and process energy requirements (amongst others).

For landfill, the most important values are the rate at which methane is oxidised to carbon dioxide in the landfill, and the integral landfill gas capture rate (i.e. the proportion of landfill gas which is captured by a mechanical system).

Based on the input assumptions and mass flow calculations, the model calculates total process emissions (i.e. direct emissions arising at the facility), indirect energy-consumption related emissions, and energy generation. Avoided electricity emissions in any given country and year can then be calculated from this latter value.

The electricity that is generated through incinerating waste displaces other electricity generation. This displaced generation would have produced GHG emissions. These displaced emissions were calculated by multiplying the electricity generation (kWh per tonne of incinerated material) by the emissions intensity of electricity production, on a Member State basis from 2018-2050.

4.1.4 Transport, Collection and Sorting

Eunomia assumptions for transport, collection and sorting greenhouse emissions were based on our experience of waste collection logistics modelling. The assumptions for the average distances are:

- 100 km from manufacture to retailer;
- 100 km from collection depot to final destination; and
- 50 km for a reuse trip.

Transport impacts are modelled based on the limits contained in the Euro standards.[423]

4.2 Air Quality Pollutant Emissions

The total environmental impacts of the emission of pollutants that affect air quality ('air quality pollutants' or 'AQ emissions') were not modelled in the analysis *per se*. However, AQ emissions are included in the calculation of total externalities arising from product manufacture, recycling, incineration and landfill (as described in Section 4.3). This means that assumptions are needed relating to the per-unit emissions of different pollutants, for each of these processes.

The pollutants accounted for in the modelling are:

- Ammonia (NH3);
- Nitrogen oxides (NOx);
- Particulates (PM2.5 and PM10);
- Sulphur dioxide (SO2), and;
- Volatile organic compounds (VOCs).

This section provides the key assumptions that subsequently allow the damage costs to be calculated.

[423] Ecoinvent database available from https://www.ecoinvent.org/

4.2.1 Electricity and Other Energy Use Impacts

The AQ emissions from electricity generation are relevant to product manufacture, recycling and incineration, as each of these either consumes or produces (and thus avoids alternative generation of) electricity. Pollutant emissions per unit of electricity consumption for each Member State were forecast out to 2050 using the EU Reference Scenario[424], which models the contribution to electricity production from each major generation type. The pollutant emissions per kWh of electricity generated by each generation were taken from the Ecoinvent 3.7 database and are shown in Table 4-5 below.

Table 4-5 Sources Used to Determine the AQ Emissions from Electricity Generation (per kWh of electricity generated)

Material	Ecoinvent process
Nuclear	Electricity production, nuclear, pressure water reactor
Coal	Electricity production, hard coal
Oil	Electricity production, oil
Natural gas	Electricity production, natural gas, combined cycle power plant
Hydro	Electricity production, hydro, pumped storage
Wind	Electricity production, wind, <1MW turbine, onshore
Solar	Electricity production, photovoltaic, 3kWp facade installation, multi-Si, laminated, integrated

Pollutant emissions from the consumption of other fuels (per kWh of heat produced) were taken from Ecoinvent 3.7. The relevant Ecoinvent processes are shown in Table 4-6 below.

Table 4-6 Pollutant emissions of heat provision from different fuels

Generation type	Ecoinvent 3.7 process
Coal	Heat production, at hard coal industrial furnace 1-10MW
Natural gas	Heat production, natural gas, at industrial furnace >100kW
Heavy fuel oil	Heat production, heavy fuel oil, at industrial furnace 1MW
Light fuel oil	Heat production, light fuel oil, at industrial furnace 1MW
Diesel	Diesel, burned in diesel-electric generating set, 18.5kW (scaled by electricity generation efficiency)

[424] Publications Office of the European Union (2016) *EU reference scenario 2016 : energy, transport and GHG emissions : trends to 2050.*, August 2016, http://op.europa.eu/en/publication-detail/-/publication/aed45f8e-63e3-47fb-9440-a0a14370f243/language-en/format-PDF

Generation type	Ecoinvent 3.7 process
Biomass	Heat production, hardwood chips from forest, at furnace 1000kW, state-of-the-art 2014

4.2.2 Manufacturing

The pollutant emissions from the primary manufacture of materials (on a per-tonne basis) were taken from several sources, shown in Table 4-7 below.

For all materials but aluminium, these sources include the pollutant emissions from the electricity requirements of the processes. The additional pollutants coming from the electricity requirements of aluminium production were estimated via the following methods:

- Pollutant emissions per unit of electricity consumption for each Member State were forecast out to 2050 using the EU Reference Scenario[425], which models the contribution to electricity production from each major generation type.
- The pollutant emissions per kWh of electricity generated by each electricity generation type were taken from the Ecoinvent 3.7 database.
- The emissions per kWh was then multiplied by the electricity requirement per tonne of manufactured aluminium, to arrive at a total figure.

Table 4-7 The Sources Providing Data on AQ Emissions from Primary Manufacturing

Material	Source	Notes / Ecoinvent process
Aluminium	World Aluminium (2017)	Global data used
Steel	Ecoinvent 3.7	Steel production, converter, unalloyed; RoW
Glass	Ecoinvent 3.7	Packaging glass production, green; RoW
Paper	Ecoinvent 3.7	Paper production, newsprint, virgin; RER
Card	FEFCO (2018) & Ecoinvent 3.7	Ecoinvent: Corrugated board box production; RER
HDPE	Ecoinvent 3.7	Polyethylene production, high density, granulate; RoW
LDPE	Ecoinvent 3.7	Polyethylene production, low density, granulate; RoW
PE	-	Assumed the same as HDPE

[425] Publications Office of the European Union (2016) *EU reference scenario 2016 : energy, transport and GHG emissions : trends to 2050.*, August 2016, http://op.europa.eu/en/publication-detail/-/publication/aed45f8e-63e3-47fb-9440-a0a14370f243/language-en/format-PDF

Material	Source	Notes / Ecoinvent process
PET	Ecoinvent 3.7	Polyethylene terephthalate production, granulate; RoW
PP	Ecoinvent 3.7	Polypropylene production, granulate; RoW
PS	Ecoinvent 3.7	Polystyrene production, general purpose; RER
PVC	Ecoinvent 3.7	Polyvinylchloride production, bulk polymerisation; RoW
Wood	Ecoinvent 3.7	Sawn wood production, hardwood, dried (u=10%); RoW

4.2.3 Recycling

Air quality emissions from reprocessing arise due to consumption of primary energy and electricity. The primary energy demand of recycling processes were taken from sources shown in Table 4-4; the emissions per kWh of electricity and primary energy are given in Table 4-5 and Table 4-6 respectively.

The energy consumption values were multiplied by the pollutant emissions per kWh of energy consumed for each material to give overall pollutant emissions. Overall emissions were then multiplied by the damage cost per tonne of pollutant.

4.2.4 Waste Treatment (Incineration and Landfill)

The pollutant emissions resulting from the incineration and landfilling of the materials in question were modelled using Eunomia's in-house waste treatment models. These models are also the source of the data used to develop the European Reference Model on waste, which was used in the impact assessment of the Circular Economy Package for DG Environment.[426] The methodology is therefore described in Annexes published alongside the documentation for the model.

4.2.5 Incineration Electricity Generation Credit

The electricity that is generated through incinerating waste (with an assumed electricity generation efficiency of 29% in keeping with much of the plant in the EU) *displaces* other electricity generation. This displaced generation would have produced pollutant emissions. These displaced emissions were calculated by multiplying the electricity generation (kWh per tonne of incinerated material) by the emissions intensity of electricity production (described in Section 4.2.1), on a Member State basis from 2018-2050.

[426] Eunomia / CRI (2014) *Development of a Modelling Tool on Waste Generation and Management*, Appendix 6 Environmental Modelling, Report for DG Environment

4.3 Climate Change and Air Quality Damage Costs

The damage costs associated with the GHG emissions (detailed in Section 4.1)and the AQ emissions (detailed in Section 4.2) associated with material manufacture, recycling, landfill and incineration, were modelled using the per-tonne emissions costs shown in Table 4-8 and Table 4-9). The results present the **combined GHG and air quality damage costs** from each of these processes, for each product in each Member State from 2018-2050.

4.3.1 Greenhouse Gas Damage Costs

The damage costs associated with the emissions of GHGs was calculated for each member state for the years 2018-2050, by multiplying the GHG emissions associated with each process (detailed in Section 4.1) by damage cost projections, shown in Table 4-8[427].

Table 4-8 Climate Change Avoidance Cost of GHGs

Year	EUROS/tonne CO_2e	Year	EUROS/tonne CO_2e	Year	EUROS/tonne CO_2e
2020	€ 100.00	2030	€ 170.42	2040	€ 240.83
2021	€ 107.04	2031	€ 177.46	2041	€ 247.88
2022	€ 114.08	2032	€ 184.50	2042	€ 254.92
2023	€ 121.13	2033	€ 191.54	2043	€ 261.96
2024	€ 128.17	2034	€ 198.58	2044	€ 269.00
2025	€ 135.21	2035	€ 205.63	2045	€ 276.04
2026	€ 142.25	2036	€ 212.67	2046	€ 283.08
2027	€ 149.29	2037	€ 219.71	2047	€ 290.13
2028	€ 156.33	2038	€ 226.75	2048	€ 297.17
2029	€ 163.38	2039	€ 233.79	2049	€ 304.21
				2050	€ 311.25

4.3.2 Air Quality Emissions Damage Costs

The damage costs associated with the air quality emissions from production, recycling, incineration and landfill were also modelled for each member state for the years 2018-2050. This analysis included NH_3, NO_x $PM_{2.5}$, PM_{10}, SO2, and VOCs, the 'pollutants'[428].

[427] These figures were provided to Eunomia by DG ENV through email correspondence

[428] IEEP (2020), *Mapping Objectives in the Field of Environmental Taxation and Budgetary Reform: Internalisation of Environmental External Costs*

Table 4-9 Air Quality Pollutant Emissions Damage Costs (2020 EUROS/tonne of pollutant)

Country	NH3	NOx	PM2.5	PM10	SO2	VOCs
Austria	€ 27,800	€ 28,700	€ 26,800	€ 19,850	€ 16,200	€ 2,200
Belgium	€ 38,200	€ 18,000	€ 34,600	€ 28,823	€ 17,100	€ 3,400
Bulgaria	€ 5,600	€ 7,000	€ 7,100	€ 12,863	€ 4,200	€ -
Croatia	€ 17,900	€ 13,300	€ 16,200	€ 17,916	€ 8,800	€ 900
Cyprus	€ 3,800	€ 5,400	€ 10,900	€ 8,629	€ 7,800	-€ 500
Czech Republic	€ 27,400	€ 17,400	€ 22,600	€ 13,915	€ 11,600	€ 1,000
Denmark	€ 14,000	€ 11,300	€ 13,900	€ 7,293	€ 11,100	€ 1,500
Estonia	€ 10,500	€ 3,900	€ 5,900	€ 4,759	€ 6,200	€ 300
Finland	€ 7,000	€ 3,900	€ 4,800	€ 4,762	€ 5,800	€ 400
France	€ 15,400	€ 19,000	€ 25,100	€ 20,285	€ 15,000	€ 1,500
Germany	€ 28,100	€ 25,500	€ 37,600	€ 29,780	€ 17,800	€ 1,800
Greece	€ 4,800	€ 3,600	€ 7,700	€ 12,158	€ 6,800	€ 300
Hungary	€ 18,900	€ 18,600	€ 20,300	€ 19,607	€ 10,900	€ 800
Ireland	€ 4,100	€ 12,100	€ 13,600	€ 10,166	€ 13,600	€ 1,700
Italy	€ 21,600	€ 17,700	€ 21,100	€ 23,767	€ 14,000	€ 1,100
Latvia	€ 8,700	€ 5,100	€ 5,700	€ 6,468	€ 5,600	€ 400
Lithuania	€ 7,900	€ 8,400	€ 7,700	€ 6,479	€ 7,300	€ 600
Luxembourg	€ 60,000	€ 45,700	€ 63,700	€ 21,480	€ 31,700	€ 6,200
Malta	€ 6,400	€ 1,700	€ 6,200	€ 10,565	€ 5,000	€ 400
Netherlands	€ 30,000	€ 18,200	€ 37,300	€ 26,610	€ 21,500	€ 2,800
Poland	€ 14,400	€ 10,400	€ 16,300	€ 13,648	€ 9,000	€ 700
Portugal	€ 4,300	€ 2,000	€ 5,200	€ 16,002	€ 5,100	€ 500
Romania	€ 9,400	€ 13,300	€ 12,400	€ 13,927	€ 8,100	€ 500
Slovakia	€ 24,400	€ 17,300	€ 18,400	€ 13,743	€ 11,100	€ 700
Slovenia	€ 23,800	€ 15,900	€ 16,000	€ 14,587	€ 10,000	€ 1,200
Spain	€ 6,400	€ 6,000	€ 9,800	€ 12,944	€ 7,900	€ 700
Sweden	€ 10,600	€ 6,900	€ 6,200	€ 7,481	€ 6,800	€ 700

Washing unit factors were based on data was provided as part of a study for DG Environment "Links between production, the environment and environmental policy", conducted by Cambridge Econometrics, IEEP and Denkstatt.

4.4 Water Consumption

4.4.1 Manufacturing

Data relating to water consumption of primary manufacturing are given in Table 4-10 below.

Table 4-10 Sources Used to Determine the Water Consumption of Material Manufacture

Material	Source	Notes
Aluminium	The Aluminium Association (2013)[429]; Argonne National Laboratory (2015)[430]; Nunez and Jones (2016)[431] and World Aluminium (2017)	Approximate average value taken
Steel	Wuppertal (2014)[432]	
Glass	Wuppertal (2014)	
Paper	Man et al. (2018)[433] and Ma et al. (2018)[434]	Approximate average value taken
Card	Wuppertal (2014)	
HDPE	Wuppertal (2014)	

[429] The Aluminium Association (2013) *The Environmental Footprint of Semi-finished Aluminum Products in North America*, 2013, https://www.aluminum.org/sites/default/files/LCA_Report_Aluminum_Association_12_13.pdf

[430] Argonne National Laboratory (2015) *Updated Life-Cycle Analysis of Aluminium Production and Semi-Fabrication for the GREET Model*, 2015, https://www.osti.gov/biblio/1224957-updated-life-cycle-assessment-aluminum-production-semi-fabrication-greet-model

[431] Nunez, P., and Jones, S. (2016) Cradle to gate: life cycle impact of primary aluminium production, *The International Journal of Life Cycle Assessment*, Vol.21, No.11, pp.1594–1604

[432] Wuppertal Institut (2014) *Material intensity of materials, fuels, transport services, food*, 2014, https://wupperinst.org/uploads/tx_wupperinst/MIT_2014.pdf

[433] Man, Y., Han, Y., Wang, Y., Li, J., Chen, L., Qian, Y., and Hong, M. (2018) Woods to goods: Water consumption analysis for papermaking industry in China, *Journal of Cleaner Production*, Vol.195, pp.1377–1388

[434] Ma, X., Shen, X., Qi, C., Ye, L., Yang, D., and Hong, J. (2018) Energy and carbon coupled water footprint analysis for Kraft wood pulp paper production, *Renewable and Sustainable Energy Reviews*, Vol.96, pp.253–261

Material	Source	Notes
LDPE	Plastics Europe (2014)[435]	
PE	Wuppertal (2014)	
PET	Wuppertal (2014)	
PP	Wuppertal (2014)	
PS	Wuppertal (2014)	
PVC	Wuppertal (2014)	
Wood	Wuppertal (2014)	

4.4.2 Material Recycling

The water consumed in recycling processes were taken from the sources shown in Table 4-11. The benefits of material recycling were calculated by subtracting the water consumption of primary production (Table 4-10) from those of reprocessing.

Table 4-11 Sources Used to Determine the Water Consumption of Material Recycling

Material	Source	Notes
Aluminium	Wuppertal (2014)	
Steel	Wuppertal (2014)	Steel scrap
Glass	Wuppertal (2014)	
Paper	Wuppertal (2014)	Secondary newsprint
Card	FEFCO (2018)	
HDPE	Chen (2019)	
LDPE	Chen (2019)	
PE	Chen (2019)	
PET	Chen (2019)	
PP	Chen (2019)	
PS	Chen (2019)	

[435] Plastics Europe (2014) *Eco-profiles and Environmental Product Declarations of the European Plastics Manufacturers*, 2014, http://www.pedagogie.ac-aix-marseille.fr/upload/docs/application/pdf/2015-11/4-_eco-profile_pe_2014-04.pdf

Material	Source	Notes
PVC	Chen (2019)	

4.4.3 Waste Treatment (Incineration and Landfill)

The water consumption resulting from the incineration and landfilling of the materials in question were modelled using Eunomia's in-house waste treatment models. These models are also the source of the data used to develop the European Reference Model on waste, which was used in the impact assessment of the Circular Economy Package for DG Environment.[436] The methodology is therefore described in Annexes published alongside the documentation for the model.

4.5 Transport and Washing of Reusable Items: Greenhouse Gas and Air Quality Emissions

The GHG and AQ impacts of transporting reusable items between their point of use and the depot or reconditioning centre were modelled at a high level. The GHG emissions from washing these items were also modelled.

4.5.1 Transport

We assumed an average distance of 20km between the point of use and the depot, and that items were transported on a 12-tonne truck with EURO Class 5 air quality emissions standards. The UK's Department for Business, Energy and Industrial strategy fuel-GHG conversion factors were used to determine the truck's CO2e emissions per tonne-km[437].

Emissions per item-reuse were calculated based on the number of items that could fit in a particular truck, and the number of uses per transportation. These values were assumed using a variety of case studies and based on the standard size and application of different products.

4.5.2 Washing

For each product, the number of uses per home wash (if at all) and per industrial wash (if at all) were assumed, based on case studies. The electricity and natural gas consumed per item in a home hand-wash[438] or dish-wash[439] were derived based on the energy consumption of a washing cycle.

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[436] Eunomia / CRI (2014) *Development of a Modelling Tool on Waste Generation and Management*, Appendix 6 Environmental Modelling, Report for DG Environment

[437] Department for Business, Energy & Industrial Strategy (2019) *Greenhouse gas reporting: conversion factors 2019*, accessed 18 September 2019, https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

[438] Stamminger, R. (2004) *Is a Machine More Efficient Than the Hand?*

[439] Publications Office of the European Union (2017) *Ecodesign and energy label for household dishwashers*, 2017, https://op.europa.eu/en/publication-detail/-/publication/f961e8ca-d96f-11e7-a506-01aa75ed71a1/language-en

4.6 Compostable Packaging

The future evolution of the mix of compostable plastic polymers is unknown at the time of writing, adding further complexity and uncertainty to the modelling of environmental impacts. The carbon content of compostable plastic was modelled based on the chemical structure of PLA, for which the relevant data was available. It is assumed 50% of this carbon is from bio sources. Although this may be somewhat higher than is the case for some product streams at present, the assumption was modelled with the expectation that support for the increased use of this material should come via implementation of Circular Economy Action plan which is aimed at supporting the bio-based economy.

The consideration of environmental impacts of compostable packaging requires an extension in the scope of the main environmental model to include consideration of AD and composting. The basis for these environmental models is set out in the Reference Model on Waste.[440] Calculations were updated for compostable plastic products to reflect the inclusion of the fossil carbon content contained within these products as is indicated above, with the relevant CO_2 emissions associated with this being included in the model outputs.

Biogenic CO_2 emissions are largely excluded from the combustion and bio-waste treatment models. The landfill model includes a credit for sequestration for the un-emitted CO_2 emissions relating to potentially degradable carbon in compostable plastics (in this case comprising of both fossil and biogenic carbon). It is noted that – notwithstanding this approach - landfill impacts for the compostable plastics remain relatively high, at 2.57 tonnes CO_2e / tonne, compared to typical incineration impacts of 0.7 tonnes CO_2e tonne. A sequestration credit is applied to the carbon that remains un-emitted in compost after 100 years when this is applied to land.

4.7 Other Environmental Impacts

The environmental appraisal focuses on the environmental impacts for which there is **the most robust data** – greenhouse gas impacts and emissions to air for which there is robust health impacts data (the latter also being the emissions covered by limits in the Industrial Emissions Directive). The appraisal therefore covers the majority of the impacts for which there is typically most concern expressed by stakeholders. The list below sets out the impacts that have been excluded from the environmental appraisal.

- **Impacts associated with emissions to water** are excluded from the appraisal, although note that the appraisal does include consideration of the impacts of water consumption for all packaging products throughout the lifecycle. Impacts are most likely to arise from product manufacturing – particularly of paper products. Less significant impacts may arise from compostable plastic and landfill. There is no agreed methodology for assessing these impacts – no damage cost data exists and outputs from the different LCA metrics that are available to potentially assess some of the impact vary considerably in their methodology. In addition, relatively little data is available on the direct emissions arising from manufacturing. Landfill emissions should be minor for facilities that are compliant with the Landfill Directive. A particular area of current concern is that of microplastic pollution.

[440] Eunomia / CRI (2014) Development of a modelling tool on waste generation and management: Appendix 6 Environmental Modelling, Report for DG Environment

- **Emissions to land**. As is the case with impacts associated with emissions to water, there is no agreed methodology for assessing these impacts. Impacts are most likely to occur indirectly, arising via emissions to air – although some impacts may occur through littering. Littering impacts are assessed qualitatively in the appraisal. A particular area of concern is that of bioplastics.

- **Biodiversity.** There is no agreed metric that could usefully assess this type of impacts quantitatively. In general, reduced use of virgin resources and reduced waste generation – both of which are key aims of the measures - should be expected to have a positive impact in biodiversity. There is likely to be an overlap between emissions to air, water and land and biodiversity impacts – with microplastic pollution to watercourses being expected to impact on biodiversity by impacting on certain species, for example. Such impacts are therefore considered alongside others covered in the qualitative appraisal of environmental impacts.

- **Construction of facilities.** We have not considered climate change impacts or damage costs associated with construction of facilities – either of additional waste management re-processing capacity or sorting (or re-use) facilities. Data from full lifecycle assessments typically confirms that construction related impacts are relatively insignificant in comparison the emissions to air. In addition, many of the materials with the greatest embedded environmental impacts (i.e., the metals) are likely to be recovered for recycling when the facility is decommissioned, reducing the overall burdens. Alongside this, the development of additional re-processing and sorting facilities would ultimately be expected to reduce the requirement for additional primary manufacturing facilities, such that the latter would be expected to offset most (if not all) of the latter.

5.0 Employment Model

In this section we present the approach used to model changes in employment resulting from the proposed measures in this study. Assumptions applied to all measures relating to manufacturing and waste treatment are outlined in Section 5.1. Employment assumptions for reuse jobs are discussed in Section 5.2.

5.1 Manufacturing and Waste Management

Manufacturing jobs were calculated using an approximate methodology, based on a comparison of date relating to the value added per worker for each material type to producer turnover.

The employment figures for various treatment and disposal options were sourced from previous Eunomia research conducted for the European Reference Model on Municipal Waste Management.[441] These employment intensities, which include jobs for collection and reprocessing / treatment are presented in Table 5-1.

Table 5-1: Employment Intensities for Waste Management Routes

Type	Waste Destination	Number of FTEs per 1000 tonnes waste
Residual	Landfill	0.7[1]
Residual	Incineration	0.7[1]
Recycling	Glass	0.8
Recycling	Steel	5.4
Recycling	Aluminium	11.0
Recycling	Paper / board	1.8
Recycling	Plastic	9.3
Recycling	Wood	0.8
Recycling	Other	9.3

Notes: 1. Includes 0.6 FTEs for residual waste collection (0.1 FTEs for disposal)

[441] Eunomia (2015). *Further development of the European reference model on waste generation and management*, Report for DG Environment

5.2 Reuse

The approach to deriving employment assumptions for reuse schemes is described in Section 3.4.1. Based on this methodology, the employment unit assumptions used for modelling are presented in Table 5-2.

Table 5-2: Employment per Million Packaging Uses, FTEs

Reuse system type	Retail staff (for reusable container return)	Transport/ Collection	Handling / Washing / Refurbishment	Administration	Total
B2B	-	36.8	2.0	0.3	**39.1**
B2C: Return on the go	0.2	0.3	0.1	0.02	**0.6**
B2C: Return from home	-	10.6	1.3	0.2	**12.1**

APPENDIX E – STAKEHOLDER SYNOPSIS REPORT

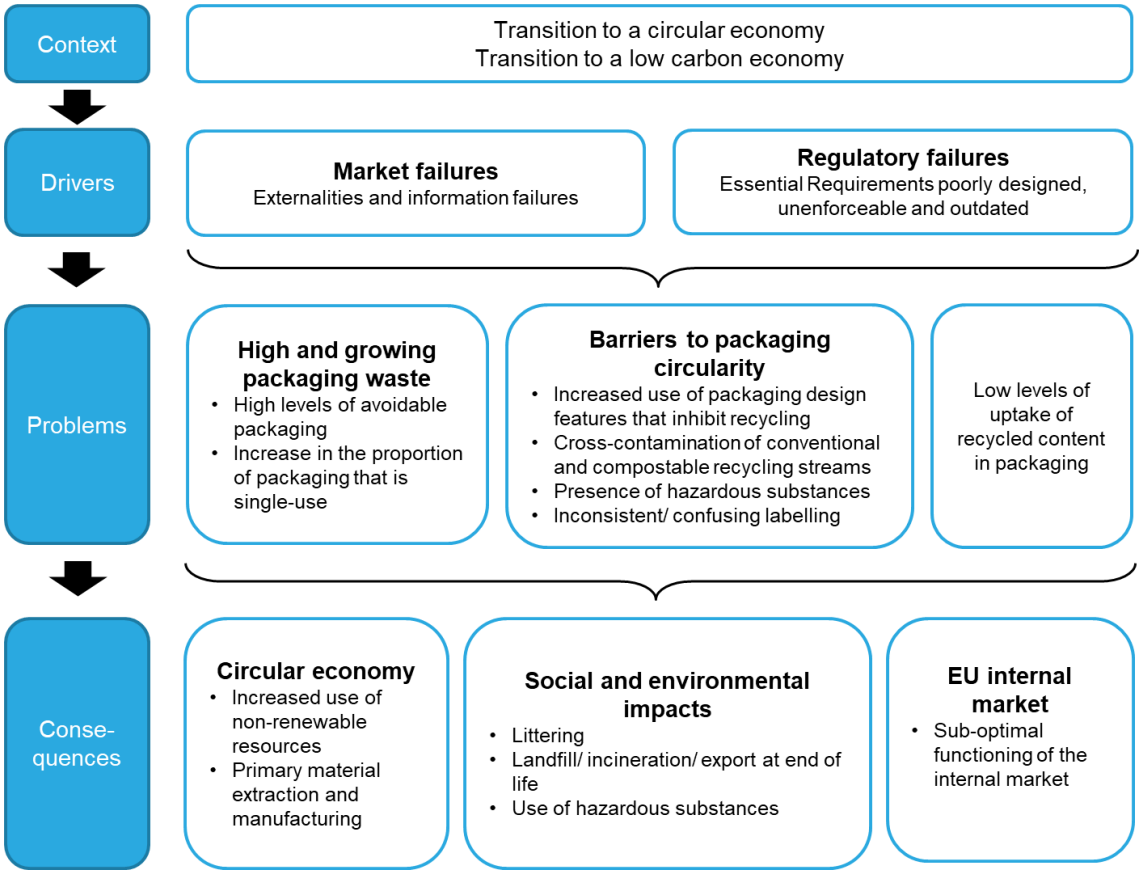
1.0 Outline of the consultation strategy

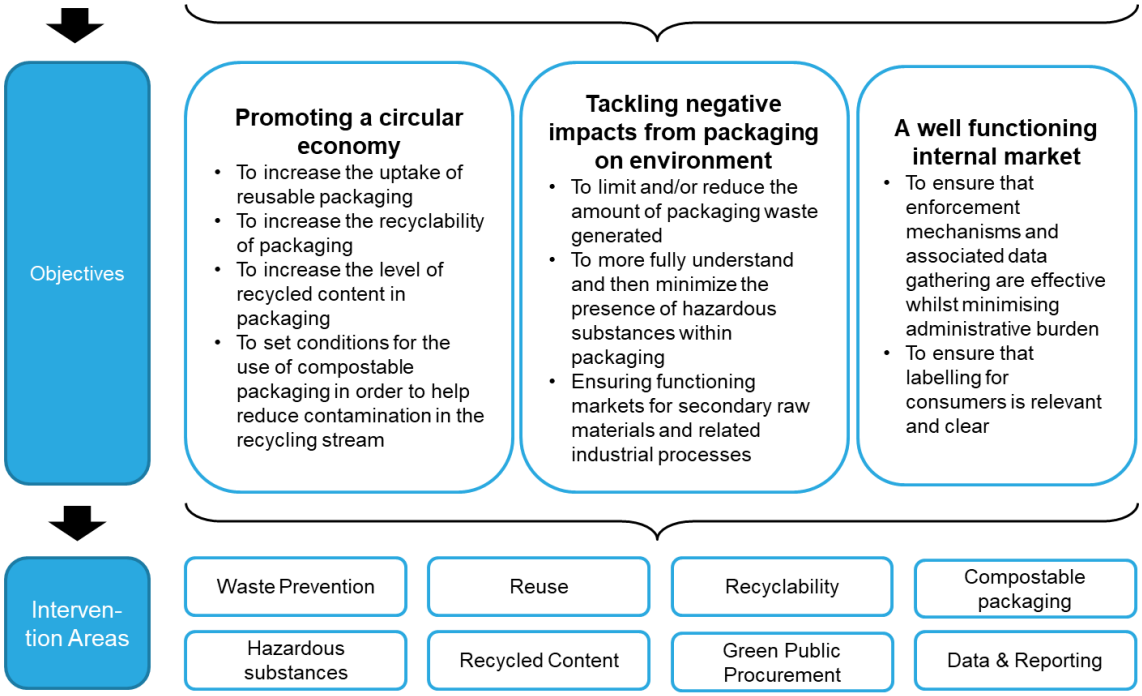
Stakeholder consultation is one of the most important deliverables of this impact assessment. In total, **over 800 unique organisations** were engaged with **more than 1,800 contact points**. Stakeholders were consulted through a combination of both public and targeted methods: inception feedback, public questionnaire, Member State questionnaire, online workshops and webinars, and one-to-one interviews. In order to have the greatest impact on the overall synthesis report, the main objectives of the consultation strategy were to:

1. Understand stakeholder views with regards to the problem definitions;
2. Provide input on the identification of measures;
3. Gather specific data required to support the construction of the Business as Usual Scenario.
4. Refine our forward projections (as part of the Business as Usual Scenario) by sense-checking key assumptions with stakeholders;
5. Provide detailed data on costs and benefits for the impact assessment CBA model;
6. Gather views on other impacts assessed in a qualitative manner; and
7. To ensure transparency in the study and encourage representation of a wide range of views from relevant stakeholders.

Particular emphasis was placed on the final of these objectives as the PPWD has garnered a lot of interest and debate among different stakeholders. As well as providing stakeholders with the freedom to comment on the issues that most concern them, the consultation strategy retained a focus on the eight intervention areas (Figure 1-1). Accordingly, this synopsis report is structured by those eight intervention areas. Prior to these intervention areas, the specific consultation tools and methods that were used throughout the strategy are explained in more detail.

Figure 1-1 Intervention logic diagram (continues next page)





Due to the large amount of interactions with stakeholders, a process inbox was setup (ppwd_ia@eunomia.co.uk) to allow for a consolidated point of contact for stakeholders and ease of response (and back-ups) by the project team.

2.0 Selected consultation methods and tools

As alluded to in Appendix E, a range of consultation methods were used throughout the impact assessment. Due to the nature of the intervention areas, some consultation methods were deemed more suitable than others. For example a targeted questionnaire was sent to the Member States with regards to GPP because these are the most relevant stakeholders in this intervention area.

The approach taken was tailored to get the most relevant information out of the key stakeholders. Organisations that are directly involved in each intervention area were invited for one-to-one interviews so as to harness their industry knowledge and to understand how they will be affected by the proposed amendments to the PPWD. For example, Flexible Packaging Europe were selected for interview on recyclability whereas Coca Cola Europe were interviewed on data, reporting and enforcement. Full details of the relevant stakeholders targeted are provided in the relevant intervention logic sections of this report.

The following sub-sections (2.1 to 2.7) detail each consultation method individually, explaining the approach used and providing a broad overview of the stakeholder groups engaged.

And in the following sections (2 to 10) the main findings within each intervention area have been summarised. In addition to providing an overview, specific reference has been made to individual responses from organisations where these have been deemed particularly relevant to the impact assessment. Where available and appropriate, tables and figures detailing key responses from the participants have been included.

2.1 Roadmap/Inception Impact Assessment

The project roadmap, as outlined in the Inception Impact Assessment (IIA), was published on the Commission's website on 11 June 2020.[442] The feedback period ran until 06 August 2020 and received 110 responses. The IIA was composed of four main sections:

- Context, Problem Definition and Subsidiarity Check;
- Objectives and Policy Options;
- Preliminary Assessment of Expected Impacts; and
- Evidence Base, Data Collection and Better Regulation Instruments.

For each section, a brief overview was provided to inform citizens and stakeholders of the planned impact assessment and to allow them to provide feedback at an early stage. Of the 110 respondents, 80 (73%) were business associations or company/business organisations, 12 (11%) were non-governmental organisations (NGOs), and the remaining 16% was made up of a variety of stakeholder groups including public authorities, EU citizens, and consumer organisations (Figure 2-1: Valid feedback instances by stakeholder groupFigure 2-1).

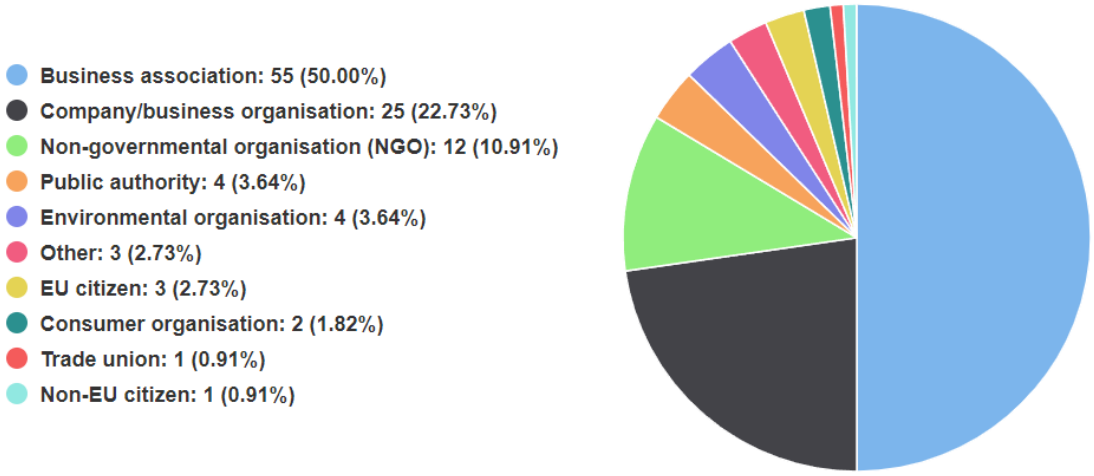
Looking at the countries of the respondents in Figure 2-2, Belgium had by far the biggest share with 34 (31%). They were followed by Germany with 19 (17%) and Netherlands with 11 (10%).

[442] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12263-Reducing-packaging-waste-review-of-rules_en

In total, 19 countries responded to the IIA, of which 17 were in the EU and the remaining 2 were the UK and the US.

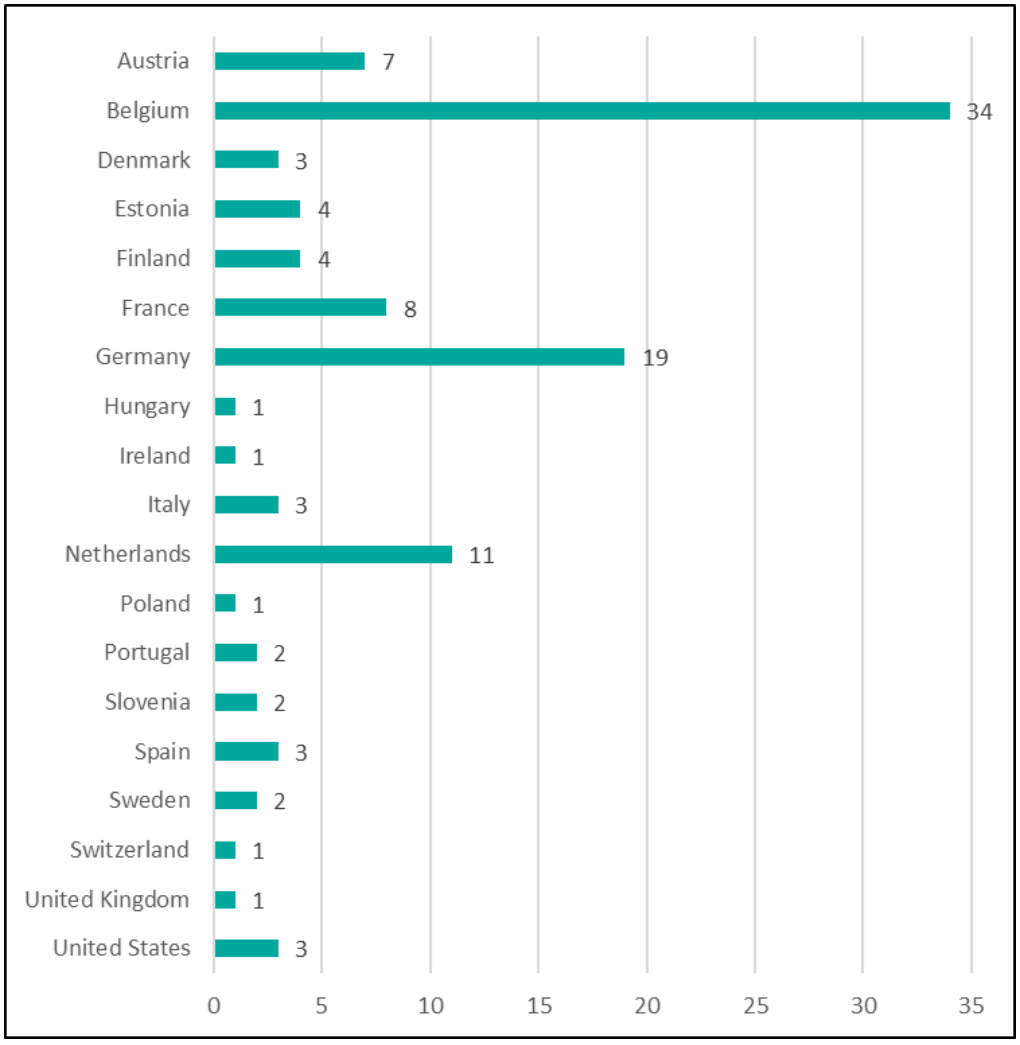
The responses to the IIA and the conclusions drawn from the feedback process are discussed in detail in the relevant sections of this synopsis report.

Figure 2-1: Valid feedback instances by stakeholder group



Source: European Commission inception impact assessment feedback

Figure 2-2: Valid feedback instances by country



Source: European Commission inception impact assessment feedback

2.2 Online Public Consultation

Public consultations are used to allow members of the public to express their views on the scope, priorities, and added value of EU action for new initiatives, or evaluations of existing policies and laws.

The PPWD online public consultation (OPC) questionnaire was developed using the EU survey tool. Before being uploaded to EU survey, it was made available in 24 official languages. It was launched on the 30th of September 2020 for a period of 12 weeks, closing on the 6th of January 2021. In total, 425 stakeholders participated in the OPC.

The OPC questionnaire was structured in three parts:

- **Personal information:** in this section, participants were asked a series of questions about themselves and the capacity in which they were responding to the consultation;
- **Questions to the general public:** in this section, participants were asked to provide their general opinions on packaging from the perspective of a member of the public; and
- **Questions to expert stakeholders:** in this section, expert stakeholders were asked to provide their views on a range of policy and operations objectives, policy measures, potential research and development opportunities, and the impact of COVID-19.

Participants were asked a mix of quantitative and qualitative questions. In addition, they were given the opportunity to upload a supporting position paper at the end of the questionnaire should they wish to do so.

In line with the European Commission's accessibility guidelines, Eunomia designed all figures to be interpretable by readers who are colour blind and/or are using a black and white display. The pattern and colour combinations have been selected for their easy distinction from one another, enabling interpretation regardless of accessibility needs.

2.2.1 Overview of the participants

At the beginning of the questionnaire, within the "Personal information" section, stakeholders were asked a series of questions about themselves and the manner in which they were contributing to the consultation. This included questions about:

- The **capacity** in which they were responding. For example, as a citizen or on behalf of a public authority;
- The **sector** whose interests they were representing. For example, packaging manufacturer or waste management;
- The **size** of their organisation; and
- Their **country** of origin.

The responses gained showed a significant spread of representation from almost all stakeholder groups. The following section explores the OPC's key findings and outlines the breadth of engagement it received. Crucially, it also highlights any stakeholder groups that were found to be underrepresented.

2.2.1.1 Capacity

For this question, participants were given a range of 11 potential answers to select from, including an "Other" category for those who felt the capacity of their response was not represented in the available answers. Table 2-1 displays the spread of the responses received.

Table 2-1: Question: I am giving my contribution as…

Answering options	No. of responses	%
Academic/research institution	6	1.4%

Answering options	No. of responses	%
Business association	112	26.4%
Company/business organisation	130	30.6%
Consumer organisation	4	0.9%
EU citizen	119	28%
Environmental organisation	6	1.4%
Non-EU citizen	0	0%
Non-governmental organisation	25	5.9%
Public authority	13	3.1%
Trade union	0	0%
Other	10	2.4%

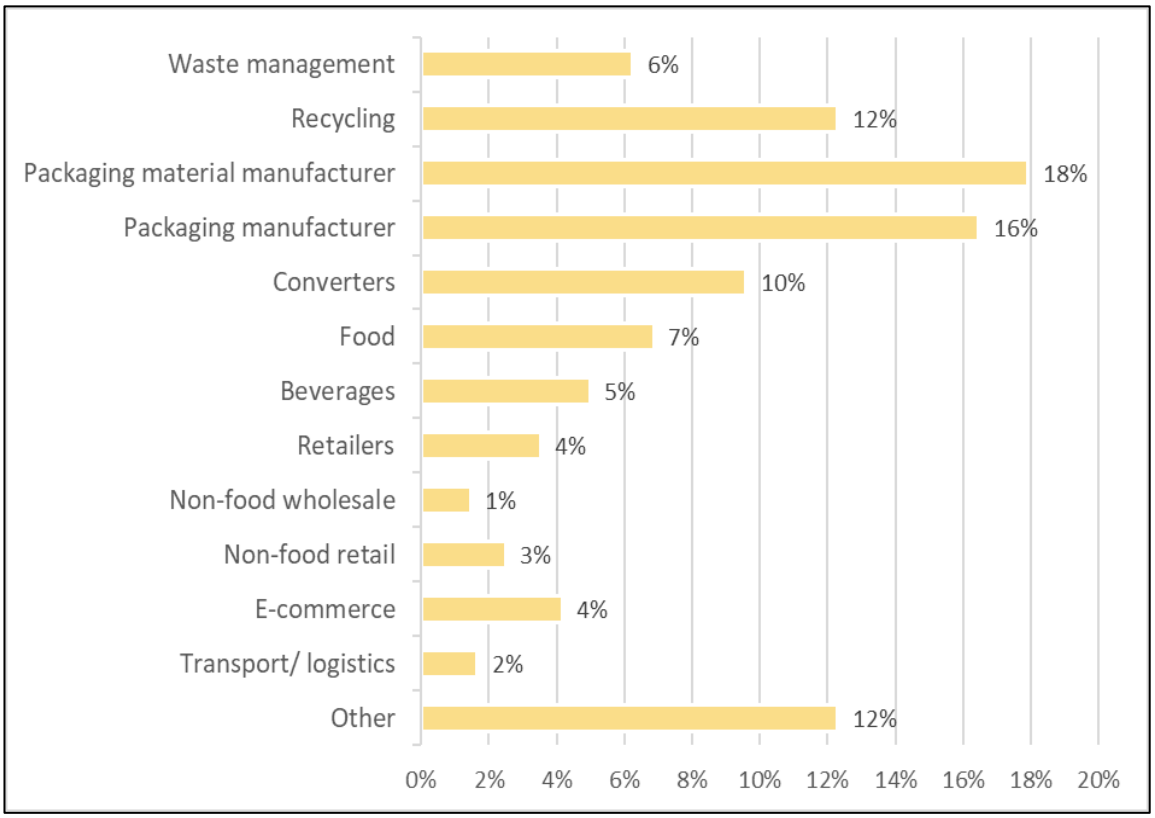
Source: Question: I am giving my contribution as... Valid responses: 425

As can be seen from the responses, with the exception of non-EU citizens and trade unions for which there were no responses, there was good representation from all key stakeholder groups. The most well-represented stakeholder group was "Company/business organisation". In total over 30% (130) of the 425 participants selected this response. Additionally, 28% (119) of participants responded as an "EU citizen" and 26% (112) on behalf of a "Business association".

2.2.1.2 Sector

In this question, participants were given a list of 13 sectors including an "Other" option for those who felt their sector was not represented in the list and preferred to self-describe. A summary of the responses can be seen in Figure 2-3.

Figure 2-3: Question: What is your area of activity/what is the sector whose interests you represent when responding to the questionnaire?



Source: Question: What is your area of activity/what is the sector whose interests you represent when responding to this questionnaire? Valid responses: 239

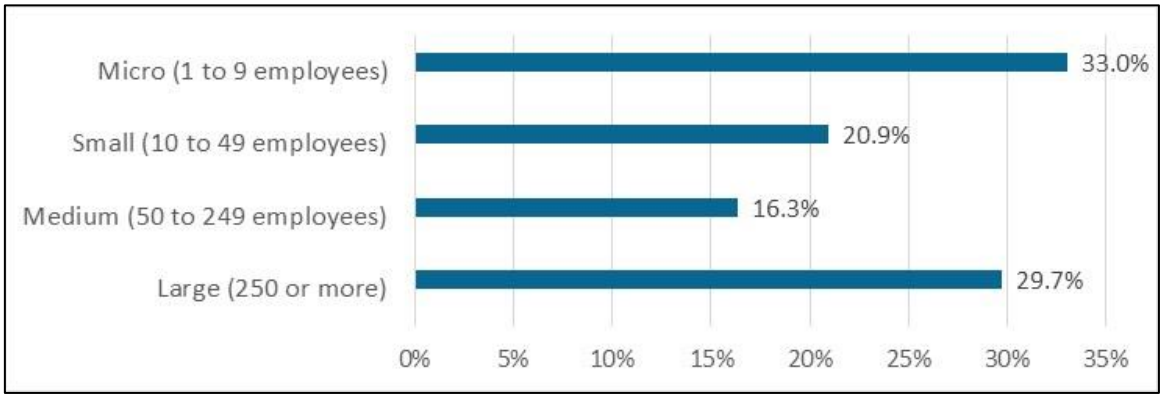
In total, 239 participants provided answers to this question. Of those, 18% (86) indicated they were representing a "Packaging material manufacturer", 18% (86) selected "Packaging manufacturer", and 12% (29) said they were representing organisations within the "Recycling" sector. The high percentage of participation from stakeholders within these sectors is expected given that they are likely to be most significantly impacted by any changes to the Packaging and Packaging Waste Directive.

In addition, 12% (59) of participants selected "Other" and qualitatively identified the sector they represented. Answers included: manufacturers of other goods (for example, toys, cosmetics, and medical products), representatives from Extended Producer Responsibility (EPR) schemes, and organisations within the chemical industry.

2.2.1.3 Size

Participants were then asked to provide information regarding the size of the organisations they were representing. They were given four options ranging from "Micro (1 to 9 employees)" to "Large (250 or more)". Whilst answering this question was not compulsory, 306 of the 425 participants chose to do so. Of these, most (33% - 101) were representing "Micro (1 to 9 employees)" organisations, but a similar number (30% - 91) were representing "Large (250 or more)" organisations. A summary of the responses can be seen in Figure 2-4.

Figure 2-4: Question: Organisation size



Source: Question: Organisation size. Valid responses: 306

2.2.1.4 Country

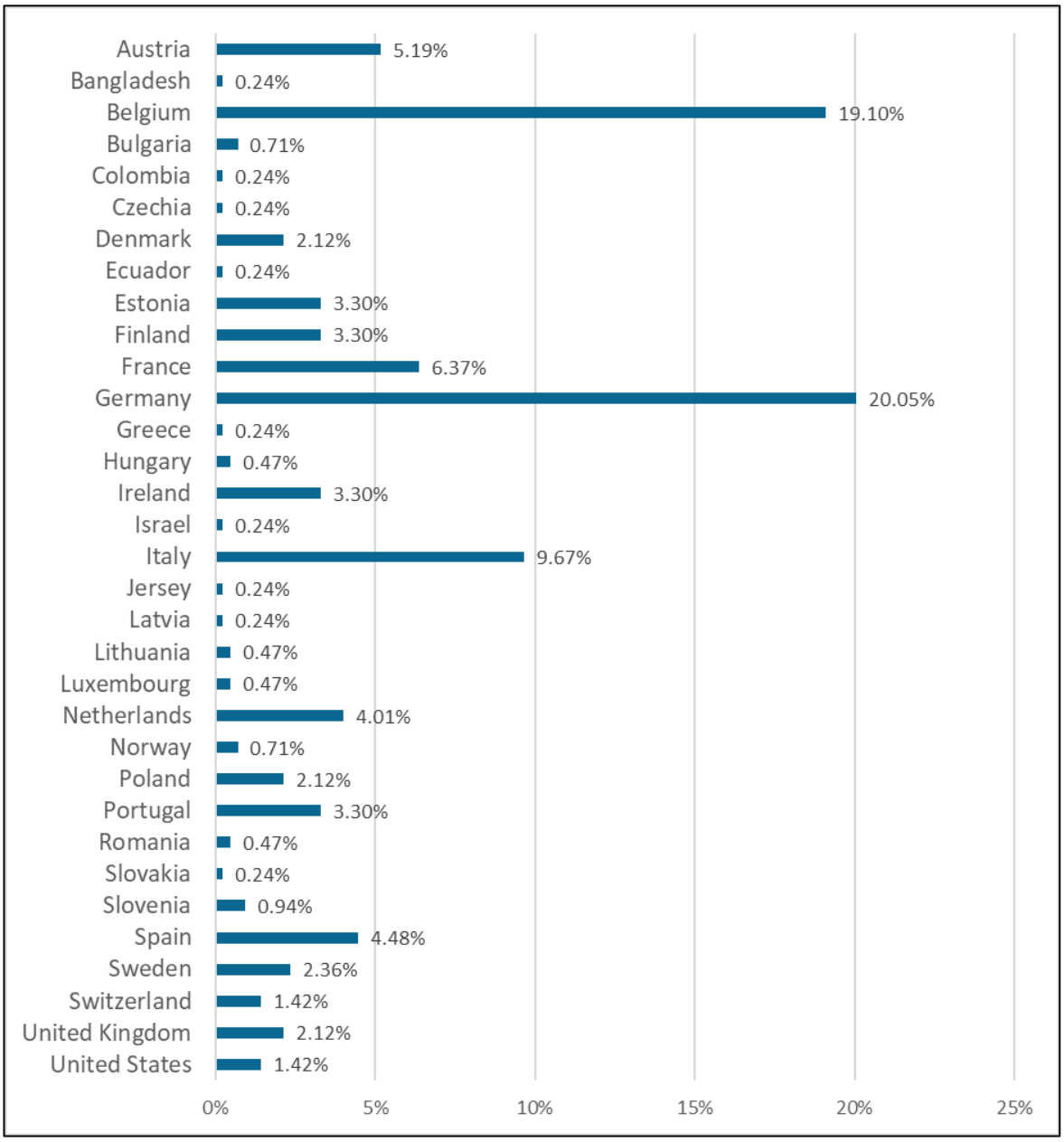
In this question, participants were asked to indicate their country of origin, or that of their organisation. In total, 33 countries were represented including 24 of the 27 EU Member States. The three Member States who were not represented by the stakeholders were Croatia, Cyprus, and Malta. The results can be seen in Figure 2-5.

Two countries were particularly well-represented in the responses to the questionnaire. These were Germany, accounting for 20.0% (85) of all participants, and Belgium, accounting for 19.1% (81) of all participants. The level of engagement from these countries is to be expected because:

8. There is a high level of interest in, and emphasis on, packaging recycling in Germany; and
9. The European Commission is located in Brussels, Belgium, which is also the home of many industry associations and European brand head offices.

Following these two countries, the next best-represented countries were Italy with 9.6% (41), France with 6.4% (27), and Austria with 5.4% (23). The remaining countries were each represented by less than 5% of the stakeholders.

Figure 2-5: Question: Country of origin



Source: Question: Country of origin. Valid responses: 425

2.2.1.5 Underrepresented stakeholder groups

When designing the responses available to participants during the "Personal Information" section of the questionnaire, careful consideration was given to the key stakeholder groups from whom feedback was desired. Therefore, in this context, lack of representation has been identified to be any instance in which an available answer has not been selected by a single participant. This helps to limit the boundaries of "lack of representation" to only include relevant stakeholder groups. Furthermore, representation from nationalities has only been considered at individual country level for Member States. Therefore, non-EU countries with limited or no representation have not been included in the following lists.

Whilst the answers provided by the participants highlighted that most stakeholder groups were included within the questionnaire responses, groups with a lack of representation have been recognised as:

- Organisations identifying as "Trade unions";
- Those originating from Croatia, Cyprus, or Malta; and
- Citizens from outside of the EU.

In addition, stakeholder groups with minimal representation have also been identified. Here, the term minimal representation has been nominally defined as an option selected by 1% or less of those who responded. These stakeholder groups include:

- Organisations identifying as "Consumer organisations";
- Organisations within the "Non-food wholesale" sector; and
- Those originating from Greece, Latvia, Lithuania, Luxembourg, Slovakia, or Slovenia.

2.2.2 Identified campaigns

The involvement of interest groups was visible in the results of the consultation. Unlike some other public consultations (for example, the online public consultation on the Zoos Directive[443]), there was no clear evidence of campaigns where a non-government organisation (NGO) or similar group had published recommended answers for members of the public to use in their responses. The organised answers identified in this consultation were almost exclusively used by business associations, company/business organisations, and NGOs themselves. This, coupled with a lack of publicly available evidence on any of the involved parties' websites to suggest otherwise, implies that the conversations conducted in order to establish campaign answers happened behind closed doors.

There were 18 opportunities for stakeholders to provide qualitative responses to the questions. For 11 of these there was some evidence of co-ordinated answers. Where repeated answers were identified, the response has been incorporated into the overall findings. However, efforts were made to ensure that such responses were not given greater emphasis than others.

2.3 Member State Questionnaires

Part of the data gathering process included a questionnaire. The aims of the questionnaire were as follows:

- To seek views on areas of public procurement which represent the highest priority for inclusion of additional packaging criteria;
- To seek views on particular product categories where mandatory requirements on packaging in public procurement might be particularly impactful and suitable; and
- To gain an understanding of any developments across Member States regarding GPP criteria for packaging.

[443] https://ec.europa.eu/environment/consultations/REFIT-Zoos-Directive_en.htm

The questionnaire was sent in November 2020 to 15 Member States: Austria, Belgium, Czechia, Denmark, Estonia, Germany, Hungary, Italy, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and in addition to UK/Wales/WRAP. Each questionnaire was addressed to:

- The Commission GPP Advisory Group;
- The Commission Expert Group on Waste (Packaging);
- The Commission Government Experts Group on Public Procurement; and
- The Commission Stakeholder Expert Group on Public Procurement.

The questionnaire was presented on a Microsoft Word document which began with a brief project background - including the GPP policy context. This was followed by 5 questions, each requiring detailed qualitative responses within pre-defined boxes. Following the questions, contact details of relevant personnel were requested. Upon completion, respondents were asked to return the document via email and attach any accompanying documents.

2.4 Workshops

Three online workshops were conducted as displayed in Table 2-2 below. In each event, an agenda and a background paper were circulated in advance, and participants provided feedback during and after the workshop.

Table 2-2 Characteristics of the workshops

Date	Intervention area	Contents	Number of participants
May 2020	Mainly Waste Prevention	Problem definition and longlist of measures	146
November 2020	Recycled Content	Problem definition, measures and impacts	349
January 2021	Waste prevention	Shortlisted measures and impacts	51

2.4.1 May 2020

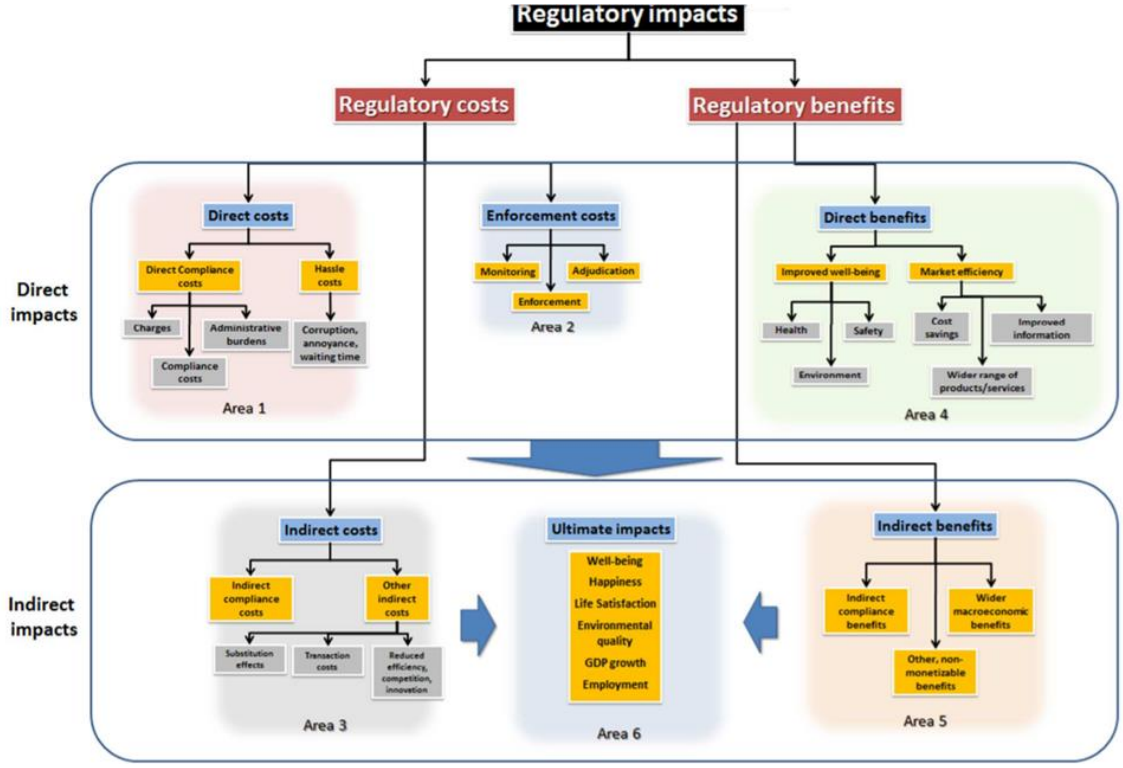
146 participants attended this first workshop which had three sessions:

- In the first session stakeholders were asked to discuss and record potential policy measures relevant to the prevention of waste and increasing the use of reusable packaging. As an output, 27 measures were identified which were added to the Longlist of Measures.
- In the second session stakeholders were asked to discuss how a particular measure (taken from those previously identified by the project team) may be implemented. Groups were given a pre-selected measure and recorded their opinions on how it could best be scoped, specified, what level it should be applied at and who the target of the measure was.

- In the **third session** stakeholders were asked to brainstorm the advantages and disadvantages of measures identified by them during the workshop. The aim was to capture the unintended consequences of measures, including co-benefits, challenges, issues and barriers.

Finally there was a follow-on session on **impact mapping**. A link to an online document was set to the participants of the workshop. This follow-up task allowed participants to record views regarding possible impacts associated with waste prevention measures. The following diagram is part of the European Commission's Better Regulations Guidelines and was used to frame the task.

Figure 2-6 Regulatory impact mapping guidelines



Souce: https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-58_en_0.pdf

Participants were asked to add comments and the specific type of impact related to packaging waste prevention measures that they believed would arise from the type of measures discussed at the workshop. Since the inputs are applicable to all intervention areas, these are display in Table 2-3 below.

Table 2-3 Inputs from stakeholders on impact mapping

Impact Type	Description of Impact Relating to Packaging Waste Prevention Measures
Compliance cost	Cost of updating packaging manufacturing facilities

Impact Type	Description of Impact Relating to Packaging Waste Prevention Measures
Assessment costs, especially for SMEs	Costs of assessing the external impact of an existing or new packaging solution. Every company should do a mandatory gate-to-gate LCA for their product. PEFs are much too expensive for SMEs. There should be a 2nd SME impact assessment of the legal trajectory, after the trilogue.
Indirect benefit: improved sea life	Improved sea life due to less microplastics entering the oceans. This impact should be included in the eco-modulation of fees, and monitored
Indirect benefit:Reduced littering	This should be an indirect impact of improved packaging solutions, which should lead to less packaging, and packaging which is better collected. Improved monitoring of littering this is crucial. Littering data is still insufficient. It is highly important because of the negative impact of litter on nature, the environment, and biodiversity.
Direct benefit: Reduction of packaging volume	EY reports that eco-modulation of fees has already reduced the volume of packaging streams. This should be a target, incentivised and monitored.
Direct benefit: Reduction of toxic additives by better alternatives or different packaging solutions	eco-modulation of fees should target this, incentivise, and it should be monitored
Indirect benefit: job creation	Reuse, redesign and recycling generate much more jobs than landfilling or incineration
Indirect benefit: green SMEs will see their markets grow	Green SMEs and startups which are now struggling with the lack of demand for circular products and services, will finally start growing more rapidly as eco-modulated fees change the market
Regulatory benefit: simple market-based system does the job	Once the existing EPR systems have been transformed into an EU wide harmonised system with science-based eco-modulation, including enforcement by independent third parties with high fines, the need for detailed, complicated regulations and bans will be less. The market will innovate towards low-carbon circular solutions

Impact Type	Description of Impact Relating to Packaging Waste Prevention Measures
Direct impact: recycled content increase	This should be targeted, incentivised, monitored
Indirect impact: product/ food loss	The impact assessment should consider the product loss that may derive from the shift to some of the packaging waste prevention measures
Direct benefits: CO2 Reduction/Environmental Quality GDP growth Employment	Mandatory LCA, Eco-Design and eco-modulated EPR fees would stimulate investment in and innovation of fully recyclable packaging formats along with the use of secondary materials
CO2 / GHG impact	Ultimately any measures should be based on an impact assessment that considers the CO2 footprint impacts
Direct Cost:Higher Cost of product sold	Higher Cost of product sold Reusing system costs will be included in the cost of the product(such as higher power, water and detergent consumption) with negative impact on final consumers
Indirect costs (Food waste)	The impact assessment should consider food waste/product waste arising from packaging reduction or from transition to reuse models (e.g. implication on food waste of bulk sales)
Indirect costs: Food Waste	The introduction of reusable food packaging generates food waste and limits the availability of food where it is not produced. wherever is needed and it must be portioned according to consumer needs food waste impact is worse than packaging waste
Indirect Cost: Job Loss	Specific Ban or Restrictions in disposable food packaging may generate social costs for unemployment by limiting on-the-go consumption and home-delivery. The entire supply chain will be seriously affected, including fast food operators, machine equipment and furniture industries, packaging suppliers, distributors, livestock and agriculture industries for hundreds of thousands people

Impact Type	Description of Impact Relating to Packaging Waste Prevention Measures
Indirect Cost: Health and Safety costs	Banning or reduction of food service disposable packaging will lead to greater persistence and circulation of foodborne pathogens. EU public health cost and lost productivity for just one foodborne pathogen has been estimated by EFSA at 2.4 Billions/year.
Indirect Cost. Environmental impact	Growth of reusable packaging will generate increase in potable water and energy consumption and detergents pollution (with additional costs for water treatment) Further to the above costs the need of dishwashing high volumes of reusable packaging, bringing them to dedicated locations, will generate significant additional logistic costs
Indirect Cost: Time cost	Increased time (and time is a cost) for people to: collect - store - clean - bring back...
Indirect Cost: impact on EU citizens freedom	Bans or restrictions on single use food packaging will limit EU citizens options and variety of choice, subsequently deteriorating quality of life and personal freedom. This will bring to a poorer system with a potential consumption reduction
Indirect impact: reduction in R&D investments	Bans and restrictions on specific materials/packaging will reduce the efforts and investments in innovation related to the specific material/packaging
Indirect cost: impact on Circular Economy	Bans and restrictions on materials/packaging which can be properly recycled will reduce the critical mass needed for an effective and efficient recycling and subsequently increasing the recycling costs. This will also contradict the Circular Economy Principles
Indirect Benefit: Ecodesign	The regular application of the Ecodesign Model will bring to a reduction of the overpackaging, to an overall reduction of packaging weight and to an increased availability of material for recycling in line with the Circular Economy targets

Impact Type	Description of Impact Relating to Packaging Waste Prevention Measures
Direct benefit: EU leadership in waste management for all kind of materials, even complex ones	To motivate implementation of Best Available new Technologies for sorting and recycling
Direct benefit: less packaging waste generation	Promotion of lower rates packaging-to-product based on plastics functionality
Indirect Benefit: Focus on recycling	Focus on recyclability targets rather than bans or restrictions will push for: 10. Improved and more available recycling streams 11. Boost in R&D and innovation activities on new materials/packaging 12. Sustain consumer education against littering and better sustainable waste management
Direct benefit: Compensation of population increase and demand	Light-weight materials compensate the increased demand without generating increase of waste
Indirect cost: Higher costs for waste management due to increased amounts	Criteria of EPR is only focused on recyclability. To consider also functionality that reduces amount of waste and GHG emissions

2.4.2 November 2020

The workshop focused specifically on the potential for increasing the uptake of post-consumer recycled (PCR) content in packaging, as one of the key areas identified by the Commission for development of measures within the scope of the study. The workshop involved representatives from across the packaging value chain, from material and packaging producers to brands, as well as non-governmental organisations. It was an opportunity to gather input from stakeholders regarding the development of key definitions and potential measures to be scrutinised and assessed more closely in the final impact assessment.

The workshop comprised of an introductory presentation to the study and initial findings by the research team, setting out the problem definition, the proposed measures to address the

problem, and the likely impacts associated with those measures. The participants were then divided into six groups to discuss these aspects and to gather input on each of the topics.

2.4.3 January 2021

This workshop focused specifically on the potential for preventing the generation of packaging waste, as one of the key areas identified by the Commission for development of measures within the scope of the study. The workshop involved representatives from across the packaging value chain, from material and packaging producers to brands, as well as non-governmental organisations. It was an opportunity to gather input from stakeholders regarding the development of key definitions and potential measures to be scrutinised and assessed more closely in the final impact assessment.

The workshop comprised of an introductory presentation on the topic of waste prevention, followed by a presentation of the suggested measures that sought to define over-packaging, implement waste prevention targets, and address cases of excessive packaging and avoidable packaging.

In each session a brief overview of the proposed measures was given, including the key considerations in the design of each measure. The participants were divided into four groups to discuss each of the presented measures in their breakout groups. Participants raised their suggestions for the design of the measures, as well as indicating their broad agreement, or disagreement, with the rationale for including the measure in the impact assessment. The participants were also invited to suggest additional measures not included in the presentation.

After the workshop 23 email responses were received with further comments and position papers.

2.5 Webinars

In June 2021, a series of webinars were hosted by Eunomia to present the interim results of this study to a range of relevant stakeholders. It also gave the stakeholders a chance to provide feedback on the measures being considered. In total, there were six webinars, one for each of the following topics:

- Compostability;
- Recyclability;
- Overarching measures: GPP, hazadousness and data & enforcement);
- Recycled content;
- Waste prevention; and
- Reuse.

Over 250 organisations participated in the June webinars and almost 100 provided detailed feedback. The stakeholder groups in attendance varied slightly between the webinars; 40-45% of participants were industry associations, 9-14% were Member States, 9-11% were packaging manufacturers, and the rest was largely made up of a combination of chemical companies, brands, EPR organisations and NGOs.

For each webinar, an agenda and briefing paper were shared in advance and the slides afterwards. During the webinar, each intervention area lead presented a summary of the problem definition, the description of the measures, and the preliminary impact assessment of

each measure. Time was allowed for questions and interventions but with an average participation of 120 attendees for each webinar, only a small selection of stakeholders could contribute directly. Thus the majority of the feedback was provided after the webinars via a feedback form which also allowed uploading separate documents such as reports and position papers. These webinars generated a lot of interest and the slides presented continue being shared upon request even months afterwards.

2.6 One-to-one Interviews

One-to-one interviews provide a valuable way of gaining insight into an individual's views and experiences of a targeted subject. The interviews supplement the data obtained from the other consultation methods to feed into the recommendations. Throughout the course of the study x interviews were organised with targeted stakeholders in order to ascertain how the problems and measures should be developed, the impacts of the measures and to further explore various case studies.

Stakeholders were selected according to a number of criteria such as availability, representation, expertise and insights, etc.

2.7 Other engagements

Asides from the previous six engagements, other *ad hoc* events place took place, in order to present, discuss, consult and align the different steps along the study:

- Meetings with other DGs of the European Commission: DG JUST and DG GROW;
- Meetings with Circular Plastics Alliance (CPA);
- Presentation at the EU Circular Talks.

3.0 Waste prevention and e-commerce

3.1 Roadmap/Inception Impact Assessment

Stakeholders expressed their opinions on waste prevention initiatives, methods to tackle excessive packaging, views on the use of restrictions, bans and reduction targets, the definition of "overpackaging", and how to reduce e-commerce plastic. Some stakeholders also provided information on lightweighting in the industry.

3.1.1 Waste prevention and tackling excessive packaging

3.1.1.1 In support

Several stakeholders agreed with the need to introduce new measures to prevent packaging waste, to ensure packaging is only used when strictly necessary, and to reduce the use of secondary packaging. Any new initiatives should encourage relevant innovation and respect progress already underway.

A.I.S.E. supported the revision of existing requirements for packaging and FPE called for performance-based, rather than prescriptive, essential requirements to ensure that legislation encouraged continuous improvement in packaging design, collection, sorting and recycling technologies, and infrastructure.

EuroFer commented that waste prevention measures should be harmonised, or aligned as much as possible, across MS. FPE pointed out that lightweight packaging was a key part of the solution, given that flexible packaging represented only 5% by weight of all packaging put on the market, and had a packaging-to-product ratio up to 5 times lower than other packaging types.

The following were some of the initiatives proposed by stakeholders to prevent waste and tackle excess packaging:

- **Delocalised packaging** whereby the product is imported into Europe with minimal packaging to ensure its protection, but then final packaging takes place within Europe to sell on the market using recycled packaging materials (SUEZ);
- **Quantitative prevention criteria** with clear and enforceable rules to prevent excess packaging. For example, this could be a maximum ratio between the volume of the packaging and the volume of the packed product (ANEC);
- **Shortening value chains** to reduce food packaging, food value chains must be shortened (The Austrian Chamber of Commerce);
- **Dialogue between suppliers and consumers** of each product is essential to discuss the extent to which packaging minimization was possible (Aarhus); and
- **Consumer information campaigns** on how to reduce consumer packaging waste, the benefits of reuse, and the externalities of single use plastics.

3.1.1.2 Raising concerns

Several stakeholders commented that, whilst it was important to minimise all plastic use, care must also be taken to not compromise the functionality of both the packaging and the product, given that changing the specifications and amount of packaging could have an influence on its quality, properties, hygiene and safety. Med Tech Europe stated that any new revisions to the PPWD that could reduce the amount of packaging needed to account for any impacts on the

safety and availability of devices and diagnostics. EDA stated that, for the dairy industry, establishing reuse systems and shifting towards certain reusable packaging types was a delicate issue from a hygiene perspective.

Stakeholders also expressed their concerns that setting product packaging ratios and increasing the product/packaging ratios could lead to larger product portions. This is key as it would not align with the EU's ambitions to promote healthier diets and could increase the amount of food waste.

EuroPen stated that it was only "packaging waste sent to final disposal (which) does not create further value from a circular economy standpoint" and that therefore only this packaging waste "should be used as baseline for considering further waste prevention measures." However, it must be noted that this is not in line with current thought leadership, as it ignores the fact that packaging materials need to be produced and that even secondary material use creates some manufacturing impacts. This is why the focus is not just on reducing residual packaging waste, but also on reducing recyclable and reusable packaging.

3.1.2 Restrictions, bans and reduction targets

3.1.2.1 In support

There was clear consensus among stakeholders that targets should be set for waste prevention and reduction, and that any targets should respect the waste hierarchy. Several stakeholders supported setting packaging waste targets, and proposed ways these could be set. Rethink Plastic Alliance and ZERO (PT) proposed that targets should be based on the total number of single use units and kg of packaging per person per year, and that specific targets should be set for major materials, product groups and sectors (transport, food, etc). There were also calls for targets to be set for an overall reduction in plastic production by sector.

In addition, there were strong calls from multiple stakeholders for the prevention and reduction targets to be binding, for example binding targets were suggested for the total volume of packaging waste produced. EuroFer commented that the introduction of reduction targets should first focus on phasing out non-recyclable and complex packaging materials. Health Care Without Harm Europe called for a clear timeline to phase out landfill and incineration of packaging waste, and Slovenian NGO Društvo Ekologi brez meja called for penalisation of disposal via landfill or incineration.

3.1.2.2 Raising concerns

Stakeholders expressed that any restrictions imposed on packaging materials should:

- Ensure they do not hinder innovation;
- Ensure they are not being overly prescriptive on the means to meet the restrictions;
- Ensure they do not lead to certain materials getting replaced by other materials that have a higher environmental impact;
- Be accompanied by a full health, environmental and social impact assessment, and avoid unfair competitive distortions;
- Exclude recyclable single use packaging made from renewable materials (German Paper Converting Association); and
- Ensure they do not have any adverse distributional impacts on lower income groups, and that the principle of a 'just transition' must be respected (EPPA).

In addition, stakeholders expressed the following concerns with imposing restrictions and setting targets:

- Imposing restrictions for niche applications such as B2B specific applications could be difficult to achieve (AISE);
- Restrictions do not take into account the availability of viable alternatives (Freshfel); and
- The complexity of packaging materials is not always fully understood, e.g. a specific packaging format and/or material may be used for different reasons for different products (Freshfel).

Several stakeholders also expressed their concerns on life cycle assessments. Stakeholders argued that reducing packaging would be at the expense of increasing food waste which had a higher environmental and carbon footprint than packaging did. EDA urged the Commission "to take no measures that could increase food waste (even slightly)" as this would have a negative global GHG impact and violate the Commission's ambition to halve per capita food waste by 2030. IK Elipso stated that "plastic packaging and film improves shelf life of food products and therefore reduces food waste (which has a much higher unit environmental impact than packaging waste)".

3.1.3 Definition of overpackaging

Stakeholders agreed that both "underpackaging" and "overpackaging" needed to be clearly defined with established criteria. However, some stakeholders stated that certain products should be excluded from the "overpackaging" criterion. One example given by various stakeholders was multipacks, which were designed to facilitate consumer and retail transport, and helped address issues of diet and calorie intake, and food waste avoidance. PepsiCo agreed, stating that "it is important that any action targeting the reduction of overpackaging does not automatically include multipacks".

3.1.4 Reduction of e-commerce plastic

Oceana submitted their views on the importance of tackling the rise of e-commerce packaging waste caused by changes in consuming shopping behaviour and the recent COVID-19 pandemic. To tackle this problem, Oceana recommended:

- That EPR schemes should ensure e-commerce companies bear the full cost of the plastic packaging they place on the market;
- An obligation to report the amount of packaging used annually by e-commerce operations, per country and material;
- A ban on the use of non-recyclable plastic for the e-commerce industry;
- Clear industry-wide reduction goals for plastic packaging, with the goal to phase out plastic packaging;
- An obligation to implement e-commerce delivery systems based on reusable packaging; and
- An obligation to increase the information and decision power of consumers during the purchasing process.

3.1.5 Baseline lightweighting information

BDIS (German Confectionary Industry Association) and IK Elipso both reported that since the introduction of the Packaging Ordinance in Germany in 1991, which introduced mass based EPR

fees, and as a result of technical progress in the German manufacturing sector, the use of plastic packaging was now 25-35% lower than 1991. EuroFer reported that the thickness of '3-piece food cans' had decreased by 50% from the 1970s to 2010s. FPE, meanwhile, reported that flexible packaging accounted for half of food primary packaging placed on the EU market (in product units) but only one sixth of packaging material in weight.

3.2 Online public consultation

Overall, many participants highlighted that function should not be compromised in the pursuit of lightweighting. They raised that packaging is used for protection, communication, and health and safety. Stakeholders identified the need for clear guidance on reducing packaging and agreed definitions for "excessive" packaging before any bans or targets are introduced.

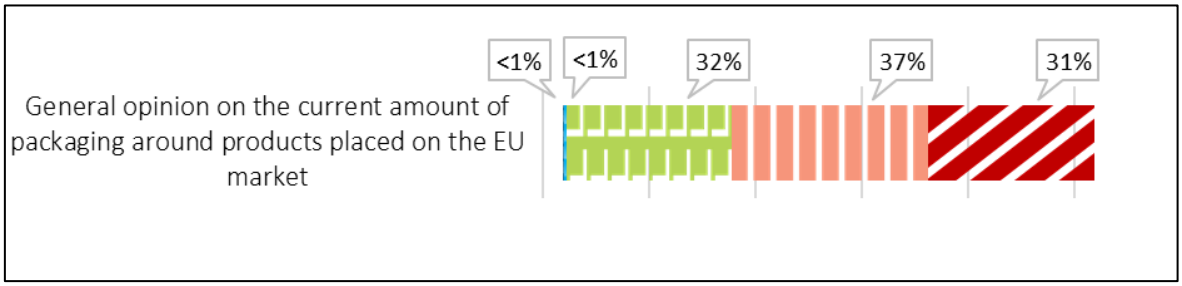
3.2.1 Definitions

Again, participants suggested that clear definitions for "overpackaging" and "underpackaging" were needed. Stakeholders highlighted that blanket bans or reduction targets could negatively affect the environmental impact of the overall product if not carefully considered. This was particularly relevant for perishable goods as without sufficient packaging, the rate of food waste would increase.

3.2.2 Avoidable packaging

Many of the participants were in support of bans for products where packaging was without function and could be avoided. Some examples identified by respondents included blister packaging, containers purposefully designed not to be refilled, and certain food packaging. Comments like this were corroborated by the quantitative responses to questions 1, 2, and 3. These questions revealed many stakeholders feel that too much packaging is used in the EU. Figure 3-1 shows that 68% of respondents think there is too much packaging in general.

Figure 3-1: Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market?



Source: Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market? Valid responses: 334

In question 2, participants were asked to indicate their opinion regarding the amount of packaging used for a range of different products. Whilst for some product streams (for example, dried foods, beverages, clothes, and shoes) most participants felts that the amount of

packaging was "just about right", for many others the responses received indicated that too much packaging is currently used. The summary of the responses for each product type can be seen in Figure 3-2.

Figure 3-2: Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items

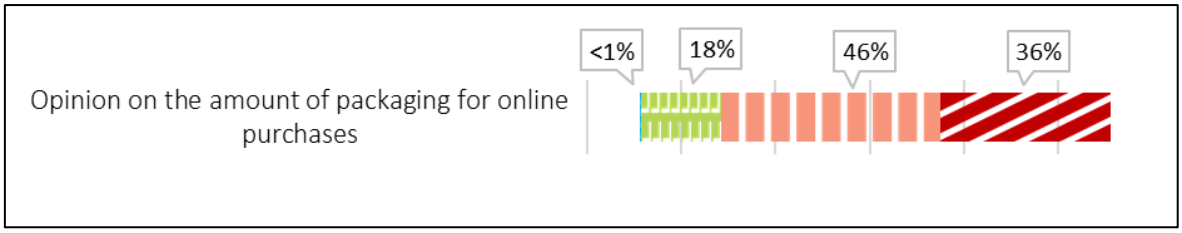
Source: Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items.
Valid responses: 261 (on average) per product

According to the stakeholders, the products of greatest concern are:

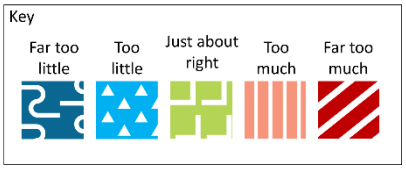
- Electronic goods including headphones, mobile phones, laptops – 81% of participants indicated that they feel there is either too much of far too much packaging;
- Children's toys – 79% of respondents feel there is either too much or far too much packaging; and
- Cosmetics – 76% of participants feel there is either too much or far too much packaging.

Furthermore, 82% of stakeholders felt that there is too much packaging used for online purchases. Figure 3-3 displays the responses received when participants were asked for their opinion.

Figure 3-3: Question 3: Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression



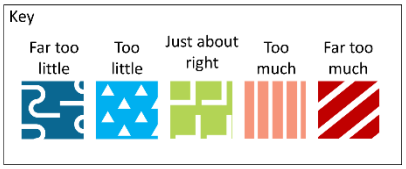
Source: Question 3: Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging.
Valid responses: 280

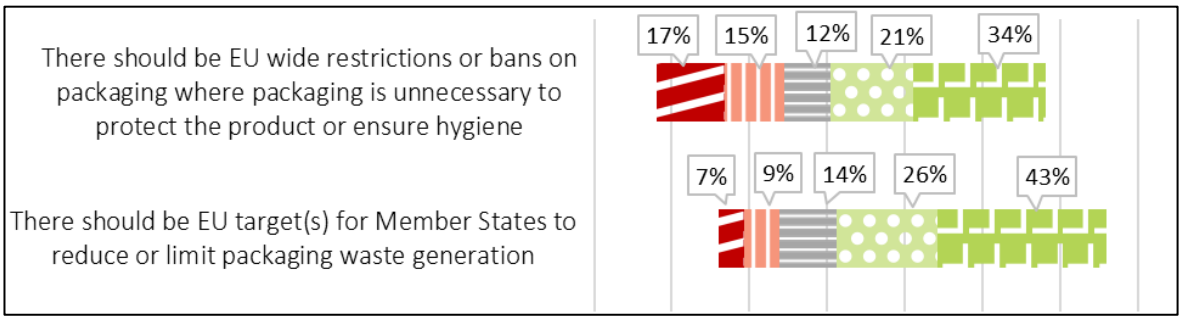


3.2.3 Restrictions and bans

Question 5 asked stakeholders to provide their views on a number of potential measures for helping to promote more sustainable (use of) packaging. Figure 3-4 displays the responses to the questions relevant to waste prevention. As can be seen, 55% of participants agreed that there should be EU-wide bans on packaging that is not needed to protect the product or ensure hygiene. In addition, 69% of stakeholders felt that there should be EU targets for Member States to reduce or limit packaging waste generation.

Figure 3-4: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?





Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?
Valid responses: 334 (on average) per product

Several participants also provided examples of products where they felt packaging was unnecessary/non-critical and should be avoided. Examples included:

- Blister packaging;
- Containers that are designed to not be refilled (e.g., disposable salt and pepper shakers); and
- Peeled and then packaged fruit.

Participants determined that, in these instances, packaging could be removed with little additional consequence and therefore it is avoidable. Other participants were eager to voice concerns regarding necessary packaging. DOW highlighted that packaging on many perishable items (e.g., food) extended product shelf-life and therefore decreased the risk of food waste.

Overall, stakeholder opinion suggests that some bans could be considered acceptable, but that they would need to be underpinned by evidence that the packaging was avoidable and/or without sufficient purpose.

3.2.4 Targets

Several participants stressed that reduction targets should not be set for all packaging items. This directly links to the need for clear definitions and the identification of applications for which packaging is avoidable/non-critical.

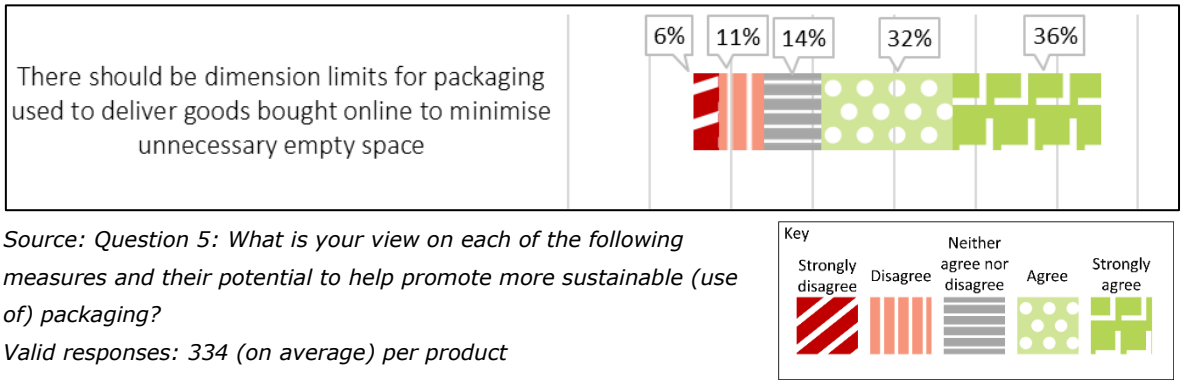
Some participants highlighted internal targets aimed at reducing excessive packaging in the short-term. Examples include:

- Aldi Sud's plan to reduce own brand packaging by 15% by the end of 2025 vs. 2020 levels; and
- L'Oréal's aim to reduce packaging by 20% by 2030 (through promoting reuse, reducing unnecessary packaging, and removing packaging entirely).

3.2.5 Dimension limits and fixed ratios

Question 5 revealed that 68% of participants felt that there should be dimension limits on packaging used to deliver online goods to minimise unnecessary space. The full responses from the participants are shown in Figure 3-5.

Figure 3-5: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?

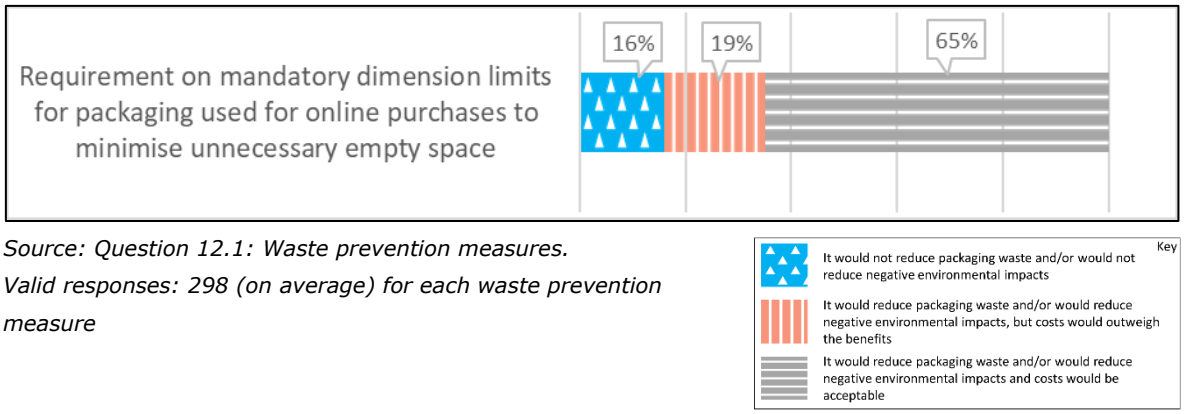


Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?
Valid responses: 334 (on average) per product

This was further reinforced by the responses to questions 12.1 and 12.2 where:

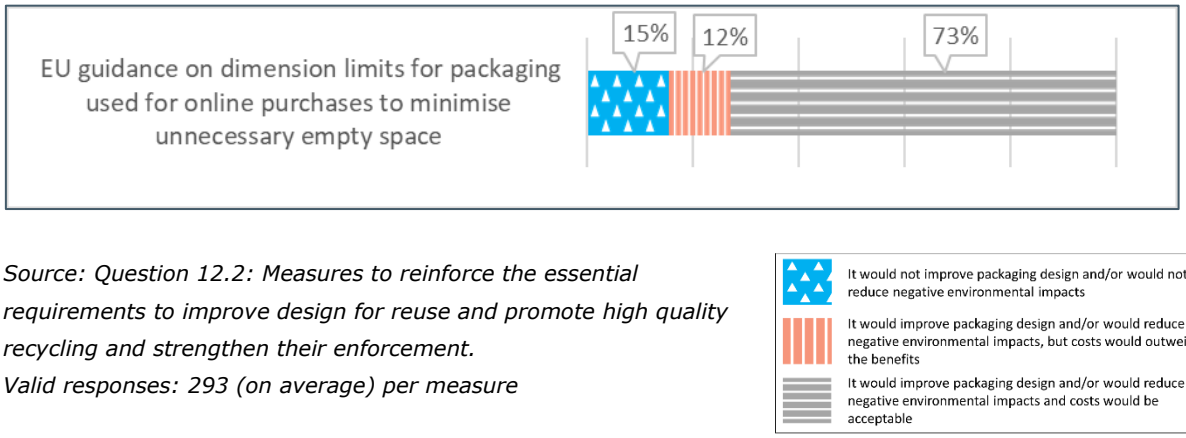
- 65% of participants agreed that introducing dimension limits would be an effective and efficient way of reducing packaging waste (Figure 3-6); and
- 73% of respondents felt dimension limits would efficiently and effectively improve packaging design (Figure 3-7).

Figure 3-6: Question 12.1: Waste prevention measures



Source: Question 12.1: Waste prevention measures.
Valid responses: 298 (on average) for each waste prevention measure

Figure 3-7: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement



Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement.
Valid responses: 293 (on average) per measure

Outside of e-commerce, fixed ratios for other applications were discussed at length in the attachments. They were, on the whole, widely considered an inappropriate solution for reducing packaging in most scenarios. AmCham noted that such requirements may inadvertently still allow for "overpackaging" in some industries whilst resulting in "underpackaging" in others.

3.3 Workshops

Two workshops were conducted to inform this area: the first one in May 2020 discussed problem definition and a longlist of measures while the second one in January 2021 did a deep-dive on the shortlisted measures,

3.3.1 May 2020 workshop

In the second session several measures were presented and stakeholders provided their views as to how it could best be scoped, specified, what level it should be applied at and who the target of the measure was.

Table 3-1 Feedback provided in the second session of the May 2020 workshop related to waste prevention

Measure	Implementation Characteristics
EU wide overall packaging waste reduction target or waste generation limit	Whilst some stakeholders thought the targets should be material neutral, others disagreed, arguing that the negative environmental impacts of packaging are not material neutral. They advised that impact assessments should be LCA based. Stakeholders thought that targets would be more readily accepted by producers if they were EU wide, and at a Member State level, but were concerned that the specific situations of Member States would not be considered. Packaging waste generation levels are not homogenous among Member States, and general targets may be counter to GDP growth targets.
EU wide material specific packaging waste reduction targets	A majority of stakeholders had reservations regarding setting material specific waste reduction targets, with concerns that it could shape bias towards one material, or alternatively lead to more packaging with a higher carbon footprint. Some stakeholders thought that any reduction targets should be per capita rather than relative to the current status, to avoid favouring those Member States who have already reduced their packaging waste or those which have a lower level of per capita consumption at present compared to wealthier Member States.
Specific packaging format or material bans	Although many stakeholders raised objection to material specific bans, due to concerns it may drive packaging towards alternative materials, rather than prevent waste, some suggested packaging types for bans. This included multi-layer packs, blister-packs, coffee capsules, EPS, single-use coffee cups, and fresh fruit and vegetable packaging. Any bans should be EU harmonised to protect the single market, although a risk would be that some Member States would extend the ban, eroding the single market. 'Unpredictable' bans should be avoided to allow industry to innovate and find alternatives.

Member State level consumption targets	Many stakeholders suggested that measures should focus on reduction of waste rather than reduction of consumption. Multiple stakeholders thought that if the targets were set at a Member State level rather than EU-wide, it would put pressures on the single market.
Standards, limits or targets on the use of e-commerce packaging related to reducing unnecessary void space	Stakeholders suggested that any standards be introduced at an EU level, to ensure harmonisation. They should be based on best practises across Member States and focus on eco-design principles. Key aspects to be confronted were void space, returned items, the avoidance of product damage, the potential for reusable and returnable packaging for e-commerce.
Obligatory corporate or sectoral packaging waste prevention plans	Stakeholders thought corporate plans were possible, however they would need to be sectoral, to account for differences between industries. Within plans, terms like 'waste prevention' would need to be clearly defined along with impact assessments, to ensure unintended negative consequences to not arise. Voluntary plans could provide space for producers to see what measures were most beneficial, and allow refinement at a later date.
Levies on packaging, either generally applied or for specific formats	Most comments from stakeholders spoke favourably of EPR systems. It was suggested that systems should be harmonised across the EU, and should be eco-modulated. Eco-modulation should incentivise low carbon, circular solutions including reuse, and be built upon life cycle analysis. Fees under EPR schemes should be high enough to drive innovation on behalf of companies.

In the third session

Measure	Advantages	Disadvantages
Minimum reuse targets e.g. targets on reusable packaging and refill quotas	Aligns with waste hierarchy, especially waste prevention. Results in lower use of virgin materials and reduction in new packaging manufactured and used (provided the trippage – i.e. return – rates are achieved). Potential environmental benefits in local supply chains with short transport distances. Potential for hospitality and catering sectors as well as for B2B and bulk packaging.	This raises the challenge of determining a baseline and how it will be measured. There is significant variation between MS. Logistical and hygiene barriers e.g. food safety issues related to the standard of cleaning. Possible negative environmental impact such as greater emissions due to increased water use and more transportation. Potential low take-up by consumers because of safety issues.

Measure	Advantages	Disadvantages
		Challenge to ensuring that the optimum number of trips is reached before the packaging is discarded. Challenges to implementation experienced in Germany. Requires a clear definition of reusability.
EU packaging waste reduction targets	Targets will apply pressure on stakeholders to find alternative solutions.	Legislation based on material may be misleading. Consumption reduction targets may face opposition from consumers who consider them too prescriptive by the EU. May increase food waste and could challenge convenience for consumers. Food safety requirements need to be considered. May incentivise a solution with worse environmental impact. This may disrupt the Single Market. There are technical limitations in reducing light weighting.
Specific packaging format or material bans	Can facilitate support for materials which are recyclable. Quick impact/effect and relatively easy to implement and enforce. Limits the number of recycling streams.	Available alternatives may have a greater negative environmental impact such as higher CO_2 emissions. May compromise shelf life and hygiene of food products, leading to overproduction. Need to consider new technologies such as in chemical recycling otherwise this measure may undermine innovation. This measure may not solve supply chain inefficiencies. This may not guarantee recyclability. The scope of 'packaging formats' would need to be clearly defined.
Industry standards	Provides a common measuring and testing protocol. Potential to be a bottom up approach. Potential to extend beyond the EU and to be global.	Standards need to be measurable and tailored to specific products. Any standard would need to align with existing standards such as for consumer safety. Long timescale for implementation.

Measure	Advantages	Disadvantages
		Challenges with voluntary standards. Requires a high level of expertise.
Tax/levies on packaging	Facilitate investments in circular economy SMEs.	Raises challenges for the functions of EPR schemes. May face opposition and could hinder innovation. The economic impacts need to be considered.
EU waste prevention measure	Establishes common rules and information across the EU. Allows common definition of the infrastructure, collection and sorting systems required. Allows choice of materials to suit application. Allows optimum development of facilities.	May allow free-riding by MS.
Metrics to determine the source of packaging waste	Enables evidence-based decision making.	
Essential Requirement reinforcement	Facilitates eco-design.	
EPR fee modulation	Drives reuse and waste prevention.	EPR should advance circularity of materials by implementing infrastructures not only by penalising certain materials.
Obligatory corporate or sectoral packaging waste prevention plans	Encourages commitments from industry partners throughout the supply chain. Encourages exchange of ideas between larger/more innovative companies and smaller companies and SMEs. May result in more scalable and relevant solutions for each sector. Could help level the playing field.	Corporate prevention plans have limited impact on consumer littering. It will be challenging to design meaningful programmes which are competition compliant. Could lead to internal market fragmentation. The challenge would be to avoid simple substitution and to ensure delivery of alternative business models.

Measure	Advantages	Disadvantages
	Obligatory sectoral plans could combine with compulsory targets to create appropriate incentives.	

3.3.2 January 2021 workshop

3.3.2.1 Measure 1 - Revised definition of over-packaging plus a reduced set of core performance criteria

[excluding marketing and possibly consumer acceptance, to allow greater objectivity and facilitate enforcement around minimisation, plus transfer of criteria list to Directive Annex (making these mandatory) from EN standard 13428]

It was noted that over-packaging should be clearly defined, as packaging is sometimes designed for technical or acceptance reasons that are not always identifiable for the final consumer.

"Fitness for purpose", around core criteria, prevents waste and should be introduced as the key approach for all packaging, following the ISO 18602:2013(E) concept for "optimum pack design". Underpackaging should be considered as well as over-packaging.

Some stakeholders noted that different Member States and regions have varying packaging needs and therefore also varying understandings of what is deemed 'unnecessary' packaging. A fixed definition would therefore not accommodate the heterogeneous perception of 'unnecessary' packaging throughout Europe.

It was also noted that a fixed definition could have the unintended consequence of acting as a significant barrier to future packaging product applications and functions, which may in the future be necessary but are currently unforeseen.

An alternative definition was suggested as: "Packaging which is not required for the purpose of making sure that the product it contains arrives in its intended form to the consumer, taking into account the updated performance criteria."

Several stakeholders accepted that the need for sustainability should be prioritised before marketing (although not all), however it was pointed out that packaging can play a critical role in changing consumer behaviour via the messaging they contain. Some participants pointed out that there were many messages that needed to be displayed on packaging to convey information regarding health and safety, ingredients, and other legislative requirements.

Whilst there was agreement of the need to embed sustainability into the key performance criteria, many stakeholders disagreed with the idea of removing consumer acceptance and marketing entirely. Some stakeholders considered that there was a need to clarify the concepts of consumer acceptance and marketing when defining the core performance areas. For example, the concept of consumer acceptance could mean anything from wanting further detailed information, to wanting less packaging.

Alternatively, the different criteria could be weighted or prioritised, so that marketing is still accepted, but not at the detriment of quantity of packaging used.

A majority of participants thought that the approach to minimisation (by defining a critical (limiting) area (parameter) should be material neutral and should be applied to each packaging material/pack type.

It was also noted that the drive towards higher recycled content, 100% recyclability, and further reuse targets, may affect the ability to lightweight within a particular product type. As such, these aspects should be also considered as core criteria that could potentially limit the ability to optimise by weight.

One stakeholder also noted that it is important to ensure that packaging minimisation also contributes to the goal of reducing overall GHG emissions.

Others noted the need to take into account the customer delivery model, e.g. purchase in store or from an online retailer.

3.3.2.2 Measure 2 - Top down packaging reduction target for Member States

[as per French approach (20% of single-use plastic packaging; 50% of which is reuse, 50% at source reduction) but to be decided if for all or just certain packaging types and sectors. This would relate to reducing placed on market quantities (against a set baseline – 2018 is used in France), which, in conjunction with reuse targets, would reduce packaging waste]

There was some qualified support for the idea of top-down reduction targets (e.g. from NGOs and one PRO), although significant opposition from some stakeholders (mostly producer businesses).

It was noted that a harmonised approach would be needed across the EU to allow the single free market to function. Allowing Member States to determine how to reach a reduction target would potentially lead to market distortions and would require increased market surveillance inspections, adding costs.

It was also noted that Member States have no simple mechanisms available in terms of influencing the design of packaging, although some stakeholders noted that EPR (including Eco-modulation) is appropriate as an existing mechanism on the basis that most fees are already dependent on weight. They also advocated for infrastructure improvements, further harmonisation between Member States the development of EU guidelines for DRS. Other stakeholder proposed using levies and/or taxes (as for plastic bags) while others commented on the disparity of application of EPR and also noted that new taxes would not be welcome in an EU recovering from Brexit and Covid.

One suggested approach was to require national legislation (at the MS level) to oblige all market operators along the entire value chain, i.e. product producers, wholesale and consumer-facing companies, to reduce packaging placed on the market (for retail, this is apparently planned for Austria) by a certain percentage, accompanied by effective sanctioning mechanisms.

One stakeholder suggested a cap on the overall number of packaging items put on the EU market, noting that companies need to be driven to explore different ways of bringing their products to the consumer through alternative business models, including packaging-free and reusable solutions.

Some stakeholder suggested a voluntary target approach although with the acceptance that this may not be as effective.

It was noted that in order to avoid unequal targets in different MS, waste prevention targets should be set relative to the EU average per capita packaging waste production (174 kilograms in 2018).

Some stakeholder noted concerns that a top down target could lead to pressures on some sectors to reduce packaging that could lead to underpackaging and greater product waste which would be counter productive.

It was also noted that an overarching target should not merely encourage the switch from heavier to lighter single use materials. It was suggested that this can be prevented by adding sub-targets for the reduction of plastic and composite as well as metal and glass packaging, although it may not be simple to establish what level of reduction is reasonable for each.

It was also noted that very light packaging can have worse recycling performance than heavier packaging although no examples were given.

3.3.2.3 Measure 3 - EU-level Best-in-Class Benchmarking (via a central tool), and associated limits, to help define overpackaging

The use of a 'best-in-class' reference threshold (a weight-based measure at a packaging sub-typel level) had 'in-principle' support among some stakeholders, noting that it could be a powerful approach.

However, there was general concern regarding the availability of the data required for such a measure at the EU-level and the need to keep that data up-to-date. It was noted, however, that the Commission's initiative to promote digital product passports for packaging (which could be an important tool to provide product information and allow manufacturers to avoid "over-reporting" that creates needless administrative burden).

Furthermore, it was noted that the 'best-in-class' dataset would have to be very granular if it is to effectively deal with the same packaging type being used for different products with different needs. An example given was carbonated water which places increased functional requirements on the bottle, and should not be compared to bottles of the same size designed for still water.

It was suggested that there is complexity in how a measure of this type may be applied. Firstly, it would need to take into account the variations in international supply chains and distribution channels. Secondly, it would need to ensure brand intellectual property rights and confidentiality is protected (e.g. which brands have the lowest weight packs and how). Thirdly it would need to be able to account for cultural differences which affect packaging design and now this may impact the 'best-in-class' limits. It was also noted that non-EU suppliers may have limited ability to reduce their packaging weights to the required threshold.

Several stakeholders questioned how the impacts on SMEs of this measure would be minimised, pointing out that they in particular would not have access to the innovative packaging designs and technologies needed to meet any best-in-class thresholds. SMEs in particular have limited influence to change packaging design as they a) may not have access to the most innovative suppliers and b) are often not able to invest in new production lines suitable for a different packaging type.

It was noted that care needs to be taken to avoid pressure to under-package and so creating more product (e.g. food) waste.

It was also noted also that such weight-based optimisation has to be within a material/pack category or it will lead to a further switch to plastic. Furthermore it was noted that changes for recyclability reasons (e.g. 100% mono-polymer in plastic) should not be penalised if this approach makes a pack heavier. Similarly the use of recycled content in cardboard can make material heavier for the same level of performance and this also needs to be taken into account.

One stakeholder noted that it should be recognised that the most effective design may not always be compatible with the minimum weight for example a square bottle which offers transport and logistic advantages generally requires more glass than round bottles.

One stakeholder noted that creating pressure to drive more packaging suppliers to reduce weight would require considerable investment in new manufacturing facilities – investment that could potentially be used to create a more significant shift to reuse and refill. It could also be used as a means to greenwash – legitimising single use over reuse.

There was more agreement around the possibility of setting such 'best-in-class' thresholds first as voluntary/advisory approach, allowing the gathering of further data before setting a mandatory limit to prohibit placing on the market.

3.3.2.4 Measure 4 - Pack to Product Weight Ratio Limits to help define over-packaging

Although there was little support for M4 in comparison to variants M3 and M5, it was noted that this type of concept was used in the EU Eco-label for cosmetics which requires that primary packaging meets a Packaging Impact Ratio (PIR). Under this requirement, for single-use products, a product must not contain less than 0.28g of packaging per gram of product, showing that there is precident for packaging/product weight thresholds. A similar approach is taken with household cleaning products under Eco-label.

3.3.2.5 Measure 5 - Void Space Limits to help define overpackaging

Some stakeholders supported the idea of void space limits alone or as a complement to the use of 'best-in-class' thresholds in M3.

Various stakeholders agreed that void space is an issue that needed resolving, however in order to do this, the concept of void space needs to be clearly defined and transparent measurement methods developed. Significant research would be needed to account for factors such as delivery route, product shape, product performance.

It was noted in particular that goods that settle, such as dry foods after packing, would need an allowance making for this settlement as it can only be accurately monitored in production before full settlement occurs.

It was also noted that void space in e-commerce and other distribution packaging would need to only consider the space between the primary product pack and the outer box or bag, given that any void within the primary pack is without the control of the fulfilment company.

It was pointed out by various stakeholders that strict limits may be difficult to implement and a more general "common sense" target, with a quite large tolerance band (e.g. 20% or 30% void space) would be sufficient. It was noted, however, that a target could in some cases encourage more void space than necessary (i.e. where it was less than the target beforehand).

3.3.2.6 Further General Comments on Measures 3-5

There was a mixed reception with regards to the benefits of combining different measures, for example combining M3 with M5. Some stakeholders considered that this would increase the level of complexity and make the measures administratively unfeasible. However, a small number of stakeholders suggested that M3 complemented M5 and these could be combined together.

There was little appetite for the inclusion of reusable packaging systems within these measures, largely because many reusable systems are not currently fully developed. When this is the case, however, reusable packaging would need to have it's own sub-category within a packaging type as the reusable systems will inevitably be heavier than single-use packaging and thus incomparable. For example, a German 1 litre PET refillable bottle is heavier than an equivalent single-trip bottle, but can be reused up to 25 times, making the weight (and carbon) per cycle very low compared to single use.

In general, it was suggested that there needed to be a more holistic consideration of the measures. Any weight criteria needs to be aligned with reusability and recyclability, and it should be prevented that this would lead to switching from heavier to lighter materials or from rigids to flexibles. Some suggested that there needs to be a wider consideration of the full life-cycle carbon impacts in terms of overall optimisation.

A food-service packaging stakeholder noted that for most activities which use packaging, the packaging item and the product it is intended for are almost always clearly known/defined in advance, but this is not the case for foodservice, where the packaging is typically filled at the point-of-sale in line with the offering of the foodservice operator and the consumer's wishes. Consequently set ratios are not feasible in this sector.

Once stakeholder noted that they believed that more data and research is needed to enable a meaningful assessment of the options to allow for legal certainty and innovation. Clear criteria should be defined for each of the options with respect to distinctive elements including material neutrality, packaging systems, differences in the packaged product and logistic aspects.

Several stakeholders questioned the appropriateness of a legislation-driven approach, noting that efforts already made by the packaging industry to minimise packaging should be better acknowledged and that there was already enough economic incentive to reduce packaging (in material weight terms). It was also noted, however, that the benefit of marketing and extra sales (driven by size, e.g. in toys, or weight in premium products) can be fra greater than the cost of additional material, somewhat weakening this effect.

Eunomia remarked that, since most packaging producer responsibility legislation in the EU is weight based, and producers have to report based on a bottom-up analysis of every single product placed on the market, commercially available weight data, for most individual products (SKUs) for most EU markets, already exists (used mainly by producers and provided by some PROs) and are very granular, whereas volume-based data currently do not exist in an easily accessible form.

Finally one stakeholder noted that they would agrere with the use of advisory (rather than mandatory) reference points by product category/sub-category. This would entail the creation of reference weight and/or volume based product-to-pack ratios across a specific product category or sub-categories that could guide towards best material solutions (e.g. to be defined in the above-mentioned conformity guidance list – which should be developed using a bottom-up value chain approach). This bottom-up approach would ensure a smooth transition and the identification of feasible and effectively implementable weight and/or volume requirements. Such rules may well be reflected in EPR modulated costs.

3.3.2.7 Measure 7 - Elimination (phase out) of packaging deemed avoidable (e.g. through reuse) or completely unnecessary, with a defined list suggested

There were very polarised opinions on this approach with NGOs generally in strong support, industry strongly against.

One stakeholder noted that bans on certain packaging would contribute to the image of an over-regulating EU that dictates to citizens what is "unnecessary". Introducing the notion of "avoidable" packaging and defining a list of packaging which is to be phased out will set an extreme precedent in EU legislation that would hinder market freedom and consumer choice, create discrimination and limit business innovation (misaligned with the Innovation Principle, a requirement of the Union's Better Regulation Agenda).

On the other hand, some NGOs put forward much longer lists of product packaging that they would like to see banned or replaced by reusable systems. For example one suggested that selected bans on various packaging types should be explored, such as bans on blister packaging for foodstuffs, clamshells, individually wrapped inert material or product, portion sized bottles and sachets, microwavable or oven-resistant trays, or containers which are designed to prevent them from being refilled (e.g. single use salt and pepper mills).

Some participants had concerns regarding the phase-out of collation packaging (multi-packs) in particular as this can offer functional necessity for packs such as cans and bottles which often allows palletisation, protection during transit and assists with shelf stacking as well as handling by consumers. This can be especially important for larger pack sizes of, e.g. 24 cans, for which a customer is unlikely to want to pack individually. Netting might be important to sell quantities of products (fruits) which would otherwise be wasted.

Multi-pack packaging was used largely for increasing customer convenience and allows customers to quickly and efficiently purchase multiple units of the same product at once. However, in addition to customer convenience, they do offer discounts which can be vital to larger families. Other participants raised the point that these types of discounts could still be offered without the collation packaging, in addition to concerns regarding the health consequences (e.g. obesity related) of discounts for multi-packs and the consequences for food waste in the home (rather than in store).

Several stakeholders raised the point that many of the categories problematically focused on plastic packaging. In order to achieve a circular economy and reduce the consumption of virgin resources the measures should be material neutral. However, other participants commented that this is just that the material used is often plastic shrink wrap, beverage can rings, or other flexible plastic packaging that cannot easily be recycled at home. It was also noted, however, that a move to carboard collation packs is unlikely to reduce weight.

One stakeholder noted that alternatives to netting are currently in the form of bags, which can use a higher quantity of packaging material. Netting is generally only used for higher weight product volumes, usually equal to or more than 1kg. In-store consumer bags, such as paper-based bags, for loose fruit and vegetable products cannot support this weight. In addition it was noted that the ban list does not take into consideration the netting material used. Sustainable material options for nets and multi-packs, including compostable and recyclable materials, are available on the market. A negative list of packaging materials could restrict innovation potential

There was a general desire that these measures make use of LCA data to ensure that the changes driven by these measures had a positive impact on GHG emissions and do not result in increased product waste. It was noted that PEF, if further developed for packaging, could help to bring a more scientific approach, and taking into account both the product and pack in combination. More generally there was concern that carbon was not being taken into account in a holistic way across all the proposed measures including recyclability, reuse etc.

Regarding the phasing out of single-serve food packaging, there is a concern about hygiene with regards to reusable alternatives, such as larger ramekins of spreads and preserves, or reusable sauce bottles. However, other participants pointed out that these items presented no greater hygiene problems and any reusable food serving crockery, and the risk could be managed. Hygiene is especially relevant in terms of concerns over Covid-19, however it was noted that despite the pandemic, customers have returned to using reusable coffee cups, and where reuse systems are possible, these should be the preferred option.

It was noted by several stakeholders that reuse systems need to be well established before imposing bans on single-serve packaging. Any ban should otherwise take into account the time necessary to develop alternatives in the way products are delivered to consumers.

Several participants commented (incorrectly) that some of the items listed are referred to within the SUP Directive and presented concerns that this presented a level of inconsistency between the SUP Directive and the PPWD Directive. In a similar vein, the point was raised that the use of packaging walls to give the impression of a larger package should be tackled by consumer protection laws rather than through the PPWD. Some stakeholders also considered that blacklisting of products should be avoided, but also considered that purely decorative packaging could be banned.

When presented with the definition of avoidable packaging, some participants were happy with the definition, but it needed to be in parallel with the core performance criteria noted under Measure 1. However, there were concerns as to the necessity of a definition, especially if this was in parallel to definitions for over and excessive packaging.

3.3.2.8 Further General Comments

One stakeholder asked the Commission to make sure to provide sufficient time for producers to adapt and implement potential measures.

Industry is still waiting to have legal clarity to implement the SUP Directive and EPR under the revision of the PPWD. Manufacturers are in great difficulty due to the Covid-19 crisis and they are struggling to adapt to the current uncertain legislative scenario. They need time to adapt production to alternative solutions or systems. Imposing new rules on the same or similar products will surely not help them to innovate to become more sustainable.

There is no "silver bullet" for achieving optimal sustainability and each industry sector must be assessed individually.

It is important to clearly distinguish measures aimed at reduction of unnecessary packaging from measures aimed to reduce the quantities of materials lost to the environment and not recycled. The reduction of packaging waste and reduction of packaging are not the same objective. The current definition of packaging waste in the PPWD is equal to packaging put in the EU market, therefore any measures aimed at reducing packaging waste is equal to any measure to reduce packaging. Such divergence should be revisited in the ongoing revision of the Directive in order to review the contribution of recycling and reuse to the overall objectives of the Commission to reduce packaging waste.

The main goal of the measures should be to achieve minimum environmental footprint for the provision of products to the consumer up until the end of life and allow innovation at scale.

A key advantage of the PPWD Essential Requirements is that—instead of designing exclusively on the basis of weight—it allows producers to create packaging solutions that take into account all the necessary functionalities and to investigate options to reduce negative environmental impacts overall.

The foreseen measures should ensure shared responsibility along the value chain. The packaging manufacturer can advise on new technical solutions to improve the quality and recyclability of the used material alongside the best packaging solution for the product.

There needs to be a level playing field with imported packaging having to meet the same requirements as EU-produced packaging.

Consumer awareness should not be forgotten. More sensibilization and knowledge is needed in order for the consumer to be really able to judge what is sustainable packaging and what might be over-packaging.

3.4 June Webinar

3.4.1 Measure 1 Over-arching changes to limiting criteria approach

A variety of stakeholders requested a clear definition for both "overpackaging" and "underpackaging" and argued that they cannot be discussed in isolation from each other.

With regards to the suggested revised list of core performance criteria, while some stakeholders supported the exclusion of product acceptance and marketing, others insisted that it should remain. Additionally, some stakeholders requested a clear definition (in the legislation, rather than implementing acts) of each of the criteria. It was also suggested that the criteria in individual Member States be evaluated and compared before a proposal is made.

3.4.2 Measure 2 Member States reduction targets (% per unit)

Firstly, some stakeholders claim that the measures focus on preventing packaging as opposed to preventing packaging waste, and that the measures should be targeted at waste that ends up in landfill or incineration which cannot be reused or recycled.

A further criticism was raised against the setting of mandatory reduction targets, with stakeholders citing the risk of penalising packaging that is already optimised, which could in turn undermine efforts to use circular materials.

With regards to this target setting, there were very diverse opinions: some stakeholders considered them too high and others too low. There were also diverging opinions on the materials included, with some requesting to have the same target for all materials and others requesting to increase the target for materials difficult to collect and recycle like plastics. If targets are applied to reusable materials as well, one stakeholder is asking for a prolonged transition period. What is more, there was some concern amongst stakeholders that Member States will diverge in their target setting and/or measures to achieve the targets, creating tensions in the single market.

Finally, instead of regulatory measures, some stakeholders believe that industry voluntary actions should be considered instead, and that previous efforts in waste prevention should be taken into account.

3.4.3 Measure 3 Best-in-class weight limits

Some stakeholders (PRO, industry, NGO) are in favour of measure 3 and some even say that it could be extended to the other major packaging types. Some stakeholders feel that measure 3 does not go far enough and should be extended to other major packaging types, while excluding

packaging that is reusable and/or contains recycled content. Other stakeholders highlight the need for the classes to be well defined. And one stakeholder suggested that a corporate best-in-class would be preferrable to a sectoral approach.

Some stakeholders argue that the proposed 20% benchmark would have a disproportionate impact on the market, as the best-in-weight bottles are not necessarily representative of the market. And other stakeholders are against measure 3 as the functionality of the packaging is not taken into enough consideration, can stifle innovation and it could unfairly target small businesses. "Overpackaging" is not the sole reason why some packaging is heavier, so wider granularity with options and exceptions is suggested instead of a single threshold.

One stakeholder mentions the importance of investigating the potential consequences of the regulations, and that if PROs are to act as the central register, they need to be given more status and power. Another cites that proper verification and enforcement is required to ensure all products on the EU market (including imported goods) meet the legal requirements. It has also been highlighted that the data required to implement it is not yet available at the European level.

3.4.4 Measure 5 Void space threshold limits

Some stakeholders are in favour of measure 5, with one proposing a roadmap to the 40% reduction. On the other hand, some stakeholders are against measure 5 as it could require customised packaging which can disproportionately target smaller businesses. There are suggestions for a voluntary approach and the setting of recommendations instead of mandatory targets. Other stakeholders believe that this measure can be addressed as part of either measure 1 or measure 2 instead.

There is a concern around consumers reporting excessive void space as it may not be reliable or accurate. Some stakeholders argue that there are conflicting objectives such as recycled content and smaller food portions to combat food waste and portion control, so some packaging should be exempt from measure 5. Fragile products or multiple products sent in one package require sufficient filling to protect them, so there are questions around how void space will be calculated in these cases.

Some clarifications are required around how the threshold was determined, the definition of void space and the methods used to calculate it, the role of void fillers and how measure 5 interacts with measure 1.

3.4.5 General Comments

There are several requests for clarity on how these measures interact with measures from the other intervention areas, particularly reuse. Some stakeholders expressed their concerns that excessive light-weighting might hinder reusability and/or recyclability. One stakeholder is concerned about the risk of material switching to packaging that has a reduced weight but a higher environmental impact.

Stakeholders have requested that all measures should also apply to imported goods to ensure a level playing field. To facilitate enforcement, Member States have to take responsibility of the necessary resources and reporting to show compliance with the criteria should not be overly burdensome.

Some stakeholders say there is an issue with data availability and quality across the Member States and some say there are errors in the data Eunomia has used. A few stakeholders think that EPR fees are the most cost-effective way to tackle "overpackaging", and that more steps need to be taken to ensure that all e-commerce organisations participate in EPR schemes. There are concerns around a potential lack of support for SMEs to adapt to these measures.

Along with void space, a measure to tackle oversized packaging in terms of unused surface should be considered. Some stakeholders think that measure 5 should also extend to excess packaging and others think an overall target should be set for each company.

3.5 One-to-one interviews

Several organisations were consulted in one-to-one interviews which are summarised in Table 3-2. Eight organisations were interviewed, with five providing input into e-commerce findings and three feeding into general problem and measures development. The organisations interviewed consisted of one environmental NGO, one standards association, one retailer association, one packaging manufacturer and three packaging manufacturer associations.

Table 3-2 Targeted stakeholder interviews for waste prevention

Organisation	Date	Stakeholder Input
ECOS	04/11/2020	E-commerce
EuroCommerce	05/11/2020	E-commerce
Flexpak Europe	06/11/2020	E-commerce
DS Smith	09/11/2020	E-commerce
FEFCO	09/11/2020	E-commerce
Zero Waste Europe	03/02/2021	Problem and measures
FEFCO	12/05/2021	Problem and measures
FEVE	25/05/2021	Problem and measures

4.0 Reuse

4.1 Roadmap/Inception Impact Assessment

The observations provided on reusable packaging can largely be split into stakeholders providing comments in support of reusable systems and those raising concerns.

4.1.1 In support

Overall, most stakeholders welcomed and supported the drive to increase reusable packaging systems.

PepsiCo argued the need for supportive and coherent legislation, such as incentives for local authorities to help create a reuse system, as well as a collaborative approach with the full value chain (food manufacturers, retailers, brand owners and more). ARECO suggested making reuse of packaging in the food supply chain mandatory, introducing reuse quotas (targets) for reusable transport packaging (RPCs) and implementing tax harmonization measures to support reuse. Deutche Umwelthilfe called for binding quantitative reuse targets, fiscal and other financial incentives to promote reuse and mandatory labelling of reusable packaging. There was also widespread support for scaling up deposit refund schemes (Rethink Plastic Alliance, ZERO (PT), UNESDA), implementing standard reusable packaging formats for the EU market (ZERO (PT), Zero Waste France) and improving data and monitoring of packaging. CITEO also called for a clear definition of reuse.

Several stakeholders (APEAL, EuroFer, European Snacks Association, Europen) emphasised that reusable packaging schemes should only be introduced where ecologically and economically feasible, and others called for "a transition phase" to allow industry to adapt to new systems and respect the existing complexities in supply chains. PepsiCo also agreed that it would take time for consumers to change their behaviour and adapt to using products delivered in reusable packaging. Europen stated that purchasing models (online vs physical retail) and specific local contexts (e.g. urban vs rural areas) should be taken into account when mandating measures on reuse. Food Drink Europe pointed out that reuse and refilling systems also require the establishment of alternative management systems and infrastructure.

The FEFPB (NL) spoke of the distinction to be made between packaging for different wood product categories, and how pallets were more suitable for re-use than industrial and lightweight packaging were.

Specific interventions suggested by stakeholders included:

- Restricting the use of certain glue and stickers on glass containers that cannot be washed (Zero Waste France)
- Limiting the transport of liquid products in plastic packaging, and using concentrating products to mix at home (No Plastic In My Sea Association)

There were also calls for reusable packaging and refill targets to be set by 2030, similar to how recycling targets had already been set.

4.1.2 Raising concerns

Concerns raised regarding the use of reusables and refillables included the following:

- Food hygiene, food safety, shelf life and food waste risks associated with the use of reusables. (EDA, EPPA)
- When supply chains are longer and cross borders, recyclable packaging is more advantageous on a life-cycle-assessment basis, so the decision between using reusable and recyclable packaging had to be taken on a case-by-case basis. Using "a horizontal instrument like the essential requirements for packaging" could be difficult for this reason. (EuroCommerce)
- Setting reuse targets for "transport packaging" risked including packaging which is already being highly recycled, thus jeopardizing a well-functioning and circular system. (European Carton Makers Association, German Paper Converting Association)
- The possibilities of reuse for cosmetic products were very limited because of their stringent safety and microbial quality requirements. (The Polish Union of Cosmetics Industry)

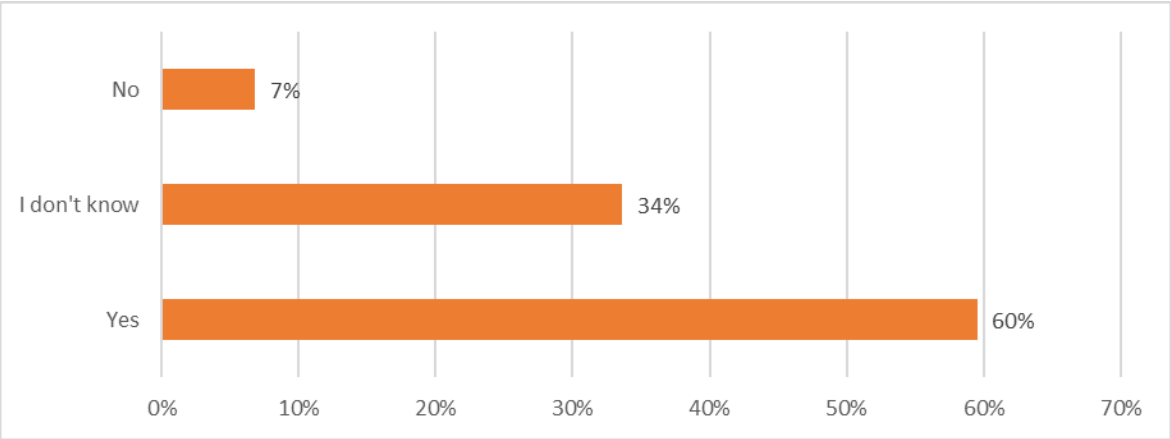
4.2 Online public consultation

Whilst most stakeholders agreed that harmonised definitions, standards, and guidance for reuse were needed, any suggestion of prioritisation of reuse systems was met with mixed responses. Some stakeholders stressed that reuse should always be the first solution, referencing the waste hierarchy. Others raised concerns that reusable products resulted in higher overall environmental impacts in some instances.

4.2.1 Attitudes towards reuse

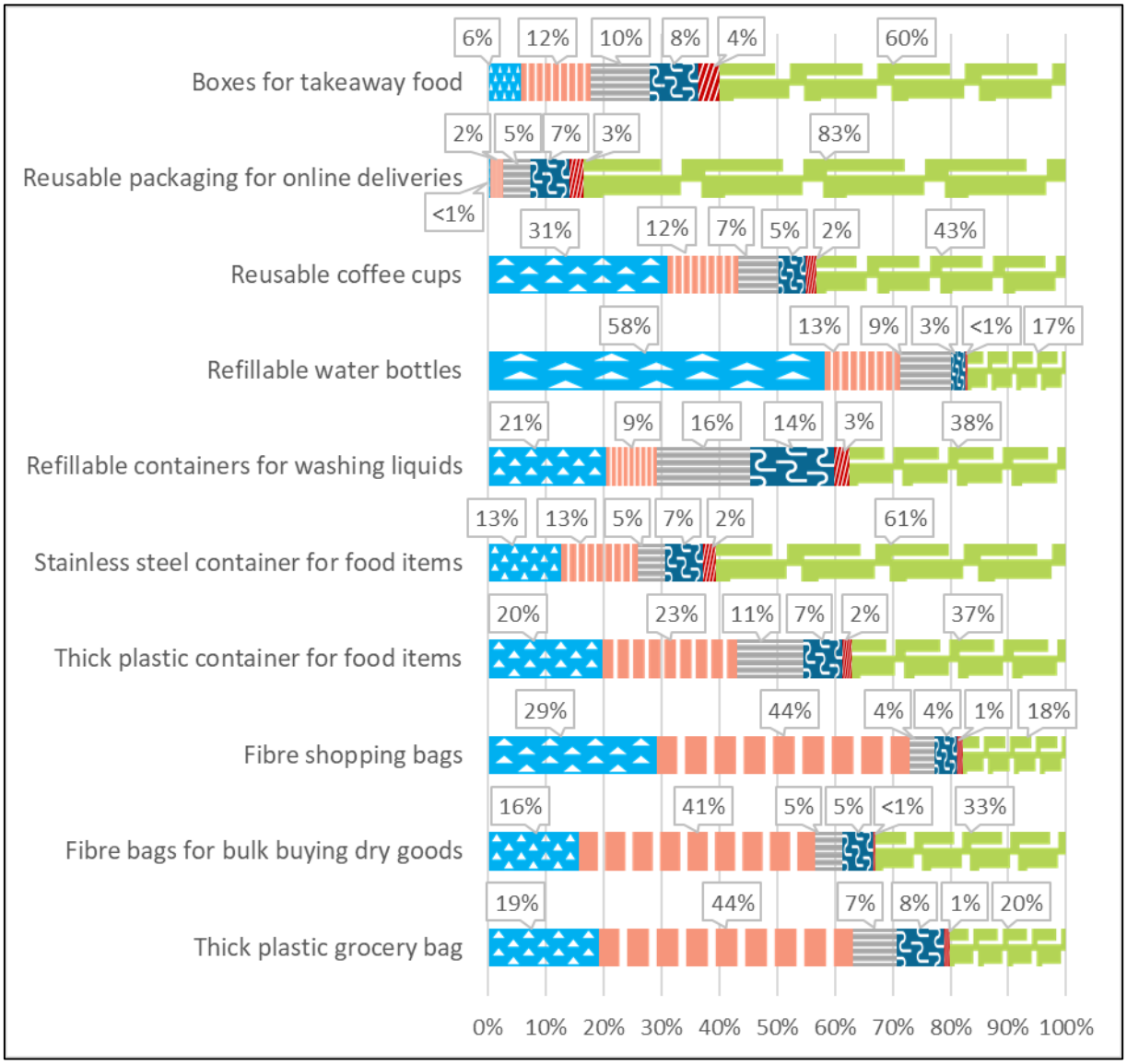
According to the responses to question 6, 60% of stakeholders currently use reusable packaging, as shown in Figure 4-1. The most popular reusable product amongst the participants was refillable water bottles, which are used daily by 58% of those surveyed. Figure 4-2 summarises the stakeholders' opinions on various reusable products.

Figure 4-1: Breakdown of question 6 responses

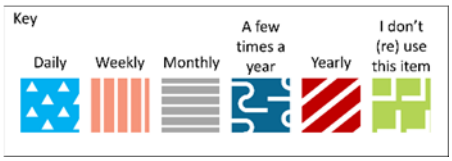


Source: Question 6: Do you use reusable packaging? Valid responses: 425

Figure 4-2: Question 6.1.1: How often do you use the following reusable packaging items?



Source: Question 6.1.1: How often do you use the following reusable packaging items? Valid responses: 228 (on average) per product



In response to question 4, in which participants were asked to provide their views on reusable packaging, 68% of respondents agreed that they would be prepared to bring their own reusable packaging to the shop either to reuse it themselves or have it cleaned and refilled. Figure 4-3 illustrates the responses from the participants.

Figure 4-3: Question 4: What is your view on the following statements regarding the consumption of packaging?

Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Valid responses: 272 (on average) per statement

Additionally, when providing comments at the end of Section 2 ('Questions to the general public'), several participants drew attention to the waste hierarchy, noting that reuse should be prioritise over recycling.

Despite these, and other, positive responses, several participants also had negative feedback on reusable systems noting that:

- Reusable packaging is not always the optimum packaging for every scenario;
- Reusable packaging is not always convenient; and
- Consumers need further information on reuse systems.

4.2.2 Reusable packaging during COVID-19

In questions 6.1.4, stakeholders provided examples of what had been in place to enable them to keep using reusable packaging in COVID-19. These included increased cleaning in stores and having more time to carry out their shopping.

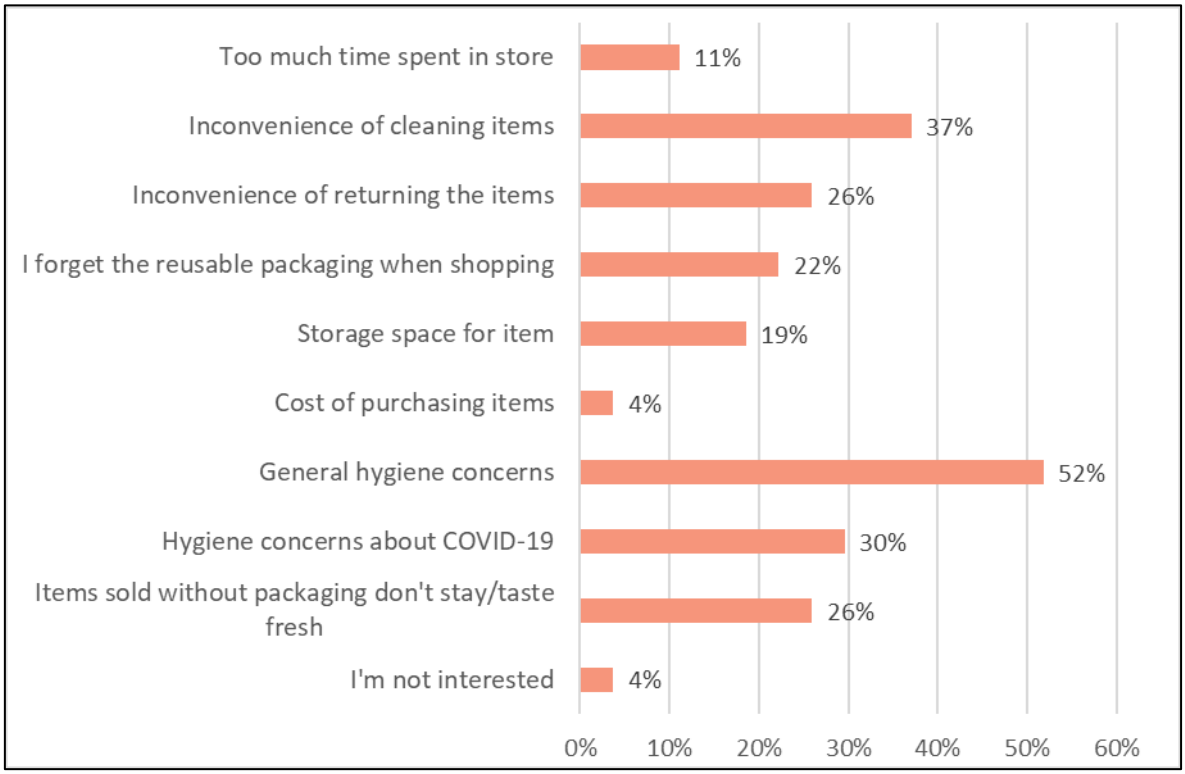
Table 4-1: Question 6.1.4: If you have had a positive experience of continuing to use it during the COVID-19 pandemic, please provide examples of what was in place to enable you to do this

Theme	Key points
Increased cleaning practices	› Disinfectants in shops › Clear information provided on correct cleaning protocol › More time to clean packaging when at home
Greater time to shop	› More free time to carry out shopping resulting in ability to visit multiple smaller stores and/or shop bulk (which typically takes longer)

Source: Question 6.1.4: If you have had a positive experience of continuing to use it during the COVID-19 pandemic, please provide examples of what was in place to enable you to do this. Valid responses: 57

Other stakeholder gave reasoning for why they don't use it (question 6.2.1, Figure 4-4) or have used it less since COVID-19 (question 6.1.3, Figure 4-5). Participants listed concerns over health and safety, lack of access to stores that accept reusable packaging, and inconvenience when compared to single-use alternatives.

Figure 4-4: Question 6.2.1: What are the reasons you do not use reusable packaging?



Source: Question 6.2.1: What are the reasons you do not use reusable packaging? Valid responses: 27

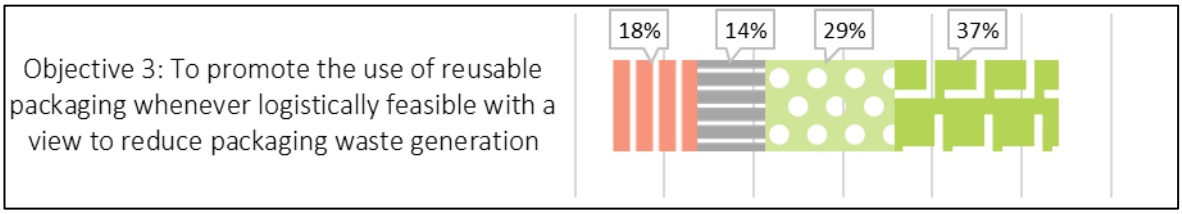
Figure 4-5: Question 6.1.3: If you have used reusable packaging less since the COVID-19 pandemic, please indicate your reason(s) below.

Source: Question 6.1.13: If you have used reusable packaging less since the COVID-19 pandemic, please indicate your reason(s) below. Valid responses: 123

4.2.3 Future use of reusable packaging

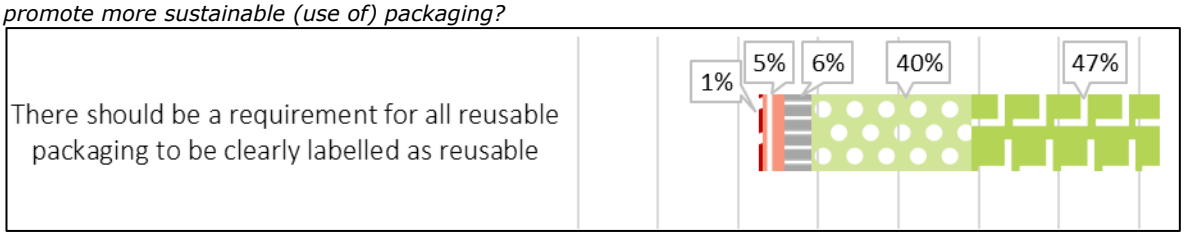
There were a number of occasions at which participants were able to suggest measures to increase uptake of reusable packaging. In question 11, 66% of stakeholders suggested that reusable packaging should be promoted wherever it is logically feasible, illustrated in Figure 4-6. In addition, in question 5, 87% of participants agreed that there should be a requirement for all reusable packaging to be clearly labelled, as shown in Figure 4-7.

Figure 4-6: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:



Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective

Figure 4-7: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?



Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Valid responses: 334 (on average) per product

Other measures recommended in the comments included:

- Standardising reusable packaging formats;
- Introducing quantitative reuse targets at national and international level; and
- Supporting reusable packaging with tax breaks.

Stakeholders were also given the opportunity to identify reasons they do not support further use of reusable packaging in the future. Here, participants raised the need to substantiate any decisions to use reusable packaging with life cycle assessment (LCA) data. Others raised concerns over contamination and hygiene.

4.3 Workshops

In the May 2020 workshop a reuse measure was presented and stakeholders provided their views as to how it could best be scoped, specified, what level it should be applied at and who the target of the measure was.

- **Measure:** Measures & targets on reusable packaging
- **Implementation characteristics:**
  - Due to benefits seen alongside scalability, it was suggested these measures should be harmonised between Member States. Building a single market for reusables was suggested before setting mandatory targets. Examples suggested included colour coding of reusable packaging to track ownership.
  - When formulating targets for reusable packaging, multiple stakeholders raised that LCA should be used to guide the targets in addition to existing obligations like labelling requirements and food safety.
  - Targets should be set depending on the type of packaging, for instance whether it is consumer packaging or transport packaging.
  - Multiple stakeholders raised that reusable packaging should also be subject to the Essential Requirements.

4.4 June Webinar

4.4.1 Measure 8 Sector-based reuse targets

4.4.1.1 General feedback

Most stakeholders were in favour of some form of targets to promote the uptake of reuse. A few stakeholders preferred voluntary targets while reuse systems are still being developed and more research is done into the appropriate formats, infrastructure, and investment needs. More stakeholders advocated for mandatory targets, to provide investment security and avoid compromising the single market through heterogenous national implementation.

Many industry stakeholders expressed their concern that more research needs to be done and data collected before mandating targets, ideally on a case-by-case basis for each category of products. Also, further work should be done into the units and measurement methods proposed to monitor reuse. Clear criteria should be specified to determine which of reusable or single-use is more preferrable, and it should be considered that some products may need to be exempted from reuse targets if evidence shows they cannot meet the appropriate criteria. It was recommended that target setting should include workshops with key industry stakeholders to better understand what would be required to produce optimal outcomes.

Some stakeholders criticise the lack of robust evidence: "at this stage as there was no evidence provided (no initial analysis) supporting that they will in fact deliver superior environmental impacts" and "Given the lack of clear robust modelling we recommend that the proposed targets for individual sector product categories are further assessed"

Furthermore, there is a high level of concern amongst food and beverage industry actors that not enough consideration has been given to the specificity of the products in their sector. They stress the need for compliance with food safety regulations and argue that inadequate research could lead to unintended consequences, such as increased food waste due to reduced shelf-life, damage or spoiling and contamination.

Industry groups also highlighted the risk of conflicting policy measures between the measures proposed for reuse, and those set out in the SUP Directive and recommended that care be taken not to confuse industry or put them in an impossible bind (e.g. increased reuse leading to effective ban on SU items, leading to lack of supply of high quality materials to meet recycled content targets).

4.4.1.2 Categorisation

A broad group of stakeholders recommended that the categorisation of products needed to be more specific and clearly defined to guarantee the best outcomes. For example, secondary and tertiary packaging need to be further broken down to account for different types of transport packaging (by material and function) and the interaction between the current categories needs to be considered. Products with distinct characteristics (e.g. milk and soft drinks) should not be grouped under the same category as they will require different processes.

Some categories were deemed to be inappropriate. Some stakeholders were strongly against any food-contact packaging being made reusable, primarily due to food safety concerns. Other were more concerned about food requiring cold chain handling (e.g. fresh or frozen food). Still more considered that wine and spirits should be excluded, as they are often shipped over long distances, and the reverse logistics would not make sense.

There were some suggestions for other categories that should be added. One was to expand the grocery category to include canned food (in tins and jars) as this is already done quite successfully in Germany. An industry representative from the transport packaging industry recommended changing the category of "tertiary packaging within businesses that constitute closed loops" to "tertiary packaging for the movement of fast-moving consumer goods" would be a more efficient categorisation.

4.4.1.3 Target levels

There were opposing views amongst stakeholders regarding the target levels. Some stated that they were not ambitious enough whilst others considered they were unrealistic and unachievable. It was highlighted that targets should only be set where reuse systems can be measured and monitored.

Many stakeholders from across industry and consumer organisations stressed that setting targets alone would not be sufficient to drive systemic change of the magnitude stated in the EU's Green Deal's objective and that great consideration should be given to the lead time and investment needed to facilitate the transition to more reuse. The main areas mentioned where business models, supply chain transformation, infrastructure development, including efficient sanitisation systems, and the consideration of consumer convenience and behaviour.

It was also noted that the targets should take into consideration the differing consumption patterns in different Member States, at the risk of disadvantaging some countries.

Finally, industry stakeholders highlighted the need for more thought to be put into how the reuse targets would affect international supply chains and non-EU economic operators will be expected to comply with the targets.

4.4.2 Measure 9 Mandatory Member States % reduction targets to be met by reuse

Many stakeholders were concerned that national top-down waste reduction targets would be too general and would cause disruption to the single-market. Any such measure would require harmonization across Member States in order to ensure smooth and efficient operations, including avoiding the need to re-package products on entry into a different Member State or region to suit reuse systems. Moreover, some stakeholders expressed concern that this measure would also require increased market surveillance inspections, adding costs and administrative burdens.

Several stakeholders highlighted that any reuse target should go hand-in-hand with recyclability and recycled content requirements for reusable packaging.

4.4.3 Measure 10 Standarisation of reusable packaging and effective reuse systems

4.4.3.1 General feedback on standardisation

There is broad support for standardisation from across the spectrum of stakeholders, as long as it takes into account current standards (e.g. around safety and hygiene), allows for regional variability depending on consumer preferences and takes into consideration reusable formats already in use so as not to disadvantage them.

Overall, there is greatest support for Measure 10a (standardisation request to CEN) as businesses are used to dealing with CEN standards, and this standard would provide best-practice guidance but would still allow businesses to innovate. Moreover, some stakeholders are concerned there isn't enough data or practical experience yet to determine robust standards for reuse packaging formats (10b) or systems (10c).

Many suggestions were made about what should and shouldn't be included in the criteria, and opinions diverge on how comprehensive the standard should be. While some stakeholders do not want too prescriptive a standard (or any standard at all) to allow for necessary innovation, brand specificity and competition in the market, others advocate for a detailed standard that aims to uniformise and simplify packaging and harmonize systems between operators of all sizes. Two criteria that stand out as being of importance to many stakeholders: the recyclability of reusable packaging and the minimum number of rotations required.

Several stakeholders stress the importance of consulting with a wide range of stakeholders, leaving enough to time to develop a strong set of standards and considering the costs and time required for industry to adapt to these standards.

It is also highlighted that for standards to be meaningful, a form of digital tracking will be required so performance can be monitored, and businesses can demonstrate compliance.

4.4.3.2 Standardisation of formats

This is the most contentious proposition, especially for stakeholders from the food and beverage industry who fear it might reduce the variety of packaging needed to meet quality and

performance requirements for their goods. There is agreement that such standards should be carefully considered, on a case-by-case basis depending on the sector and the type of reuse.

That being said, stakeholders from France and Germany highlighted that standards on reusable food and beverage reusable packaging are already in development in their countries.

4.4.3.3 Standardisation of reuse systems

Industry representatives from the reusable transport packaging industry were highly in favour of standardisation of reuse systems in the tertiary packaging sector, as this would provide businesses with legal certainty and confidence in investing in these systems.

There were conflicting views on whether standardising reuse systems would simplify the logistics around packaging, or whether it would increase the burden on businesses to adapt to ill-fitting systems.

4.4.4 Measure 11 Implementation of a business advisory body for reusable products and packaging

There was broad support for an advisory board to be set up as a supportive measure. A few stakeholders questioned its necessity on top of the standardisation, or suggested that the two measures could be merged.

There were many views on what the role of such a body should be. Overall, the consensus was that it should be used to coordinate the development of reusable packaging systems, share best practice, monitor and report data on reuse, and provide strategic direction. Several stakeholders stressed that it should not create more administrative burden for businesses and that its financing should be carefully considered. There were differing views on whether it should operate at national or EU level.

Stakeholders stated that the advisory body should be fully independent and should include representatives from across the board: from the packaging and materials industry, national authorities and PROs, consumer representatives, and retailers.

4.4.5 Measure 12 Requirement for all reusable packaging to be labelled as reusable using a harmonised European approach / logo

There is general support for some form of labelling, but stakeholders are very aware of the need to keep it simple so as not to overburden the packaging and confuse consumers. There are many opinions as to which criteria should be included on the label. Many stakeholders suggest that transferring most of the information online and off the label, via QR codes for example, would be a good way of dealing with the amount of information to get across. Dematerialising the information would enable brands to share relevant points in a more engaging, precise and relevant way.

Any labelling standardisation should take into account such labelling initiatives already taking place (e.g. in France and Germany, or Nestlé's eco-labelling trial from autumn 2021). Moreover, such harmonized labelling should be part of a horizontal proposal to provide sorting instructions to consumers in all packaging and not only on reusable packaging.

Finally, for any labelling to be effective, it will need to be coordinated with infrastructure to handle such a labelling system. And most importantly, it will necessitate thorough awareness raising campaigns and consumer engagement.

4.5 One-to-one interviews and email exchanges

One organisation was consulted in a one-to-one interview which is summarised in Table 4-2. This interview was with a packaging manufacturer association and fed into general problem and measures development.

Table 4-2 Targeted stakeholder interviews for reuse

Organisation	Date	Stakeholder Input
FEVE	25/05/2021	Problem and measures

5.0 Recyclability

5.1 Roadmap/Inception Impact Assessment

The key topics raised pertaining to the recyclability of packaging were support for recyclability of packaging, R&D, labelling and minimum quality standards, and concerns around reducing the complexity of polymers and increasing the recyclability of packaging.

5.1.1 In support

Overall, there was a high degree of support for all packaging to be either reusable or recyclable. Stakeholders called for packaging design obligations, Design-for-Recycling (DfR) guidelines and incentives through eco-modulation of EPR fees. Others called for a reduction in the complexity of packaging materials (e.g. multilayer packaging) and the use of standardised packaging to improve their recyclability. Where re-design of packaging was not feasible, stakeholders supported investing in research & development (R&D) to develop emerging and innovative recycling technologies (e.g. chemical recycling), and improve knowledge of the recovery and recyclability of packaging (A.I.S.E., AIM, BDSI). Chemical Recycling Europe stated that eco-modulation fees should be applied to all recyclable materials regardless of the recycling technology used.

Stakeholders also spoke of the need to harmonise collection systems and increase collection rates to improve quality of recyclates across the EU. Several argued that deposit return schemes (DRS) were an effective way to do so, and that guidance was needed to ensure their implementation was effective.

There was widespread support for a clear and enforceable definition of 'recyclable packaging'. CEPE and EXPRA called for the definition to be qualitative only, as this would allow for material neutrality and innovation. Other stakeholders stated that harmonisation of the definition across all MS was important because the rise of EPR schemes meant each may start to use their own definition. PepsiCo commented that any definition should be revised regularly to allow for technological change. Plastics Europe, meanwhile, supported a recyclability assessment at EU level that took into account the development of packaging design, material innovation, collection, sorting and recycling technologies.

Specific interventions suggested to improve the recyclability of packaging included:

- Eliminating the use of mixed plastic packaging, such as laminates, where alternatives can provide the same technical specifications. (Aarhus)
- Reducing and eliminating the use of labels (Aarhus) and other features such as prints, colours, glues and staples, that worsen the recyclability of packaging (FEAD, EuRIC).
- Eliminating plastics who's supply chain and life cycle was not fully sustainable, such as PVC and PS. (Aarhus)
- Improving the suitability of packaging for automated sorting. (EuRIC)
- Increasing digital recording and sorting data. (Henkel)
- A ban on the marketing of non-recyclable packaging. (No Plastic In My Sea Association)

IK Elipso stated that, currently, in Germany, about 75% of household plastic packaging was recyclable, and that there was further scope for improvement, with the German manufacturers of plastic packaging setting themselves the ambitious goal to improve this to 90% by 2025.

5.1.2 Raising concerns

Concerns raised regarding measures to improve the recyclability of packaging included the following:

- Eliminating mixed plastic packaging, such as laminates, to improve packaging recyclability could lead, in certain instances, to an overall rise in the amount of plastic packaging produced. This was because when the use of laminates is restricted, packaging requires a thicker layer of a single polymer packaging to provide the same technical properties. (Aarhus)
- Reducing the complexity of packaging materials, without assessing the existence of more sustainable alternatives, could have unintended environmental consequences such as increasing food waste and undermining the EU's climate and food waste agenda. (EuroCommerce, FPE)
- Reducing the complexity of packaging materials can have an impact on the health and safety, and functioning, of the packaging. (FPE, ACE, Herbalife Nutrition, BDSI, NRK VERPAKKINGEN)
- Manufacturing less complex packaging could often be more costly. (Herbalife Nutrition)
- Having positive lists of criteria that define what types of packaging are allowed on the market, and negative lists of types of packaging that hinder recycling processes, risks being too prescriptive, stifling innovation. (CEPE)
- Nonrecyclable plastic packaging that has clear environmental benefits compared to recyclable alternatives should not discriminated by market bans. (IK Elipso)

IK Elipso also argued that, as long as the reuse or recycling of packaging was economically feasible, there was no need to reduce the complexity of packaging or of the materials and polymers used.

5.1.3 Labelling

Some stakeholders supported the use of appropriate labelling measures to improve packaging recyclability. One stakeholder called for a way to easily distinguish between brown and green glass, for those who suffer from colour blindness, and that this could be, for example, a unique marking on one glass colour. Slovenian NGO Društvo Ekologi brez meja called for standardized and mandated labelling on packaging so that consumers could make fully informed consumption choices. Senatsverwaltung für Umwelt also called for appropriate labelling and identification systems.

5.1.4 Minimum quality standards

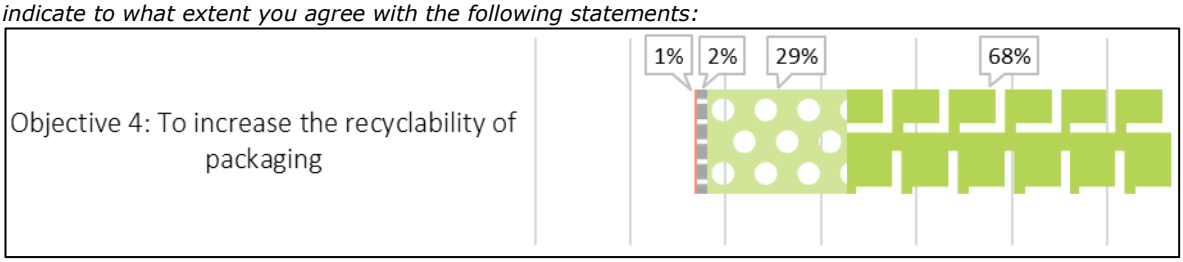
There was support across stakeholders (A.I.S.E., EuroCommerce, Henkel, NRK VERPAKKINGEN) for the introduction of minimum quality standards for recyclates and outputs of recycling

processes. Henkel called for standards to differentiate between different materials and uses, particularly with non-food applications.

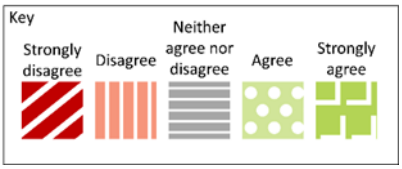
5.2 Online public consultation

Overall, there was a high degree of support for all packaging to be recyclable. This was showcased clearly in responses to question 11, which asked stakeholders to indicate to what extent they agree with the objective of increasing packaging recyclability. Figure 5-1 illustrates the responses received.

Figure 5-1: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:



Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective



Of the 383 stakeholders that provided valid responses, 97% (373) either agreed or strongly agreed that packaging recyclability should be increased. In addition, there were a number of questions that specifically asked for opinions on recyclability as well as a variety of instances where stakeholders were able to comment. The data has been grouped into five themes:

- Definitions, guidance, and enforcement;
- Packaging complexity;
- Maintaining the value of recyclate;
- Labelling; and
- Consumer influence.

5.2.1 Definitions, guidance, and enforcement

Many participants (e.g., BASF, DOW, and FEVE) spoke about the need for harmonised definitions across the EU for what constitutes recyclable packaging, proposing definitions they considered particularly suitable.

Some organisations highlighted that these definitions must be technology neutral to avoid unintentionally favouring or excluding certain processes.

5.2.2 Packaging complexity

A number of stakeholders raised the topic of reducing the number of polymers in packaging and/or simplifying designs to increase recycling rate. Responses were mixed, with some participants supporting this concept (e.g., EUROCITIES) and others raising issues (e.g., APK).

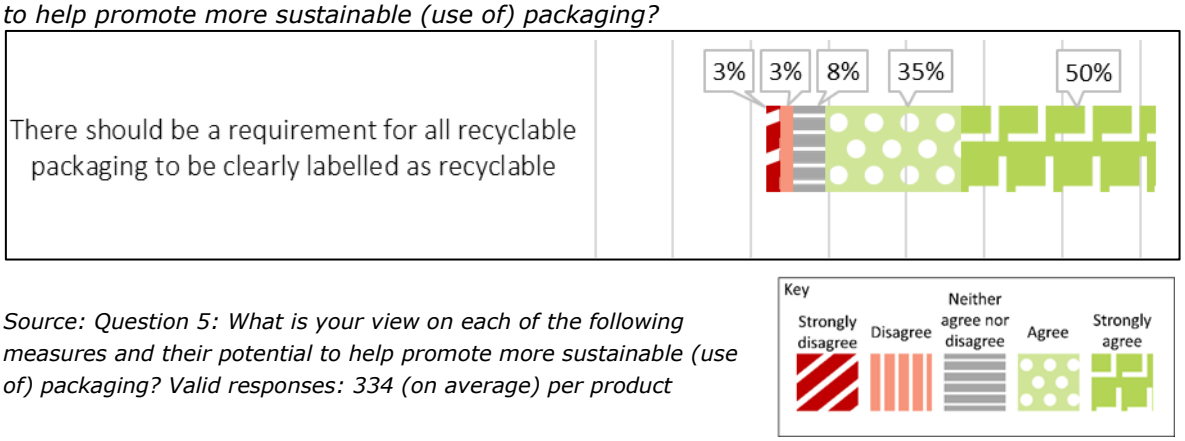
5.2.3 Maintaining the value of recyclate

A few participants highlighted the need to differentiate between recycling technologies that are capable of maintaining the value of the material and those that result in downcycling. They felt that clarity is needed to ensure that industry does not unintentionally benefit from "easy" routes.

5.2.4 Labelling

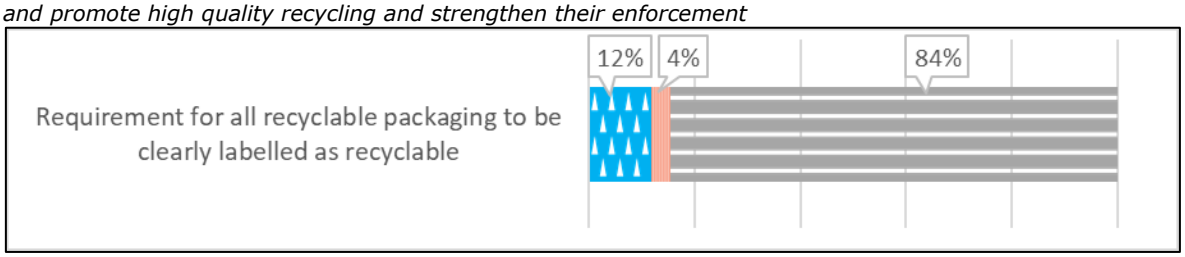
In question 5, stakeholders were asked for their views on whether there should be a requirement for all recyclable packaging to be clearly labelled as recyclable. Overall, 85% of participants agreed with this statement, as shown in *Figure 5-2*. In addition, 84% of respondents said that they felt that labelling relating to recyclability could improve packaging design and/or reduce negative environmental impacts whilst keeping costs acceptable. Figure 5-3 illustrates this response.

Figure 5-2: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?



Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Valid responses: 334 (on average) per product

Figure 5-3: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement



Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement. Valid responses: 293 (on average) per measure

Many participants noted that this labelling should be harmonised across the EU, highlighting that it could help increase collection and sorting. However, stakeholders also raised that even if

labelling was harmonised, recycling rates might not increase Europe-wide as waste management practices differ across Member States.

5.2.5 Consumer influence

Several stakeholders pointed out that recyclability depends on the ability of consumers to correctly identify recyclable materials, separate them, and sort them into the correct waste streams. Amazon suggested that improved recyclability of packaging only matters if consumers are aware of what the changes enable in practice.

Description of the results of each consultation activity, including qualitative and interpretative analysis; if different consultation activities have been undertaken in the context of the same consultation scope, a comparison of their results including interdependencies, consistencies, or contradictions in relation to contributions and main stakeholder categories.

5.3 Workshops

In the May 2020 workshop in the third session a labelling measure was presented, and stakeholders were asked to brainstorm the advantages and disadvantages.

1. **Measure:** Awareness and education such as through labelling for on-the-go consumption packaging
2. **Advantages:** Consumer awareness is required to achieve the desired behaviour change. Highlighting the benefits and savings made by consumers is particularly important.
3. **Disadvantages:** The current convenience consumption culture presents a significant barrier.

5.4 June Webinar

5.4.1 Measure 21 Updates to the Essential Requirements

Widespread support for the ambition of measure 21a - no dissenting voices but debate about scope of what is included as recycling (i.e chemical or compostable as organic recycling). There was wide support for the removal of 'energy recovery' from ER but some concern of unintended consequences such as increase in landfilling. Also the wood sector expressed that 'best' EOL of wood may be energy recovery.

With regards to Measure 21b, some stakeholders argued that non-recyclable reusable packaging should be allowed on the market provided that the reuse is proven and the environmental impacts are lower than the single-use counterpart. On the other hand, some stakeholders (industry, NGO) argued that exemptions should not be allowed due to concerns that those will be exploited by the market, and that the requirements for reuse should be on par with requirements for other packaging. There was a suggestion to extend the deadline until 2035 for reusables.

5.4.2 Measure 22 Defining recyclable packaging

5.4.2.1 Measure 22a

There was wide support for qualitative definition 22a) over a quantitative one 22c). Many stakeholders questioned where the key terms should be defined - in the legislation, or implementing act? They requested that definitions and core criteria must be clearly established in the body of the Directive and expressed concern about leaving the details to implementing acts and other secondary legislation.

There was a debate over which of the two criteria should be considered: packaging design / material properties or existing recycling infrastructure. Some stakeholders argued that only the former should be considered while a majority of stakeholder advocated for both. Additionally, some stakeholders argued for technological 'neutrality' as a way of giving chemical recycling the same standing as mechanical recycling. Finally, while some stakeholders called to follow existing definitions of recyclability such as EN13430, others argued that these are obsolete.

5.4.2.2 Measure 22b

There was a good level of support for this measure, with some stakeholders advocating for a and b. There was a call for wide stakeholder engagement in agreeing the DfR criteria as some report that their products are disadvantaged in current formulations of DfR guidelines. Also it was highlighted the need for a system in place for proper review of these guidelines, a pan european body. There were different views on frequency with which they need to be reviewed - some say annually. Finally, there was a request to ensure that DfR favours existing recycling technologies.

5.4.2.3 Measure 22c

There was widespread agreement that this measure isn't feasible, or desirable, on the basis that it would be difficult to implement – a high level of granularity would be needed, and the current EU recycling targets are material-specific, not product-specific. One NGO suggest pursuing this measure by implementing now a data collection system (from PROs) which would allow the targets to be set in 2025.

5.4.3 Measure 23 Harmonisation of EPR modulation criteria for recycling

There was widespread agreement that this is a useful measure, with the exception of the pharmaceutical industry who are concerned that they will be penalised. Some stakeholders also expressed concerns about product substitutions/switching.

5.4.4 Measure 27 Harmonised standards for labelling of recyclable packaging

There was a wide support for EU harmonisation of the labelling requirements, to strengthen the single market functioning and reduce consumer confusion. One divergent view from paper and board converters who believe there is no need for additional requirements. With regards to the content, the preference of the majority of the stakeholders was to provide information on sorting instructions – however, most acknowledged the lack of harmonisation in collection system across and withing Member States so they proposed either having digital label linking to

local instructions or waiting for a EU-harmonised collections approach (JRC study). In any case, there was some support for information being digitalised.

With regards to the format, there was strong support from brands for a language-neutral system: logos, pictograms or codes for material components; additionally, some stakeholders requested that any new labelling is subject to consumer testing to ensure acceptance and that it drives the targeted behaviours.

5.4.5 General comments

Some stakeholders highlighted the need for policy coherence between PPWD, SUPD and Green Claims initiative, and some even requested that the legal consequences for no/poor recyclability (ban) should be harmonized at EU level.

5.5 One-to-one interviews

Several organisations were consulted in one-to-one interviews which are summarised in Table 5-1. 16 organisations were interviewed in 14 interviews, all of which fed into various case studies. Five interviews contributed to a case study on flexible pouches, three contributed to a case study on film packaging, three contributed to a case study on beverage cartons and three contributed to a case study on rigid food PET thermoforms. The organisations interviewed consisted of nine packaging companies, five packaging manufacturer associations and two food and beverage brands.

Table 5-1 Targeted stakeholder interviews for recyclability

Organisation	Date	Stakeholder Input
Flexible Packaging Europe	22/01/2021	Case study – flexible pouches
Mondi Group / Papier Mettler	22/01/2021	Case study – film packaging
Amcor	22/01/2021	Case study – flexible pouches
Kunststoffver Packungen	22/01/2021	Case study – film packaging
ACE Europe / EXTR:ACT	28/04/2021	Case study – beverage cartons
Petcore	03/05/2021	Case study – Rigid Food PET Thermoforms
Trioworld	05/05/2021	Case study – film packaging
Danone Alpro	06/05/2021 17/05/2021	Case study – beverage cartons

CEFLEX	10/05/2021	Case study – flexible pouches
Tetra Pak	11/05/2021	Case study – beverage cartons
Gualapack	13/05/2021	Case study – flexible pouches
Klochner Pentaplast	24/05/2021	Case study – Rigid Food PET Thermoforms
Pepsico	24/05/2021	Case study – flexible pouches
Faerch	25/05/2021	Case study – Rigid Food PET Thermoforms

6.0 Compostability

6.1 Roadmap/Inception Impact Assessment

There was widespread support for increasing the use of compostable packaging, and there were several arguments made by stakeholders for how this could be achieved.

6.1.1 In support

Aarhus called for "progressive criteria" for compostable and renewable-source packaging to be introduced, as well as an implementation date set in legislation. Henkel support the use of biobased plastics, in order to move away from fossil based plastics, but that these should always be evaluated based on their carbon footprint and circularity potential. IK Elipso support a policy framework on bio-based and biodegradable or compostable plastics which sets out the sustainable production, use and disposal of bio-based materials, commenting that "drop-in" solutions like bio-based PET or PE are identical to fossil-based plastics and can be recycled in the respective recycling streams.

Kotkamills called for clear, standard-based and technology-neutral definitions for biodegradability and compostability of packaging. Novamont and Assobioplastiche both called for the definition of "recyclable" packaging to include organic recycling among the possible recycling technologies and for their use applications to not be limited, so that compostable packaging is not discriminated against and the principle of technological neutrality is not violated.

Nestlé believed that "concrete solutions such as drop-in bio-based plastics for packaging can help the EU meet its ambitious targets". It currently produces cost-effective, scalable and sustainable bio-based drop-in plastics, which can be reused as well as recycled using existing recycling infrastructure. PepsiCo also fully supported the need to clearly define 'biodegradability' and 'compostability' of packaging.

BBIA supported the use of compostable materials to reduce the amount of flexible plastic packaging that could not be recycled, for example when contaminated with food.

The European Snacks Association and PepsiCo both called for a requirement to specify and define what packaging materials were suitable for home composting as opposed to industrial composting.

The Polish Union of Cosmetics Industry argued that current waste management systems were not always set up to sort and recycle certain bio-plastics, and therefore, clear rules and recommendations for the sorting and recycling of each type of bio-plastics were needed.

6.1.2 Raising concerns

IK Elipso and FEAD pointed out that bio-degradation does not provide a solution to littering issues as the plastics do not decompose easily in nature (they need certain conditions to degrade). IK Elipso added that when bio-degradation takes place, the energy bound in the plastic is lost and cannot be used in power generation. Veolia commented that bioplastics and biodegradable plastics did not necessarily lead to a better environmental outcome.

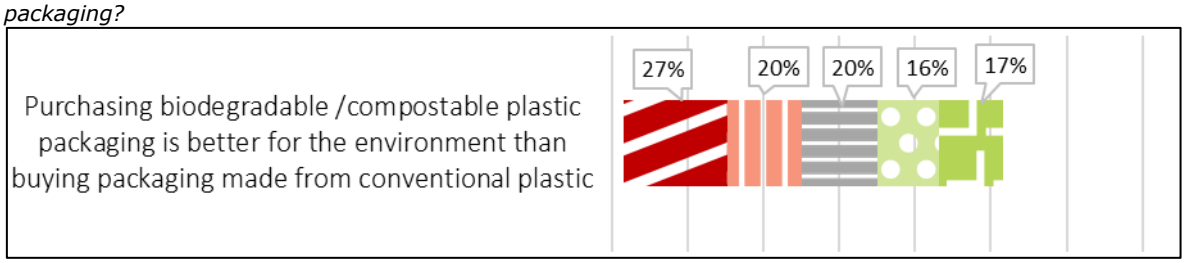
Though FEAD supports the use of bio-based plastics, they called for a clear distinction to be made between bio-based and biodegradable plastics, and between biodegradability and compostability. FEAD pointed out that some bio-based plastics do not biodegrade in bio-waste treatment plants, and that none degrade completely in the natural environment. FEAD also had concerns that mixing biodegradable plastics with recyclable plastics would "impact the integrity of recyclates".

6.2 Online public consultation

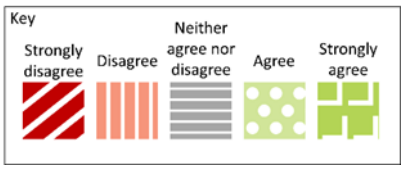
Much of the opinion provided on compostable packaging was split between manufacturers of compostables supporting their use and waste companies raising concerns. When asked in question 4 to express whether they felt that biodegradable/compostable plastic packaging was better for the environment than buying packaging made from conventional plastic, 47% of stakeholders disagreed versus 33% who agreed. Figure 6-1 illustrates the responses received.

<INSERT QUESTION 4>

Figure 6-1: Question 4: What is your view on the following statements regarding the consumption of packaging?



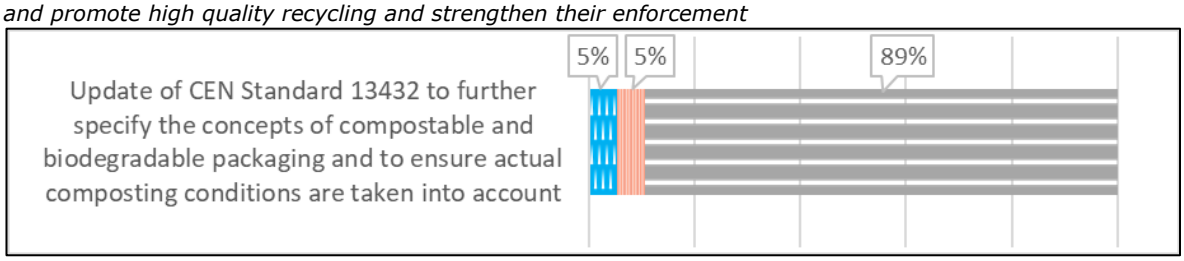
Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Valid responses: 272 (on average) per statement



6.2.1 Standards, labelling, and definitions

Many stakeholders highlighted the need for standards for compostability. ASSOBIOPLASTICHE suggested that the existing EN 13432 standard should be revised. This was further elaborated on in question 12.2. As shown in Figure 6-2, almost 90% of participants felt that updating the EN 13432 standard to further specify the criteria for compostable and biodegradable packaging (including composting conditions) would be an efficient and effective way to improve packaging designs. BASF and FNADE further added that the focus should be on certifying products that are compostable in any kind of plant or process.

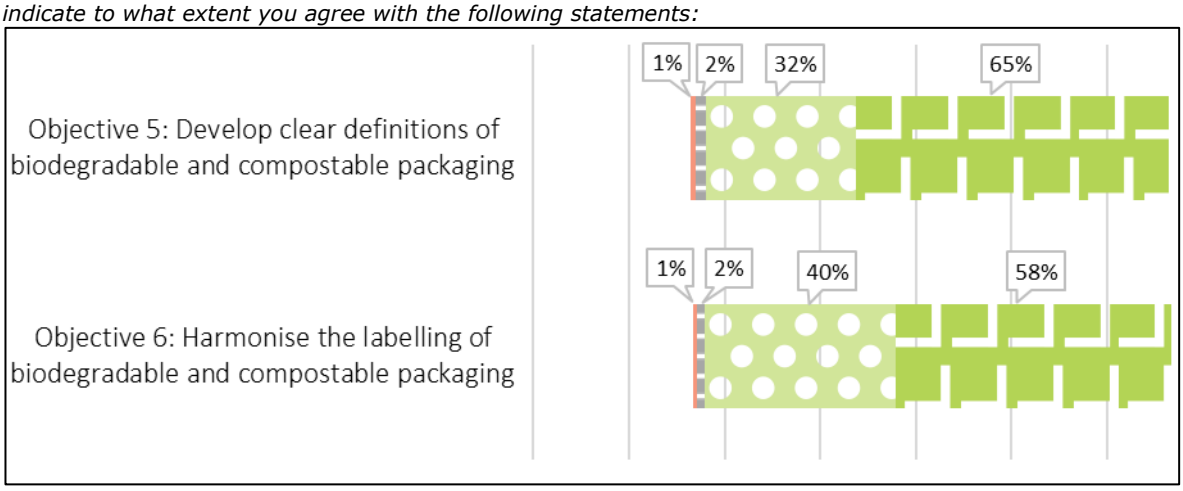
Figure 6-2: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement



Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement. Valid responses: 293 (on average) per measure

This was further reinforced in the views on policy and operational objectives in question 11. Figure 6-3 summarises the results. In total, 97% of stakeholders agreed with objective 5 (developing definitions for biodegradable and compostable packaging) and 98% of stakeholders agreed objective 6 (harmonising labelling of biodegradable and compostable packaging).

Figure 6-3: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:

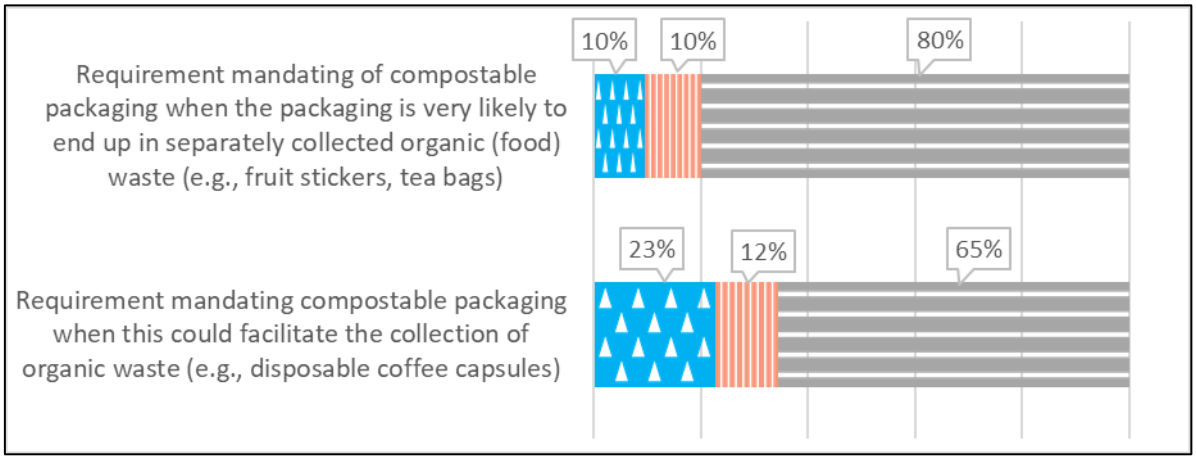


Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective

6.2.2 Application-specific implementation

Question 12.2 asked participants for their views regarding the efficiency and efficacy of mandating compostable packaging in a number of specific scenarios with the aim of improving packaging design. Overall, stakeholders deemed applications for which the packaging was likely to end up in food waste (e.g., tea bags) to be the most effective (80%), followed by applications that could facilitate the collection of organic waste (e.g., disposable coffee pods) (65%). These responses are illustrated in Figure 6-4.

Figure 6-4: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement



Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement. Valid responses: 293 (on average) per measure

Europen added that organic waste accounts for more than 50% of municipal solid waste and that compostable packaging for this waste would be preferable as it can be collected together and processed accordingly.

6.2.3 End-of-life

In question 4, a number of stakeholders commented that biodegradable/compostable packaging can be a good solution where the correct end-of-life conditions are available. In the same question, others highlighted that "compostable" materials are rarely home-compostable and require specific processing conditions. The responses are shown in Table 6-1.

Table 6-1: Qualitative response summary for question 4

Compostability	• Biodegradable/compostable packaging can be a good choice where the right EoL conditions are available • Existing standards on compostability do not reflect reality • Home compostability of "compostable" materials is not always possible

Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Number of qualitative responses: 117

During the final comments at the end of Section 2, a number of participants drew attention to the composting infrastructure in Italy. These respondents commented that compostable packaging is well-managed there and suggested that if similar processes were introduced across the rest of the EU, compostable packaging may be a preferable option.

In contrast, when participants were prompted to provide reasons why they were not in support of compostable packaging, responses included a number of comments that some biodegradable and compostable materials can negatively affect bio-waste, often can't be recycled, and can risk confusing consumers, inadvertently encouraging littering.

6.3 June Webinar

6.3.1 Measure 28 Updates to EN 13432

With regards to the scope, some comments were received from forest/paper associations requesting that the update of EN13432 includes paper-based products.

Several stakeholders across the board consider that there should be an EU standard on home composting and believe this could result in divergent standards by different Member States, which adds barriers withing the single market. However other stakeholders believe that composting should be limited to industrial processes and/or that home composting could turn out to be environmentally harmful.

There was strong sentiment amongst the stakeholders that the quality of the compost should be prioritised and short composting times should not be allowed unless they result in effective outputs. There was also strong consensus to take into account the actual composting conditions of the facilities.

There was concern amongst some stakeholders around the lack of harmonisation of collections and even the wider issue of bio-waste management – there was a request for EU-wide harmonisation.

There was a strong support for an updated and harmonised definition of compostable and biodegradable. Some stakeholders also expressed that the standard should be clear enough to clear compliance (and enforcement) without additional certifications. Most stakeholder agreed with a revision of the standard that takes into account the latest technological developments and best practices. Some stakeholders agree with the proposal of combining articles 3(c) and (d) to eliminate the term 'biodegradable' all together. An NGO objects to the norm itself, claiming that it does not lead to environmental benefits.

6.3.2 Measure 29 Criteria for compostable packaging

Some stakeholders expressed preference for measure 29a and rejected any type pf restrictions on the market. At the same time, other stakeholders objected to measure 29a on the basis that it would perpetuate the issue of cross-contamination and consumer confusion.

Some stakeholders support measure 29b (recycling industry, PRO, packaging manufacturers, trade associations) since they believe it will lead to higher quality stream of compostable material and less contamination from conventional plastics. On the other hand, several stakeholders objected to measure 29b for very different reasons: some industries consider it discriminatory and disproportionate, an NGO considers that exceptions would confuse customers that efforts should rather be allocated to reuse alternatives, other industries consider that bans hamper innovation and/or that producers should be allowed to choose the type of material for

their packaging products. In any case, the proposed list of products generated diverse views, with several stakeholders objecting to the criteria for selecting the products and the proposed list of products.

Finally, with regards to Measure 29c, some stakeholders expressed their preference (plastic industry, recycling industries, PROs, a Member State) on the basis that all packaging must be recyclable. Several other stakeholders considered measure 29c discriminatory, disproportionate and potential leading to a loss of competitive advantage (and even a barrier to international trade).

6.3.3 Measure 30 Harmonised labelling and/or watermarking

In general, there was a strong support for harmonised labelling, noting the current confusion and diverging practices in the market. Additionally, there was a strong request from stakeholders to consider labelling in a wider sense within PPWD so that there is a horizontal measure to describe the sorting instructions of the package. Many of the stakeholders also requested harmonised collection and sorting systems across the Member States. On the other hand, some stakeholders believed that labelling would only add to the existing confusion. Finally, some stakeholders noted that there are good certificates and labels for compostable, such as EN13423, Italian and Irish certification schemes, Seedling and OK compost.

With regards to the text, some stakeholders objected to the proposal on different grounds: too lengthy, would need to specifically mention if the packaging is suitable for industrial or home composting. Additionally, it was requested to make clear that the packaging is not suitable for plastic recycling, to avoid contamination. Several stakeholders agreed with the message of "do not litter" to consumer confusion. There was also a comment that vague, confusing or misleading terms (especially "biodegradable") should be forbidden.

Some stakeholders expressed their recommendations for digital watermarking solutions and/or any kind of technological solutions that allow dedicated messages in different territories. Some stakeholders (industry and brands) expressed concerns on the availability of space in labels to include additional messages. Finally, some stakeholders noted the need to accompany any new labelling requirement with communication to consumers.

6.3.4 General comments

There were diverging views on the debate 'is composting recycling or is recycling superior to composting' – some stakeholders believe that composting should be considered organic recycling and at the same level in the waste hierarchy to mechanical recycling.

6.4 One-to-one interviews

Several organisations were consulted in one-to-one interviews which are summarised in Table 6-2. Seven organisations were interviewed, one of them twice.

Table 6-2 Targeted stakeholder interviews for compostability

Organisation	Date	Stakeholder Input
BBIA	15/01/2021	Problem definition and measures
EUBP - 1	25/01/2021	Problem definition
Novamont	27/01/2023	Problem definition and measures
ECN	03/02/2021	Problem definition and measures
Rethink Plastic	25/03/2021	Problem definition and measures
Amcor	29/03/2021	Measures
Associobioplastico Italy	15/04/2021	Problem definition and measures
EUBP – 2	15/04/2021	Measures

7.0 Recycled content

7.1 Roadmap/Inception Impact Assessment

7.1.1 In support

There was widespread support across stakeholders of the need to increase recycled content in packaging, but there were different views as to how this should be achieved and how much government intervention was needed.

Europen and AISE called for an increase in recycled content to be driven by a voluntary approach before considering the imposition of mandatory requirements. Europen added that a well-functioning EU market for high-quality secondary raw materials at a competitive price was needed to improve the uptake of recycled content. Any national measures that discriminate against secondary raw materials sourced from other MS should not be permitted. Food Drink Europe called for measures to incentivize, encourage and reward the circularity of packaging materials.

Nestlé stated that chemically recycled feedstock could help incorporate high quality recycled content in packaging, and strongly supported the increasing use of recycled content in packaging as a "win-win-solution for a circular economy".

Stakeholders such as Aarhus and Health Care Without Harm Europe called for progressive criteria to be introduced that encouraged the use of secondary raw materials (recycled) in packaging. EuRIC called for increased support for recycled plastics in packaging, and for its environmental benefits to be rewarded, so these could be reflected in their prices and support their economic viability, particularly in times when virgin material prices were low due to the collapse of crude oil prices.

Stakeholders acknowledged that the price of food-grade r-PET should be decoupled from oil prices by setting clear recycled content targets in new products which the industry could work towards.

The following measures were suggested to increase the recycled content of packaging:

- A reduction of VAT on products which have highly recyclable packaging. (FEAD)
- Voluntary agreements in the private sector. (FEAD)
- Removing constraints on the use of recycled vs. virgin plastics food-grade packaging. (Veolia)
- A reduction of subsidies for the use of virgin plastic materials, and an increase in subsidies for the use of secondary raw materials. (Estonian Ministry of Environment)

The European Snack Association, Pepsico and UNESDA called for a clear definition for recycled content, and one that is harmonized and stays technology-neutral while accounting for latest innovation in recycling technologies.

Several stakeholders made comments about the need to amend food contact provisions to facilitate the increased supply of secondary material from food contact applications, whilst maintaining consumer safety. Health Care Without Harm Europe called for consistency between the reformed Food Contact Materials (FCMs) legislation and other policies related to food, products, and packaging.

7.1.2 Recycled content targets

Stakeholders such as FEAD, FNADE and NRK Recyclate stated their support for the introduction of mandatory recycled content targets, arguing that binding targets were essential to increase the demand for and the price of recycled plastics, and to channel investment into the recycling sector.

Aarhus called for target recycled content percentages to be established in consultation with the whole supply chain. The Polish Union of Cosmetics Industry argued that any recycled content targets should consider the safety requirements of particular consumer good categories (e.g. cosmetics products) as well as the availability of secondary materials.

When introducing recycled content targets for specific packaging formats, Rethink Plastic Alliance called for giving "clear prioritisation to recycling processes yielding outputs that produced polymer materials directly while strictly excluding more carbon-intensive processes", and Tetrapak called for low-carbon materials such as renewable and bio-based materials to be treated equally to recycled materials.

7.1.3 Support for labelling of recycled content

FEAD called for the development of a standard label which showed the percentage of recycled content in each plastic packaging type, arguing this would build trust between consumers and producers and lead to an increase in consumer demand for products with a high level of recycled content.

7.1.4 Raising concerns

There were stakeholders, however, who raised some concerns or aspects to be aware of in the drive to increase the recycled content of packaging and impose targets. Food Drink Europe cautioned that safety standards would be compromised unless clear guidance for foodgrade recycled plastics was provided. The European Mineral Wool Insulation Manufacturers, meanwhile, argued that the technical performance of certain packaging types needed to be considered when increasing the recycled content of such packaging.

There were several stakeholders who also cautioned that setting targets could unfairly favour certain market players. The Swedish Forest Industries Federation argued that targets or requirements for the proportion of recycled raw material could in some cases "disrupt an already functioning market (e.g. paper/cardboard)" and APEAL argued similarly. AISE called for the setting of targets to be avoided especially for "specific material or packaging formats" as this could hinder innovation. Instead, any targets should "be set as 'minimum content' that is achievable across a sector". AISE, European Carton Makers Association and the German Paper Converting Association called for any mandatory requirements to be targeted at packaging materials whose secondary markets need to be incentivized.

EOS commented that a demand for mandatory recycled fibres would lead to increased imports of recycled fibres, as most producers in Northern Europe use fresh fibres, and this would increase transport costs and emissions.

FPE called for the Commission to ensure the availability of food grade recyclates before adopting any mandatory targets, and for drivers such as the price of primary raw materials and the state of infrastructure to be factored into any impact assessments.

IK Elipso expressed that "quality standards, traceability and assurance systems for recycled materials were urgently needed by converters in order to mitigate risks for product quality and consumer safety and ensure legal security of the producer". Additionally, a limiting factor, in certain packaging segments, was the unavailability of large quantities of recycled material in consistent quality.

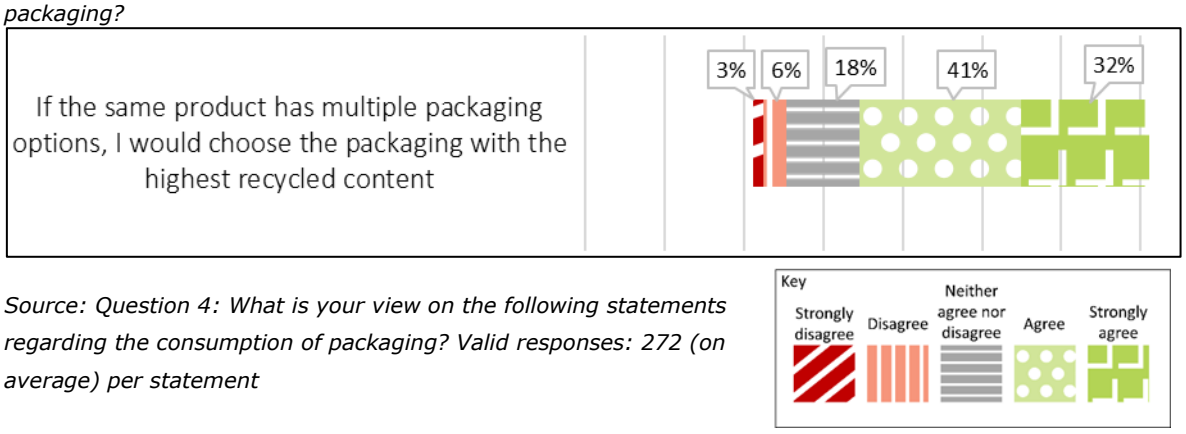
7.2 Online public consultation

Overall, the quantitative responses throughout the questionnaire were largely in support of increasing the recycled content in packaging. Despite this, within the comments there were a number of stakeholders who raised concerns over increasing the use of recyclate.

7.2.1 Support for increasing recycled content

Question 4 asked participants to indicate to what extent they agree with the statement "If the same product has multiple packaging options, I would choose the packaging with the highest recycled content". In total, 73% of the 271 participants who provided valid responses said they either agree or strongly agree with this. See Figure 7-1.

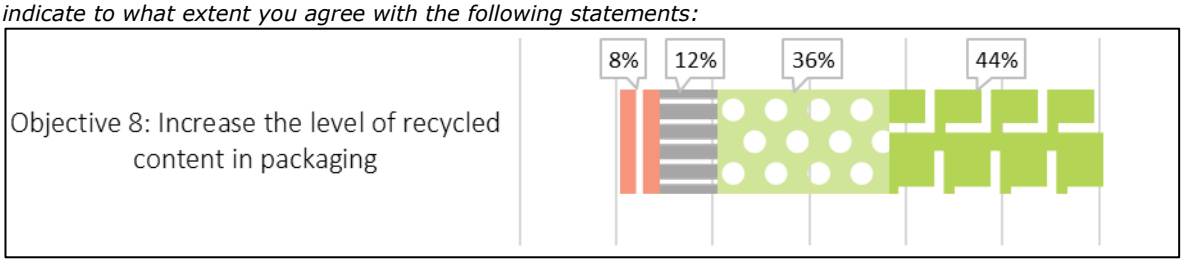
Figure 7-1: Question 4: What is your view on the following statements regarding the consumption of packaging?



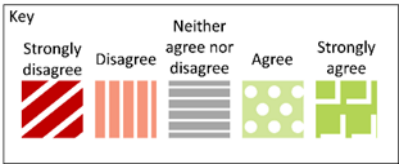
Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Valid responses: 272 (on average) per statement

In addition, in question 11, participants were asked to indicate to what extent they supported the objective to "increase the level of recycled content in packaging". In total, 80% of 376 participants agreed or strongly agreed with the objective. See Figure 7-2.

Figure 7-2: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:



Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective



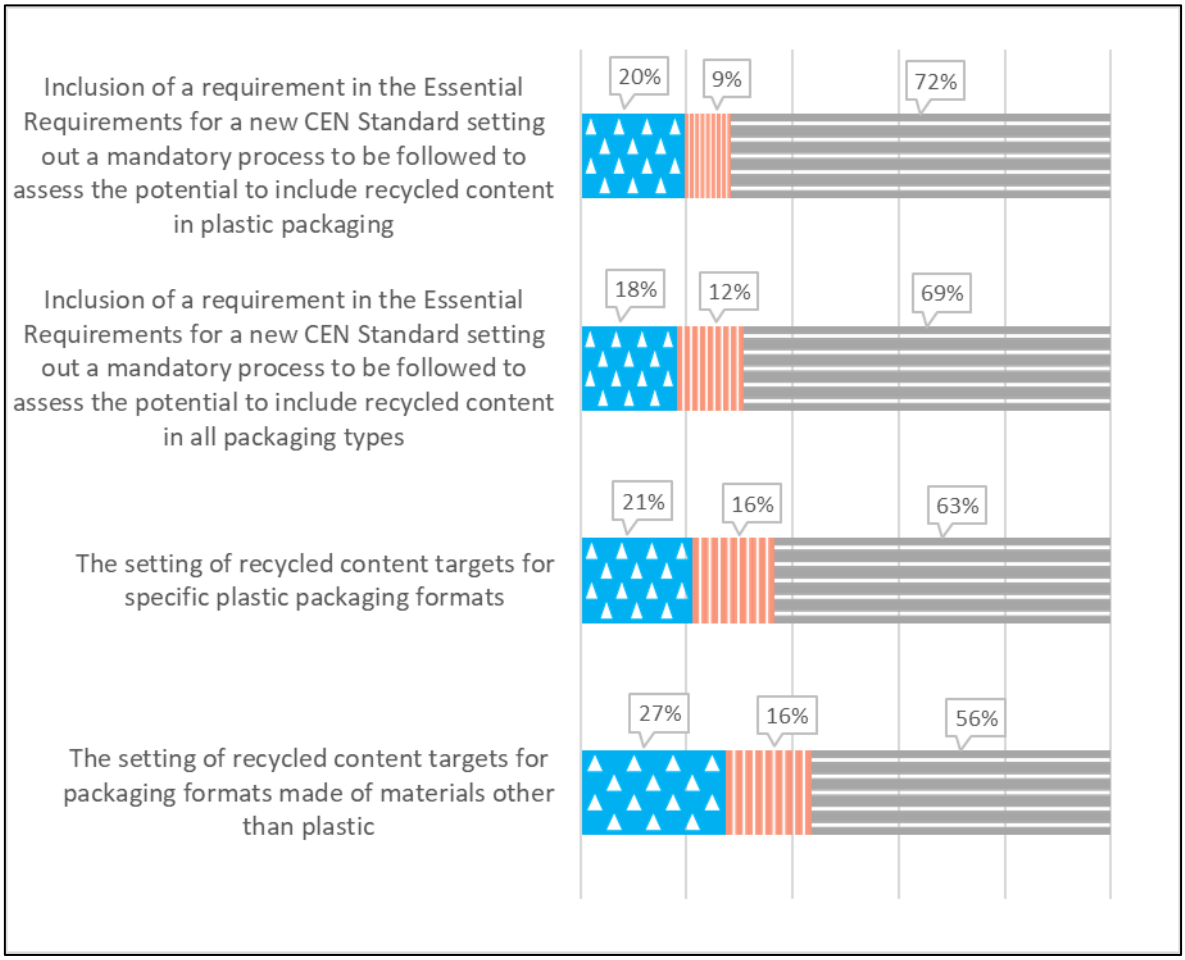
7.2.2 Concerns over increasing recycled content

Despite the quantitative analysis, there were several stakeholders who raised concerns over the introduction of minimum recycled contents targets throughout the comments and attachments. In particular, several participants (for example, DuPont) highlighted that food contact applications were unable to use most recycled polymers and that mandatory targets could favour certain industries over others, skewing the market. This point was further reinforced in question 13, where a number of stakeholders suggested that certain products should be exempt from using recycled content if safety could be compromised (e.g., certain food or pharmaceutical products).

7.2.3 Suggestions for increasing recycled content

Question 12.3 asked participants to assess four measures related to increased recycled content in packaging and comment on whether they felt the measures would be effective (i.e., would increase demand for recycled content and/or reduce negative environmental impacts) and/or efficient (i.e., costs would be acceptable). The questions and responses are illustrated in Figure 7-3. On average, 65% of participants felt that the measures would be both efficient and effective.

Figure 7-3: Question 12.3: Measures related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials



Source: Question 12.3: Measures related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials. Valid responses: 366 (on average) per measure

When given the opportunity to suggest additional EU-level measures to help increase recycled content in packaging in question 13, suggestions included:

- Incentivising recycled content instead on mandating its use;
- Setting ambitious minimum recycled content targets for packaging; and
- Establishing EU standards surround recycling plastic.

7.3 Workshop

The November 2020 workshop was fully devoted to Recyled Content and it yielded useful insights.

7.3.1 Problem Defintion

Some participants raised the following broader comments related to the suitability of the packaging sector:

- there is a need to ensure that all materials are collected and recycled with an end-market in sight, regardless of whether the end market represents a closed-loop application or not. In some cases, it was noted that the most suitable applications of recycled packaging materials may not be in the packaging sector (e.g. recycled polypropelene packaging, which cannot currently be used in food contact packaging applications, already has a reliable end market in the automotive sector.)
- on the other hand, the importance of avoiding "dead-end" recycling was also highlighted, where there may be strong demand for PCR in applications that are themselves not amenable to recycling (e.g. PET bottles recycled into PET trays that are then incinerated).
- in addition, stakeholders highlighted that at present there might be more potential to include RC in secondary and tertiary packaging, relative to primary packaging due to a number of barriers.
- Overall, the discussion of targets that would be applied across the packaging sector as a whole was inconclusive, with some progress made on specific targets for particular materials/ applications as highlighted below.

In terms of economic barriers to RC uptake, participants recognised the existence of a "chicken and egg" situation in which demand relies on quality and quantity of supply, and investment on the supply side relies on strong demand for secondary materials.

- It was agreed that so far, there has been misalignment in policy implementation which has largely focused on the supply side, and therefore there is a need for targets or other incentives to balance this out on the demand side in some applications. The SUPD target for recycled content in beverage bottles was assessed to be working well in stimulating demand for PET and keeping prices of PET high (thereby bridging the price gap with virgin materials that is currently a barrier in this sector).
- Conversely, it was also noted by some participants that supply is a key barrier to recycled content uptake for packaging of certain materials, in terms of a need for increased collections and a higher quality of sorting to ensure the security and quality of supply. This was cited particularly in the case of aluminium and steel packaging, in which lower secondary material costs, and the form of recycling (contamination and technical limits) are not a problem, and strong demand for secondary materials are already in place.
- In terms of improving collections, it was noted that issues of capacity and matching demand with the right infrastructure for supply were problematic, with the example of underutilised capacity in PET reprocessing being provided. A need to focus on design for recyclability, and to develop domestic recycling capacity (to avoid losses of high quality reyclate in waste shipments) were also mentioned.

In terms of the packaging material specific issues that were discussed, in addition to the supply side problems faced in the aluminium packaging sector, the following points were also raised.

- Participants generally supported the definition of a problem in recycled content uptake in plastic packaging, largely driven by volatility in prices of secondary

materials and the discrepancy between virgin and secondary material costs. It was noted that while PET bottle recycling is relatively well developed in some countries, this is not true of all EU Member States. A specific barrier to improving the recycling of other plastic packaging types was noted, related to a lack of clarity in existing legislation, for example, defining 'reusable and recyclable in a cost effective manner' and 'improving design for reuse and promoting high quality recycling'.

- For paper/ card packaging, it was noted that markets are well-established and functioning properly, supported by long-standing industry standards for the use of recycled fibres in packaging that are in place – this could be replicated for other materials. Discussions of fibre products with lower recycled content focused on beverage cartons, in which a number of barriers were identified, including low collection volumes and quality,competing demand for high quality fibres, technical and legal barriers associated with food and drink contamination and functional integrity of the packaging. It was noted however, that there is some potential for RC inclusion in beverage cartons, for example, by including a thicker carton wall using shorter fibres, using PCR in the PE lining (if enabled by revisions to the food contact regulations and approved by COM), and replacing aluminium foil layers with "renewable materials", though it was unclear whether these incorporate recycled content or not.

The food contact material regulations were also cited as a key factor underpinning the poor performance of plastics in particular. In this respect, it was noted that the current process for approvals is too slow, with a need for simplification of the standards and broadening to include recycled polymers aside from PET. Chemical recycling was mentioned as one possible solution to this issue, though the uncertainty associated with the timescale and viability of non-mechanical recycling approaches, as well as the potential reduction in environmental benefits when shifting from mechanical to non-mechanical recycling were identified as concerns. A further suggestion included the potential restriction of the use of certain polymers for food contact.

Finally, several of the groups also discussed consumer attitudes as a potential barrier to increasing RC uptake, in so far as the visible characteristics of packaging incorporating secondary materials may be less preferable than more conventional virgin material packaging. It was suggested that this barrier may be relatively straightforward to overcome through the use of marketing and communications regarding the positive impacts of increased recycled content, which consumers are likely to be more willing to accept than industry might fear.

7.3.2 Potential Measures

1. Targets

It was suggested that a more holistic view of recycled content targets (across all sectors by material as opposed to packaging specific) merits further consideration given the structure of the secondary materials market, albeit bearing in mind the potential benefits of closed loop recycling

In terms of recycled content targets for the packaging sector specifically, the general view was that some materials/ packaging products do not need targets at all (particularly metals and paper/ card – aside from beverage cartons). For such materials, the need for higher recycling rates to allow increased RC uptake was noted. In addition, it was noted that RC targets should not detract from ongoing reuse/ refill/ refurbishment for some packaging in line with the waste hierarchy.

The need for a distinction between contact sensitive (food, toys, cosmetics) and non contact sensitive applications was widely noted as a key consideration in the setting of targets, with bigger opportunities currently present in the latter segment, though contact sensitive applications should still be considered where appropriate.

In terms of the scope of targets, stakeholder views varied widely, with some proposing a high level of granularity, and others suggesting more broad, flexible targets. Some participants suggested a mixed approach might be suitable, with some targets for a material category or application category as a whole, and other more specific targets for particular materials and applications that need to be more driven to use PCR. For plastics, several groups identified a polymer specific approach as being suitable given the variations in recycling processes for different polymers. Existing frameworks for packaging categorisation in DfR approaches were proposed as a starting point.

It was noted that longer term ambitious targets would be most appropriate to send a clear signal to industry, potentially focussed on specific materials and applications that are feasible in the short term and changing in scope and ambition in the longer term as the technology, regulations and information improve. It was also noted that there is a need for targets to ramp up progressively – to signal the clear intention and help drive infrastructure investment. In the short term, there may be a risk of targets being set too high too soon, without adequate EFSA approval for recyclate from mechanical recycling processes in food contact plastics, resulting in a shift to chemical recycling, which will erode environmental benefits relative to mechanical recycling. Hence, a short term focus on specific packaging materials and applications, which are most feasible (the "low hanging fruit"), with a longer term extension of the scope and level of targets was suggested.

2. **Standards.** While stakeholders agreed that there is a need for harmonised standards to encourage recycled content uptake in the packaging sector, a standard for assessing potential recycled content in particular (as presented) was not identified as necessary. Instead, stakeholder comments focused on harmonised standards related to:

   Secondary material output quality, particularly for plastics. It was suggested that this would provide a degree of quality assurance for the use of particular recycled plastic grades to meet specific requirements, and reduce both the current competition for food-grade plastic in downcycled applications (simply because it is the only secondary material of reliable quality at present), as well as continued reliance on virgin plastics in some applications where secondary materials could be applied (but are associated with quality risk at present).

   Alternatively, it was suggested that the issue might also be solved using standards for recycling technologies (including collection and sorting), to achieve alignment across the EU in terms of the quality of input, and therefore output of recycled materials, enabling the development of uniform grades of material to meet specific requirements. It was noted that this could include recognition of chemical recycling where appropriate.

3. **Labelling.** Stakeholders agreed with the need to question the purpose of harmonised requirements for labelling related to the percentage of recycled content in packaging, noting the following key points:

   Labelling of the percentage of recycled content in packaging would be of limited interest to consumers, and it is not clear what consumer behaviour such a label would be intended to drive.

   RC labelling has the potential to be misleading – e.g. stakeholders noted that at present, some brands are advertising recycled content as a % without any means of verifying this information, leading to the misconceptions that it is easy to include recycled content in packaging and that the brand as a whole is using secondary materials – this amounts to greenwashing.

Similarly, it was noted that adding further labels to packaging may be confusing, with particular risks if consumers were unable to distinguish between recyclability information (which is already a subject of confusion) and recycled content.

4. In addition, if a measure related to recycled content labelling was to be taken forward, stakeholders raised the following key comments related to the scope and design of such a requirement:
   - It was noted that the consumers would likely be more interested in the emissions reductions resulting from the use of the recycled content.
   - It was suggested that labelling related to environmental benefits should be for the whole product in question, not just the packaging
   - The need for any information related to RC to be backed up by strong auditing and value chain traceability was raised. Related to this, it was noted that a measurement method for recycled content in packaging should be developed in a non-discriminatory way (i.e. applicable to all materials)
   - Finally, the potential for the use of markers/ identifiers on packaging to enable tracing across the value chain was also discussed.
5. **Supporting Measures.** In addition to the three main measures (targets, standards and labelling) presented at the workshop, stakeholders noted a number of potential additional/ supporting measures to be considered:
   - The need for clarity and a harmonised understanding of recyclability (in particular, end of life recycling) and recycled content were highlighted. In particular, the need for a definition of recycled content was noted, including the scope of such a definition (material specific or for all packaging, post consumer recycling or pre-consumer as well, etc.)
   - Some participants suggested that taxes could play a key role either in place of, or alongside targets, to address the issue. For example, relatively low recycled content targets across the sector could be applied, with modulated taxes on virgin materials/ items with lower levels of PCR to incentivise higher levels of uptake. It was noted however, that the implementation of this might be tricky, and some suggested the revenues from such taxes should be ring-fenced to be invested in R&D (e.g. to speed up EFSA processes) and infrastructure for better collection, sorting and reprocessing
   - The potential role of EPR in supporting further uptake of recycled content in packaging was also discussed. This was from the perspective of:
     - A collaborative approach to eco-modulation of EPR fees to encourage design for recycling, limiting the use of difficult to recycle packages and allowing for system change through access to increased quality and quantities of material on a larger scale than at the level of an individual MS.
     - Allowing packaging producers an element of control over their stream of packaging waste, i.e. an EPR scheme should offer first refusal to members in order to use the material.
     - Requiring EPR schemes to sell recyclate at a lower price than virgin materials, instead of raising EPR fees to offset the loss in revenue.
     - Utilising eco-design criteria, not necessarily to encourage recycled content, but packaging efficiency (i.e. focusing on getting recycled materials into "same or similar" packages).

7.3.3 Likely Impacts of Measures

The following likely impacts of the measures were highlighted by the stakeholders, largely associated with the risks around implementation of recycled content targets:

1. Managing impacts on smaller producers, who may not have similar means to secure the material as large producers, was identified as being potentially challenging, with the need for a mechanism to ensure fair and equal access to supply. In addition, the need to ensure that imports are also subject to the requirements, including not only recycled content targets for packaging, but also certification/ traceability requirements for secondary materials, was noted as key to preventing a competitive disadvantage to domestic reprocessors/ packaging producers.
2. In the short term, risks associated with increased demand without an accompanying increase in supply were highlighted. There is a risk for demand and prices to increase significantly, especially for rPET. However, participants also noted that, in the longer term, increased demand should stimulate supply side investment, along with funding via the EPR schemes, resulting in economies of scale and a reduction in PCR prices over time (relative to virgin prices) as well as a reduction in the price volatility currently associated with secondary plastics, in particular. The need to prevent potentially valuable waste materials from being exported outside the EU for recycling was also noted as important to secure supply.
3. Increased prices of secondary material in the short term are likely to be passed on to consumers, who in some cases will also see a reduction in the quality of packaging (e.g. visual appearance for plastic packaging specifically). On the supply side, there will also be additional costs associated with the collection and sorting of higher quality materials to meet the demand, that will result in increased costs along the supply chain. A clear communications strategy for consumers is therefore essential. It was suggested that in the long term, an ideal scenario could be the establishment of a secondary materials commodity market, allowing materials to be traded on a European exchange.
4. A number of potential unintended consequences of setting the targets too high, or with too ambitious a timeframe, were also noted as listed below:

   A number of requirements and targets related to recycling and recycled content are already in place for the years 2025, 2030 and 2035, with inadequate time for the supply chain to adjust to these existing requirements before implementing additional ones – setting targets beyond 2035 might be less burdensome.

   RC targets for packaging will result in RC being diverted from elsewhere, with increased costs to consumers (e.g. rPET diverted from polyester for textiles to packaging, making garments more costly), and potential negative impacts on the functional integrity of the packaging (e.g. food contact PP packaging forced to switch to rPET due to regulatory barrier). This will mean no growth in overall demand, and therefore no environmental benefit.

   The above may also lead to a shift to chemical recycling as a "quick win" (with potentially negative environmental consequences relative to mechanical recycling);

   Seasonality in the packaging market (e.g. Christmas time, higher volumes of packaging demand) needs to be considered alongside the available supply, to allow for stability;

   Overall, there is likely to be an increase in consumer costs, alongside a reduction in quality/ visual appearance until the market has had time to adjust.
5. Finally, a number of observations were made related to the potential implementation and enforcement of recycled content targets:

   The pros and cons of implementation at the Member State level versus at the EU level were discussed in several groups, noting that the transport of large volumes of material for use at the national level as opposed to the EU market level is inefficient and costly, in addition to the burden associated with the need for enforcement/ reporting at the Member State level. However, at the EU level, it was noted that the costs of setting up a responsible authority may also be disproportionate.

   The potential to link the enforcement/ implementation of targets to EPR schemes, which can force sorting plants to deliver a certain quality of materials, and potentially

DRS systems within these to ensure quality and quantity of supply, was also noted. The potential risk of price dumping by competing EPR schemes in order to keep their clients was highlighted.

7.4 June Webinar

7.4.1 Measure 34

In general, the stakeholders wanted to ensure that it was clear at what level the reporting is done at (e.g product level, brand level, packaging level, or the average per year) as the impact on manufacturers and brand owners could vary significantly. There were differing opinions on what level reporting should be done at with a supporter for each of: packaging category, brand, product, average yearly values, and not per "individual functional unit". Clarification was needed on the definition and scope of a "brand". It was pointed out that harmonised definition and measurement method applicable to all materials would be required to ensure a level playing field.

Some stakeholders indicated that mandatory reporting could cause a considerable and disproportionate amount of extra work (while not increasing the amount of recycled content in packaging), especially for packaging that doesn't have a mandatory recycled content target. There would also need to be a harmonised measurement and reporting method to ensure fairness. There also is a worry that mandatory reporting would have a bigger impact on SMEs in terms of higher administrative burden, and lack of quality and quantity of recycled content. One stakeholder suggested a threshold level for reporting could mitigate this issue.

Some stakeholders felt that it was important that there is easy availability and access to Secondary Raw Materials throughout the EU and one suggested designing a safety net in case of a lack of materials. One stakeholder suggested that ensuring the prices of recycled materials are lower than virgin materials then mandatory recycled content targets would be reached without disrupting the supply chain. There are also concerns about the availability of quality recycled material on the market and that adequate investments need to be put in place to make sure there is enough quantity and quality of recycled material available. Furthermore, the quality of the product itself should not be affected by the use of recycled material.

Some stakeholders suggested that for some applications with strict requirements (such as food or pharmaceutical use) the targets for recycled content should be lower, not obligatory, or the products should be completely exempt. One stakeholder suggested that bio-based alternatives should be considered as a substitute for recycled content in these scenarios as plastic mechanical recycling can rarely fulfil the needs. Some stakeholders pointed out aspects to consider beyond safety and hygiene, for example: weight and functional properties; legal and technical barriers; and availability of supply.

Some stakeholders suggested that the targets need to account for new technologies such as chemical recycling, including regulatory clarity on the ability to count chemical recycling towards the targets.

Some stakeholders argued that recycled content in different materials needs to be treated in context – applications for recycled cardboard are minimal compared to recycled plastic. Recycled contact targets for whole packaging formats wouldn't take into account product specific characteristics and one stakeholder suggested that reporting should only apply where recycled content targets are being imposed. However, one stakeholder thought that reporting obligation should cover all materials.

It was discussed that there is varying complexity of supply chains across materials – sufficient time would be needed to ensure preparatory measures can be implemented before reporting takes effect. Some stakeholders raised the issue of specific EPR schemes not existing in most countries for packaging. Adequate waste collection and sorting infrastructure also needed in all countries. One stakeholder suggested each member state given access to database for reporting (to follow up market development).

Some stakeholders worry that targets as an Essential Requirement could lead to a ban of products which could cause increase of packaging more difficult to recycle and less incentive for recycled content uptake. One stakeholder suggested a soft measure with potential to justify lack of recycled content. Some stakeholders thought the Essential Requirements should be amended to include renewable materials and one stakeholder wanted clarity on the suggested definition in the webinar and what that meant for renewables.

7.4.2 Measure 35

Generally, there is more support for bottom up targets compared to top down targets but many stakeholders identified issues with both methods. For top down targets, there is the worry that it would create a disadvantage for producers of specialist materials such as food contact or pharmacy applications. For bottom up targets, there is the worry about the demand of quality recycled material. The Secondary Raw Materials may be more expensive where infrastructure is underdeveloped and there may not be enough to supply demand. Some stakeholders suggested this could have unintended consequences such as affecting the quality of the final product, market disruptions, and some companies could cut corners or find alternative solutions without care for the environmental impact. Some stakeholders suggested a combination of top-down and bottom-up targets where, for example, brands producing specialised applications have a pooled obligation to achieve an average recycled content within those groups.

Stakeholders commented on the implication of the recycled content measures for food packaging, including the suggestion that the food contact material legislation needs to be reviewed. Some stakeholders suggested that a scale up in chemical recycling would be needed to meet the requirements for food packaging. Furthermore, SMEs who only manufacture food packaging may suffer as they cannot offset their quota with non-food applications (which have less strict requirements regarding quality and functionality). Some stakeholders brought up similar issues for medical or pharmaceutical packaging, where there are also strict requirements for quality and safety.

Some stakeholders argue that an increase of recycling capacities and investments is needed for achieve the required target. Some also have opinions on chemical recycling, wanting clearer definitions on whether it's included, suggesting that a scale-up of chemical recycling is essential, and the worry that mandatory target for food packaging would result in forced chemical recycling (and have bigger negative environmental impact).

Stakeholders indicated that it is important to define whether both pre and post-consumer waste would be included in the definition of "recyclates". Some stakeholders think that only post-consumer waste should be accepted while others think that pre-consumer waste should be accepted too. For one stakeholder, including pre-consumer recyclates would provide a bridge to move to post-consumer grades that would increase in quality over time.

Some stakeholders argue that recycled content targets should also be established in other material categories and that only targeting plastics is discriminatory. Furthermore, one stakeholder suggested that applications should also accept waste from other value chains, not just packaging. However, some stakeholders were happy the recycled content target didn't extend to other material categories. In particular, glass (because the increase of the average recycled content is directly linked to the availability of more, better-quality recycled glass) and paper/board (because paper recycling market works well and introducing mandatory requirements could cause disruptions).

Some stakeholders believe that the 30% target, although ambitious, is achievable by 2030 given certain enabling conditions. Some stakeholders, however, wanted clarification on "minimum average percentage (by weight)", whether it means by weight of plastic content or by weight of entire packaging, and also the rationale behind the target for pots, trays and tubs being lower than bottles.

A couple of stakeholders mentioned ensuring the costs are not disproportionate, both in terms of admin costs relative to environmental benefit and for companies who may have to use a more granular system of collection and sorting.

Some stakeholders indicated that the ability to achieve the targets may come down to factors beyond the control of the brand owners. In this instance, a safety net concept should be introduced if brand owners can prove they have taken all reasonable steps to meet the obligations.

Some stakeholders wanted to ensure that the targets would be based on thorough impact assessments and would take into account the time necessary for research and to attain the recyclates.

Some stakeholders wanted to ensure equal treatment of EU, non-EU, small and large companies and not violate single market concept. One stakeholder specified that small member states should have access to PCR from other countries if no availability in their country. Furthermore, another stakeholder mentioned the importance of harmonising collection and recycling systems across member states.

Some stakeholders were worried about the supply of high quality recyclates once the requirements are enforced. Therefore, there is the suggestion that improvements need to be made alongside the targets in recycling technologies, collection and sorting of waste, and harmonisation of quality standard in order to increase availability of secondary raw materials and not disrupt the market.

7.4.3 Measure 37

There was strong support from stakeholders for Measure 37, claiming that a harmonised definition and calculation are key to creating a level playing field and avoid fragmentation of the single market. There were a strong debate and enquiries about the inclusion of chemical recycling; and a stakeholder recommended that bio-based content should be considered equivalent to recycled content. There were a couple of comments regarding the interplay with ISO 14021 and CEN CR 13504.

With regards to the measurement method, there was strong support for the mass balance approach. It was highlighted that the method needs to be reliable and efficient. There was a request to consider the ongoing work of the industry and to ensure the information is transparently conveyed to consumers. There were some comments stating that the proposed methodology should apply (and be the same) for all materials.

Some stakeholders stated that the recycled content targets could be not determined until the methodology is defined. Finally, while some stakeholders supported the implementing act, others believe that all definitions should be in the Directive.

8.0 Green public procurement

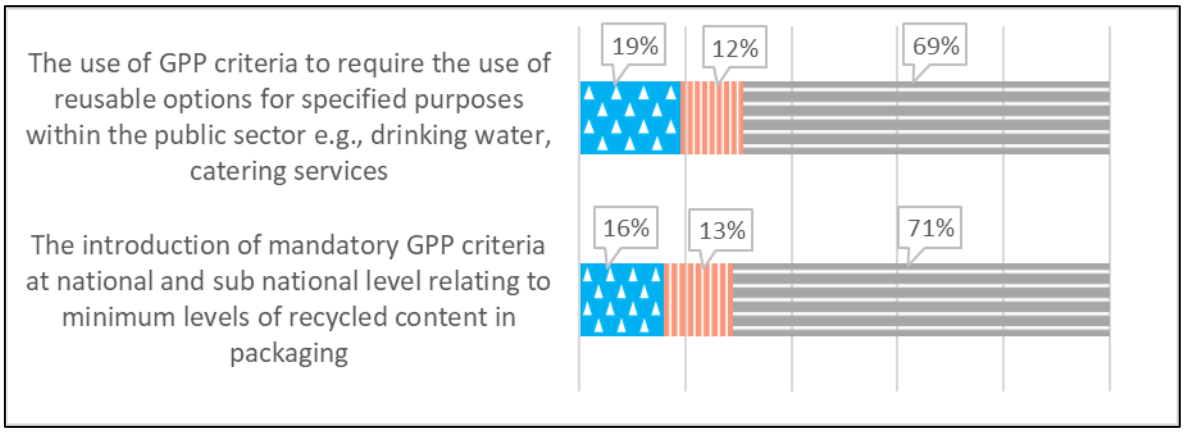
8.1 Roadmap/Inception Impact Assessment

A number of stakeholders highlighted that green public procurement (GPP) was an important method to improve the demand for sustainable packaging and create a new market for recycled plastics. Stakeholders such as ACE, Aarhus and Health Care Without Harm Europe supported the introduction of minimum mandatory green procurement criteria and targets, and FEAD called for the introduction of measures to encourage GPP. EuroCommerce stated that GPP "can play an important role in stimulating markets for secondary raw materials and help accelerate the use of sustainable packaging". Other stakeholders expressing their support for GPP included the European Panel Federation, Swedish Forest Industries Federation and ZERO (PT).

8.2 Online public consultation

Overall, few stakeholders engaged significantly in the topic of GPP throughout the questionnaire. In question 12.4, participants were asked to consider measures related to GPP and using this as a tool to promote reusable packaging or recycled content in packaging. They were asked to assess the efficacy and efficiency of the measures. Figure 8-1 shows the introduction of mandatory GPP criteria relating to minimum levels of recycled content in packaging was deemed and effective and efficient method by 71% of stakeholders. Similarly, introducing mandatory GPP criteria to require the use of reusable options for specific purposes within the public sector (e.g., drinking water) was deemed to be an efficient and effective measure by 69% of participants.

Figure 8-1: Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging



Source: Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging. Valid responses: 249 (on average) for each measure

8.2.1 Harmonisation of criteria

Few stakeholders expanded further on GPP throughout the questionnaire. Those who did wished to highlight that the criteria must be feasible and harmonised across the EU. For example, DIGITALEUROPE stated that they are in support of the proposal for specific GPP criteria but feel that it would be nearly impossible for manufacturers to comply if criteria vary across Member States.

8.2.2 Bio and compostable criteria

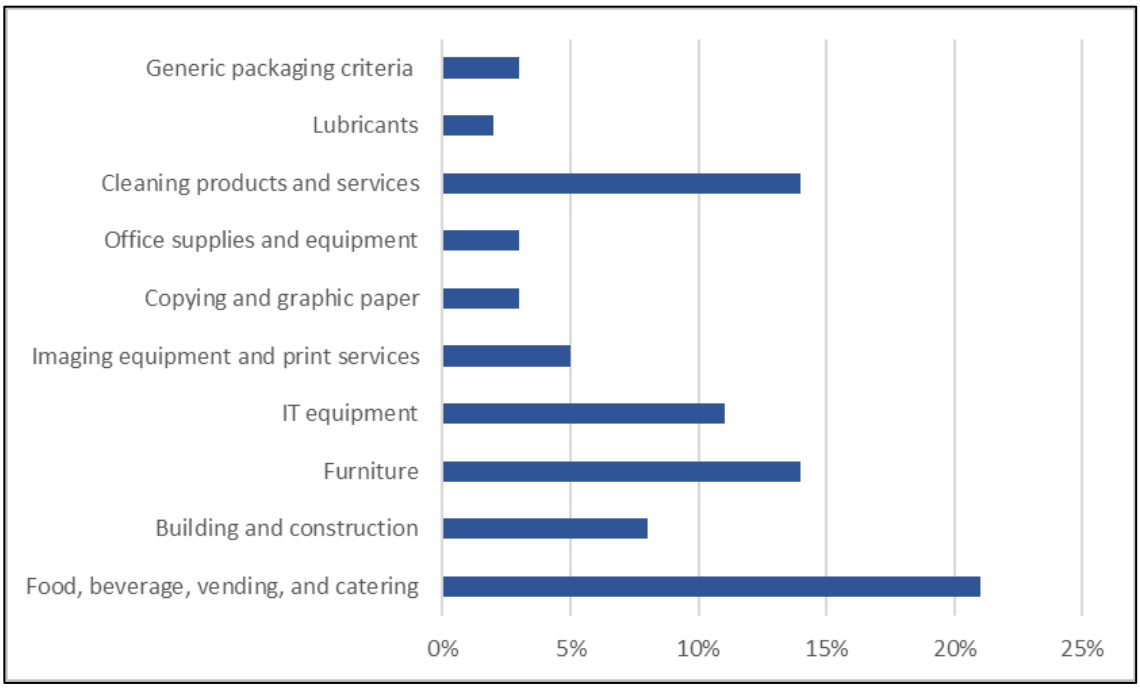
Other participants suggested that the use of bio-based and/or compostable packaging should be included in GPP when asked to suggest additional EU-level measures for meeting the sustainable (use of) packaging policy measures.

8.3 Member States questionnaire

8.3.1 Question 1

Question 1 asked participants to suggest which product categories they consider represent the highest priority for inclusion of additional packaging criteria. As displayed through Figure 3-1, the data was grouped into 10 themes. Of the 63 participants who provided valid responses, 21% deemed food, beverage, vending, and catering as the highest priority category, followed by 14% for furniture, 14% for cleaning products and services, and 11% for IT equipment. These categories were firstly selected because of the nature of the product market - mass-produced, widely distributed, and frequently replaced, and secondly, because the products have reusable packaging alternatives readily available.

Figure 3-1: In the context of public procurement, which product categories do you consider represents the highest priority for inclusion of additional packaging criteria?

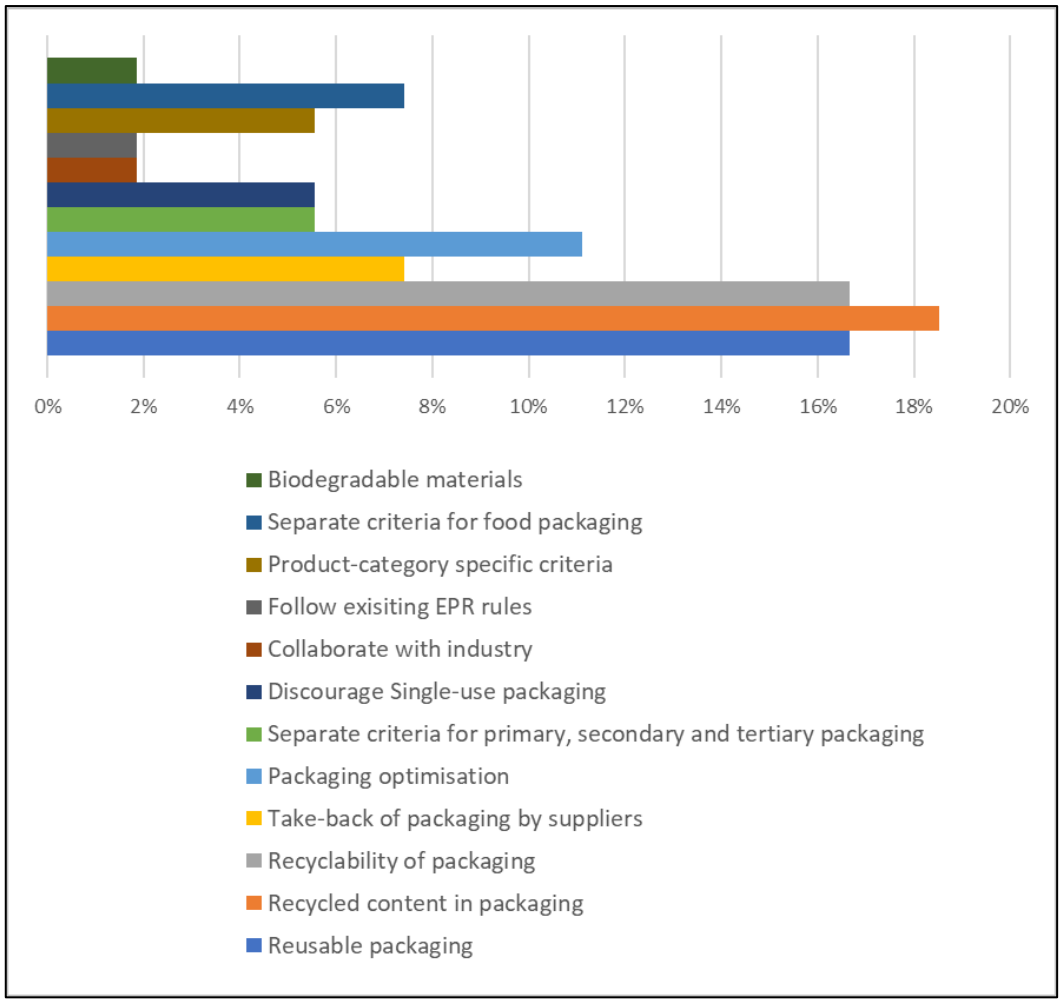


Source: Question: In the context of public procurement, which product categories do you consider represents the highest priority for inclusion of additional packaging criteria? Valid responses: 63.

8.3.2 Question 2

Question 2 asked participants to suggest what type of additional packaging criteria they felt appropriate for those product categories listed in Question 1. As presented through Figure 3-2, responses were grouped into 12 categories. Of the 54 participants, 19% deemed recycled content in packaging as the most appropriate criterion. The next best alternatives were reusable packaging (17%), recyclable packaging (17%), and packaging optimisation (11%). In contrast, just 2% of respondents deemed biodegradable materials, collaboration with industry, and the following of existing EPR rules, as the most appropriate additions.

Figure 3-2: For any product categories identified in Question 1 above, what type of additional packaging criteria do you feel might be appropriate?



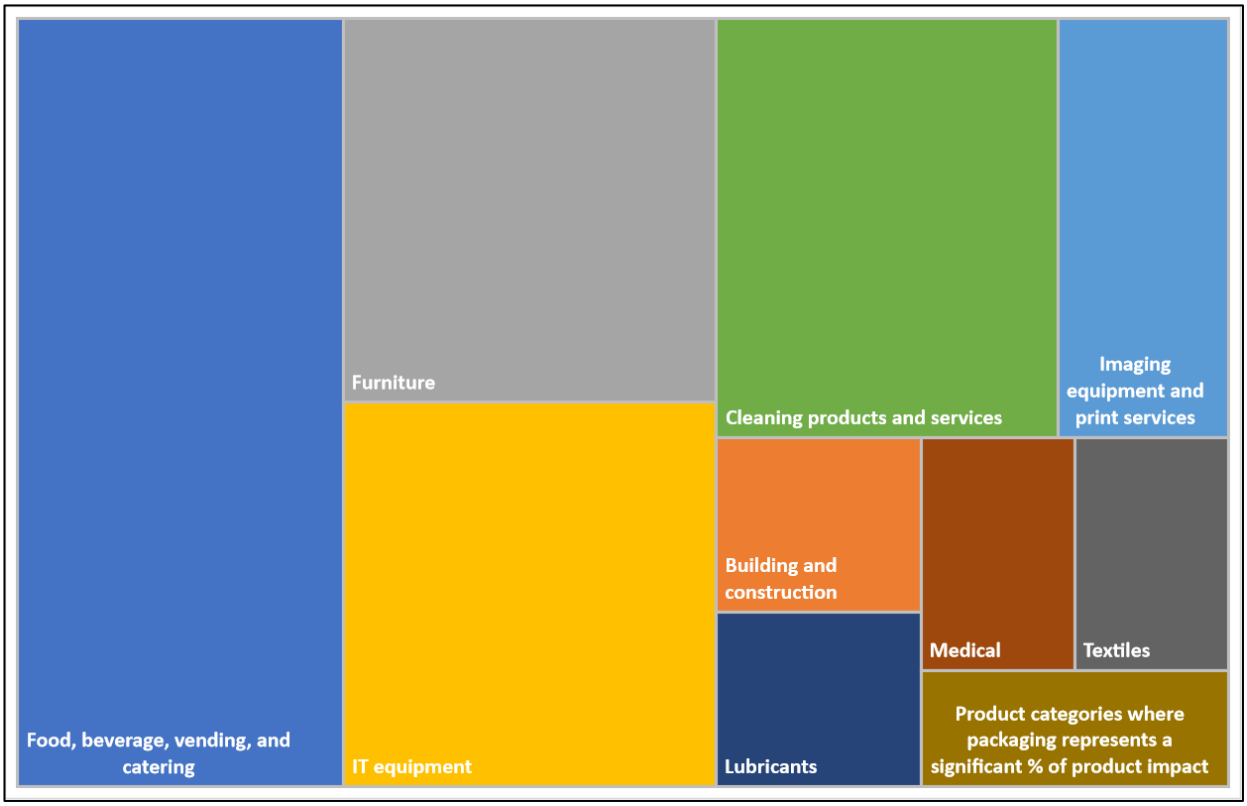
Source: For any product categories identified in Question 1 above, what type of additional packaging criteria do you feel might be appropriate? Valid responses: 54.

Despite the diversity of responses, there was a clear consensus that packaging criteria should be based upon the waste hierarchy in terms of waste prevention, reuse, and recycling. In addition, several respondents reinforced that limiting the production of single-use items should be a key priority within any additional packaging criteria.

8.3.3 Question 3

Question 3 asked participants whether they considered mandatory packaging requirements in public procurement as especially impactful in any particular product categories, and if so, which product groups would represent the highest priority. Figure 3-3 illustrates that of the 27 respondents, 26% expected the food, beverage, vending, and catering category to have the most significant impact from mandatory packaging requirements. Respondents based their reasoning upon the sheer volume of excessive packaging within the food and drink industry, as well as the material mixtures within packaging, serving to reduce recyclability and increase excess waste. Other respondents perceived cleaning products and services as most impactful (15%), as well as furniture (15%) and IT equipment (15%) due to the preventability of packaging and scope for innovation in design and delivery. These product categories identically reflect those indicated in Question 1, reflecting a clear consensus towards high priority areas.

Figure 3-3: Do you consider that there are any particular product categories where mandatory requirements for packaging in public procurement would be particularly impactful and suitable? If so, which product groups do you feel represent the highest priority, and why?



Source: Do you consider that there are any particular product categories where mandatory requirements for packaging in public procurement would be particularly impactful and suitable? If so, which product groups do you feel represent the highest priority, and why? Valid responses: 27.

At the end of this question, several respondents noted that if mandatory requirements were to be introduced, they should initially be tested within a certain time frame, with a very limited scope of covered procurement. This would allow the European Commission and Member States to gain experience with the functionalities of mandatory requirements, and become aware of practical difficulties linked to their implementation.

8.3.4 Question 4

Question 4 asked participants if they were aware of any examples of public procurement practice at a national/local level, which have set criteria in relation to packaging, and if they could provide any examples of good practice. Among the range of suggestions given, a selection are summarised in Table 3-4:

Table 3-4: Are you aware of any examples of public procurement practice at a national/local level, which have set specific (or mandatory) criteria in relation to packaging? If so, could you provide any examples of good practice?

Example	Key points
Mandatory sustainable procurement practices	› Federal and state governments enforce sustainable procurement requirements with relation to packaging criteria and technical specifications (Austria) › 15 product groups have a list of product-specific sustainable packaging requirements. The first 2 requirements set a minimum requirement for all government procurement (Netherlands) › Obligatory packaging requirements for 20 product areas (Slovenia) › Packaging requirements set for cleaning products and cosmetics, with criteria currently in development for construction, food and beverages, and healthcare products (Sweden) › Minimum criteria for food and beverage packaging (Italy) › Use of LCAs within packaging assessments and requirements (Wales)
Ban on single-use products	› Ban enforced at the municipality level for single-use items, such as plastic bottles and single-use utensils (Denmark)
DRS	› Uniformity, recyclability, and easy collection required for plastic bottles and metal cans (Sweden)
Packaging criteria included in contract performance clause	› Use of recyclable packaging as a contract clause for the supply of public materials (Belgium/Poland/Hungary)

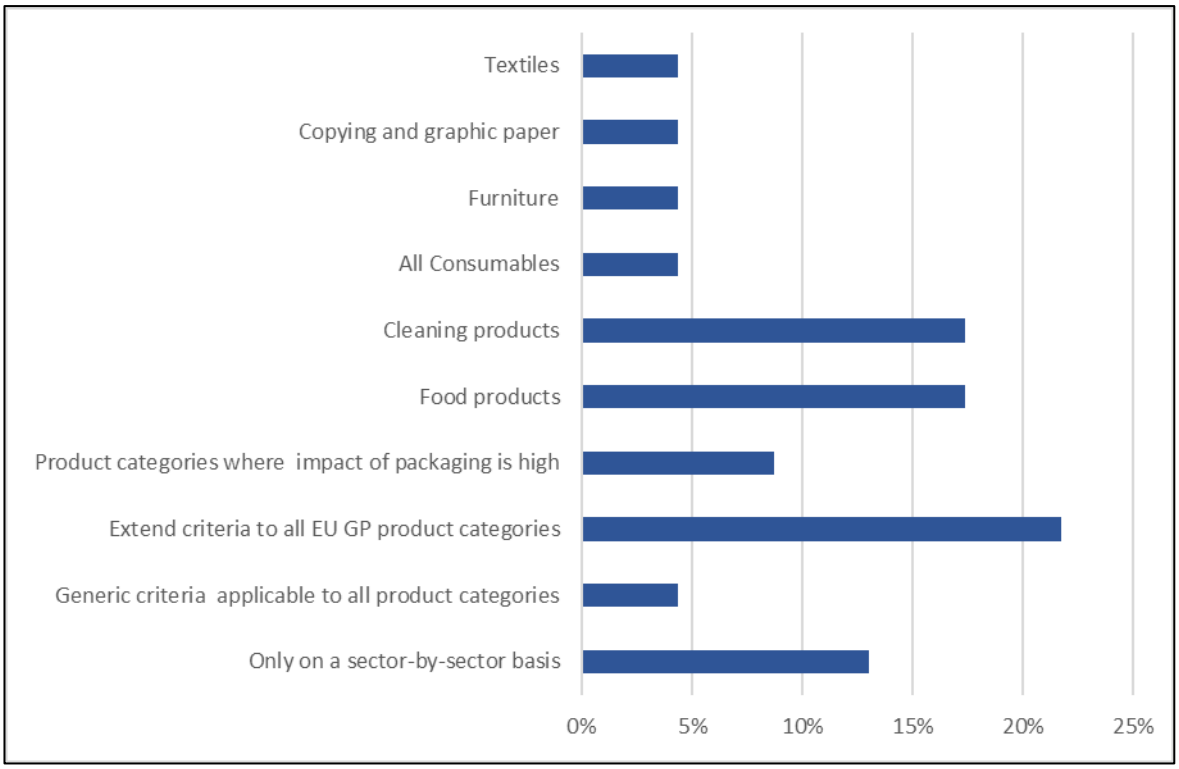
Source: Are you aware of any examples of public procurement practice at a national/local level, which have set specific (or mandatory) criteria in relation to packaging? If so, could you provide any examples of good practice?

8.3.5 Question 5

Question 5 asked participants if they felt there is a case for extending packaging criteria to all EU GPP product categories, and if so, which they consider represent the highest priority. As demonstrated through Figure 3-5, out of the 23 respondents, 22% felt there is a case for extending packaging criteria to all EU GP product categories - albeit done in a thoughtful and gradual manner grounded upon circular economy principles. This includes on-going work in EU standardisation definitions and mass balances and/or relevant certification systems. Product categories selected with the highest priority included cleaning products (17%) and food products (17%), which were justified through their significant environmental impact with regard to excess waste.

In contrast, 13% did not feel there is a case for extending packaging criteria to all EU GPP product categories, given that packaging criteria are so often product specific. This includes the fact that certain categories, such as paper, require no or minimal space for improvement. Hence, a sector-by-sector approach was favoured. A minority of respondents felt there is insufficient data and background research to make a considered judgement on the matter.

Figure 3-5: Do you feel there is a case for extending packaging criteria to all EU GPP product categories? If so, which do you consider represent the highest priority?



Source: Do you feel there is a case for extending packaging criteria to all EU GPP product categories? If so, which do you consider represent the highest priority? Valid responses: 23.

8.4 Workshops

In the May 2020 workshop a GPP measure was presented and stakeholders provided their views as to how it could best be scoped, specified, what level it should be applied at and who the target of the measure was.

- Measure: Use of Green Public Procurement to require use of reusable options for specified purposes within the public sector
- Implementation characteristics: Participants thought that this should be introduced via an EU Directive, with Member States able to individually implement routes for achieving targets. Overall targets should be set for key product groupings or sectors, or for the number of successful tenders that meet green criteria.

8.5 June Webinar

8.5.1 Measure 40 Packaging criteria in GPP

8.5.1.1 Measure 40a

A small group of stakeholders noted that whilst other GPP criteria are voluntary, any additional packaging-specific criteria should be too. One stakeholder also highlighted that voluntary approaches backed by industry are often able to achieve policy goals faster and with better results. Whilst the stakeholder provided an example of success they had experienced with voluntary targets, it was not sufficiently comparable to GPP.

A stakeholder representing the Swedish Environment Agency (EPA) expressed that, even though Sweden had a long history of applying voluntary environmental and sustainability criteria, they recognised that non-binding recommendations may not have sufficient impact to achieve socio-political goals.

Finally, a representative from the food and drink industry noted that the packaging criteria within the wider catering GPP criteria were already sufficiently complete to meet the overall aims. They highlighted that these existing criteria should be aligned with the PPWD revision suggestions.

8.5.1.2 Measures 40b and 40c

Many of the stakeholders were in favour of mandatory minimum packaging criteria for GPP. Often, there was no definition made between measure 40b and measure 40c. However, several stakeholders highlighted that there was a need for some exceptions or additional considerations:

- Minimum requirements should not restrict the ability of contracting authorities to set more ambitious sustainability requirements where desired;
- Any mandatory requirements introduced by the PPWD should be aligned with established packaging criteria where they exist (e.g., in catering); and
- There should be pre-defined procedures to enable exemptions in exceptional circumstances (e.g., disaster relief).

8.5.2 Measure 41 Required used of environmental award criteria

Stakeholder feedback can be summarised in two key points:

- Any environmental award criteria should relate to the entire life cycle of the product, not just the waste. Any ranking or favourability should be based on overall environmental benefits, quantified/justified by life cycle assessment or other equally quantitative means; and
- Award criteria should be aligned with existing standards/labels that show environmental performance (e.g., eco-labelling schemes).

8.6 One-to-one interviews

Eight organisations were interviewed in six interviews (summarised in Table 8-1), all of which fed into general problem and measures development. The organisations interviewed consisted of seven government agencies and one NGO.

Table 8-1 Targeted stakeholder interviews for GPP

Organisation	Date	Stakeholder Input
Vlaanderen Circulair (Circular Flanders) / OVAM	06/11/2020	Problem and measures
Directorate-General for Public Works and Water Management (Rijkswaterstaat)	12/11/2020	Problem and measures
WRAP Cymru	23/11/2020	Problem and measures
Public Procurement Office for Poland	25/11/2020	Problem and measures
Italian Ministry for Environment - Department for Ecological Transition and Green Investments / Consip	26/11/2020	Problem and measures
Ministry of Environmental Protection and Regional Development of the Republic of Latvia	27/11/2020	Problem and measures

9.0 Data, reporting and enforcement

9.1 Roadmap/Inception Impact Assessment

9.1.1 Single market approach

Most stakeholders supported harmonised approaches and stressed the importance of not restricting the smooth operation of the single market. AISE stated that any "national legislation with potentially distorting effects on the common EU framework" needed to be assessed thoroughly in terms of its compatibility with the objectives of the single market, and AIM believed EU legislation must not require, or encourage, MS to adopt national measures on packaging design as this risked causing divergence. Stakeholders also called for the free movement of packaging and packaged goods across borders, the removal of barriers and the avoidance of fragmentation of the single market, the establishment of fully harmonised rules, requirements and standards on packaging, and for transparency and predictability for MS to comply and report.

9.1.2 Extended producer responsibility schemes

A large majority of stakeholders called for further harmonisation of EPR schemes at EU level.

9.1.3 Monitoring and enforcement

Stakeholders called for improved monitoring of packaging and enforcement of packaging rules, and increased information sharing of best practice across MS.

FEAD and FNADE called for there to be a requirement for packaging imports to abide by EU rules. This, they argued, would help address problems currently faced by the EU waste management sector such as differing chemical compositions of the packaging to be processed. In addition, FEAD called for the strengthened enforcement of the essential requirement rules of Annex II to also be imposed on importers, which would prevent third-country producers importing into the EU from deviating from the essential requirements.

EXPRA supported a proposal to self-certify producers via an online compliance form, or via the implementation of harmonised CEN standards, and for certification tools to also be explored as a complementary means to self-certification.

Some stakeholders called for the EU to use new tracking and tracing technologies, combined, for example, with blockchain technology to improve monitoring and enforcement. They argued that by including new digital technologies, packaging waste management related transactions could be registered and monitored on a running basis.

Zero Waste France called for the monitoring of waste packaging production to be based on packaging units and recyclability, in addition to weight.

9.1.4 Targets

Stakeholders highlighted the importance of defining targets, and setting clear deadlines for implementation. Defining an end-point, and suitable intermediate goals, was key to ensure the whole supply chain had clarity and direction to work towards. Some called for ambitious, legally binding measures to be set, and others called for measurable milestones for the reduction of packaging waste, reduction of "overpackaging", and compulsory waste segregation.

Some argued that targets and goals should avoid being overly prescriptive on the means to meet them, and appropriate transition periods should be set for any new measures imposed at EU or Member State level.

9.1.5 Standards and end of waste criteria

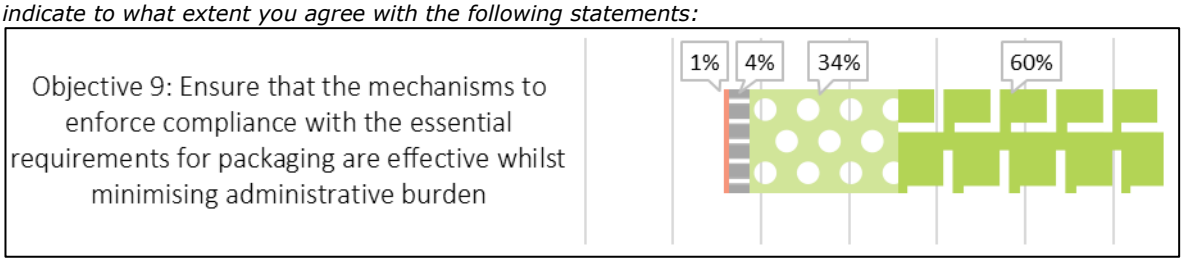
Stakeholders encouraged the use of environmental tools such as LCAs to assess the effectiveness, functionality and environmental performance of packaging alternatives. The Estonian Retailer Association called for the EU to be clear on how they measure the environmental performance of packaging and to disseminate this "throughout the business community". One stakeholder stated that packaging types that were both recyclable and low carbon should face no further requirements or restrictions. Finally, effective and harmonized 'end-of-waste' criteria was needed to provide reassurance to manufacturers, regulators and consumers over the use of recyclates.

9.2 Online public consultation

Much of the suggestions related to enforcement discussed in the questionnaire were regarding the introduction of taxes for those not complying with mandatory targets or bans. To understand the wider attitude towards enforcement, this section also includes stakeholder opinions on bans and targets in general as well as monitoring approaches.

Objective 9 in question 11 raised the need to ensure compliance with the Essential Requirements. In total, 94% of stakeholders agreed that any enforcement mechanisms should be effective but should also minimise administrative burdens. The responses are illustrated in Figure 9-1.

Figure 9-1: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:

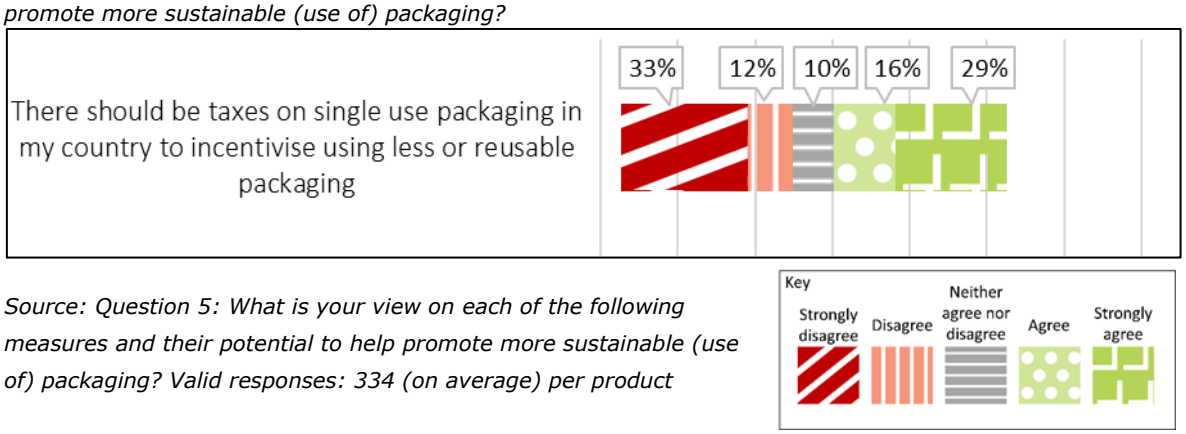


Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective

9.2.1 Taxes

Question 5 highlights the polarity of responses regarding taxes on single-use packaging. Although 45% of participants agreed that such taxes should be introduced in their country, an additional 45% of participants did not agree. See Figure 9-2.

Figure 9-2: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?



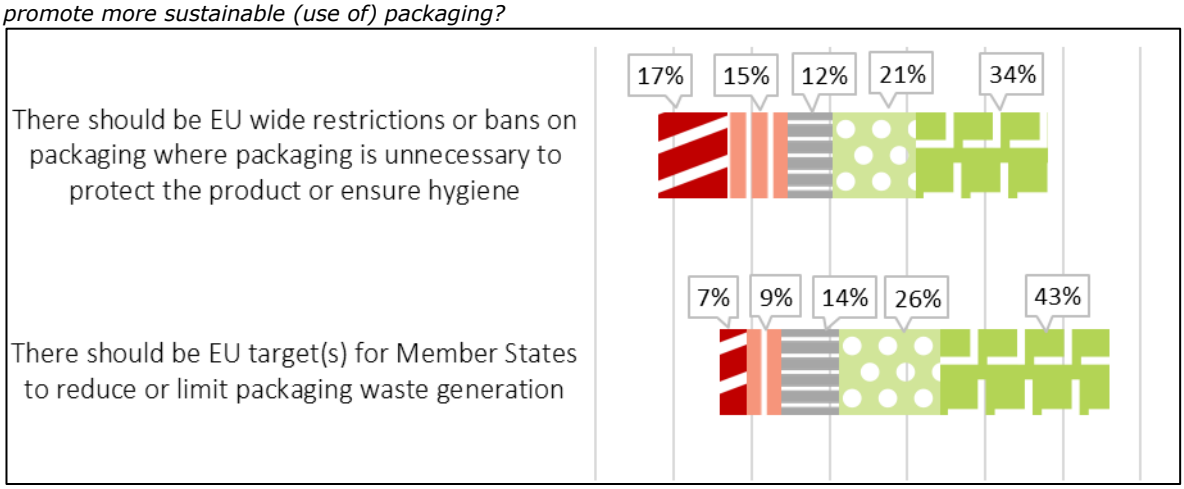
Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Valid responses: 334 (on average) per product

Stakeholders then discussed this further in the comments, suggesting that tax breaks should incentivise the most sustainable option rather than taxes penalising the least. There were also suggestions that taxes and fees collected for unsustainable packaging should be used to build better recycling and reuse infrastructure.

9.2.2 Bans and targets

In question 5, stakeholders were asked to give their views on a number of measures aimed at promoting more sustainable (use of) packaging. Several of the potential proposed measures were regarding targets for, or bans on, specific product streams or packaging types. In total, 69% of participants agreed that there should be EU targets for Member States to reduce or limit packaging waste generation and 55% agreed that there should be EU-wide restrictions or bans on packaging where it is unnecessary to protect the product or ensure hygiene. See Figure 9-3.

Figure 9-3: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?



Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Valid responses: 334 (on average) per product

9.2.3 National packaging registries

Whilst some participants, for example APK-AG, regarded a national packaging registry as an appropriate and efficient method for monitoring packaging use, other, for example, PepsiCo, worried that such requirements risked disclosing confidential information. In addition, there were some participants who stressed that any new EU-level packaging registry must be fully compatible with existing registers. AGVU specifically referenced the need to align with the registry in Germany.

9.2.4 Extended producer responsibility

Among the attachments, there was also some discussion regarding monitoring requirements for EPR and associated administrative costs. It was highlighted that the administrative costs association with correctly joining an EPR scheme and registering products can significantly outweigh the cost of end-of-life processing for smaller businesses.

9.3 June Webinar

9.3.1 Measure 42 EPR reporting harmonisation and packaging registry

There was an almost unanimous support for harmonisation of EPR requirements among Member States with some caveats that it should not disproportionately increase admin burden.

With regards to the database, there were some stakeholders favouring variant 42a (PROs reporting to a EU level database) while other stakeholders favoured variant 42b (PROs reporting to Member States). There were some concerns regarding data confidentiality and the level of aggregation.

Finally, with regards to the objective of the database, some stakeholders acknowledge that it could be useful in aiding enforcement and fine-tuning future packaging policy while other stakeholders believe it would bring no added value.

9.3.2 Measure 45 Reinforcement of the Market Surveillance Authorities and enforcement

There was unanimous support among stakeholders for this measure, with additional requests to ensure the Member State enforcement authorities have the appropriate resources.

9.3.3 General comments

There were several comments about Member State enforcement, mainly noting there are areas of improvement. Special attention was brought to imports, noting that these should be subject to the same measures and stakeholders did not see a clear plan to address this.

9.4 One-to-one interviews

Several organisations were consulted in one-to-one interviews which are summarised in Table 9-1. Nine organisations were interviewed in 10 interviews, of which eight fed into general problem and measures development, one contributed to EPR scheme research and one contributed to PRO packaging research. The organisations interviewed consisted of one government agency, one packaging manufacturer associations, three food and drink brands and two packaging EPR schemes and two packaging registries.

Table 9-1 Targeted stakeholder interviews for enforcement

Organisation	Date	Stakeholder Input
Zentrale Stelle VERPACKUNGSREGISTER (Foundation Central Packaging Register)	06/11/2020	Problem and measures
Citeo	06/11/2020	Problem and measures
EUROPEN	09/11/2020	Problem and measures
Nestle	11/11/2020	Problem and measures
Danone	17/11/2020	Problem and measures
Coca Cola Europe	18/11/2020	Problem and measures
Afvalfonds Verpakkingen	09/11/2020	EPR scheme

Organisation	Date	Stakeholder Input
	28/01/2021	
Interregional Packaging Commission (IRPC)	30/04/2021	Problem and measures
Ministry of Environment, Ireland / Irish EPA	30/04/2021	Problem and measures
Afvalfonds Verpakkingen	03/05/2021	PRO packaging

10.0 Hazardousness

10.1 Roadmap/Inception Impact Assessment

Stakeholders agreed that reducing and eliminating the hazardousness and toxicity of packaging was a key priority.

FEAD stated that the long-term policy goal should be to achieve toxic-free material cycles, starting at the product design stage, and called for chemical traceability of plastic packaging with clear rules and improved information for waste management operators on the chemical substances contained within products. Health Care Without Harm called for more stringent standards on the presence of hazardous chemicals in the recycling process, and EuRIC stated that packaging which is free of hazardous substances should be rewarded. Henkel called for the creation of a safe framework for dangerous goods packaging, including EU-wide uniform procedures, quality standards and standardization.

Kotkamills advocated for the introduction of regulatory measures to reduce the use of fluorinated chemicals in the PPWD or during the upcoming revision of the Food Contact Materials regulation. Other stakeholders expressing their support for measures to achieve a toxic-free environment included Rethink Plastic Alliance, NRK VERPAKKINGEN and Veolia. To achieve this, Veolia encouraged the separation of contaminated streams and for the principle of decontamination to be upholded.

10.2 June Webinar

10.2.1 Measure 31 Update hazardous substances in PPWD

Several stakeholders agreed with aligning PPWD's definition with the definition REACH to facilitate compliance. One notable exception believes that PPWD should only refer to substances in packaging and not to general lists of substances that might not be fully applicable to packaging.

10.2.2 Measure 32 Reporting of hazardous substances in packaging

Three variants were presented and discussed:

- 32a Assessment of the information provided through SCIP notification
- 32b Assessment of substances with harmonised classification under CLP
- 32c Assessment of all substances used/present

The majority of consulted stakeholders are in favour of measure 32a and expressed concerns on measure 32c regarding reporting burden, difficulty of implementation and confidentiality of commercial data.

10.2.3 Measure 33 Restriction of substances in packaging under the PPWD

Many stakeholders from brands, industry associations and EPR schemes believe that the issues of hazardous substances in packaging should be addressed via REACH, the EU Chemicals Strategy for Sustainability and the Food Contact Material (FCM) regulations. They see a potential policy duplication if addressed via PPWD and claim that PPWD is not the appropriate legislative tool for this area.

10.2.4 General comments

Some stakeholders requested a clear reference to the Food Contact Material (FCM) legislation, some even suggesting that it should be clear that FCM prevails over PPWD.

APPENDIX F – ONLINE PUBLIC CONSULTATION REPORT

1.0 Introduction

1.1 Objectives of the Online Public Consultation

COWI, alongside Eunomia, and Milieu, have been commissioned by DG Environment to support an impact assessment of the Packaging and Packaging Waste Directive. The online public consultation is part of a wider consultation exercise that also includes targeted interviews and workshops with key stakeholders.

This document provides a full analysis of the results of the OPC received through the EU survey tool.

1.2 Approach to the Online Public Consultation

A questionnaire was developed using the EU survey tool for the purposes of the consultation. The questionnaire was made available in 24 official EU languages and uploaded to the EU survey tool. The questionnaire was launched on 30 September 2020 for a period of 12 weeks. The survey then closed on 06 January 2021.

1.3 Accessibility

In line with the European Commission's accessibility guidelines, Eunomia has designed all figures within this report to be interpretable by readers who are colour blind and/or are using a black and white display. The pattern and colour combinations have been selected for their easy distinction from one another, enabling interpretation regardless of accessibility needs.

1.4 Interest Groups

The involvement of interest groups was visible in the results of the public consultation. Unlike some other public consultations (for example, the online public consultation on the Zoos Directive), there was no clear evidence of campaigns where a non-governmental organisation (NGO) or similar group had published a recommended answer for members of the public to use in their response. The organised answers identified in this consultation were almost exclusively used by business associations, company/business organisations, and NGOs themselves. This, coupled with a lack of publicly available evidence on any of the involved parties websites to suggest otherwise, implies that the conversations conducted in order to establish campaign answers occurred behind closed doors.

There were 18 opportunities for stakeholders to provide qualitative responses to the questions. For 11 of these there was some evidence of coordinated responses.

2.0 Online Public Consultation Questionnaire

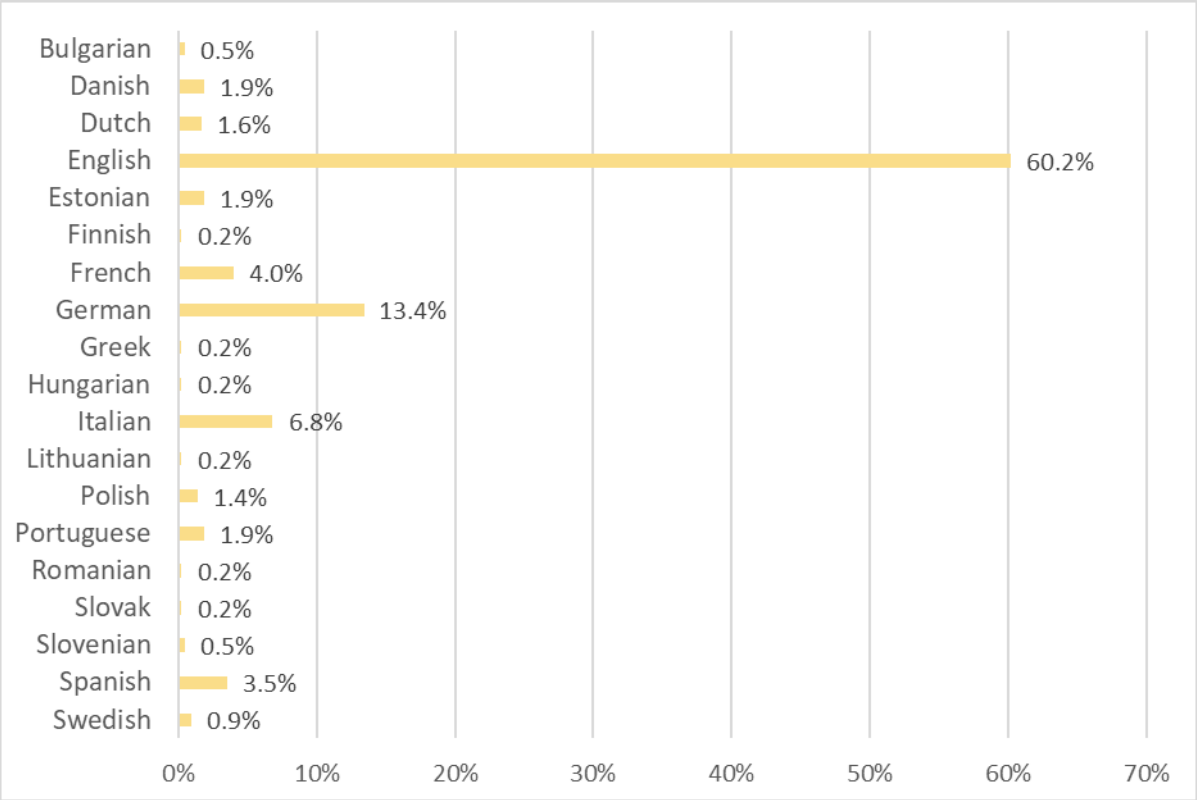
2.1 About the Respondents

The consultation questionnaire received a total of 425 responses.

Question: Language of my contribution

Participants were asked to indicate the language in which they would be making their contribution. This question was compulsory, therefore there were 425 valid responses. Of the 24 language options, 19 were used by at least one participant. The five languages that were not used by anyone responding to the survey were Croatian, Czech, Gaelic, Latvian, and Maltese. Over 60% (256) of participants selected English, 13% (57) selected German, and 7% (29) selected Italian. The full breakdown of the answers can be seen in Figure 2-1. The five languages that were not selected by any participants have not been included in the figure.

Figure 2-1: Question: Language of my contribution



Source: Question: Language of my contribution. Valid responses: 425

Question: I am giving my contribution as…

In this question, participants were asked to describe the capacity in which they were responding. Possible options, and the number and percentage of responses are show in Table 2-1. This question was compulsory, therefore there were 425 valid responses. Over 30% (130) of participants indicated they were answering on behalf of a "Company/business organisation", 28% (119) as an "EU citizen", and 27% (112) on behalf of a "Business association". There were no responses from "Non-EU citizens" or "Trade unions". All answers can be seen in Table 2-1.

Table 2-1: Question: I am giving my contribution as...

Participant's answering options	No. of responses	%
Academic/research institution	6	1.4%
Business association	112	26.4%
Company/business organisation	130	30.6%
Consumer organisation	4	0.9%
EU citizen	119	28%
Environmental organisation	6	1.4%
Non-EU citizen	0	0%
Non-governmental organisation	25	5.9%
Public authority	13	3.1%
Trade Union	0	0%
Other	10	2.4%

Source: Question: I am giving my contribution as... Valid responses: 425

Question: First name
Participants were asked to provide their first name. This information is not reported here.

Question: Surname
Participants were asked to provide their surname. This information is not reported here.

Question: Email
Participants were asked to provide their email address. This information is not reported here.

Question: Scope
In this question, participants were asked to describe the scope in which they operate. This question was not compulsory and was only answered by 13 participants. No explanation of the terms was provided. The breakdown of the answers given can be seen in Table 2-2.

Table 2-2: Question: Scope

Scope	No. of responses	%
Local	4	30.8%
Regional	7	53.8%
National	2	15.4%

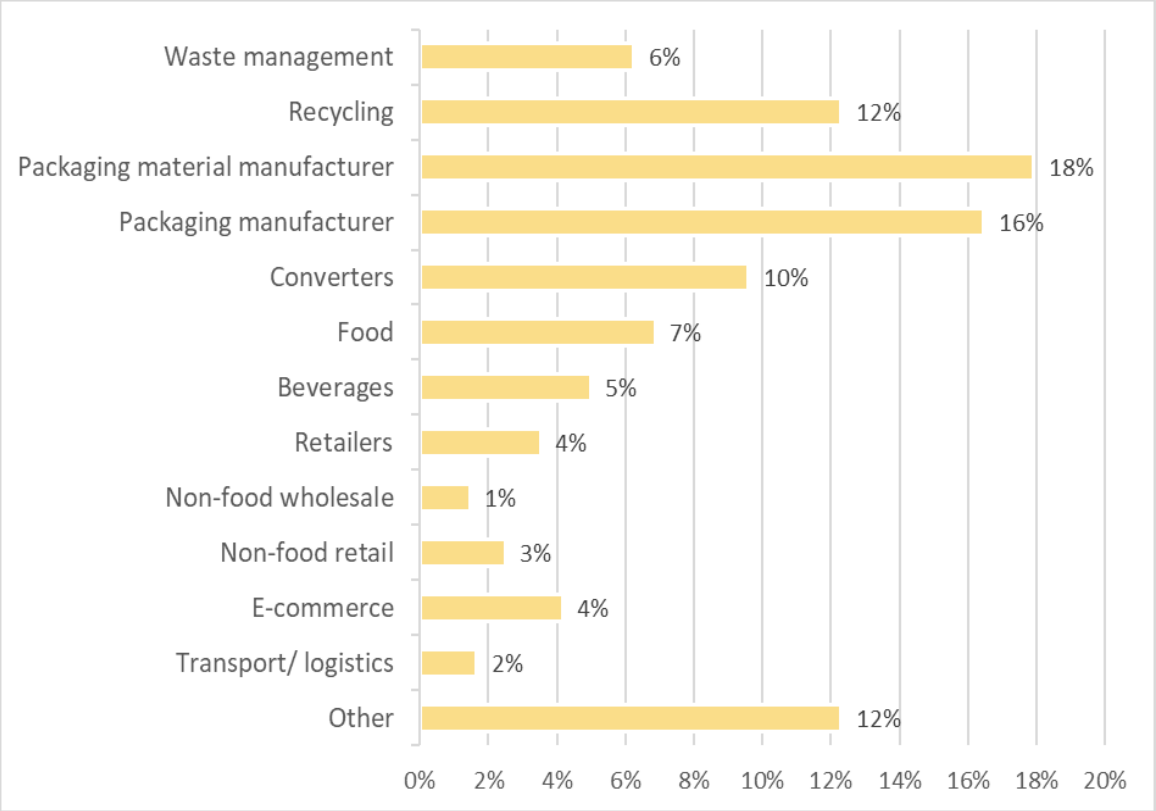
Source: Question: Scope. Valid responses 13

Question: What is your area of activity/what is the sector whose interests you represent when responding to the questionnaire?

For this question, participants were able to select all that applied to them. They were also given the opportunity to select 'other' and provide a qualitative response. This question was not compulsory. In total 239 participants provided answers. Of the participants that provided answers, 18% (86) indicated that they were representing a "Packaging material manufacturer", 16% (79) selected "Packaging manufacturer", and 12% (29) showed they were representing an organisation within the "Recycling" sector. A summary of all responses can be seen in Figure 2-2.

In addition, 12% (59) of participants selected "Other" and provided qualitative commentary. These included manufacturers of other goods (for example, toys, cosmetics, and medical products), representatives from Extended Producer Responsibility (EPR) schemes, and organisations within the chemical industry.

Figure 2-2: Question: What is your area of activity/what is the sector whose interests you represent when responding to the questionnaire?

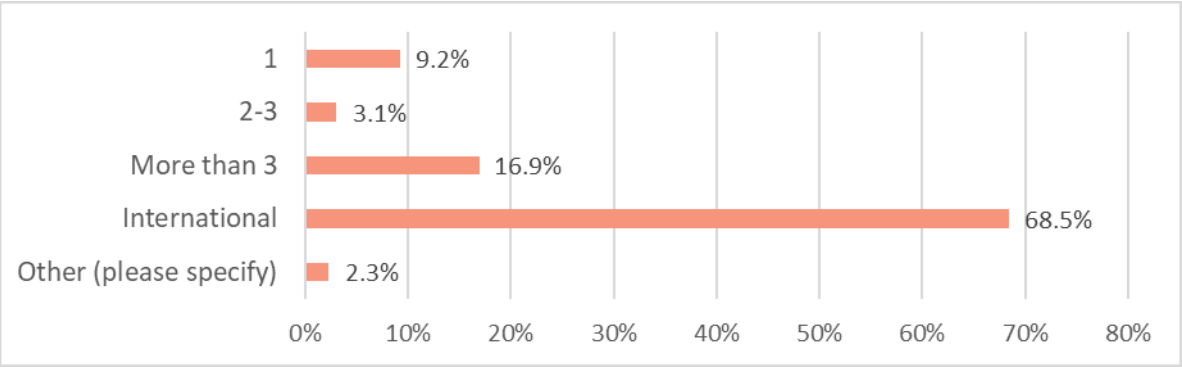


Source: Question: What is your area of activity/what is the sector whose interests you represent when responding to this questionnaire? Valid responses: 239

Question: If "Company/business organisation", in how many Member States are located your customers?

The 130 participants answering on behalf of a company/business organisation were then asked to indicate the number of Member States within which their customers are located. There were 130 valid responses. Almost 70% (89) of responses indicated "International" and 17% said "More than 3". The summary of all the answers can be seen in Figure 2-3.

Figure 2-3: Question: If "Company/business organisation", in how many Member States are located your customers?



Source: Question: If "Company/business organisation", in how many Member States are located your customers? Valid responses: 130

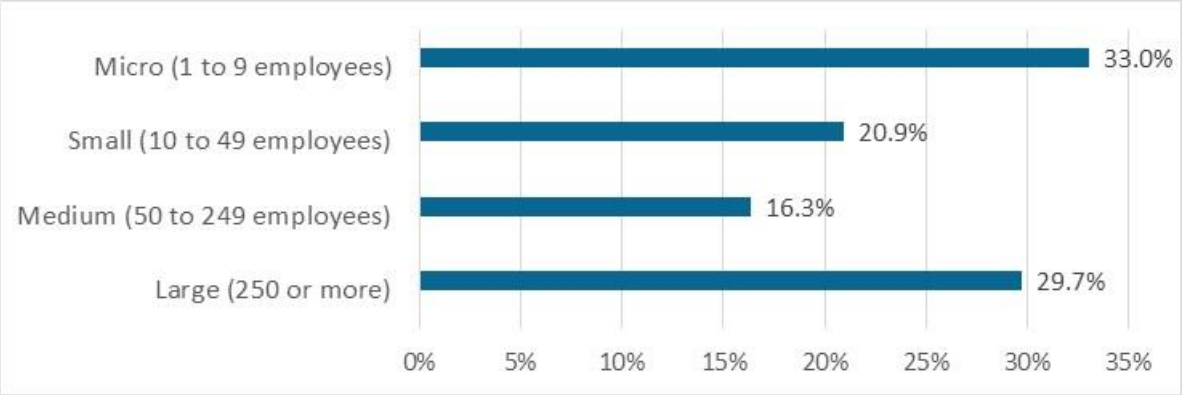
Question: Organisation name

Participants were asked to provide the name of their organisation. This information is not reported here.

Question: Organisation size

Participants were then asked to provide information regarding the size of the organisations they were representing. They were given four options ranging from "Micro (1 to 9 employees)" to "Large (250 or more)". Answering this question was not compulsory. Of the 306 valid responses, 33% (101) were representing "Micro (1 to 9 employees)" organisations and 30% (91) were representing "Large (250 or more)" organisations. A summary of the responses can be seen in Figure 2-4.

Figure 2-4: Question: Organisation size

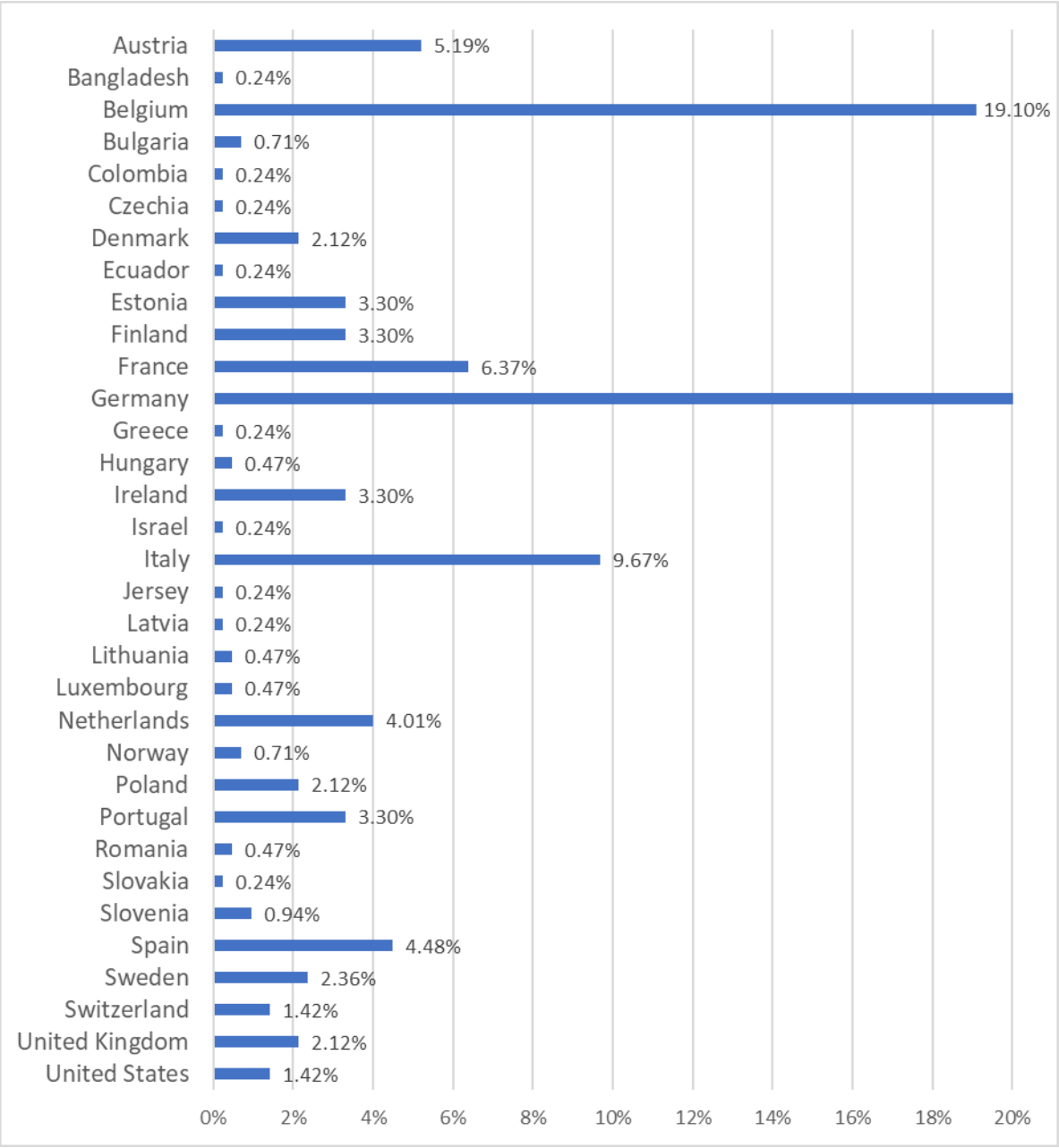


Source: Question: Organisation size. Valid responses: 306

Question: Country of origin

Participants were then asked to add their country, or that of their organisation. The results can be seen in Figure 2-5. In total, 33 countries were represented including 24 of the 27 EU Member States. The three Member States who were not represented by the stakeholders were Croatia, Cyprus, and Malta.

Figure 2-5: Question: Country of origin



Source: Question: Country of origin. Valid responses: 425

Two countries were particularly well-represented in this questionnaire. These were Germany, accounting for 20% (85) of all participants, and Belgium, accounting for 19.1% (81) of participants. Following these, the next best represented countries were Italy with 9.6% (41), France with 6.4% (27), and Austria with 5.4% (23). The remaining countries were all represented by less than 5% of the stakeholders.

2.2 Questions to the General Public

The questions in this section were compulsory for all stakeholders. Many participants were representing organisations and did not feel they were able to answer questions to the general public on behalf of their organisation. In these cases, the participants have often selected 'No

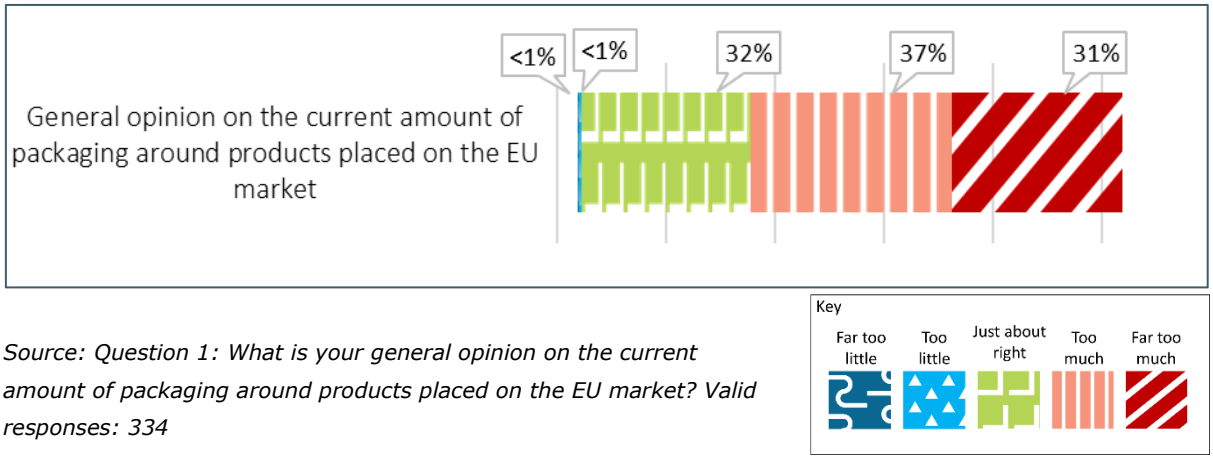
opinion' and explained their reasoning in the comments. To account for this, all 'No opinion' responses have been excluded from the valid responses total.

2.2.1 Questions 1-5: Packaging in general

Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market?

Participants were asked to indicate their general opinion on the amount of packaging currently used for products placed on the EU market. Although question 1 was compulsory, participants were able to indicate that they had "No opinion". Throughout this questionnaire, "No opinion" responses have not been counted towards the total valid responses. For question 1, 21% (91) of participants selected this option. Of the remaining 334 participants, responses were relatively evenly split between "Just right" (31%), "Too much" (37%), and "Far too much" (31%). Only one participant (<1%) indicated they felt there was "Too little" packaging and a further one (<1%) selected "Far too little". The full breakdown of the responses can be seen in Figure 3-1.

Figure 2-6: Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market



Source: Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market? Valid responses: 334

Participants were then given the opportunity to provide further explanation for their choice. Participants responded in a range of languages, as can be seen in Figure 2-1. The qualitative answers have been analysed, split into themes, and summarised here.

Table 2-3: Qualitative response summary for question 1

Theme	Key points
Excessive packaging	› the ratio between packaging and product is often not functionally justified, particularly where online purchases are concerned
Life cycle assessment	› LCA should be used to be used to accurately assess the suitability of packaging
Health & safety	› Health and safety concerns are a key deciding factor when assessing the suitability of packaging

Theme	Key points
Question too general	› Question too general – answer highly dependent on the product category and/or sector

Source: Question 1: What is your general opinion on the current amount of packaging around products placed on the EU market? Number of qualitative responses: 213

Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items.

In question 2, participants were asked to consider their visits to EU stores in the past 12 months and indicate their views regarding the amount of packaging used for a range of products. Although this question was compulsory, participants were able to select that they had "No opinion". In line with the approach of the overall study, these responses have not been included in the valid response totals for each question. A summary of the number of valid responses for each product can be seen in Appendix A, Table A-1.

Among the remaining participants, overall responses were split between participants who felt that the amount of packaging across the range of products was appropriate and those who felt that it was excessive. For all but three of the product categories, more than 50% of participants indicated that there was either "Too much" or "Far too much" packaging. On average, 45% felt that the amount of packaging was "just about right", and less than 1% of participants said that there was "Too little" or "Far too little" packaging.

According to the stakeholders, the products of greatest concern are:

- Electronic goods including headphones, mobile phones, laptops – 81% of participants feel there is either too much or far too much packaging;
- Children's toys – 79% of participants feel there is either too much or far too much packaging; and
- Cosmetics – 76% of participants feel there is either too much or far too much packaging.

The summary of the results for each product type can be seen in Figure 3-2. In this figure, the "Other" category has not been included. When selecting "Other", participants were able to qualitatively identify any additional product(s) that they wished to provide an opinion on. An additional 82 participants submitted responses for "Other", and the products they listed include confectionary, jewellery, perfume, magazines, office supplies, pharmaceutical, dairy products, and baby formula. In addition, several participants chose to use this "Other" option to indicate that, as they were representing businesses, they had selected "No opinion" for all products.

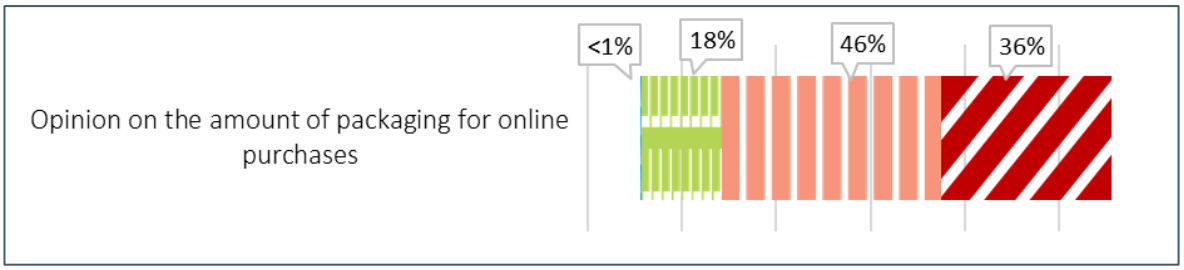
Figure 2-7: Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items

Source: Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items. Valid responses: 261 (on average) per product

Question 3: Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging.

Although question 3 was compulsory, 145 participants (34%) selected "No opinion" and their answers were therefore not included in the total of valid responses. There were therefore 280 valid responses. Of these, 46% (130) of participants felt that there was "Too much" packaging and 36% (101) felt there was "Far too much". Less than 1% said that there was not enough packaging, and the remaining 18% said the amount of packaging on online purchases was "Just about right". The results of question 3 can be seen in Figure 2-8.

Figure 2-8: Question 3: Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression



Source: Question 3: Considering any online purchases in the last 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging. Valid responses: 280

Question 4: What is your view on the following statements regarding the consumption of packaging?

In question 4, participants were asked to consider a list of statements and provide an indication of to what extent they agreed or disagreed. Although question 4 was compulsory, participants were able to select that they had "No opinion". These responses have not been included in the total valid responses figure. A summary of the number of valid responses for each statement in question 4 can be seen in Appendix A,

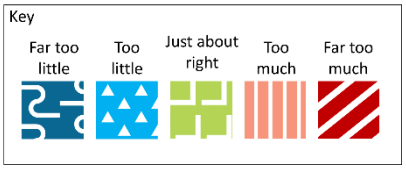
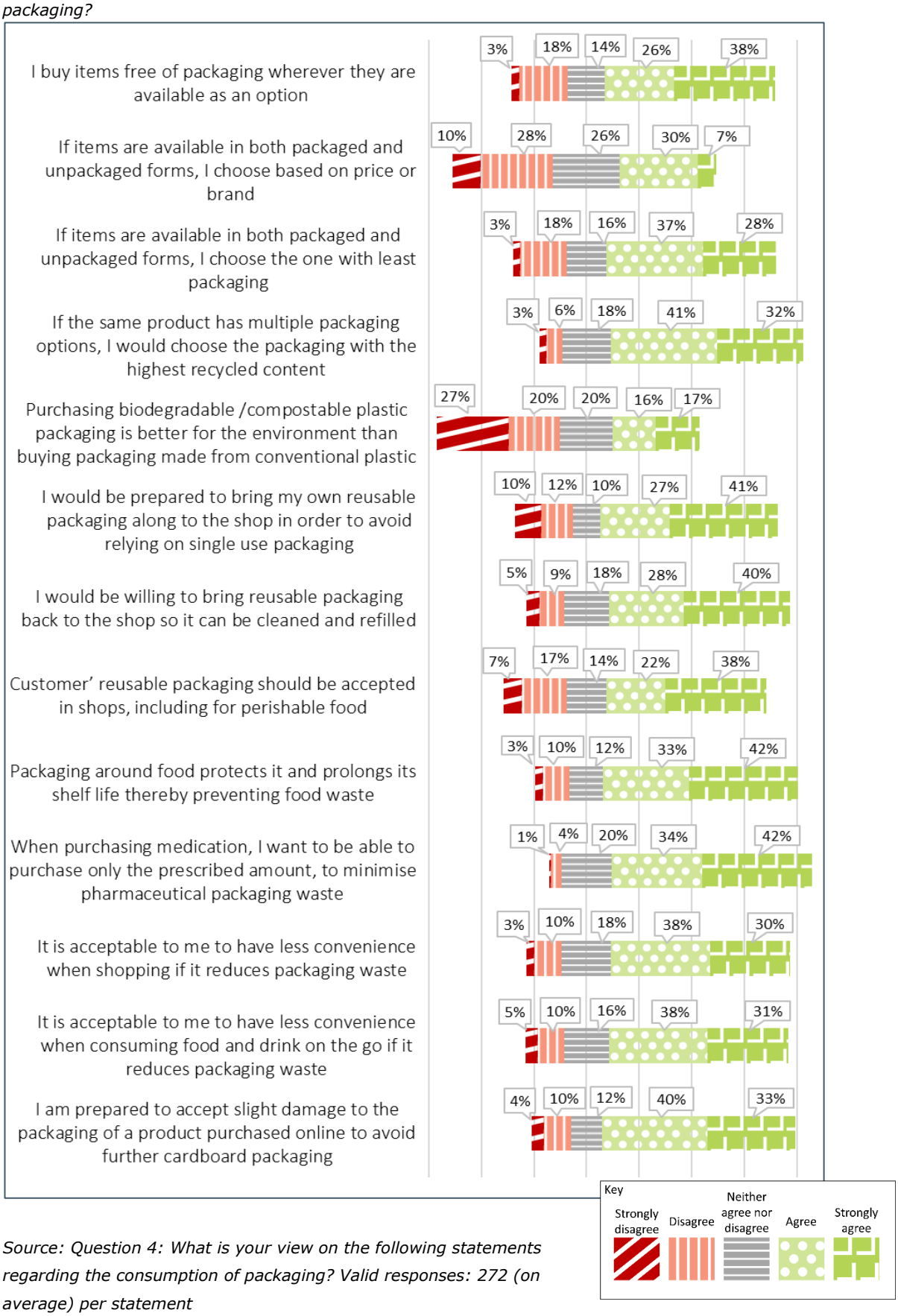


Table A-2. A summary of the spread of responses for all the statements can be seen in Figure 2-9.

The results from question 4 indicate that, in general, many of the participants actively try to reduce their packaging consumption. This was shown in the high degree of agreement with statements regarding choosing product options that are packaging free (64% agreed or strongly agreed) or with the least amount of packaging (65% agreed or strongly agreed). It is worth noting, however, that other factors also contribute to some participants' purchasing decisions. For example, 37% of respondents highlighted that price and brand were determining factors for them where items are available in both packaged and unpackaged forms, and 73% of participants agreed that given the choice they would choose packaging with the highest recycled content.

Figure 2-9: Question 4: What is your view on the following statements regarding the consumption of packaging?



Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Valid responses: 272 (on average) per statement

Additionally, a number of the statements assessed the willingness of the participants to forego a level of convenience in order to reduce packaging waste. In total, 68% of participants agreed or strongly agreed that it was acceptable for them to have less convenience when shopping if it reduces packaging and 69% said the same but for when consuming food and drink on the go. Furthermore, most participants agreed that they were prepared to undertake a level of additional effort to decrease their packaging consumption. This included bringing their own reusable packaging to a shop to refill it (68%) and bringing reusable packaging back to the shop that supplied it for it to be cleaned and refilled (69%).

The results also indicated that the subject of compostable packaging split the opinion of participants. In total, 47% of respondents either disagreed or strongly disagreed that purchasing biodegradable or compostable plastic is better for the environment than buying packaging made from conventional plastic. In contrast, 33% of participants agreed.

Participants were then given the opportunity to provide further explanation for their choice. Participants responded in a range of languages, as can be seen in Figure 2-1. The qualitative answers have been analysed, split into themes, and summarised in Table 2-4.

Table 2-4: Qualitative response summary for question 4

Theme	Key points
LCA approach	› Packaging accounts for a small amount of the total impact of a product
Food waste	› Consumers can have to choose between organic or packaging free. Need to know which is more important › Reducing food waste should be of primary importance when considering packaging on food
Function of product	› Consumers choose a product based on the product itself, not the packaging
Function of packaging	› Packaging functionality must not be compromised › For online products, packaging is not currently designed correctly › Packaging should uphold health and safety requirements › Packaging also acts as a vehicle for product information (e.g., nutrition). This function must be sustained
Reusable systems	› Reusable packaging is not always ideal › Reusable packaging must still be convenient › Consumers need more information on how reusable systems work
Compostability	› Biodegradable/compostable packaging can be a good choice where the right EoL conditions are available › Existing standards on compostability do not reflect reality › Home compostability of "compostable" materials is not always possible
Recycled content	› Recycled content is difficult to measure › Recycled content doesn't mean recyclability

Theme	Key points
	› Flaunting recycled content can be greenwashing

Source: Question 4: What is your view on the following statements regarding the consumption of packaging? Number of qualitative responses: 117

Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?

For question 5, participants were asked to consider a number of measures and their potential to help promote more sustainable packaging. Although question 5 was compulsory, participants were able to indicate that they had "No opinion". These responses have not been included in the total valid response figure. A summary of the number of valid responses for each statement can be seen in Appendix A,

Table A-3. The full breakdown of responses can be seen in *Figure 2-10: Question 5: What* is your *view* on each of the following measures and their potential to help promote more sustainable (use of) packaging?

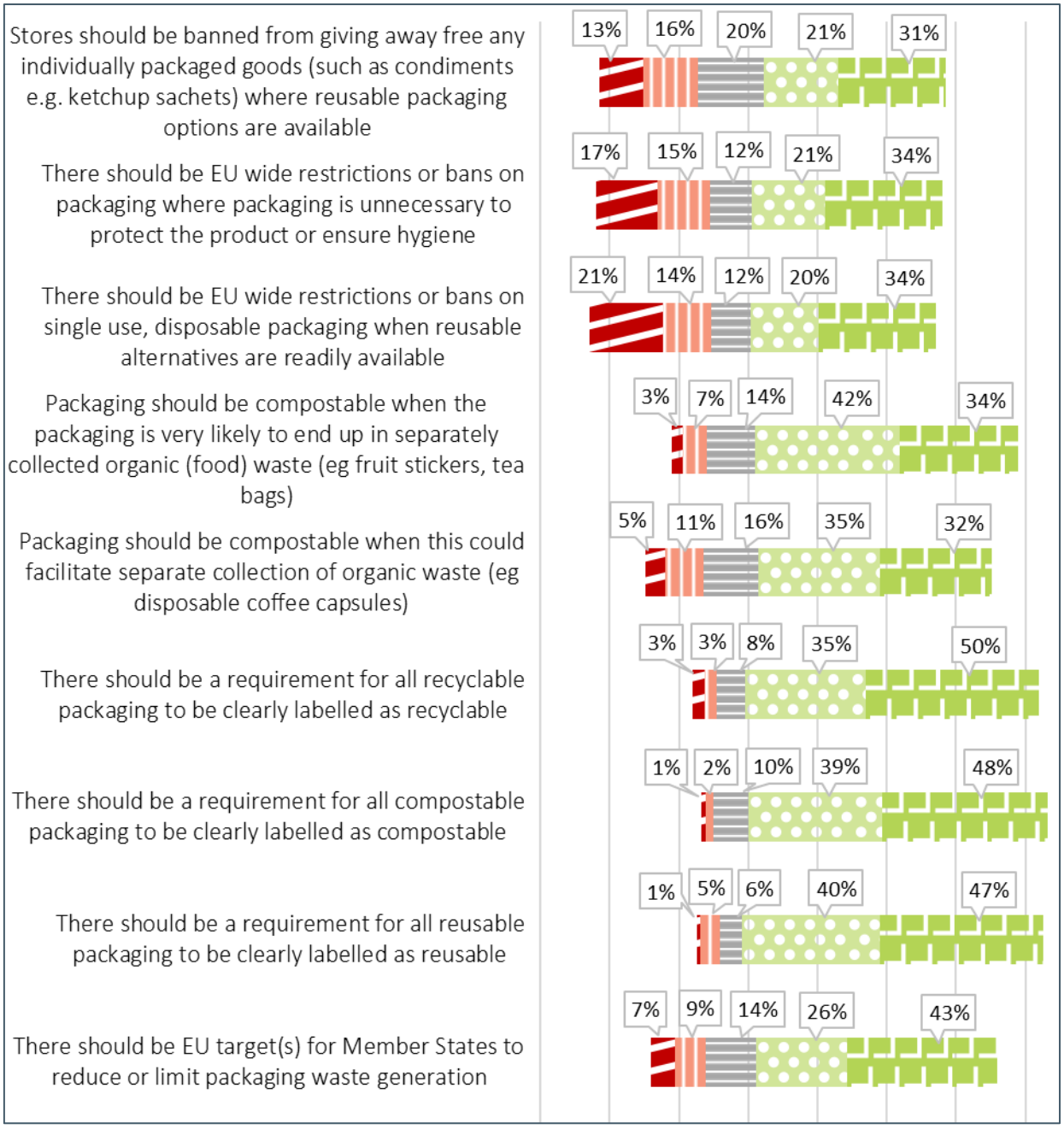
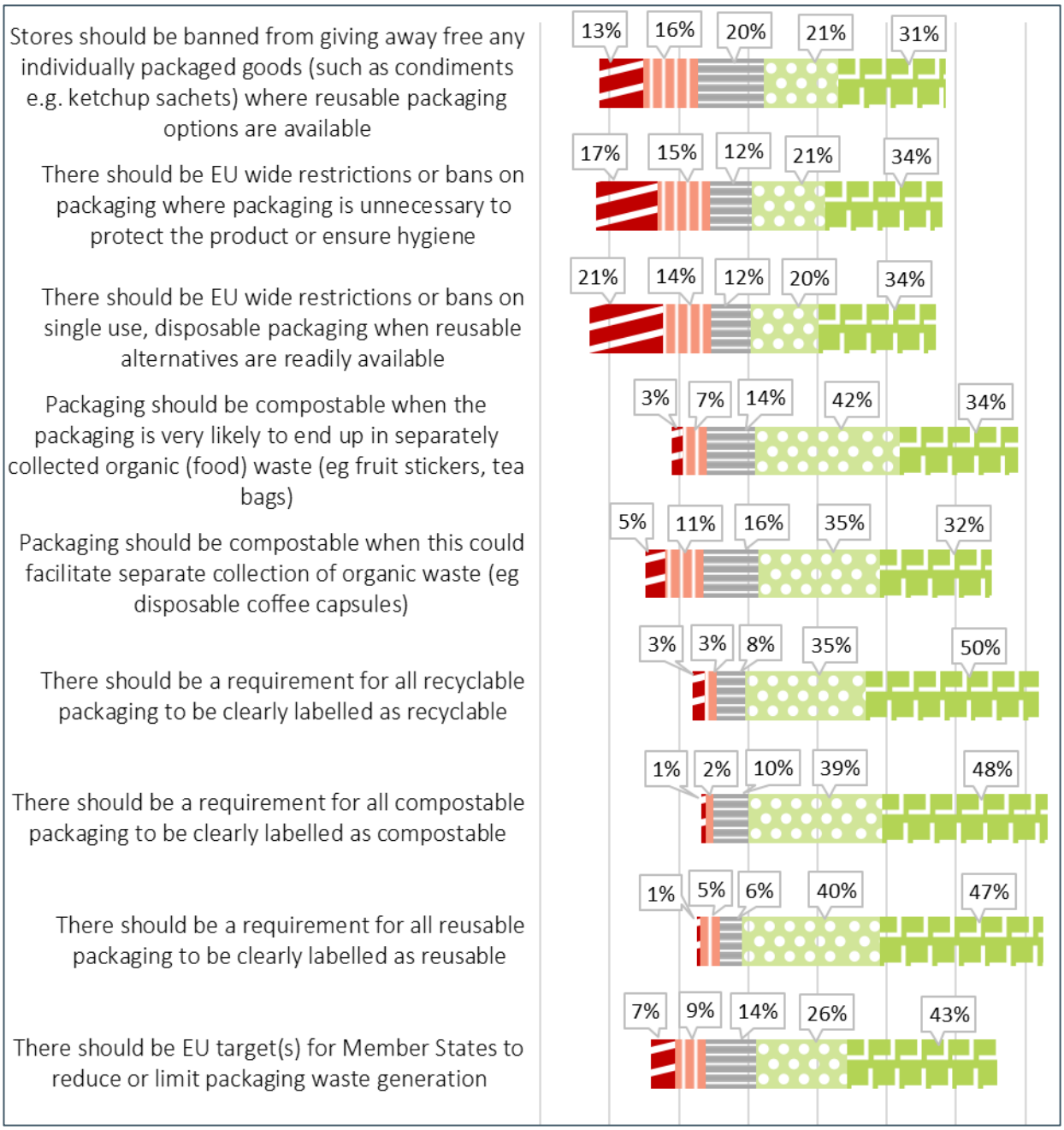
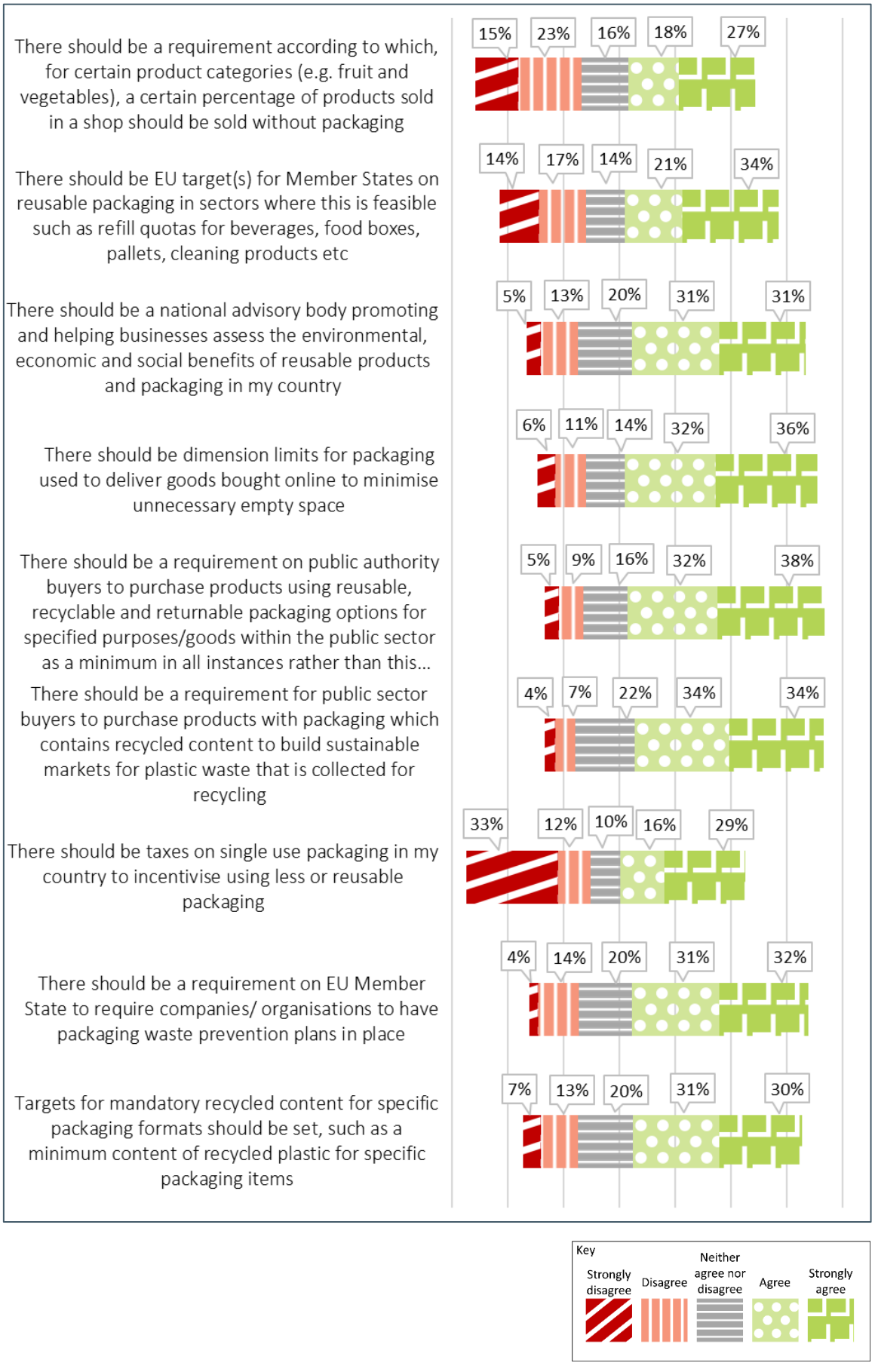


Figure 2-10: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?




There should be a requirement according to which, for certain product categories (e.g. fruit and vegetables), a certain percentage of products sold in a shop should be sold without packaging
15%
23%
16%
18%
27%
There should be EU target(s) for Member States on reusable packaging in sectors where this is feasible such as refill quotas for beverages, food boxes, pallets, cleaning products etc
14%
17%
14%
21%
34%
There should be a national advisory body promoting and helping businesses assess the environmental, economic and social benefits of reusable products and packaging in my country
5%
13%
20%
31%
31%
There should be dimension limits for packaging used to deliver goods bought online to minimise unnecessary empty space
6%
11%
14%
32%
36%
There should be a requirement on public authority buyers to purchase products using reusable, recyclable and returnable packaging options for specified purposes/goods within the public sector as a minimum in all instances rather than this...
5%
9%
16%
32%
38%
There should be a requirement for public sector buyers to purchase products with packaging which contains recycled content to build sustainable markets for plastic waste that is collected for recycling
4%
7%
22%
34%
34%
There should be taxes on single use packaging in my country to incentivise using less or reusable packaging
33%
12%
10%
16%
29%
There should be a requirement on EU Member State to require companies/ organisations to have packaging waste prevention plans in place
4%
14%
20%
31%
32%
Targets for mandatory recycled content for specific packaging formats should be set, such as a minimum content of recycled plastic for specific packaging items
7%
13%
20%
31%
30%
Key
Strongly disagree
Disagree
Neither agree nor disagree
Agree
Strongly agree

Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Valid responses: 334 (on average) per product

In general, the participants giving valid responses supported the statements provided. For each, an average of 36% of participants indicated that they "Strongly agree", 29% said that they "Agree", 15% said that they "Neither agree nor disagree", and 20% selected either "Disagree or Strongly disagree". At least 50% of participants agreed with almost all (18 of 20) statements. The two exceptions to this were:

- There should be a requirement according to which, for certain product categories (e.g., fruit and vegetables), a certain percentage of products sold in a shop should be sold without packaging, e.g., loose – 33% of responses disagreed with this statement versus 45% of responses that agreed with it; and
- There should be taxes on single use packaging in my country to incentivise using less or reusable packaging – 45% of responses disagreed with this statement versus 45% of responses that agreed with it.

Participants were also given the opportunity to provide further explanation for their choice. Participants responded in a range of languages, as can be seen in Figure 2-1. The qualitative answers have been analysed, split into themes, and summarised in

Table 2-5.

Table 2-5: Qualitative response summary for question 5

Theme	Key points
Labelling	› Labelling for compostability or recyclability should be specific to local capability › Labelling could lead to more packaging if digital solutions aren't considered › If the Plastic Strategy requires all packaging to be recyclable by 2030, mandating labelling adds nothing › Packaging should only be labelled as reusable if it is part of an operating system that guarantees it'll be reused
Guidance and definitions	› Need guidance on how to design effective and efficient packaging › Definitions for recyclable, compostable etc. are needed › Guidance on collection and sorting is needed › National advisory boards could be introduced to offer financial and technical support to markets › Harmonisation at EU-level will help
Taxes	› Instead of taxing SUP packaging, the use of virgin materials should be taxed › Taxes should incentivise the most sustainable option as opposed to penalise the less sustainable option › Taxes and fees collected from SUP packaging should be used to build better recycling and reuse infrastructure
Recycled content	› Mandatory recycled content could ensure increased use of recyclate › Mandatory recycled content should not be introduced until there is an established adequate supply of high-quality recyclate › There needs to be a way to measure recycled content

Theme	Key points
Mandates, targets, and bans	› Dimensional limits for online packaging should be introduced › Specific inclusion/exclusion criteria must be defined before setting any bans › Bans, mandates, and targets can drive the wrong behaviour › Targets should only be introduced when there is sufficient evidence indicated that the targets improve overall environmental impact
Educating consumers	› Consumers must be educated about the materials and packaging types that can be recycled
Waste regulation (e.g., EPR, DRS, etc.)	› Modulation of fees through EPR can help to promote sustainable packaging design › Deposit return systems can prevent packaging waste through incentivisation of collection and return
Compostable packaging	› Compostable packaging should only be an option where there is adequate infrastructure in place
Reusable packaging	› Reusable packaging should only be used where it makes sense from an environmental perspective › SU packaging should be replaced with reusable packaging wherever possible

Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging? Number of qualitative responses: 117

2.2.2 Questions 6-9: Reusable packaging

Question 6: Do you use reusable packaging?

Question 6 asked participants to indicate whether they currently use reusable packaging. Question 6 was compulsory. The breakdown of answers can be seen in Table 2-6.

Table 2-6: Breakdown of question 6 responses

Response	No. of responses	Percentage of total responses
Yes	253	60%
No	29	7%
I don't know	143	24%

Source: Question 6: Do you use reusable packaging? Valid responses: 425

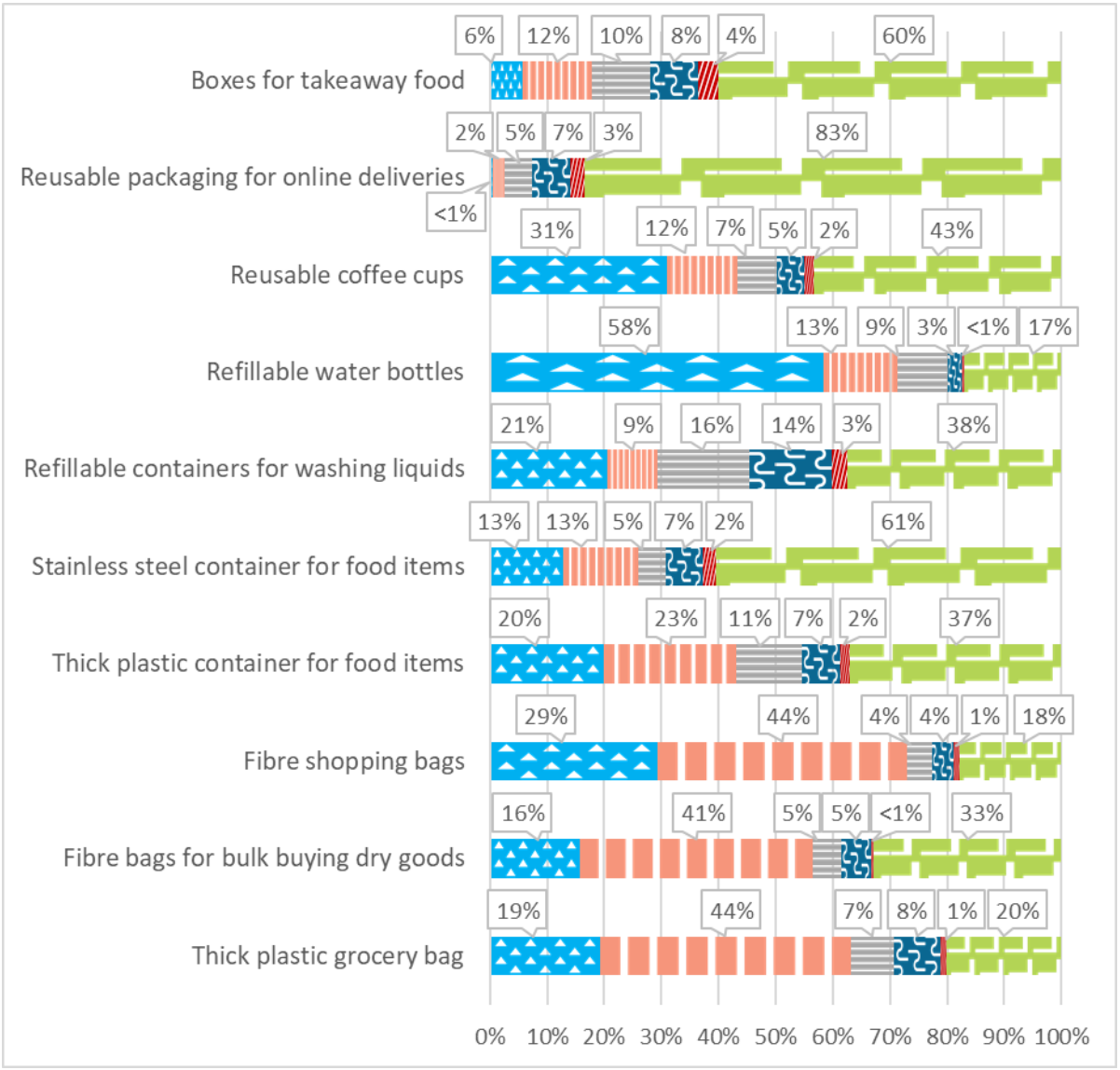
Question 6.1.1: How often do you use the following reusable packaging items?

In question 6.1.1, participants were asked to indicate how often they used a range of ten

reusable packaging items. Question 6.1.1 was not compulsory. A summary of the number of valid responses for each statement in question 6.1.1 can be seen in Appendix A, Table A-4. Those who did answer could select from five frequencies as well as "I don't (re)use this item".

Across each of the ten statements, an average of 228 participants provided their views. Of these, 41% said "I don't (re)use this item", 21% said that they use the item "Daily", 21% said they use the item "Weekly", and 19% said they use it either "Monthly", "A few times a year", or "Yearly".

Figure 2-11: Question 6.1.1: How often do you use the following reusable packaging items?



Source: Question 6.1.1: How often do you use the following reusable packaging items? Valid responses: 228 (on average) per product

The valid responses indicate that refillable water bottles (58%) and reusable coffee cups (31%) are the most likely to be reused daily. Whilst thick plastic grocery bags (44%), fibre shopping bags (44%), and fibre bags for bulk buying dry goods (41%) are the most likely to be used

weekly. The least likely product to be reused is packaging for online deliveries, for which 83% of participants said that they do not reuse this item. The full breakdown of the responses for each statement can be seen in Figure 2-11.

In addition to the ten defined products, participants were also given the opportunity to select "Other" and give a qualitative description of any additional product(s) that they wished to include. 95 participants (22%) used this option. Amongst these additional products were glass jars and bottles for bulk dry goods, reusable packaging for beauty and hygiene products, reusable containers for dairy products (e.g., yogurt or milk), gas canisters, and printer cartridges.

Question 6.1.3: If you have used reusable packaging less since the COVID-19 pandemic, please indicate your reason(s) below.

Question 6.1.3 then asked participants to indicate their views on reusable packaging in light of the COVID-19 pandemic. They were asked to consider if they have used reusable packaging less since the pandemic, and if so, indicate why. Participants were able to select all that applied from a list of six reasons. They were also able to select an "Other" option where they could provide further explanation. Question 6.1.3 was not compulsory. The full summary of the responses to question 6.1.3 are displayed in Figure 2-12.

Figure 2-12: Question 6.1.3: If you have used reusable packaging less since the COVID-19 pandemic, please indicate your reason(s) below.

Source: Question 6.1.13: If you have used reusable packaging less since the COVID-19 pandemic, please indicate your reason(s) below. Valid responses: 123

Of the 123 (29% of total participants) participants who answered the question, 44% indicated that the stores that they go to no longer accept reusable items. 36% said they felt less safe

handling scoops used by many people, and 33% said they felt less safe using reusable packaging handled by store staff.

Thirty-six participants (8%) choose to provide additional explanation. Of these, several highlighted that there has been no proven link between reusable packaging and an increased risk of transmission of COVID-19. Others raised that reusables have been used less as people are at home more and therefore not looking to refill water bottles or reusable coffee cups on-the-go. A number of participants also stated that some LCA studies have proven that reusable packaging is "not often the most environmental option".

Question 6.1.4: If you have had a positive experience of continuing to use it during the COVID-19 pandemic, please provide examples of what was in place to enable you to do this.

In question 6.1.4, participants were asked to provide examples of what was in place to enable them to continue using reusable packaging despite the COVID-19 pandemic. The question was not compulsory, however 57 participants provided answers. Responses have been analysed and grouped into themes. These can be seen in Table 2-7.

Table 2-7: Question 6.1.4: If you have had a positive experience of continuing to use it during the COVID-19 pandemic, please provide examples of what was in place to enable you to do this

Theme	Key points
Increased cleaning practices	› Disinfectants in shops › Clear information provided on correct cleaning protocol › More time to clean packaging when at home
Changing practices	› Introduction of new processes (e.g., contactless free coffee refills) › Takeaways and restaurants more open to using reusable packaging when provided by the consumer
Greater time to shop	› More free time to carry out shopping resulting in ability to visit multiple smaller stores and/or shop bulk (which typically takes longer)
Continued use regardless	› Many shops and cafes continued to cater for reusable products › Some consumers have maintained existing practices
Staying at home	› Reduction in the use of disposable packaging when purchasing on-the-go
Availability of local shops and markets	› Consumers shopping more local › Farmers markets and bulk stores tend to be less crowded than supermarkets
Less risk of contamination vs. SUP	› Products packaged in SUP come into contact with more individuals than those that come in bulk › Using personal reusable packaging allows consumers more control on who comes into contact with a product

Source: Question 6.1.2: If you have had a positive experience of continuing to use it during the COVID-19 pandemic, please provide examples of what was in place to enable you to do this. Valid responses: 57

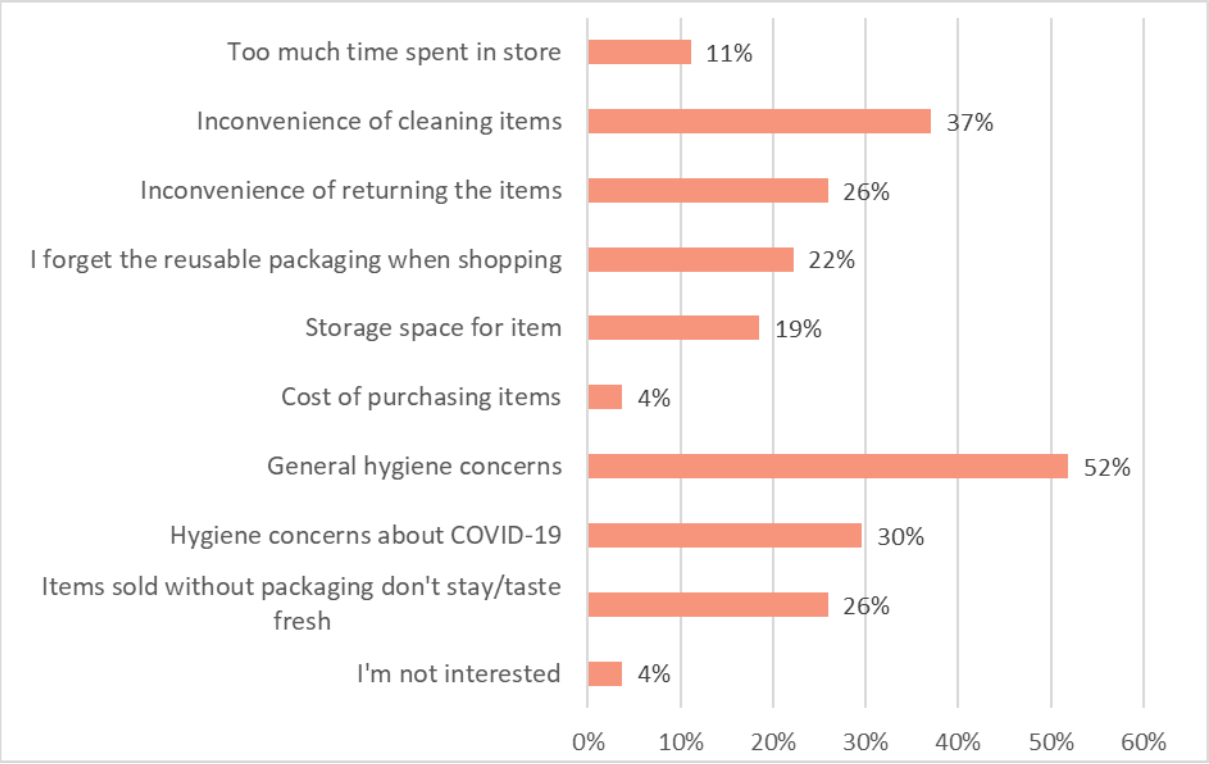
Question 6.2.1: What are the reasons you do not use reusable packaging?

Question 6.2.1 asked participants to indicate the reasons why they do not use reusable packaging. This question was not compulsory. Participants were provided with ten statements and were allowed to select as many as they felt applied to them. In addition, they were able to select "Other" and give additional explanation. The answers can be seen in Figure 2-13.

Of the 27 participants who answered the question, 52% (14) stated general hygiene concerns, 37% (10) identified the inconvenience of cleaning items, and 30% (8) said hygiene concerns specific to COVID-19.

All of the 27 participants selected "Other" and provided further explanation. Additional answers referenced poor availability of bulk foods, the need for single use packaging to extend the shelf-life of perishable food items, and the consumption of resources associated with washing reusable packaging.

Figure 2-13: Question 6.2.1: What are the reasons you do not use reusable packaging?



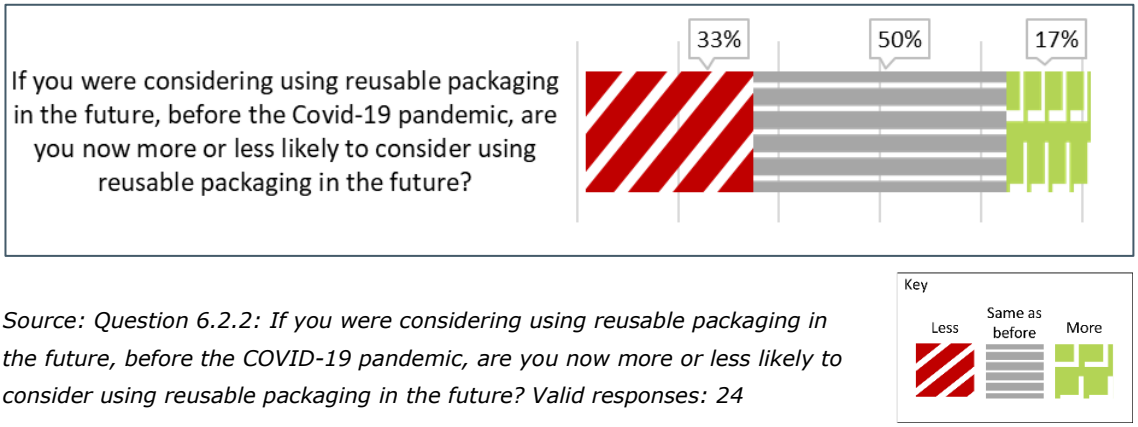
Source: Question 6.2.1: What are the reasons you do not use reusable packaging? Valid responses: 27

Question 6.2.2: If you were considering using reusable packaging in the future, before the COVID-19 pandemic, are you now more or less likely to consider using reusable packaging in the future?

In question 6.2.2, participants were asked to indicate whether the COVID-19 pandemic had impacted their plans for using reusable packaging in the future. Specifically, whether they were now more or less likely to consider using reusable packaging following the pandemic. This question was not compulsory. Question 6.2.2 was answered by 27 participants. Of these, 3 (11%) indicated that they did not know, leaving 24 valid responses. Twelve participants (50%)

said they were as likely as before to use reusable packaging, 33% said they were less likely, and 17% said they were more likely. Figure 2-14 shows the spread of the responses.

Figure 2-14: Question 6.2.2: If you were considering using reusable packaging in the future, before the COVID-19 pandemic, are you now more or less likely to consider using reusable packaging in the future?



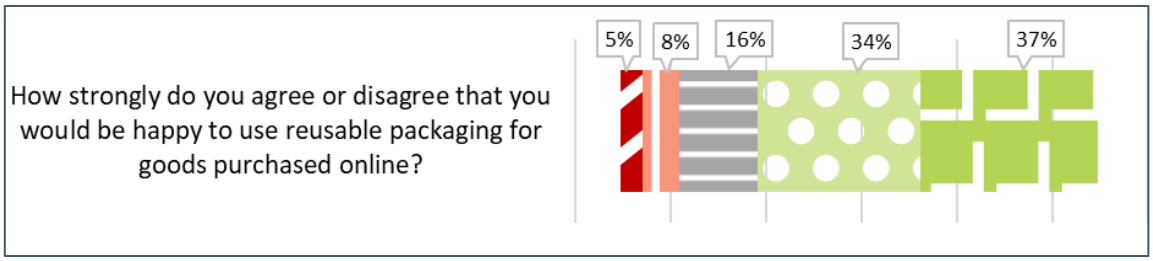
Source: Question 6.2.2: If you were considering using reusable packaging in the future, before the COVID-19 pandemic, are you now more or less likely to consider using reusable packaging in the future? Valid responses: 24

Question 7: How strongly do you agree or disagree that you would be happy to use reusable packaging for goods purchased online?

Although question 7 was compulsory, participants were able to select "No opinion" as a response, these were not included in the valid response total. For this question, 275 participants gave valid responses.

Of the valid responses, 37% (102) of participants said that they "Strongly agree", 34% (94) said they "Agree", and 16% (45) indicated that they "Neither agree nor disagree". The remaining 13% either "Disagree" or "Strongly disagree". The full breakdown of the responses can be seen in Figure 2-15.

Figure 2-15: Question 7: How strongly do you agree or disagree that you would be happy to use reusable packaging for goods purchased online?



Source: Question 7: How strongly do you agree or disagree that you would be happy to use reusable packaging for goods purchased online? Valid responses: 275

Question 8: Do shops or other providers of food and drinks exist in your area that provide the option for you to use your own reusable container?

In question 8, participants were asked whether shops or providers of food and drinks in their area facilitate the use of their own reusable containers. Question 8 was compulsory. The breakdown of answers can be seen in Table 2-8.

Table 2-8: Breakdown of question 8 responses

Response	No. of responses	Percentage of total responses
Yes	142	33%
No	70	50%
I don't know	213	16%

Source: Question 8: Do shops or other providers of food and drinks exist in your area that provide the option for you to use your own reusable containers? Valid responses: 425

Question 9: In the last year have you actively looked for shops or other food and drink providers that provide the option for you to use your own reusable container?
Question 9 asked participants to indicate whether they had actively looked for shops or other food and drink providers over the past year that provide the option to use reusable containers. Question 9 was compulsory. Table 2-9 shows the distribution of responses.

Table 2-9: Breakdown of question 9 responses

Response	No. of responses	Percentage of total responses
Yes	105	25%
No	166	39%
I don't know	154	36%

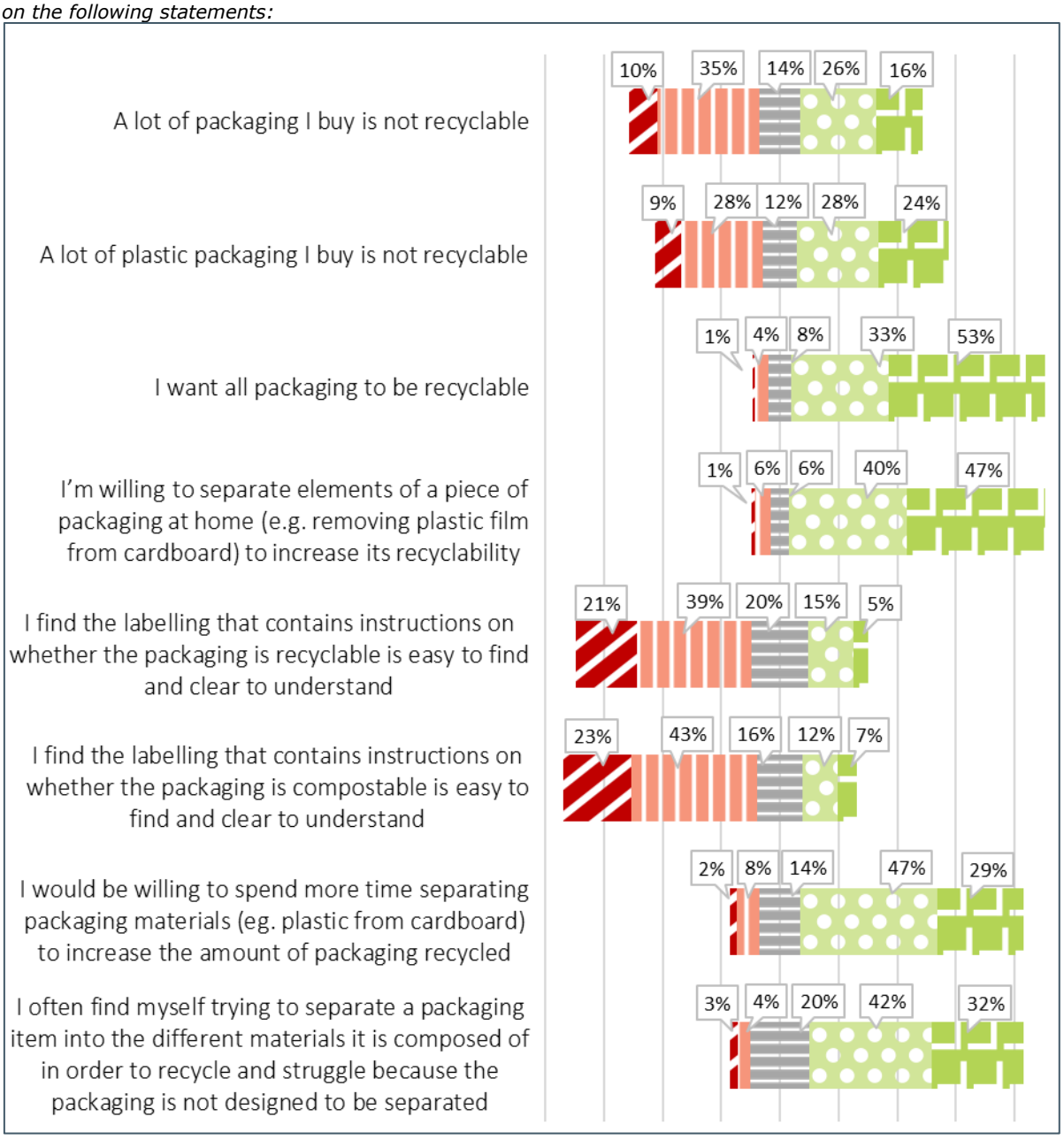
Source: Question 9: In the last year, have you actively looked for shops or other food and drink providers that provide the option to use your own reusable container? Valid responses: 425

2.2.3 Question 10: Recyclability and labelling of packaging

Question 10: Regarding the recyclability and labelling of packaging, please indicate your view on the following statements:
In question 10, participants were asked to indicate their views on eight statements regarding the recyclability and labelling of packaging. Although question 10 was compulsory, participants were able to indicate that they had "No opinion". These responses have not been included in the total valid responses figure. On average, there were 294 valid responses per statement. A summary of valid responses for each statement in question 10 can be seen in Appendix A, Table A-5. Figure 2-16 shows the level of agreement of the participants with the statements provided.

The statement garnering the most support from the participants in question 10 was the statement "I want all packaging to be recyclable". In total, 86% of participants either agreed or strongly agreed with this. This represents the desired future state amongst respondents. The two statements highlighting the current state appeared to somewhat split opinion. When asked whether a lot of the packaging they buy is not recyclable, 45% of participants either disagreed or strongly disagreed versus 42% who agreed or strongly agreed. When asked the same question but specific to plastic packaging, 37% disagreed and 52% agreed, indicating that, on average, participants felt that plastic packaging was less recyclable than packaging made from other materials.

Figure 2-16: Question 10: Regarding the recyclability and labelling of packaging, please indicate your view on the following statements:



Source: Question 10: Recyclability and labelling of packaging, please indicate your view on the following statements. Valid responses: 295 (on average) per statement

2.2.4 Part 2 final comments

At the end of Part 2, participants were given the opportunity to expand on any of their answers and provide further comments. The responses, analysed and grouped into themes, can be seen in Table 2-10.

Table 2-10: End of Section 2 additional comments

Theme	Key points
Labelling	› Packaging should be clearly labelled (recyclable, compostable, non-recyclable etc.) › Refillable packaging should be labelled as refillable › Consumers need help sorting waste. Labelling would help
Design for end-of-life	› Packaging should be designed so that it doesn't need dismantling before separation into collection bins › If packaging must be dismantled, it should be quick, easy, and intuitive
Concerns over safety and/or quality	› Recyclability and end-of-life should not be at the expense of safety, quality, and hygiene
The waste hierarchy	› Reducing the amount of packaging should be the first priority › Reuse should be promoted over recycling › Recyclability should not be relied upon. Just because something is recyclable does not mean it will be recycled
Additional, specific products	A number of additional products were identified by participants. The majority of these were multi-material packaging producers. The most frequently occurring have been listed here: › Paper envelopes with plastic windows › Plastic coated paper packaging › Multi-layer cartons and boxes › Paper bags with plastic windows
Greenwashing	› There is considerable greenwashing in the packaging space
EU harmonisation	› EU guidance on definitions and labelling is needed › The EU should provide guidelines on design for end of life/eco-design
Optimising recycling and recyclability	› Recyclability of a container should not rely on the ability of the consumer to separate materials › New technologies that are better at recycling are needed › Consumer behaviour influences collection and recycling rates
Bio- and compostable packaging	› Compostable packaging should be easily identifiable to consumers › Compostable packaging is well managed in Italy
Life cycle approach	› The entire life cycle of packaging should be accounted for before packaging is deemed "good" or "bad"

Source: End of Section 2 additional comments. Valid responses: 173

2.3 Questions to Expert Stakeholders

In addition to the general considerations regarding packaging and packaging waste investigated in in Section 2.2, expert stakeholders were then invited to give their views on a range of policy and operational objectives, policy measures, the potential for research and development opportunities, and the impacts of COVD-19. Although this section was not compulsory, between 360 and 390 participants answered almost all the questions.

2.3.1 Question 11: Policy and operational objectives and related measures targeting packaging

Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:
For each objective, participants were provided with a short paragraph outlining the background. Question 11 was not compulsory.

As with previous questions, participants were able to indicate that they had "No opinion". These answers have not been included in the valid response total. However, unlike previous questions, participants were not able to select that they "Strongly disagree" with the objective. Therefore, the available answers ranged from "Disagree" to "Strongly agree". On average, there were 371 valid responses for each objective. The number of valid responses per objective are displayed in Appendix A, Table A-6.

Overall, there was strong agreement with the objectives among the participants who provided valid responses. On average, 53% said they "Strongly agree" with the objectives, 35% said they "Agree", 7% indicated they were "Undecided", and the remaining 5% highlighted that they "Disagree" with the objectives. Three objectives were agreed with by 97% of the participants who provided valid responses, these are:

- Objective 4: To increase the recyclability of packaging – 68% of responses were "Strongly agree" and 29% were "Agree";
- Objective 5: Develop clear definitions of biodegradable and compostable packaging – 65% of responses were "Strongly agree" and 32% were "Agree"; and
- Objective 6: Harmonise the labelling of biodegradable and compostable packaging – 58% of responses were "Strongly agree" and 40% were "Agree".

One objective was disagreed with by more than 10% of the participants who provided valid responses:

- Objective 3: To promote the use of reusable packaging whenever logically feasible with a view to reduce packaging waste generation – 18% of responses were "Disagree" and 14% were "Undecided".

Figure 2-17 shows responses to all the objectives.

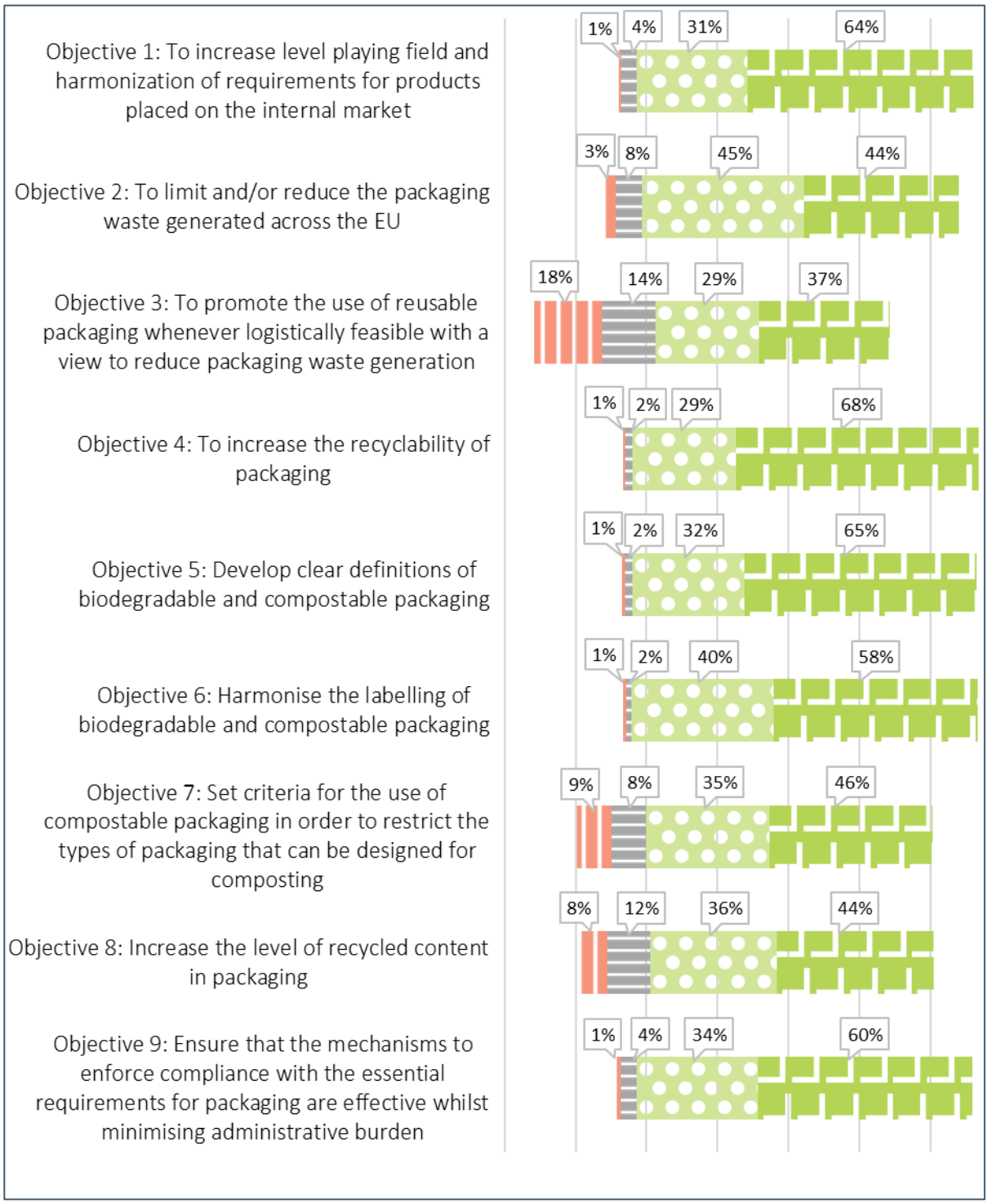
Three objectives were agreed with by 97% of the participants who provided valid responses, these are:

- Objective 4: To increase the recyclability of packaging – 68% of responses were "Strongly agree" and 29% were "Agree";
- Objective 5: Develop clear definitions of biodegradable and compostable packaging – 65% of responses were "Strongly agree" and 32% were "Agree"; and
- Objective 6: Harmonise the labelling of biodegradable and compostable packaging – 58% of responses were "Strongly agree" and 40% were "Agree".

One objective was disagreed with by more than 10% of the participants who provided valid responses:

- Objective 3: To promote the use of reusable packaging whenever logically feasible with a view to reduce packaging waste generation – 18% of responses were "Disagree" and 14% were "Undecided".

Figure 2-17: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements:



Source: Question 11: Policy and operational objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements. Valid responses: 371 (on average) per objective

2.3.2 Questions 12-14: Policy measures

Participants were then asked questions regarding a range of potential policy measures considered to have the potential to help overcome some of the challenges identified. Topics include waste prevention, improving design for reuse, promoting high quality recycling, increasing recycled content, and Green Public Procurement.

Question 12.1: Waste prevention measures

Question 12.1 asked participants to consider a range of potential waste prevention policy measures and to indicate their views on the level of effectiveness and efficiency of each. When commenting on these measures, participants were able to indicate they had 'no opinion' or to select from three statements:

1. It would not reduce packaging waste and/or would not reduce negative environmental impacts;
2. It would reduce packaging waste and/or would reduce negative environmental impacts, but costs would outweigh the benefits; and
3. It would reduce packaging waste and/or would reduce negative environmental impacts and costs would be acceptable.

Where participants indicated that they had "No opinion" on a policy measure, their answer was not counted towards the valid response total. On average, there were 298 valid responses for each waste prevention measure. The number of valid responses for each measure can be seen in Appendix A, Table A-7.

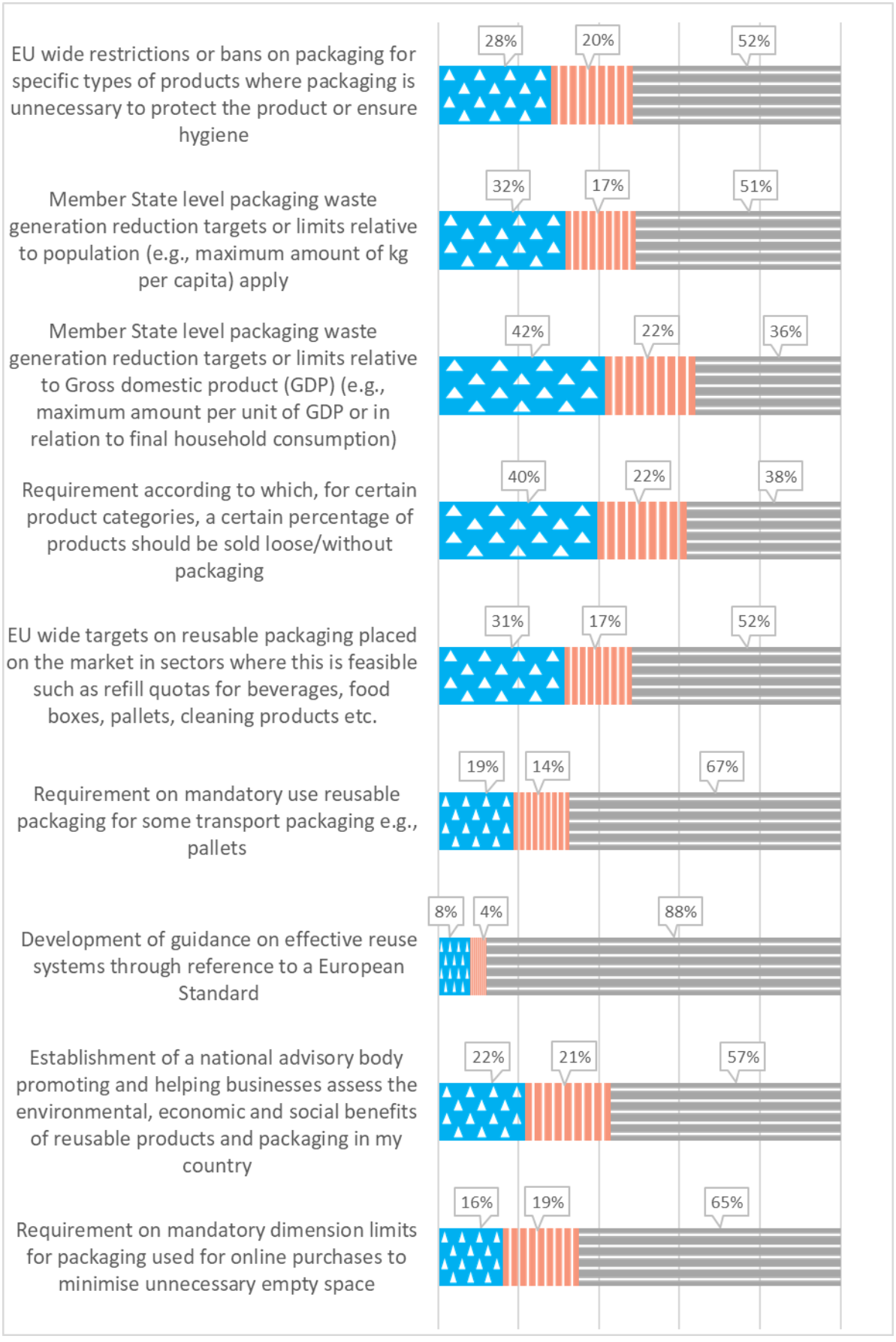
Among the participants that provided valid answers, on average:

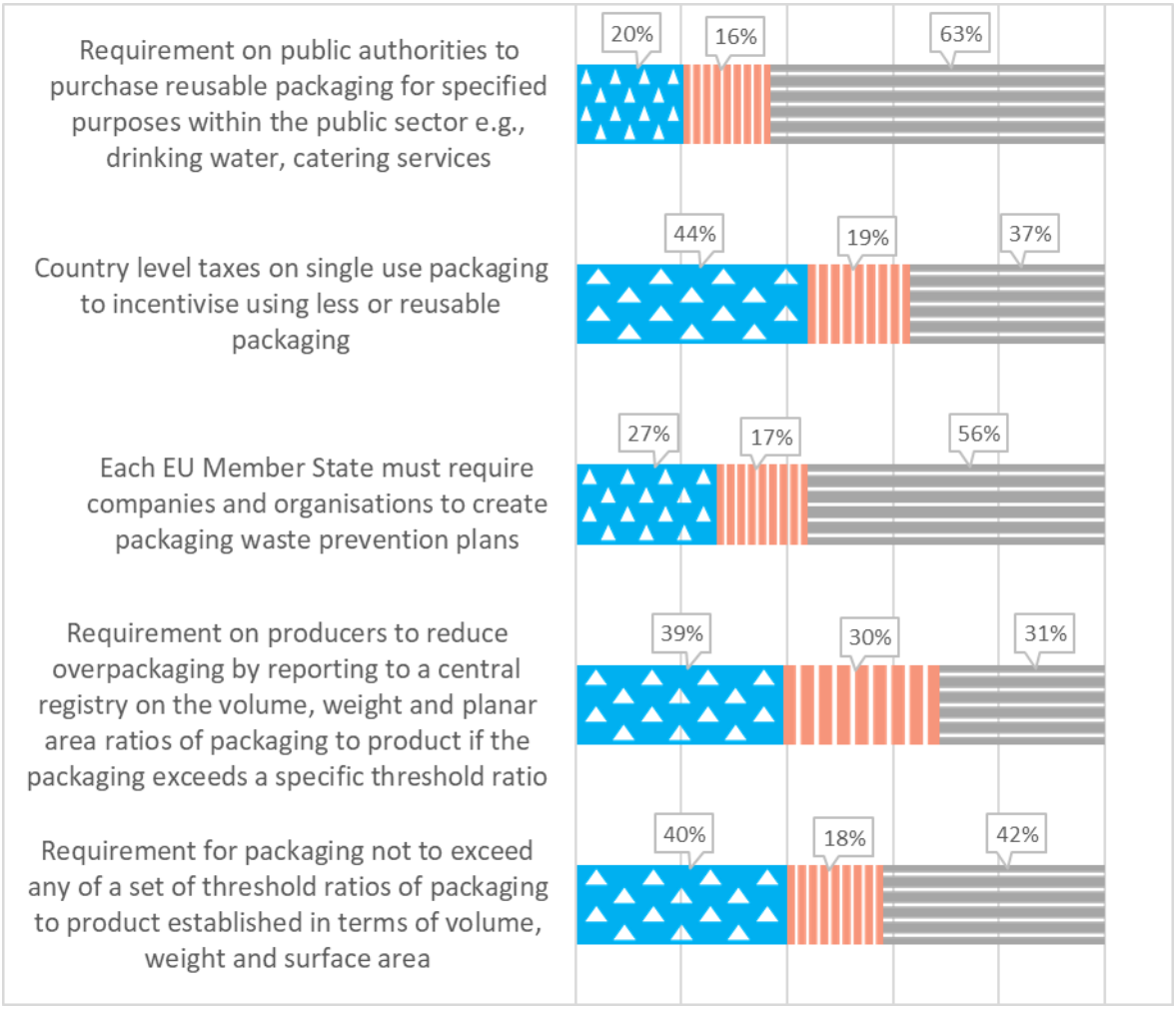
- 29% indicated that they felt the measures would not reduce packaging waste and/or would not reduce environmental impact;
- 18% said that the measures would reduce packaging waste and/or reduce negative environmental impact, but that the costs would outweigh the benefits; and
- 52% felts that the measures would reduce packaging waste and/or reduce negative environmental impact, and that the costs would be acceptable.

In total, nine of the suggested measures received support from over 50% of the participants who answered questions 12.2. Many of the measures referenced some level of EU or national guidance. The measure deemed to be the most efficient and effective method for preventing packaging waste and/or reducing environmental impact at an acceptable cost was the development of guidance on effective reuse systems through reference to a European Standard. Of the participants, 88% felt that this measure would help to prevent packaging waste and/or minimise its associated impact.

Figure 2-18 shows a breakdown of responses for each policy measure.

Figure 2-18: Question 12.1: Waste prevention measures





Source: Question 12.1: Waste prevention measures. Valid responses: 298 (on average) for each waste prevention measure

An additional three measures also referenced the need for guidance through the introduction of bans, restrictions, and targets. Highly supported measures in this area include:

- Introducing EU-wide restrictions on packaging for products where it was unnecessary to protect the product or ensure hygiene (52% of participants);
- Creating Member State level packaging waste generation reduction targets (51% of participants); and
- Instigating EU-wide targets on reusable packaging in feasible markets. For example, refill quotas for beverages, food, cleaning products etc. (52% of participants).

This suggests an appetite amongst the respondents for government (whether local, regional, or EU) guidance. This desire for guidance was further displayed in the significant support (57%) for the measure suggesting that a national advisory board should be created to help businesses assess the environmental, economic, and social benefits of reusable packaging.

Three well-supported measures identified the need for mandates in specific industries or applications. In the transport sector, 67% of participants felt that requiring mandatory use of

reusable packaging for some applications (e.g. pallets) would help to prevent packaging waste at an acceptable cost. In e-commerce, 65% of respondents highlighted that placing dimensional limits on packaging used for online purchases to minimise unnecessary empty space would reduce packaging waste and/or environmental impact. And in the public sector, 63% of participants expressed the view that public authorities should be required to purchase reusable packaging for specified purposes (e.g. drinking water or catering services).

Finally, 56% of participants highlighted that requiring companies and organisations within EU Member States to create packaging waste prevention plans would be an efficient and effective measure to reduce packaging waste.

According to the participants, the least effective measure for reducing packaging waste would be to introduce country-level taxes on single use packaging with the aim of incentivise lower levels of use. 44% of participants felt that this was not an effective policy measure, and 19% said that it would reduce packaging waste and/or negative environmental impact, but the cost would be too high.

Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement

Question 12.2 asked participants to consider a range of potential measures for strengthening the reinforcement of the essential requirements to improve design for reuse and promote high quality recycling. To support this question, participants were provided with a link to the scoping study on reinforcing essential requirements for packaging[444]. They were given three statements as well as the option to select 'No opinion. The statements were:

1. It would not improve packaging design and/or would not reduce negative environmental impacts;
2. It would improve packaging design and/or would reduce negative environmental impacts, but costs would outweigh the benefits; and
3. It would improve packaging design and/or would reduce negative environmental impacts and costs would be acceptable.

Where participants indicated that they had "No opinion" on a policy measure, their answer was not counted towards the valid response total. On average, there were 293 valid responses for each measure. The number of valid responses per measure are in Appendix A, Table A-8.

In general, the participants providing valid responses regarding their views on the proposed policy measures felt that most would be efficient and effective at improving packaging design and/or reducing negative environmental impacts. For each suggested measure, an average of 72% of respondents agreed on their high levels of efficacy and efficiency. Only one measure received support from less than 50% of participants, this was for defining the term 'recyclable' through use of a recycling rate threshold facilitated by digital watermarking technologies. This measure was supported by 46% of participants.

[444] Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement - Publications Office of the EU (europa.eu)

Additionally, mandating a ban on compostable/biodegradable packaging for certain applications split opinions. 52% of participants supported this measure as a method for improving packaging design and 42% were against it.

Many of the measures participants felt to be most efficient and effective surrounded the requirement for clear labelling, particularly for reusable (90% of participants agreed) and compostable (88%) packaging. Additionally, 84% and 79% of participants respectively highlighted labelling recyclable packaging as recyclable and non-recyclable packaging as non-recyclable to also improve packaging design effectively and/or reduce negative environmental impacts.

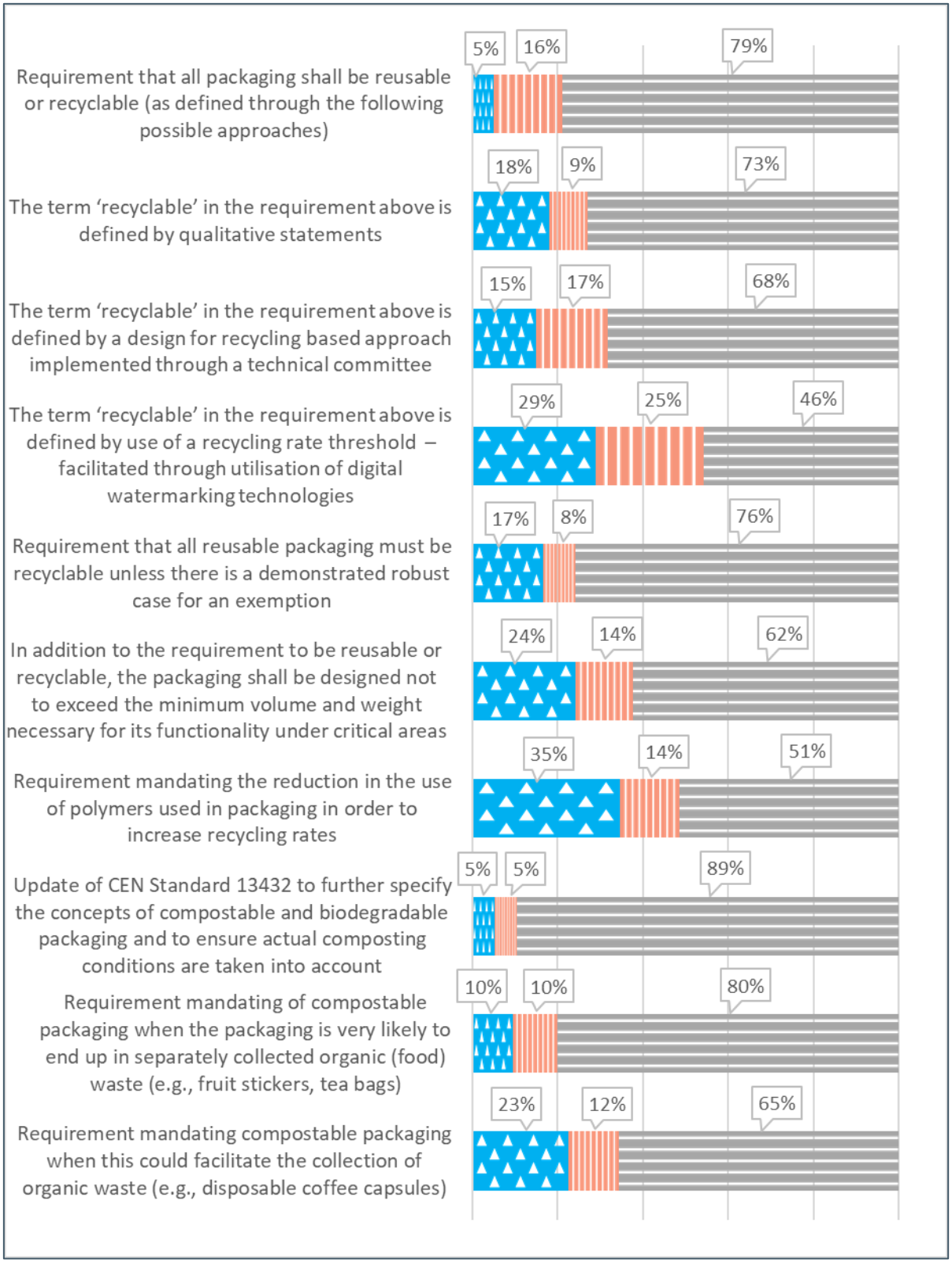
As well as labelling, 79% of participants noted that mandating that all packaging is reusable or recyclable would also improve packaging design at a competitive cost. Additionally, 76% said that ensuring reusable packaging is also recyclable would further support the essential requirements. Many noted that reinforcing this with agreed definitions for the term 'recyclable' would enhance packaging design. 73% felt that the term should be defined by qualitative statements and 68% by a design for recycling approach implemented through a technical committee.

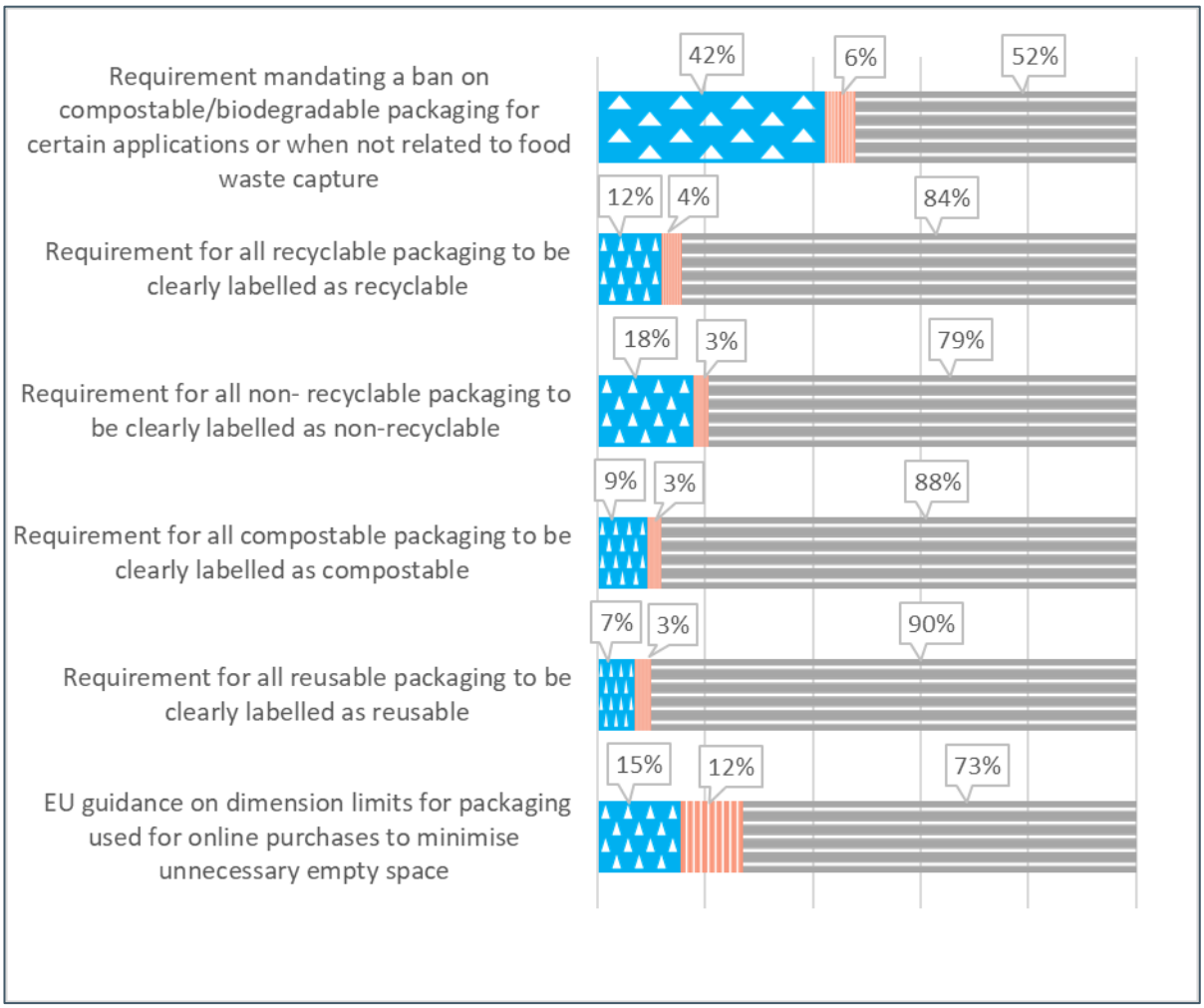
In addition to being reusable or recyclable, 62% of participants felt that ensuring packaging is designed to not exceed the minimum volume and weight necessary for its function would be an effective measure. 51% of participants also supported a requirement mandating the reduction in the use of polymers used in packaging. The concept of minimising the number and volume of materials used in packaging was further reinforced in the field of e-commerce. 73% of participants felt that EU guidance on dimensional limits for packaging used for online purchases could help to improve packaging and reduce negative environmental impacts.

Furthermore, many participants also supported efforts to standardise and legislate in the case of compostable packaging. This included support for updating CEN standard 13432 to further specify the concepts of compostable and biodegradable packaging, ensuring actual composting conditions are taken into account (89% of participants) and mandating the use of compositable packaging where packaging is either likely to end up in separately collected organic waste (80%) or could facilitate the collection of organic waste (65%).

A full breakdown of the responses for each potential policy measure can be seen in Figure 2-19.

Figure 2-19: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement





Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen their enforcement. Valid responses: 293 (on average) per measure

Question 12.3: Measures related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials

Question 12.3 asked participants to consider a range of measure related to increasing recycled content in packaging and to assess their effectiveness and efficiency with regards to increasing demand. Participants were given three statements to select from as well as the option to select 'No opinion. The statements were:

1. It would not increase demand and/or would not reduce negative environmental impacts;
2. It would increase demand and/or would reduce negative environmental impacts, but costs would outweigh the benefits; and
3. It would increase demand and/or would reduce negative environmental impacts and costs would be acceptable.

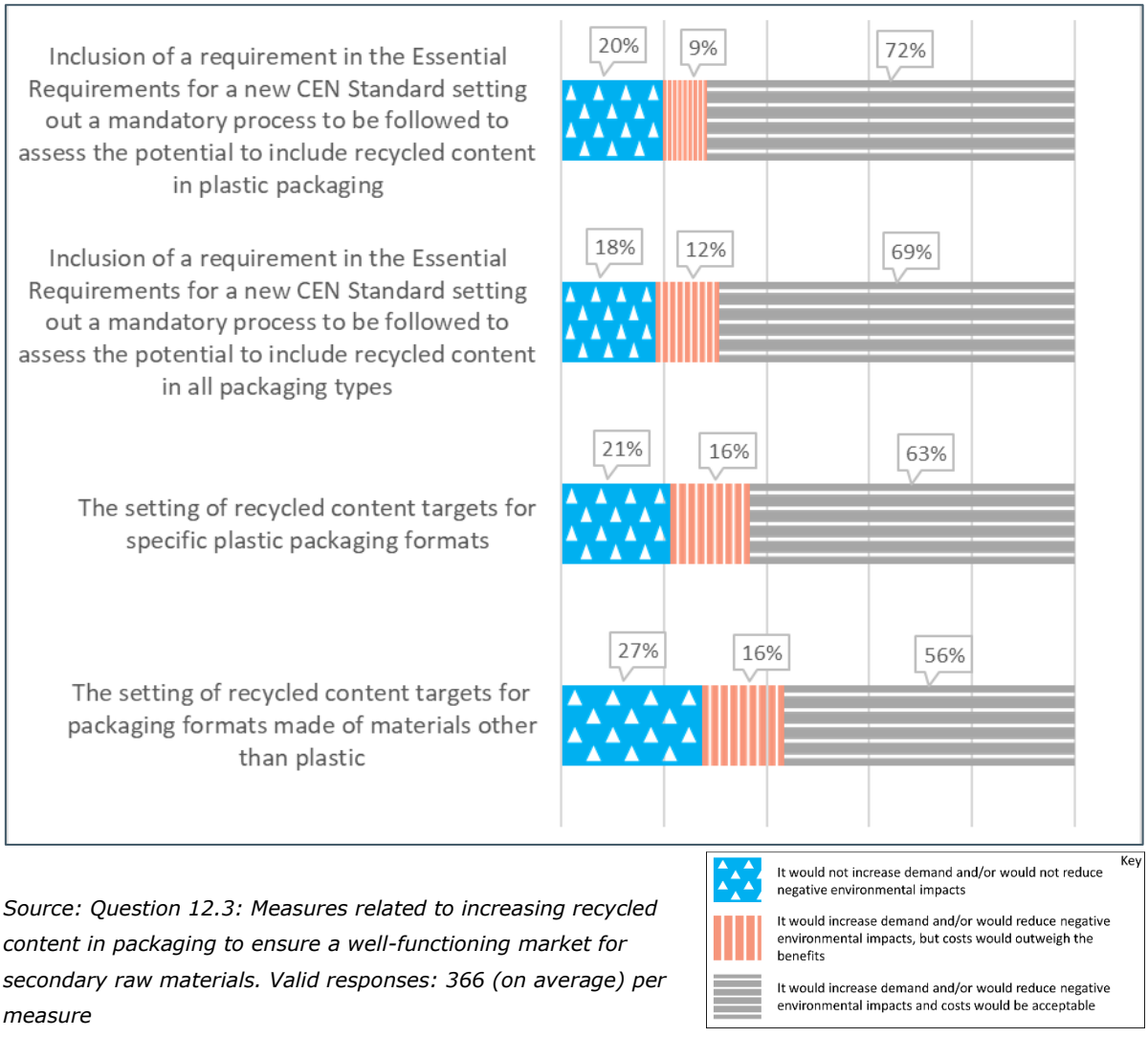
Where participants indicated that they had "No opinion" on a policy measure, their answer was not counted towards the valid response total. On average, there were 366 valid responses for each waste prevention measure. The number of valid responses for each measure can be seen in Appendix A, Table A-9.

In general, the participants that provided valid responses regarding their views on the proposed policy measures felt that most would be effective and efficient. On average:

- 22% said that they felt the measures would not increase demand and/or would not reduce negative environmental impacts; and
- 13% indicated that they thought the measures would increase demand and/or reduce negative environmental impacts, but that the costs would outweigh the benefits; and
- 65% felt that the measures would increase demand and/or reduce negative environmental impacts, and that the costs would be acceptable.

A full summary of the valid responses can be seen in Figure 2-20.

Figure 2-20: Question 12.3: Measures related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials



Source: Question 12.3: Measures related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials. Valid responses: 366 (on average) per measure

According to the participants, the most likely measure to increase demand effectively and efficiently for recycled content at an acceptable cost would be the inclusion of a requirement in the Essential Requirements for a new CEN Standard setting out a mandatory process to be followed to assess the potential to include recycled content in plastic packaging. Seventy-two

percent of participants providing valid responses felt that this was an effective and efficient policy measure.

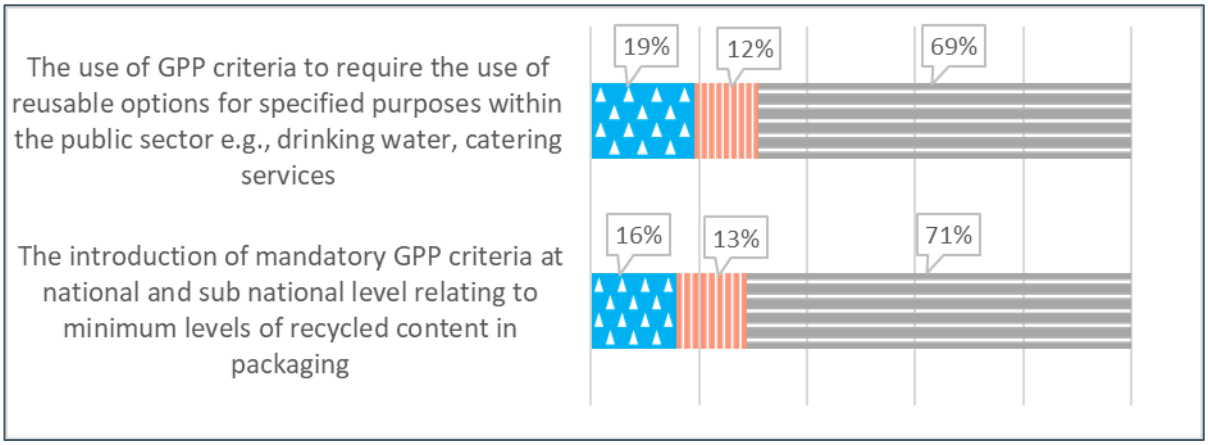
The policy measure identified by the most participants to be ineffective at increasing demand for recycled content was the setting of recycled content targets for packaging formats made of materials other than plastic with 27%. An additional 16% said this measure would effectively increase demand and/or decrease negative environmental impacts but thought that the costs would outweigh the benefits.

Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging

In question 12.4, participants were asked to consider a range of measures related to GPP and using this to promote reusable packaging or recycled content in packaging. They were asked to assess the effectiveness and efficiency of two policy measures. Participants were given three statements to select from as well as the option to select 'No opinion'. The statements were:

1. It would not be effective and/or would not reduce negative environmental impacts;
2. It would be effective and/or would reduce negative environmental impacts, but costs would outweigh the benefits; and
3. It would be effective and/or would reduce negative environmental impacts and costs would be acceptable.

Figure 2-21: Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging



Source: Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging. Valid responses: 249 (on average) for each measure

Where participants indicated that they had "No opinion" on a policy measure, their answer was not counted towards the valid response total. On average, there were 249 valid responses for each measure. The number of valid responses for each measure can be seen in Appendix A, Table A-10.

Responses to both potential policy measures were similar. On average, 70% of participants providing valid responses felt that the measures were both efficient and effective, 12.5% thought that the measures were effective but that the cost would outweigh the benefit, and 17.5% said that the measures would not be effective. Figure 2-21 summarises the responses for both potential policy measures.

Question 13: What additional EU level measure(s), if any, would you recommend to meet any of the policy objectives set out above?

Participants were asked to identify and/or describe any additional EU-level measures that they would recommend to help meet any of the policy objectives set out in question 12. In total, 217 participants answered question 13, 32 of which were EU citizens. The responses have been analysed and grouped into themes. These can be seen in Table 2-11.

Table 2-11: Question 13: What additional EU level measure(s), if any, would you recommend to meet any of the policy objectives set out above?

Theme	Key points
Evaluation, certification, and targets	› Need a method for setting evaluation guidelines to help companies to evaluate packaging sustainability › Develop consistent methods for measuring recycled content › Targets should drive investments in innovation and technology › There should be a minimum target for the use of recycled content in packaging › PPWD should be aligned with Green Deal's objective for achieving carbon neutrality › There should be EU-wide targets for packaging reduction and waste prevention › There should be EU targets for refill opportunities › Food & drink and pharmaceuticals should be exempt from targets for recycled content
Collection and processing	› Incentivise improved separate collection and processing (practices and capacity) › Harmonise separate waste collection across the EU › Differentiate between requirements for household and industrial packaging
Life cycle approach	› LCA should be used when setting targets to ensure chosen solution is the most environmental responsible › Packaging should be chosen based on lowest impact › Introduce a fee/taxes based on environmental impact › Green public procurement should be based on LCA
Definitions	› All policy objectives should be underpinned by harmonised and agreed definitions, and the public should be educated on these terms › Define: reusable, single-use, recycling, recycled, recyclable, biodegradable, compostable, recycled content

Theme	Key points
Bio-based, bio-derived, biodegradable, compostable	› Correct end of life processing for biodegradable packaging should be defined & publicised › The use of biobased and/or compostable packaging should be included in GPP › Biodegradable plastics should be restricted as they are not recyclable
Labelling and traceability	› Create a traceability system for packaging throughout the entire value chain › Develop EU-wide recyclability e-label to help customers improve recycling rates › Mandatory labelling of both single-use and reusable packaging › Digital labelling could aid more effective sorting techniques
Bans and restrictions	› Banning certain types of packaging could create unintended consequences › Bans on specific items need to be backed up by supporting infrastructure. E.g., if considering bans on bottled water, must be public access water fountains
Incentives	› Consider tax reductions to incentivise sustainable practice › EPR schemes and Ecomodulation can also provide incentives
EPR and ecodesign	› Long term investment is needed to encourage advancements in EcoDesign › The EcoDesign Directive needs to be revised
Standards and regulation	› Existing EU standard used to show compliance with the essential requirements for packaging needs to be updated › Use of recycled plastic is prevented by the lack of EU standards, establishing these needs to be a priority › Specificities of Foods for Special Medical Purposes (FSMPs) needs to be considered when reviewing the requirements for packaging and other measures to prevent packaging waste › Reusable packaging standards need to be defined
Promoting reuse	› Reusable packaging formats need standardisation › Quantitative reuse targets at national and international level are needed › Greater focus is needed on promoting reusable packaging and reusable supporting technologies rather than recycling (waste hierarchy) › Reusable packaging should be supported by tax breaks
Innovation and technology	› Investments in materials, design, and technology innovation is needed › Technology approach to recycling is needed and must be improved › Sorting capability and capacity must be improved
Recycled content	› Ambitious minimum recycled content targets for packaging › Certain products should be exempt from the need to use recycled content where safety could be compromised (e.g., food or pharmaceuticals)

Theme	Key points
	› Lack of EU standards prevents the use of recycled plastics
Mass balance approach	› Mass balance approach needed to make chemical recycling work at scale › Acceptance of this approach will be critical in start-up and transition phases for enabling recycling technologies
Deposit systems	› Deposit systems should be introduced in all EU countries › Deposit systems should encourage reuse, not recycling
Education	› All children in Europe should be taught about recycling › Consumers need to be educated on what should be used and collected and how › Definitions will form a huge part of education

Source: Question 13: What additional EU level measure(s), if any, would you recommend to meet any of the policy objectives set out above? Valid responses: 217

Question 14: Which are the most important reasons for you to have decided that you do not support specific measures above (for example loss of flexibility, administrative costs, risks, ongoing industry-led initiative will resolve the issue)? Please substantiate your statement with qualitative data as much as possible. You can add information by using the option of attaching a document to your response (see end of survey)

Question 14 asked participants to identify the most important reasons for them to have decided that they do not support the specific measures outlined question 12. In total, 212 participants choose to answer this question, 34 of which were EU citizens. The responses have been analysed and grouped into themes. These can be seen in Table 2-12.

Table 2-12: Question 14: Which are the most important reasons for you to have decided that you do not support the specific measures able?

Theme	Key points
Conflicting priorities versus waste hierarchy	› The waste hierarchy should provide a method for prioritisation of measures › Reduction of unnecessary packaging should be the first priority › Reuse should be incentivised and promoted over recycling
Lack of holistic approach	› Measures should consider the environmental impact of all functions of the packaging › Economic and social impacts over the entire life of the packaging and the product it contains should also be quantified and accounted for › Decisions should be made based on LCA results and data-driven assessments
Economic considerations	› Cost of implementation of many of these measures is too high › Mandatory rules should only be introduced if they are economically viable

Theme	Key points
	› Mandatory use of expensive recyclate in packaging across the EU may put Member States at a competitive disadvantage versus non-EU countries and markets
Concerns of product safety	› Reducing the amount of packaging used must not compromise the safety of the product inside › COVID-19 has resulted in additional hygiene concerns. This prevents some from feeling safe using reusables › Recycled materials are not always appropriate for use as packaging for perishable (i.e., food) items
Confused or conflicting guidance	› Any policy requirements must be harmonised and underpinned by sound technical criteria › Waste infrastructure differs across Member States. Guidance at EU-level must not compromise a Member State's ability to collect and process waste › Some terms, e.g., "recyclable", "recycled", "compostable" are inconsistent therefore suggested measures are difficult to interpret › Although harmonised guidance is lacking, if it is introduced, it should not be so prescriptive as to stunt innovation within organisations and markets
Views on composting and biodegradability	For: › The relationship between compostables and food waste is clear › In some countries (e.g., Italy), industrial composting is well-established Against › Some biodegradable and compostable materials can negatively affect bio-waste treatment › Compostable packaging risks confusing consumers and encouraging littering
Lack of technical solutions/support	› Existing recycling technologies are not capable of effectively and efficiently processing the volumes of packaging waste generated › Waste management systems are not equipped (technology and personnel) to collect and process the required volumes of waste
Negative impact on innovation	› Too many measures can prevent innovation in business models, design, and technology › Restrictive policy can prevent upscale and implementation of technologies with the potential to provide workable solutions
Restrictive nature of overarching bans	› Premature blanket banning of certain materials or products without fact-based reasoning may result in alternatives with worse environmental impacts › Some SUP products are ideal for their use and in fact the best option for the environment › Complete bans for certain materials (e.g., compostable plastics) will negatively impact innovation, employment, and livelihood in Europe

Theme	Key points
Concerns over contamination and/or hygiene	› Preparation for reuse is not always carried out in hygienic conditions › Packaging for pharmaceuticals and medical products/devices should be considered separately
Complexity of implementation of measures	› Administrative and logistic considerations associated with implementation of the suggested measures are too complex › Measures should focus on efficacy and efficiency
Consideration of ceramics	› Ceramic containers should be outside of the recycled content requirement
Limitations of the questionnaire	› Available questionnaire responses were not always adequately qualified, making it impossible to identify potential trade-offs › The outlined measures do not address the main problems associated with packaging waste › Suggested measures are not always clear

Source: Question 14: Which are the most important reasons for you to have decided that you do not support the specific measures above? Valid responses: 212

2.3.3 Question 15: Research & development and innovation potential

Question 15: Which of the following drivers do you consider has the potential to make a large contribution to increasing the recycling of packaging and its cost-effectiveness within the next 10 years?

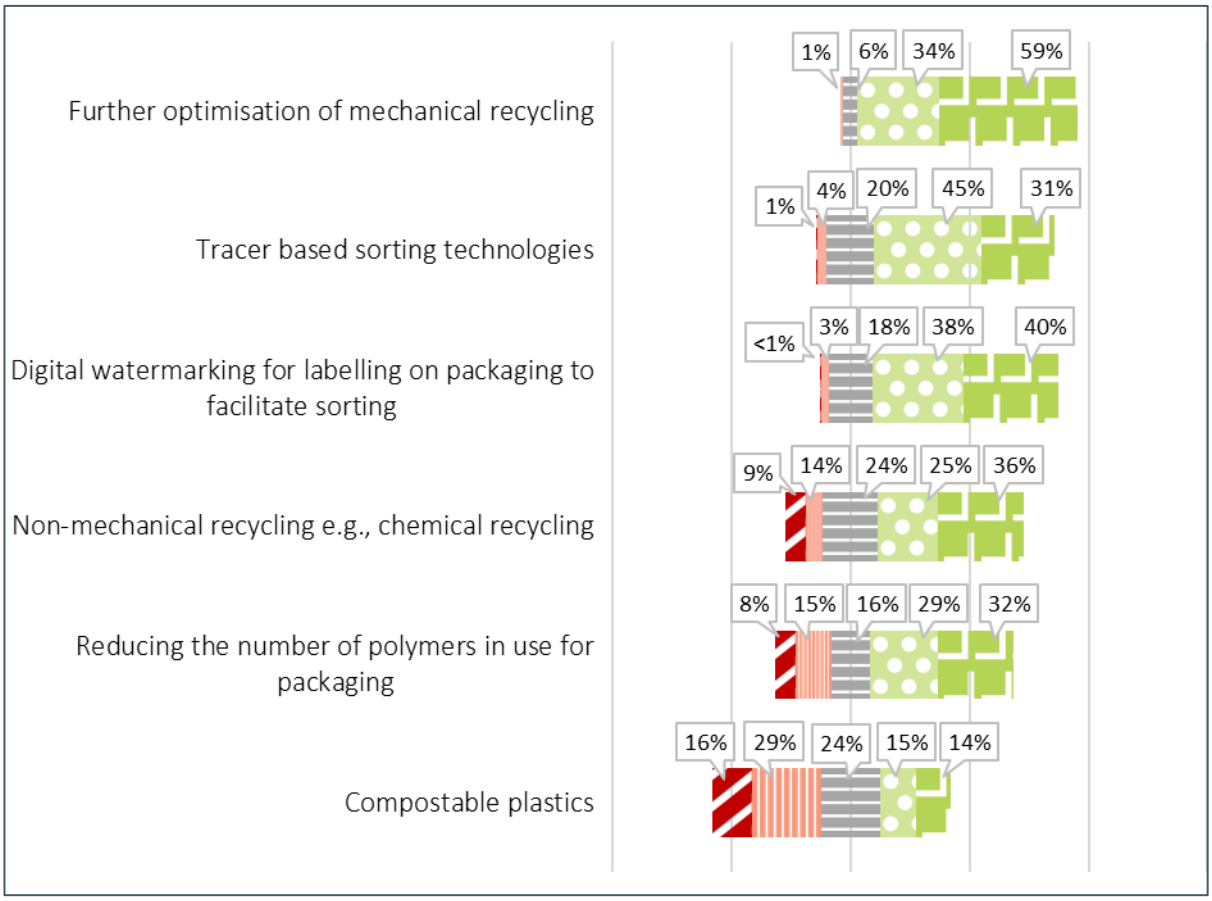
In question 15, participants were asked to consider the potential of several drivers for increasing the recycling of packaging and its cost effectiveness within the next ten years. They were asked to indicate to what extent they agree with each driver. Questions 15 was not compulsory, and those who did answer were able to select "No opinion". These answers have not been included in the valid responses total. On average, there were 317 valid responses for each driver. The number of valid responses for each driver are in Appendix A.

The participants that provided valid responses largely agreed with the suggested drivers. On average:

- 41% of participants strongly agreed that the drivers had potential to contribute to increasing packaging recycling;
- 29% said that they agree;
- 16% indicated that they neither agree nor disagree;
- 9% disagreed; and
- 5% strongly disagreed.

The full summary of responses to the drivers can be seen in Figure 2-22.

Figure 2-22: Question 15: Which of the following drivers do you consider has the potential to make a large contribution to increasing the recycling of packaging and its cost-effectiveness within the next 10 years?



Source: Question 15: Which of the following drivers do you consider has the potential to make a large contribution to increasing the recycling of packaging and its cost-effectiveness within the next 10 years? Valid responses: 317 (on average) per driver

The driver agreed by most to have the potential to make a large contribution to increasing the recycling of packaging was further optimisation of mechanical recycling. For this driver, 59% of participants stated that they "Strongly agree" and 34% "Agree". Only 1% of participants said that they "Disagree" with this driver, and no participants selected "Strongly disagree".

In addition, digital watermarking for labelling on packaging to facilitate sorting also received a lot of support. In total, 78% of participants either agreed or strongly agreed that digital watermarking had considerable potential to increase the recycling of packaging and its cost-effectiveness within the next ten years.

In contrast, the driver disagreed with by the most was compostable plastics. For this driver, 16% of participants indicated that they "Strongly disagree" with its potential to make a large contribution to increasing the recycling of packaging and 29% said that they "Disagree".

In addition, participants were able to select an "Other" option and qualitatively describe any additional driver(s) they felt could make a large contribution to increasing the recycling of packaging and its cost-effectiveness within the next ten years. Of the 203 participants who choose to use this function, 141 left further commentary.

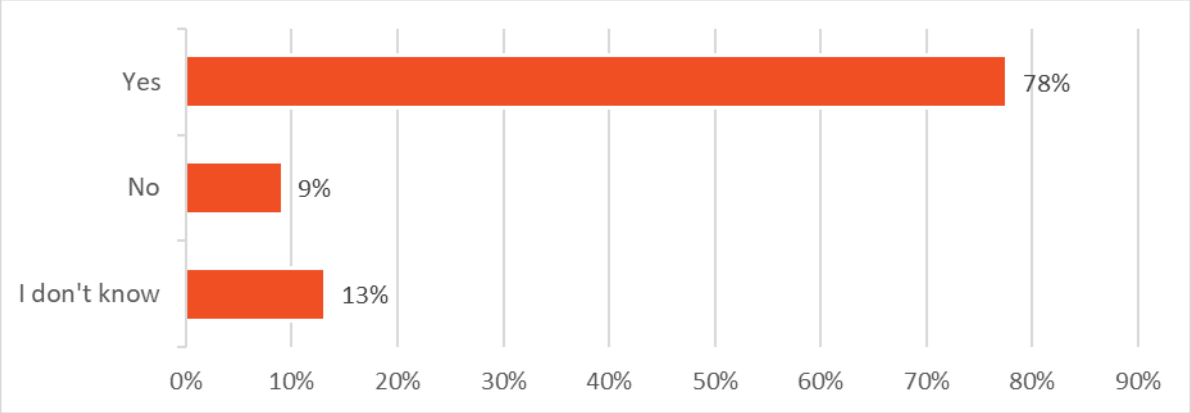
The most common additional driver mentioned surrounded the need for further innovation in collection and sorting. Other suggestions included creation of new methods for reducing printed ink on packaging, and development of widespread design for recycling practices. In addition, some participants also pointed out that the question should have either included drivers for reuse and waste prevention, or clearly stated that it was a question solely on recycling.

2.3.4 Questions 16-18: Impacts of Covid-19

Question 16: In your experience, has the COVID-19 pandemic impacted the demand for packaging?

Question 16 asked participants to consider the impact of the COVID-19 pandemic on the demand for packaging. Question 16 was not compulsory. In total there were 371 responses, the majority of which (78%) said that yes, the pandemic has impacted the demand for packaging. The breakdown of the responses can be seen in Figure 2-23.

Figure 2-23: Question 16: In your experience, has the COVID-19 pandemic impacted the demand for packaging?



Source: Question 16: In your experience, has the COVID-19 pandemic impacted the demand for packaging?
Valid responses: 371

Question 16.1: What have been the impacts on the demand for packaging?

Participants were then able to provide a qualitative description of the impacts that the COVID-19 pandemic has had on the demand for packaging. In total, 231 participants choose to include commentary here. The responses were analysed and grouped into themes. The results can be seen in Table 2-13.

Table 2-13: Question 16.1: What have been the impacts on the demand for packaging?

Theme	Key points
Changing consumer behaviour	› The way in which consumers now shop has changed. Lockdowns have resulted in more online shopping, consequently producing more online shopping packaging
Health and safety	› Demands for more stringent health and safety practices because of the pandemic, particularly in the food and drink sector, have led to an increase in packaging

Theme	Key points
	› There has been an increase in sales of certain hygiene and pharma products, leading to an increase in packaging for these products › There are more products that are packaged as single items, resulting in more packaging
Changing demand	› Reduced industrial activity has resulted in less commercial waste › Lockdowns and self-isolations have resulted in more household packaging › New consumer needs (single-packed items, masks, gloves) have increased certain packaging waste streams, and in some cases created almost new streams

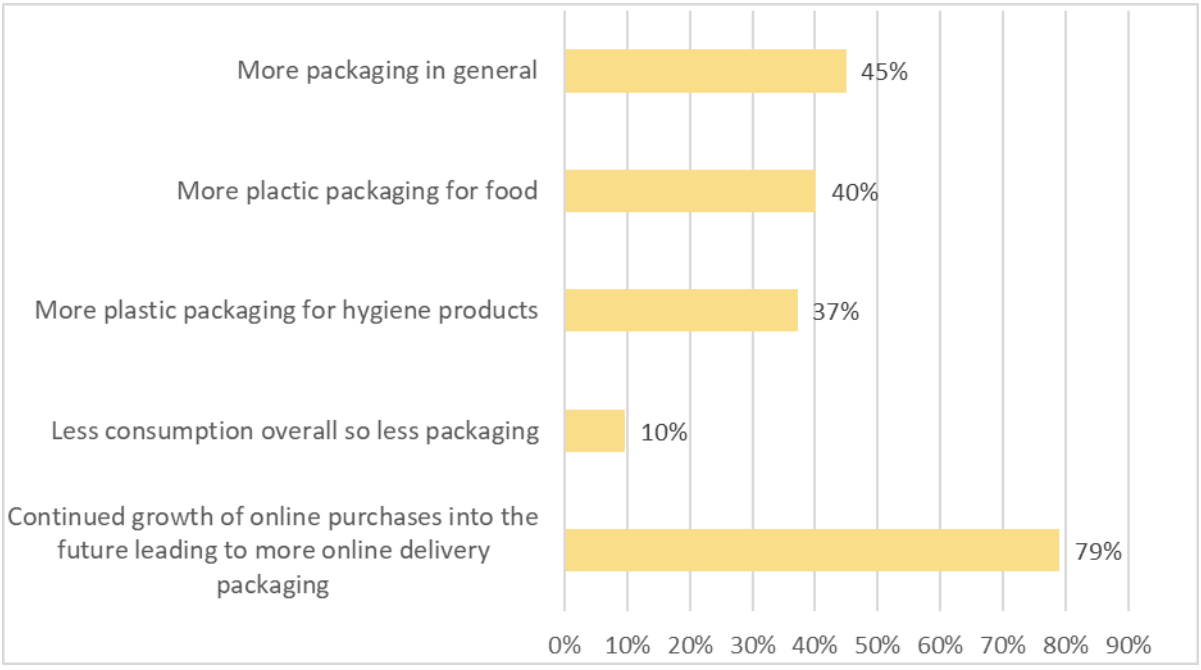
Source: Question 16.1: What have been the impacts on the demand for packaging? Valid responses: 231

Question 16.2: If yes, what changes do you expect to persist beyond 2021?

If participants felt that yes, the COVID-19 pandemic had impacted the demand for packaging, in question 16.2 they were asked to identify which changes they expected to persist beyond 2021. Participants were given a list of options to choose from and were able to select all that applied to them. In addition, participants were able to select an "Other" option and include further explanation for their choices.

Of the 309 participants who answered this question, 79% (244) indicated that they felt continued growth of online purchases leading to more online delivery packaging would persist beyond 2021. In addition, 45% (139) of participants felt there would continue to be more packaging in general and 40% (124) said that there would continue to be more plastic packaging for food. The complete breakdown of the responses can be seen in Figure 2-24.

Figure 2-24: Question 16.2: If yes, what changes do you expect to persist beyond 2021?



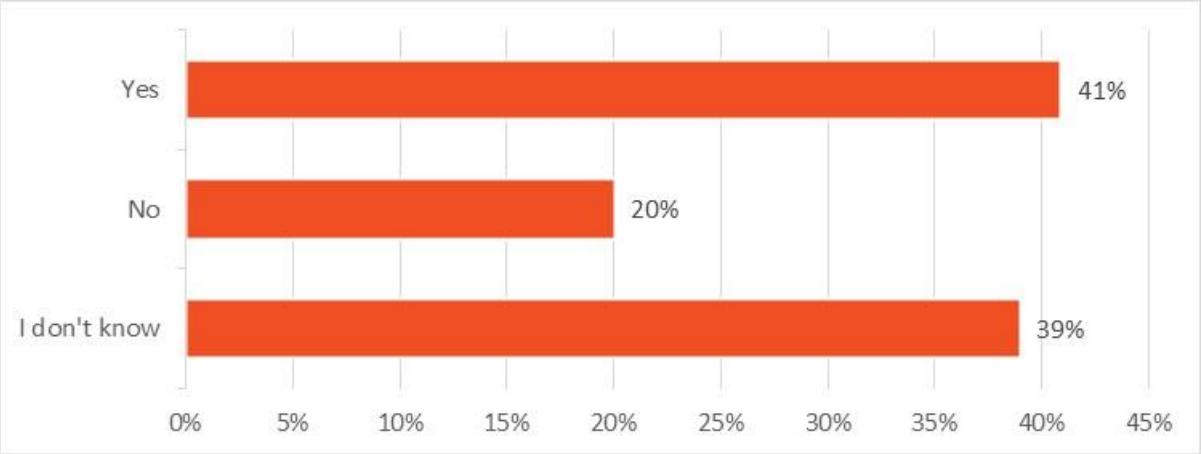
Source: Question 16.2: If yes, what changes do you expect to persist beyond 2021? Valid responses: 309

In total, 31 participants included further explanation for their choices. Several participants noted that the consumption of packaging has shifted because of the COVID-19 pandemic. Packaging from industry has decreased due to forced closures, however packaging waste generated through online sales has increased. In addition, some consumers have become more hesitant to use reusable packaging.

Question 17: Has the COVID-19 pandemic affected the recycling of packaging waste?
Question 17 asked participants to consider the impact of the COVID-19 pandemic on the recycling of packaging waste. Question 17 was not compulsory. In total there were 364 responses, the majority of which (41%) said that yes, the pandemic has impacted the demand for packaging. The breakdown of the responses can be seen in

Figure 2-25.

Figure 2-25: Question 17: Has the COVID-19 pandemic affected the recycling of packaging waste?



Source: Question 17: Has the COVID-19 pandemic affected the recycling of packaging waste? Valid responses: 364

Question 17.1: What have been the impacts on recycling of packaging waste?
Participants were then able to provide a qualitative description of the impacts that the COVID-19 pandemic has had on the recycling of packaging waste. In total, 120 participants chose to include commentary here. The responses were analysed and grouped into themes. The results can be seen in Table 2-14.

Table 2-14: Question 17.1: What have been the impacts on recycling of packaging waste?

Theme	Key points
Collection, sorting, and recycling disruptions	› Many countries and regions saw disruptions in collection, sorting, and recycling services due to closures and lack of personnel › Lower collection levels of some materials (e.g., paper) left recyclers without waste to recycle
Falling prices of virgin materials	› Falling oil prices left recycled plastics unable to compete with low prices › Falling prices of other competitive virgin materials had similar effects

Theme	Key points
Changing consumer behaviours	› Changing behaviours redistributed waste and changed its composition › Lockdowns and self-isolations resulted in more people at home creating waste, rather than doing so when out › Masks, gloves, and sanitisers etc. have resulted in a new packaging waste stream
Lack of demand for recycled materials	› Partially related to falling virgin material prices › Less focus within businesses on sustainable practice (i.e., less organisations choosing to use recycled materials)
Contamination	› Increased volumes of contaminated waste (e.g., disposal takeaway boxes contaminated with food) that cannot be recycled › Some instances of lower recycling rates due to fear of contamination from COVID-19

Source: Question 17.1: What have been the impacts on recycling of packaging waste? Valid responses: 125

Question 17.2: If yes, what changes do you expect to persist beyond 2021?

If participants felt that yes, the COVID-19 pandemic had impacted the recycling of packaging waste, question 17.2 asked them to identify which changes they expected to persist beyond 2021. Participants were given a list of options to choose from and were able to select all that applied to them. In addition, participants were able to select an "Other" option and include further explanation for their choices. A summary of the responses can be seen in Figure 2-26.

Of the 139 participants who answered this question, 79% (110) indicated that they felt that the low price of virgin materials would continue to make recycled materials less competitive beyond 2021. In addition, 48% (67) of participants felt that the lack of sufficient supply of separately collected and sorted waste would continue to impact the recycling of packaging.

Figure 2-26: Question 17.2: If yes, what changes do you expect to persist beyond 2021?

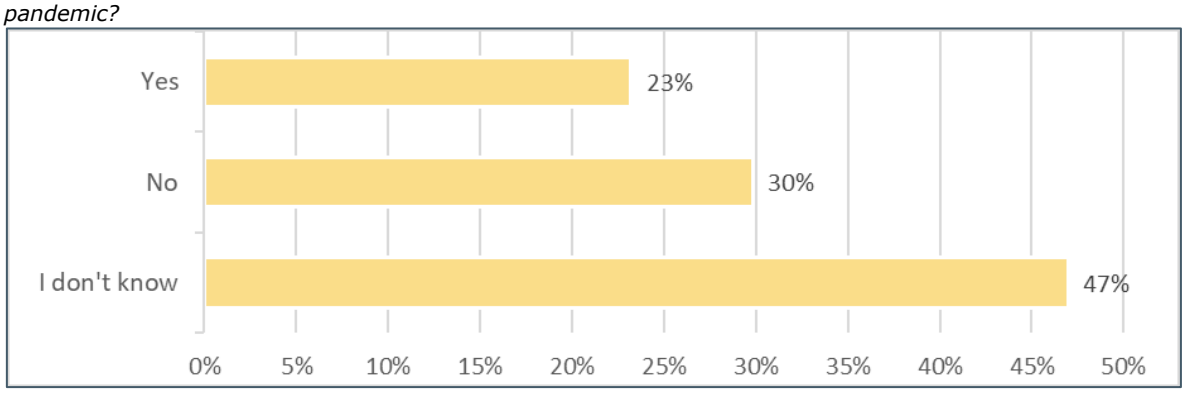
Source: Question 17.2: If yes, what changes do you expect to persist beyond 2021? Valid responses: 139

In total, 7 participants included further commentary on their choices. Participants listed increased consumption, lack of demand for packaging in industrial sectors, and reduced investments in technical solutions as other changes likely to persist beyond 2021.

Question 18: Have the packaging production supply chains been disrupted by the COVID-19 pandemic?

In question 18, participants were asked to indicate whether they felt the packaging production supply chains had been disrupted by the COVID-19 pandemic. Question 18 was not compulsory. In total there were 362 responses, the majority of which (47%) said they did not know. The breakdown of the responses can be seen in Figure 2-27.

Figure 2-27: Question 18: Have the packaging production supply chains been disrupted by the COVID-19 pandemic?



Source: Question 18: Have the packaging production supply chains been disrupted by the COVID-19 pandemic? Valid responses: 362

Question 18.1: What have been the impacts on the packaging supply chain, and do you expect them to persist beyond 2021?

Participants were then able to provide a qualitative description of the impacts that the COVID-19 pandemic has had on the packaging supply chain. In total, 55 participants chose to include commentary here. The responses have been analysed and grouped into theme. These can be seen in Table 2-15.

Table 2-15: Question 18.1: What have been the impacts on the packaging supply chain, and do you expect them to persist beyond 2021?

Theme	Key points
International trade	› International trade was significantly disrupted due to border closures. This caused delivery delays › Difficulties maintaining international trade reduced overall globalisation, particularly trade from Asia › One participant noted that the reduction in imported goods did improve the competitiveness of local producers › Many participants were appreciative of the Commission's efforts to establish Green Lanes

Theme	Key points
Closure of some industries	› Restrictions on manufacturing operations, particularly at the beginning of the pandemic, disrupted supply chains › Many participants identified that packaging is an essential component of the product groups identified by the Commission as essential, e.g., "health-related and perishable goods, notably foodstuffs"
Change in demand for packaging	› Participants noted the changes in demand for packaging, namely that there was less demand in industrial sectors and more for cleaning industries
Disruptions to supply chains	› Many participants highlighted that supply chains had been disrupted › Restrictions in production have caused more competition for certain goods (e.g., dry food) › Transport has been significantly impacted - free movement across the EU and wider world is restricted
Shortages of workers	› Lockdowns and self-isolations restricted the number of employees able to come into offices, manufacturing sites, and waste management facilities › Restrictions on movement of expert personnel across Europe have cause difficulties in some organisations
Shortages of materials	› Restricted supply chains and temporary business closures have led to shortages in certain products (e.g., ethanol used for inks to print packaging) › Volumes of paper waste available for input into recycling has decreased
Consumers in lockdown	› Changes in consumer behaviours have caused differences in demand › Online shopping has increased, therefore packaging from online shopping has increased

Source: Question 18.1: What have been the impacts on the packaging supply chain, and do you expect them to persist beyond 2021? Valid responses: 55

Question 19: Interviews

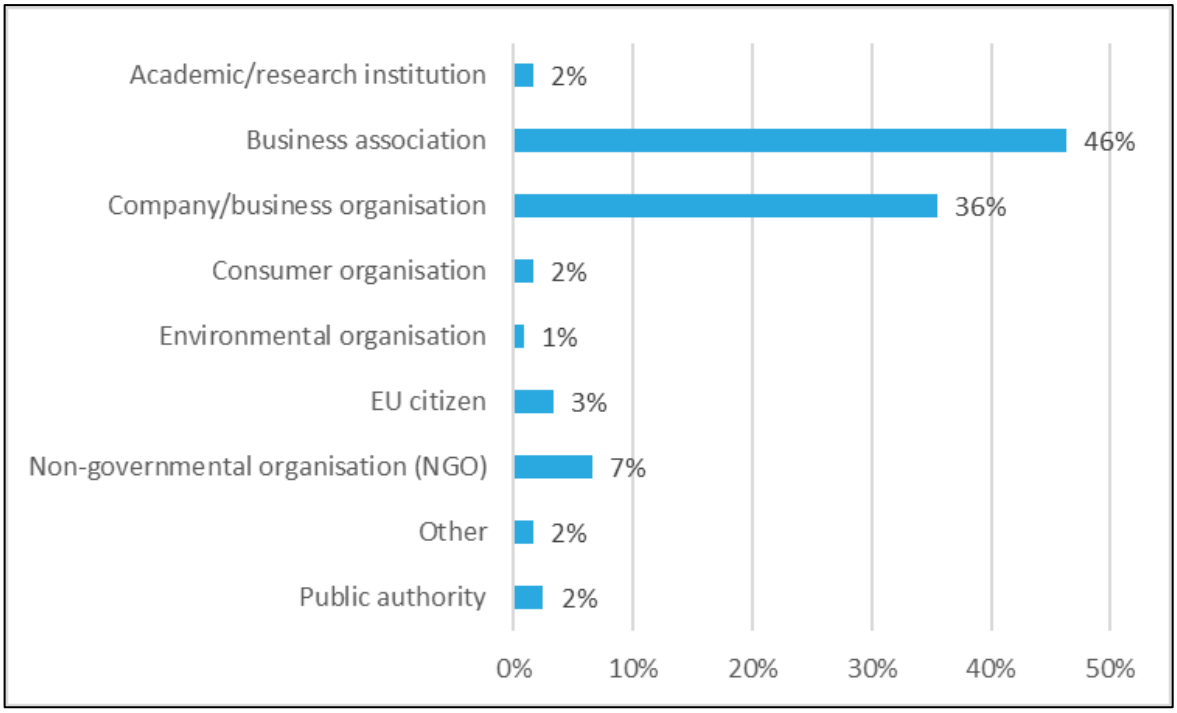
Finally, participants were asked if they would be willing to take part in follow-up interviews to gather more information and views about the PPWD. Question 19 was not compulsory. In total, 378 participants provided valid responses to this question, 81% (306) of which said yes, they were happy to be contacted for follow up interviews. The remaining 19% indicated that they were not.

3.0 Attachments

Final remarks

At the end of the questionnaire, participants were given the opportunity to upload documents to provide additional information or raise points not covered by the questionnaire. Adding attachments was optional, however 121 participants choose to do so. A summary of the types of organisations the participants who provided attachments represented can be seen in Figure 3-1.

Figure 3-1: Summary of the type of organisations the participants who provided attachments represented



Source: OPC attachments. Valid responses: 121

Interrogating the stakeholder attachments revealed a number of key topic areas of interest that featured regularly. These have been summarised below and ordered in line with the waste hierarchy:

1. Data and enforcement
2. Waste prevention
3. Reuse
4. Recyclability
5. Compostability
6. Recycled content
7. Green public procurement (GPP)

3.1 Data and enforcement

Stakeholders highlighted the requirement for accurate data collection and therefore the need for robust reporting systems. Two reporting frameworks were discussed with relative frequency:

1. National packaging registries; and
2. Extended producer responsibility schemes.

3.1.1 National packaging registries

Whilst some participants, for example APK-AG, regarded a national packaging registry as an appropriate and efficient method for monitoring use, others, for example PepsiCo, worried that such requirements risked disclosing confidential information. In addition, there were some participants who stressed that any new EU-level packaging registry must be fully compatible with existing registers. AGVU specifically referenced the registry in Germany.

3.1.2 Extended producer responsibility schemes

Stakeholders noted the monitoring requirements associated with compliance with EPR schemes. Participants identified the administrative burden that comes with correct compliance, highlighting that administrative costs associated with joining an EPR scheme and registering products can outweigh the actual cost of end-of-life processing. AGVU specified the need for harmonisation of EPR requirements, Valpak and the University of Bologna both noted that eco-design criteria must be consistent across Member States, and GROW highlighted the need for good practice incentives to be coordinated at EU-level. Amazon further encouraged the Commission to show ambition and propose harmonised measures in order to simplify the compliance model. They recommended that all reporting and fee payment should be made possible through an EU-wide one-stop-shop solution allowing producers to register and report weights placed on the market in each Member State in accordance with national requirements.

3.2 Waste prevention

Overall, comments on waste prevention were primarily focussed on bans, targets, and fixed ratios. There were stakeholders both in support of these approaches and raising concerns with them. Furthermore, many attachments drew specific attention to the need for waste prevention in e-commerce.

3.2.1 Bans

Many of the participants were in support of measured and considered bans for certain products. Some example products/applications were provided:

- Blister packaging;
- Containers that are designed to not be refilled (e.g., disposable salt and pepper shakers); and
- Peeled and then packaged fruit.

Such products were identified as their packaging was deemed avoidable and could therefore be removed with little additional consequence. Other participants were eager to raise concerns

regarding what packaging is considered unnecessary. DOW highlighted that packaging on many perishable items (e.g. food) extended product shelf-life and therefore decreased the risk of food waste.

Participants vocalised the need for clear definitions for "overpackaging" and "underpackaging", Europen suggested good examples for both.

Overall opinion suggests that some bans could be considered acceptable, but that they would need to be underpinned by evidence to say the packaging was avoidable and/or without sufficient purpose.

3.2.2 Targets

Several participants stressed that reduction targets should not be set for all packaging items. This ties in with the need for clear definitions and the identification of applications for which packaging is avoidable/non-critical.

Some participants highlighted internal targets aimed at reducing excessive packaging in the near future. Examples include:

- Aldi Sud plan to reduce own brand packaging by 15% by the end of 2025 vs 2020 levels; and
- L'Oréal will reduce packaging by 20% by 2030 (through promoting reuse, reducing unnecessary packaging, and removing packaging entirely).

3.2.3 Fixed ratios

Fixed ratios featured heavily in the attachments and, on the whole, were widely regarded to be an inappropriate solution for excessive packaging. AmCham noted that fixed ratios may still allow for overpackaging in some industries whilst also resulting in underpackaging in others. AGVU supported this and added that underpackaging could then cause adverse environmental impacts such as food spoilage.

DIGITALEUROPE added that fixed ratios could hamper innovation, and the European Snack Association identified that packaging ratios would likely lead to preferential choice of bigger portions. This would not be in line with dietary advice and may increase the risk of food waste.

3.2.4 E-commerce

Many participants noted the growing presence of on-line sales resulting from the pandemic. Rethink Plastic Alliance stated that it is expected to become the largest retail channel in 2021. Much of the commentary focused on dimensional limits for online packaging purchases. Some participants highlighted the need for harmonisation of these limits should they be introduced. Europen reinforced this point by noting that much of e-commerce is cross-border and therefore a unified approach is needed to protect the integrity of the Single Market. Several stakeholders suggested that any dimensional limits should be non-binding EU guidelines as opposed to legally mandated legislation.

Many of the participants commenting on e-commerce noted the growing presence of on-line sales resulting from the pandemic. Rethink Plastic Alliance stated that it is expected to become the largest retail channel in 2021.

3.3 Reuse

Some stakeholders referenced specific material streams for which they felt reusable packaging should be further investigated. Several participants noted reusable e-commerce packaging to be a gap in the market. Rethink Plastic Alliance highlighted Repack as an example of good practice.

The observations provided on reusable packaging can be largely split into comments from participants in support of reusable systems and comments from those raising concerns.

3.3.1 In support

Overall, most stakeholders welcomed and supported the drive for more reusable packaging systems, however some (e.g., EAACA) added that industry needed time to amend, invest, and adapt to new systems. Several participants identified specific products/applications that they considered "low hanging fruit". These included:

- Refillable cleaning products – DuPont;
- Beverages in bottles – Europen; and
- Dry food products – Rethink Plastic Alliance.

The need for harmonised definitions and standards for reuse was raised frequently. Europen supported the need for standards, but also highlighted that enforcing them would require digital tracing and/or unique product coding so that data could be centrally managed and verified. Metal Packaging Europe echoed this, stating that serialisation could play an important strategic role in the increased use of reusable packaging moving forwards

Many of the comments spoke of a requirement for reuse to be assessed on a full life cycle approach to ensure that overall impacts do not increase. L'Oréal referenced an example where luxury brand Yves Saint Laurent have launched refillable perfume bottles that result in a reduction of total packaging waste of 52% once the bottle is refilled three times.

3.3.2 Raising concerns

The majority of the concerns raised by the participants were regarding the potential for some reusable products to result in higher overall environmental impacts versus single use alternatives. Suggested reasoning for this included:

- Reduction in the shelf life of perishable goods (i.e., increasing food waste) – DuPont;
- Return logistics (i.e., returning reusable packaging back to the sender) – Amazon; and
- Preparation for reuse (i.e., washing and sterilising of reusable containers) – Essenscia.

Stakeholders including Amazon and Alpha identified the need for full life cycle assessments (LCA) to ensure systems don't lead to higher impacts.

Other issues raised included health and safety concerns (e.g., contamination) and the possibility of reusable packaging altering the taste of food items.

3.4 Recyclability

Overall, there was a high degree of support for all packaging to be recyclable. The key topics raised pertaining to the recyclability of packaging were:

- Definitions and guidance;
- Packaging and polymer complexity;
- Maintaining the value of recyclate; and
- Labelling.

3.4.1 Definitions and guidance

Many participants spoke about the need for harmonised definitions across the EU for what constitutes recyclable packaging. Several organisations, including BASF, DOW, and FEVE, proposed definitions for recyclability that they considered particularly suitable.

In contrast, there were some concerns raised surrounding the instigation of strict definitions. Some organisations highlighted that these definitions must be technology neutral to avoid unintentionally favouring or excluding certain processes.

Other participants identified the need for guidance on design for recycling (DfR) practices. ALPHA, for example, proposed a "dynamic and regularly updated positive/negative list" that could be developed alongside industry to give clarity and harmonisation across Europe. Many participants, such as TOMRA and Reloop, supported this and added that positive and negative lists could be reinforced through the use of digital watermarking technologies.

3.4.2 Packaging and polymer complexity

A number of participants raised the topic of reducing the number of polymers in packaging and/or simplifying designs. Responses were mixed with some in support and others raising issues.

Those who were in support of simplifying packaging included:

- EUROCITIES, who suggested that the Commission should encourage producers to manufacture packaging from a single material; and
- EuroCommerce, who support efforts to reduce the complexity of packaging materials.

Those who raised issues with the practice included:

- APK, who highlighted the existence of innovative dissolution recycling which is apparently capable of processing multi-layer packaging; and
- PCEP, who feel that reducing the number of polymers used in packaging could limit innovation.

3.4.3 Maintaining the value of recyclate

A few participants highlighted the need to differentiate between recycling technologies that are capable of maintaining the value of the material and those that result in downcycling. They felt

this clarity is needed to ensure that industry does not unintentionally benefit "easy" recycling routes that produce recyclate only applicable for use in low-value secondary applications.

3.4.4 Labelling

Many participants highlighted the need for accurate and harmonised labelling cross the EU. Amazon highlighted that improved recyclability of packaging only matters if consumers are aware of what can be recycled. This view was echoed by EUROCITIES and UNESDA, with the European Snack Association adding that mandatory labelling could help increase collection and sorting.

Several participants raised that national and local waste management often differs across Member States and that even if labelling was harmonised, recycling may not always increase. EUROCITIES suggested that digital labelling could be tailored using Geolocation data to find country-specific information on local recycling services.

3.5 Compostability

Much of the opinion provided on compostable packaging was split between manufacturers of compostables supporting their use and waste companies raising concerns. Comments have been summarised into four key topics:

1. Standards and definitions;
2. Separation;
3. Application-specific opportunities and concerns; and
4. End-of-life treatment.

3.5.1 Standards and definitions

Several participants highlighted the need for national/international standards for compostability. ASSOBIOPLASTICHE stated that the existing EN 13432 standard should be revised. BASF and FNADE added that the focus of such a standard should be on certifying products that are compostable in any kind of plant or process. The Norwegian Environment Agency also mentioned that standards for biodegradable plastic are less relevant for cold climate zones, and ALPHA raised that the focus should be on innovation surrounding country-specific conditions.

3.5.2 Separation

EUROCITIES drew attention to the fact that most citizens are not able to distinguish between biodegradable or compostable packaging and "conventional" packaging. Several organisations, including the Swedish EPA, recommended that clear labelling is needed to distinguish products, but others highlighted that labels were at risk of confusing customers and ultimately may results in additional littering.

3.5.3 Application-specific opportunities and concerns

Among the attachments there was some discussion about specific packaging products that should be made to be compostable. Many highlighted that packaging for food related products is preferable if it is compostable. BASF listed examples including tea bags, brewing aids, and fruit stickers as specific applications in which compostable technology would be of benefit.

Europen added that organic waste accounts for more than 50% of municipal solid waste, and that compostable packaging for this waste would be preferable as it can be collected together and processed accordingly.

3.5.4 End-of-life treatment

Many drew attention to the need for careful consideration of the climatic conditions needed to correctly treat compostable waste. EUROCITIES stated that recycling of some biodegradable and compostable packaging waste is technically feasible if it is correctly separated.

The Norwegian Environment Agency highlighted that biodegradable plastics are actually less suited to mechanical recycling, and many others identified that misunderstanding from consumers regarding compostability could lead to increased littering.

3.6 Recycled content

Throughout the attachments, there was limited discussion of recycled content in packaging. Of the participants who did discuss the topic, comments were primarily raising concerns with the introduction of recycled content targets, particularly in relation to food contact packaging.

AISE drew attention to the fact that recycled content targets would favour certain industries. The ability of different industries to meet any targets in this space would heavily rely on the materials currently being used, their associated material flows, and the product the packaging should contain. DuPont reinforced this point, identifying food contact applications as unable to make use of most recycled polymers.

BASF and AGVU proposed that incentivising recycled content rather than mandating its use may provide a preferable method for increasing uptake.

3.7 Green public procurement

A number of stakeholders highlighted the need for green public procurement (GPP) criteria to be feasible and harmonised across the EU. For example, DIGITALEUROPE are in support of the proposal for specific GPP criteria but feel that it will be nearly impossible for manufacturers to comply if criteria vary across Member States.

3.8 Cross-cutting themes

In addition to the intervention area-specific theme discussed in Sections 4.1-4.8, a number of cross-cutting themes emerged. These can be summarised as:

- Innovation and research & development (R&D): many participants highlighted the need for R&D to improve capability in all intervention areas. One example is APK-AG who explained that new recycling technologies could negate some of the current issues around multi-layer and complex packaging.

- Single market approach: almost every attachment voiced support for a harmonised approach in all areas of packaging and stressed the importance of not restricting the smooth operation of a single market. One example is DIGITALEUROPE, noting that misalignment on any of the proposed measures, the underlying definitions, or referenced standards could lead to an uneven playing field and increase regulatory complexity.
- Harmonised packaging collection: Many stakeholders referenced the need for harmonised collection systems, increased collection rates, and increased quality of recyclate across the EU. One example, Sappi, calls on the Commission to present a harmonised approach to sorting, collection, and recycling to provide legal clarity and a future-orientated perspective for producers wishing to invest in innovative packaging designs and recycling technologies.
- Harmonisation of EPR schemes: A large majority of stakeholders, for example AISE and AGVU, called for further harmonisations of EPR schemes at EU-level.
- End of Waste: A few participants, for example DOW, highlighted the need for end of waste criteria
- Decarbonisation: Many stakeholders, for example APK-AG and ALPHA, identified the overall carbon impacts of packaging and products, and stressed that these should be minimised to support Green Deal initiatives etc.
- LCA and full value chain approaches: A considerable number of stakeholders identified the need for taking an LCA-based approach to determining optimum packaging on a case-by-case basis. Stakeholders, for example ALDI SUD, stressed that LCA standards should be harmonised at EU-level.
- Consumer information campaigns: A number of participants highlighted that importance of consumer information campaigns to generate the necessary level of engagement and behavioural change. For example, EUROCITIES suggested that the Commission should work with producers, retailers, and cities to set up awareness campaigns.

Appendix A Number of valid responses to questions

Appendix A provides the number of valid responses for questions with multiple parts.

Table A-1: Number of valid responses for question 2

Product	No. valid responses
Fresh fruit and vegetables	285
Cosmetics	264
Ready meals	274
Cleaning products	274
Beverages (alcoholic and soft drinks)	287
Dried foods such as rice and pasta	276
Electronic goods	276
Sports equipment	228
Clothes	262
Shoes	264
Fashion accessories	220
Children's toys	245
Gardening equipment	228
Household electric items	261
Pharmaceutical products	267
Meat	271
Other	82

Source: Question 2: Considering your visits to EU stores in the past 12 months, please choose a description from the options below that best matches your general impression about the amount of packaging for the listed items.

Table A-2: Number of valid responses for question 4

Statements	No. valid responses
I buy items free of packaging wherever they are available as an option	271
If items are available in both packaged and unpackaged forms, I choose based on price or brand	260
If items are available in both packaged and unpackaged forms, I choose the one with least packaging	268
If the same product has multiple packaging options, I would choose the packaging with the highest recycled content	271
Purchasing biodegradable /compostable plastic packaging is better for the environment than buying packaging made from conventional plastic	290
I would be prepared to bring my own reusable packaging along to the shop in order to avoid relying on single use packaging	263
I would be willing to bring reusable packaging back to the shop so it can be cleaned and refilled	268
Customers' reusable packaging should be accepted in shops, including for perishable food	276
Packaging around food protects it and prolongs its shelf life thereby preventing food waste	298
When purchasing medication, I want to be able to purchase only the prescribed amount, to minimise pharmaceutical packaging waste	260
It is acceptable to me to have less convenience when shopping if it reduces packaging waste	268
It is acceptable to me to have less convenience when consuming food and drink on the go if it reduces packaging waste	272
I am prepared to accept slight damage to the packaging of a product purchased online to avoid further cardboard packaging being used if the product itself was undamaged	268

Source: Question 4: What is your view on the following statements regarding the consumption of packaging?

Table A-3: Number of valid responses for question 5

Product	No. valid responses
Stores should be banned from giving away free any individually packaged goods (such as condiments e.g., ketchup sachets) where reusable packaging options are available	306
There should be EU wide restrictions or bans on packaging where packaging is unnecessary to protect the product or ensure hygiene	349
There should be EU wide restrictions or bans on single use, disposable packaging when reusable alternatives are readily available	354
Packaging should be compostable when the packaging is very likely to end up in separately collected organic (food) waste (e.g., fruit stickers, tea bags)	333
Packaging should be compostable when this could facilitate separate collection of organic waste (e.g., disposable coffee capsules)	328
There should be a requirement for all recyclable packaging to be clearly labelled as recyclable	350
There should be a requirement for all compostable packaging to be clearly labelled as compostable	340
There should be a requirement for all reusable packaging to be clearly labelled as reusable	349
There should be EU target(s) for Member States to reduce or limit packaging waste generation	338
There should be a requirement according to which, for certain product categories (e.g., fruit and vegetables), a certain percentage of products sold in a shop should be sold without packaging e.g., loose	323
There should be EU target(s) for Member States on reusable packaging in sectors where this is feasible such as refill quotas for beverages, food boxes, pallets, cleaning products etc	332
There should be a national advisory body promoting and helping businesses assess the environmental, economic, and social benefits of reusable products and packaging in my country	322
There should be dimension limits for packaging used to deliver goods bought online to minimise unnecessary empty space	321
There should be a requirement on public authority buyers to purchase products using reusable, recyclable and returnable packaging options for specified purposes/goods within the public sector as a minimum in all instances rather than this being a voluntary option	312
There should be a requirement for public sector buyers to purchase products with packaging which contains recycled content to build sustainable markets for plastic waste that is collected for recycling	315

Product	No. valid responses
There should be taxes on single use packaging in my country to incentivise using less or reusable packaging	347
There should be a requirement on EU Member State to require companies/ organisations to have packaging waste prevention plans in place	342
Targets for mandatory recycled content for specific packaging formats should be set, such as a minimum content of recycled plastic for specific packaging items	350

Source: Question 5: What is your view on each of the following measures and their potential to help promote more sustainable (use of) packaging?

Table A-4: Number of valid responses for question 6.1.1

Statements	No. valid responses
Thick plastic grocery bags	228
Fibre bags for bulk buying dry goods	228
Fibre shopping bags	229
Thick plastic container for food items	227
Stainless steel container for food items	228
Refillable containers for washing liquids	229
Refillable water bottles	230
Reusable coffee cups	229
Reusable packaging for online deliveries	228
Boxes for takeaway food	225

Source: Question 6.1.1: How often do you use the following reusable packaging items?

Table A-5: Number of valid responses for question 10

Statement	No. valid responses
A lot of packaging I buy is not recyclable	301
A lot of plastic packaging I buy is not recyclable	301
I want all packaging to be recyclable	313
I am willing to separate elements of a piece of packaging at home to increase its recyclability	290

Statement	No. valid responses
I find the labelling that contains instructions on whether the packaging is recyclable is easy to find and clear to understand	298
I find the labelling that contains instruction on whether the packaging is compostable is easy to find and clear to understand	292
I would be willing to spend more time separating packaging materials to increase the amount of packaging recycled	289
I often find myself trying to separate a packaging item into the different materials it is composed of in order to recycle and struggle because the *packaging* is not designed to be separated into its individual components	273

Source: Question 10: Recyclability and labelling of packaging

Table A-6: Number of valid responses for question 11

Objective	No. responses	No. valid responses
Objective 1: To increase level playing field and harmonization of requirements for products placed on the internal market	389	380
Objective 2: To limit and/or reduce the packaging waste generated across the EU	388	374
Objective 3: To promote the use of reusable packaging whenever logistically feasible with a view to reduce packaging waste generation	389	372
Objective 4: To increase the recyclability of packaging	388	383
Objective 5: Develop clear definitions of biodegradable and compostable packaging	384	370
Objective 6: Harmonise the labelling of biodegradable and compostable packaging	384	366
Objective 7: Set criteria for the use of compostable packaging in order to restrict the types of packaging that can be designed for composting	383	345
Objective 8: Increase the level of recycled content in packaging	386	376
Objective 9: Ensure that the mechanisms to enforce compliance with the essential requirements for packaging are effective whilst minimising administrative burden	385	371

Source: Question 11: Policy and operation objectives and related measures targeting packaging. Please indicate to what extent you agree with the following statements.

Table A-7: Number of valid responses for question 12.1

Waste prevention measure	No. responses	No. valid responses
EU wide restrictions or bans on packaging for specific types of products where packaging is unnecessary to protect the product or ensure hygiene	377	325
Member State level packaging waste generation reduction targets or limits relative to population (e.g., maximum amount of kg per capita) apply	375	299
Member State level packaging waste generation reduction targets or limits relative to Gross domestic product (GDP) (e.g., maximum amount per unit of GDP or in relation to final household consumption)	373	267
Requirement according to which, for certain product categories, a certain percentage of products should be sold loose/without packaging	372	291
EU wide targets on reusable packaging placed on the market in sectors where this is feasible such as refill quotas for beverages, food boxes, pallets, cleaning products etc.	372	313
Requirement on mandatory use reusable packaging for some transport packaging e.g., pallets	376	321
Development of guidance on effective reuse systems through reference to a European Standard	375	313
Establishment of a national advisory body promoting and helping businesses assess the environmental, economic and social benefits of reusable products and packaging in my country	374	287
Requirement on mandatory dimension limits for packaging used for online purchases to minimise unnecessary empty space	374	274
Requirement on public authorities to purchase reusable packaging for specified purposes within the public sector e.g., drinking water, catering services	375	279
Country level taxes on single use packaging to incentivise using less or reusable packaging	374	318
Each EU Member State must require companies and organisations to create packaging waste prevention plans	374	303
Requirement on producers to reduce overpackaging by reporting to a central registry on the volume, weight and planar area ratios of packaging to product if, for either one of these three measures, the packaging exceeds a specific threshold ratio	374	296
Requirement for packaging not to exceed any of a set of threshold ratios of packaging to product established in terms of volume, weight, and surface area	373	285

Source: Question 12.1 : Waste prevention measures

Table A-8: Number of valid responses for question 12.2

Policy measures	No. responses	No. valid responses
Requirement that all packaging shall be reusable or recyclable (as defined through the following possible approaches)	371	341
The term 'recyclable' in the requirement above is defined by qualitative statements	369	298
The term 'recyclable' in the requirement above is defined by a design for recycling based approach implemented through a technical committee	369	293
The term 'recyclable' in the requirement above is defined by use of a recycling rate threshold – facilitated through utilisation of digital watermarking technologies	370	273
Requirement that all reusable packaging must be recyclable unless there is a demonstrated robust case for an exemption	371	312
In addition to the requirement to be reusable or recyclable, the packaging shall be designed not to exceed the minimum volume and weight necessary for its functionality under critical areas	370	294
Requirement mandating the reduction in the use of polymers used in packaging in order to increase recycling rates	371	302
Update of CEN Standard 13432 to further specify the concepts of compostable and biodegradable packaging and to ensure actual composting conditions are taken into account	371	284
Requirement mandating compostable packaging when the packaging is very likely to end up in separately collected organic (food) waste (e.g., fruit stickers, tea bags)	372	250
Requirement mandating compostable packaging when this could facilitate the collection of organic waste (e.g., disposable coffee capsules)	370	252
Requirement mandating a ban on compostable/biodegradable packaging for certain applications or when not related to food waste capture	371	244
Requirement for all recyclable packaging to be clearly labelled as recyclable	372	320
Requirement for all non- recyclable packaging to be clearly labelled as non-recyclable	373	318
Requirement for all compostable packaging to be clearly labelled as compostable	372	310
Requirement for all reusable packaging to be clearly labelled as reusable	368	321

Policy measures	No. responses	No. valid responses
EU guidance on dimension limits for packaging used for online purchases to minimise unnecessary empty space	370	278

Source: Question 12.2: Measures to reinforce the essential requirements to improve design for reuse and promote high quality recycling and strengthen enforcement

Table A-9: Number of valid responses for question 12.3

Policy measures	No. responses	No. valid responses
Inclusion of a requirement in the Essential Requirements for a new CEN Standard setting out a mandatory process to be followed to assess the potential to include recycled content in plastic packaging	368	278
Inclusion of a requirement in the Essential Requirements for a new CEN Standard setting out a mandatory process to be followed to assess the potential to include recycled content in all packaging types	366	290
The setting of recycled content targets for specific plastic packaging formats	367	289
The setting of recycled content targets for packaging formats made of materials other than plastic	363	278

Source: Question 12.3: Measure related to increasing recycled content in packaging to ensure a well-functioning market for secondary raw materials

Table A-10: Number of valid responses for question 12.4

Policy measures	No. responses	No. valid responses
The use of GPP criteria to require the use of reusable options for specified purposes within the public sector e.g., drinking water, catering services	370	252
The introduction of mandatory GPP criteria at national and sub national level relating to minimum levels of recycled content in packaging	369	245

Source: Question 12.4: Measures related to Green Public Procurement (GPP) to promote reusable packaging or recycled content in packaging

Table A- 11: Number of valid responses for question 15

Policy measures	No. responses	No. valid responses
Further optimisation of mechanical recycling	373	347

Policy measures	No. responses	No. valid responses
Tracer based sorting technologies	369	312
Digital watermarking for labelling on packaging to facilitate sorting	372	330
Non-mechanical recycling e.g., chemical recycling	371	317
Reducing the number of polymers in use for packaging	370	341
Compostable plastics	367	318

Source: Question 15: Which of the following drivers do you consider has the potential to make a large contribution to increasing the recycling of packaging and its cost-effectiveness within the next ten years?

APPENDIX G – GREEN PUBLIC PROCUREMENT RESEARCH

1.0 Product category prioritisation

Government expenditure on works, goods and services represents around 14% of EU GDP, accounting for EUR 1.8 trillion annually. [445] Due to the wide range of products and packaging formats consumed by the EU public sector, it is important to focus on those that have the most environmental impact as a priority. Prioritisation can be based on a wide range of factors including amount consumed, relative impacts of different packaging types, and the potential for influence and change.

Limited primary data comparing packaging intensity and impacts of the major product categories consumed by the EU member states public sector has been identified in the literature review, therefore a simplified assessment approach was needed. A method was therefore developed to rapidly assess and prioritise product categories without additional primary research and LCA.

Common Procurement Vocabulary (CPV) codes are used across the European public sector for the purpose of public sector contract notice classification (including associated products and services). The CPV coding system was used as a starting point, since the dataset comprises individual project codes (e.g. 15321100-5 Orange juice), which are grouped together with other similar products under 45 Divisions (e.g. 15 - Food, beverages, tobacco and related products). A simple prioritisation scorecard was developed to assess the significance of different CPV Divisions in terms of:

- EU public sector spend;
- An estimate of the intensity of packaging used;
- An estimate of the environmental impact of packaging types typically associated with that CPV division; and
- The potential for public procurement to influence the Division.

1.1 EU Public sector spend

European procurement value data (€) for 2016 was collated by CPV Division from the Tenders Electronic Daily (TED) database of high-value public sector contracts. Whilst this only provides data for contracts over a certain financial threshold, it was assumed that as a sample, it would be representative of all public sector spend, and hence suitable for the prioritisation method. This data was used to classify each Division by scale of EU public sector spend in 3 categories (high, medium, low) as follows:

- High (scoring 3 on the scorecard) – EU spend greater than €100 Billion p.a.
- Medium (scoring 2 on the scorecard) – EU spend between €100 Billion and €10 Billion p.a.
- Low (scoring 1 on the scorecard) - EU spend lower than €10 Billion p.a.

1.2 Packaging Intensity

No data was identified that would allow a rapid assessment of packaging intensity at a CPV division level or levels of greater granularity. A high-level review of each CPV division and its sub codes was therefore

[445] EU. Buying Green, a Handbook of Green Public Procurement, (2016). Available online: https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf (accessed on 16 October 2020).

undertaken by Eunomia, considering whether the products were likely to fall within 3 levels of packaging intensity - high (score 3), medium (score 2), and low (score 1) as follows:

- High – Products likely to be highly packaged to provide product protection across supply chain e.g. Food, beverages, tobacco and related products.
- Medium – Product likely to typically have some packaging associated with it across its supply chain, i.e. not delivered in bulk, product processing and packaging likely e.g. Printed matter and related products.
- Low - Likely to be low packaging or delivered in bulk across their supply chain. E.g. Mining, basic metals and related products.
- Packaging Environmental Impact

Within the prioritisation score card, Packaging Intensity refers the amount of packaging typically associated with products in the Division. No primary data was identified on the packaging intensity at a CPV Division level, and information at a product level was sparse and inconsistent. To undertake primary detailed analysis at the product level was also considered to be outside the available budget for this element of the study. A high-level qualitative assessment of each CPV division and its products was therefore undertaken using Eunomia's experience of products and their supply chains to identify whether the Division categories were likely to fall within 3 levels of packaging intensity – high, medium, and low as follows:

- High (scoring 3) – The Division contains products likely to be highly packaged to provide product protection across supply chain e.g. Food, beverages, tobacco and related products.
- Medium (scoring 2) – The Division contains products likely to have moderate packaging associated with them across its supply chain, i.e. not delivered in bulk, but product protection and packaging likely across the supply chain e.g. Printed matter and related products.
- Low (scoring 1)- The Division contains products likely to have limited packaging or delivered in bulk across the supply chain e.g. Mining, basic metals and related products.

1.3 Potential to influence the market

Potential to influence the market is a key criterion[446] when considering priorities for green public procurement, due to the importance for suppliers of having public sector clients. Various approaches were investigated to establishing the proportions of EU public vs private sector spend at a CPV Division level, but data was limited. There were also limited existing studies evaluating the potential for public sector to influence the market.

To help in categorising the potential to influence, the presence of existing GPP criteria was used as a proxy, the logic being that in the absence of other data the existence of GPP criteria for a product group acted as an indicator that it was one that public procurement had previously considered to be a market that could be influenced. In addition to this each Division was considered for additional evidence of potential to influence the market, based on the findings of the literature review.

[446] https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

A high-level review of each CPV division was therefore undertaken by Eunomia, considering whether the products were likely to fall within 3 levels of potential to influence:

- High (scoring 3) – Existing EU GPP criteria (or National GPP Action Plans) are highly relevant to this Division; or the literature review identified good potential for influence.
- Medium (scoring 2) - Existing EU GPP criteria (or National GPP Action Plans) relevant for some of this Division; or the literature review identified some potential for influence.
- Low (scoring 1) - No Existing EU GPP criteria (or National GPP Action Plans) associated with this Division; or limited potential for influence identified in the literature review.

2.0 Overall product category prioritisation

Figure 2-1 below contains a summary of each Division's scores against the aspects detailed above, with a total category prioritisation score out of 12 provided. Any category scoring a total of 9 or above (i.e. >75%) was considered to be a priority. This identified the following priority categories:

- 3 - Agricultural, farming, fishing, forestry and related products
- 15 - Food, beverages, tobacco and related products
- 18 - Clothing, footwear, luggage articles and accessories
- 22 - Printed matter and related products
- 30 - Office and computing machinery, equipment and supplies except furniture and software packages
- 31- Electrical machinery, apparatus, equipment and consumables; Lighting
- 33 - Medical equipment, pharmaceuticals and personal care products
- 38 - Laboratory, optical and precision equipment (excl. glasses)
- 39 - Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products
- 44 - Construction structures and materials; auxiliary products to construction (excepts electric apparatus)
- 45 - Construction work
- 50 - Repair and maintenance services (across a wide range of product groups)
- 60 - Transport services (excl. Waste transport).

Figure 2-1 Product Categorisation Scorecard

CPV	Description	A. Budgetary importance	B. Packaging Intensity	C. Packaging Impact	D. Potential to influence the market	Total
30000000	**Agricultural, farming, fishing, forestry and related products**	1	3	3	3	10
9000000	Petroleum products, fuel, electricity and other sources of energy	3	1	2	2	8
14000000	Mining, basic metals and related products	1	1	2	3	7
15000000	**Food, beverages, tobacco and related products**	2	3	3	3	11
16000000	Agricultural machinery	1	1	2	1	5
18000000	**Clothing, footwear, luggage articles and accessories**	2	2	3	3	10
19000000	Leather and textile fabrics, plastic and rubber materials	1	2	2	2	7
22000000	**Printed matter and related products**	1	2	3	3	9
24000000	Chemical products	2	1	3	1	7
30000000	**Office and computing machinery, equipment and supplies except furniture and software packages**	3	3	3	3	12
31000000	**Electrical machinery, apparatus, equipment and consumables; Lighting**	2	2	3	2	9
32000000	Radio, television, communication, telecommunication and related equipment	2	2	3	1	8
33000000	**Medical equipments, pharmaceuticals and personal care products**	3	3	3	3	12
34000000	Transport equipment and auxiliary products to transportation	2	1	2	3	8
35000000	Security, fire-fighting, police and defence equipment	1	2	2	3	8
37000000	Musical instruments, sport goods, games, toys, handicraft, art materials and accessories	1	2	2	1	6
38000000	**Laboratory, optical and precision equipments (excl. glasses)**	2	3	3	1	9
39000000	**Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products**	2	2	3	3	10
41000000	Collected and purified water	1	1	2	1	5
42000000	Industrial machinery	1	1	2	1	5
43000000	Machinery for mining, quarrying, construction equipment	1	1	2	1	5
44000000	**Construction structures and materials; auxiliary products to construction (excepts electric apparatus)**	2	3	3	3	11
45000000	**Construction work**	3	3	3	2	11
48000000	Software package and information systems	3	1	1	1	6
50000000	**Repair and maintenance services**	3	2	2	2	9
51000000	Installation services (except software)	1	1	2	1	5
55000000	Hotel, restaurant and retail trade services	2	1	2	3	8
60000000	**Transport services (excl. Waste transport)**	3	3	2	2	10
63000000	Supporting and auxiliary transport services; travel agencies services	1	1	2	1	5
64000000	Postal and telecommunications services	2	3	2	1	8
65000000	Public utilities	2	1	2	3	8
66000000	Financial and insurance services	2	1	2	1	6
70000000	Real estate services	1	1	2	1	5
71000000	Architectural, construction, engineering and inspection services	3	1	2	2	8
72000000	IT services: consulting, software development, Internet and support	3	1	2	1	7
73000000	Research and development services and related consultancy services	1	1	2	1	5
75000000	Administration, defence and social security services	2	1	2	1	6
76000000	Services related to the oil and gas industry	1	1	2	1	5
77000000	Agricultural, forestry, horticultural, aquacultural and apicultural services	2	1	2	1	6
79000000	Business services: law, marketing, consulting, recruitment, printing and security	3	1	2	1	7
80000000	Education and training services	2	1	2	1	6
85000000	Health and social work services	3	1	2	1	7
90000000	Sewage-, refuse-, cleaning-, and environmental services	3	1	2	1	7
92000000	Recreational, cultural and sporting services	2	1	2	1	6
98000000	Other community, social and personal services	1	1	2	1	5

3.0 Mandatory approaches to packaging criteria in public procurement – Case Study: Netherlands

Whilst the majority of EU member states have adopted a voluntary approach to GPP, Member States including Austria and the Netherlands have introduced mandatory green procurement for central government.

The Netherlands introduced mandatory green procurement for their central government departments, with implementation of the minimum requirements contained in environmental criteria documents being a requirement for all government procurements. Research shows that approximately 70% of Dutch government bodies including minimum GPP requirements in the early phases of tender specifications development.[447]

Whilst only mandatory for central government bodies, many regional and local government bodies also make use of criteria templates available via the Rijksoverheid Socially Responsible Procurement (MVI) toolkit.[448]

The Dutch government has developed mandatory minimum criteria for packaging, which covers 16 product groups:

- Audio visual equipment
- ICT hardware and mobile devices
- Networks, data centre hardware and telephone services
- Reproduction equipment
- Toner cartridges
- Vending machines
- Workwear clothing
- External meetings and accommodation
- Printing
- Facilities
- Office supplies
- Office furniture
- Paper
- Catering
- Cleaning work clothing
- Cleaning products and services

Packaging criteria for the above product groups includes:

- Minimum criteria – use of secondary / tertiary packaging made from recycled material.

[447] ClimateWorks Foundation (2019) Curbing Carbon from Consumption – the Role of Green Public Procurement https://www.climateworks.org/wp-content/uploads/2019/09/Green-Public-Procurement-Final-28Aug2019.pdf

[448] https://www.mvicriteria.nl/nl/webtool#////nl

- Minimum criteria – mandatory explanation of packaging choice in accordance with Essential Requirements arising from the European Packaging Directive and the Packaging Management Decree.
- Award criteria - reusability and recycling of packaging.
- Award criteria - higher collection and recycling of packaging.

Box 3-1 and 3-2 provide more detail in relation to the specific requirements set out in relation to packaging criteria across the 16 product groups.

Box 3-2 Dutch Government Packaging Criteria – Minimum Requirements (16 product groups)

Minimum criteria – use of secondary / tertiary packaging made from recycled material

When cardboard boxes are used for secondary and / or tertiary packaging, they must consist of at least 80% recycled cardboard.

When plastic film or sheets are used for secondary and / or tertiary packaging, they must consist of at least 75% recycled material.

If biobased plastic is chosen, this requirement does not apply.

If for certain reasons this requirement cannot be met, the supplier must provide substantiated explanation.

Verification:

The tenderer may be asked to provide technical details of the packaging at the time of registration, together with a corresponding statement stating that this criterion has been met.

Minimum criteria – mandatory explanation of packaging choice in accordance with Essential Requirements

The tenderer must explain the choice of packaging, in line with the Essential Requirements arising from the European Packaging Directive and the Packaging Management Decree. The explanatory notes deal with:

- The substantiation for the packaging choice;
- The way in which you test whether your choice of packaging is the most optimal from an environmental point of view, for example with the aid of the standards NEN-EN 13427 to NEN-EN 13430 or your own assessment framework;
- Which measures have been carried out and will be taken to keep the volume and weight of the packaging as small as possible while continuing to meet the functional requirements in the field of safety, hygiene and acceptability for the packaged product.

Explanation

The purpose of this requirement is that the purchasing organization gains insight into the substantiation of the supplier for the packaging choice and the role that the packaging supplier plays in making the packaging more sustainable. The requirement encourages the choice of packaging that is most optimal for the environment.

Verification:

The tenderer sends his explanation with his registration. If the tenderer can demonstrate that he has applied the standards NEN-EN 13427 to NEN-EN 13430, the choice of packaging will in any case be in line with the Essential Requirements. Other appropriate forms of evidence, such as documents showing that a different or own assessment framework has been applied, are also accepted.

Box 3-2 Dutch Government Packaging Criteria – Award Criteria (16 product groups)

Award criteria – higher collection and recycling of packaging

Where the tenderer takes better care of the collection and recycling of the packaging supplied by him, this part of the tender will be valued higher.

The tenderer states:

- What percentage of the packaging supplied by him is collected / taken away;
- What percentage of the packaging supplied by him is recycled;
- How the used packaging is processed in the waste phase;
- In case of recycling: which recycler recycles this material; and if known: what the recycled material is used for.

Verification:

The tenderer may be asked to indicate:

- What percentage of the packaging supplied by him is collected / taken away;
- What percentage of the packaging supplied by him is recycled;
- How the used packaging is processed in the waste phase;
- In case of recycling: which recycler recycles this material; and if known: what the recycled material is used for.

Award criteria - reusability and recycling of packaging

Where the tenderer ensures better possibilities for reuse or recycling of the packaging, this part of the tender will be valued higher. The registrant can earn points by:

- Using packaging that is suitable for multiple use;

- Using packaging that can be recycled well, the use of multilayers, and avoid composite packaging and use "lower rate" plastics as much as possible.

Verification:

The tenderer may be asked to indicate:

- What percentage of the packaging is suitable for multiple use;
- What percentage of the packaging is suitable for recycling;
- Which system is in operation to use the packaging multiple times (think of a pool system or deposit system, for example);
- What system is in place to properly recycle the packaging;
- Whether multilayers and composite packaging are used;
- Whether plastics are used at a "lower rate", according to the definition of the waste fund.

4.0 Product Category Research

4.1 Textiles and workwear products

Europe's public sector are major consumers of textiles and workwear, with analysis of the Tenders Electronic Daily (TED), the online supplement to the EU Official Journal suggests that for 2015, €15.3 billion of contract awards for clothing, footwear, luggage articles and accessories were made across the EU28 countries. The following non-exhaustive products (Table 4-1) are part of the workwear product group.

Table 4-1 Workwear product group by CPV code

Products	CPV code
Clothing, footwear, baggage items and accessories	18000000-9
Occupational clothing, special workwear and accessories	18100000-0
Outerwear	18200000-1
Garments	18300000-2
Special clothing and accessories	18400000-7
Footwear	18800000-7
Protective and safety clothing	35113400-3
Personal and support equipment	35810000-2

Research undertaken by the European Clothing Action Plan (ECAP)[449] analysed the breakdown of the contract awards for workwear purchased by the EU public sector, which shows that health, defence and the emergency services account for the largest individual procurement services for textiles and clothing. Europe is a net importer and relative to other markets is not necessarily

[449] ECAP – European Textiles & Workwear Market – the role of Public Procurement in making textiles circular http://www.ecap.eu.com/wp-content/uploads/2018/10/ECAP-Workwear-Report.pdf

the most influential which reduces the influence of procurement upstream in production and design decisions.

Whilst the major environmental impacts of the sector arise from production impacts (energy and toxic chemicals) through to disposal impacts (landfill and incineration), workwear packaging waste also contributes to environmental impacts. The shipping of textiles around the globe adds to transport emissions and packaging waste[450]. Workwear packaging can include polythene bags, plastic clips and pins to maintain product shape, cardboard boxes for shipment, and plastic used to wrap pallets and cages during stock transportation.

Whilst this results in waste materials and pollution in the production process are inside and outside of EU territorial boundaries, it also increases the levels of packaging waste to longer supply chains and also examples of repackaging[451]. There is increased recognition around the role of customer demand in encouraging increasing innovation for improved sustainability, and how market demand can widen the scope for reduced or reusable packaging[451].

EU GPP Criteria for textile product packaging

EU GPP Criteria for Textile Products and Services criteria focuses on the most significant environmental impacts along the life cycle of the products, including fibre sourcing, chemical restrictions, durability and lifespan extension, energy conservation during use, and design for reuse and recycling. Packaging impacts are not addressed within the GPP criteria, and whilst packaging impacts are not dominant against product specific impacts, they are not negligible either.

Within the JRC Technical Report that accompanies the 2017 Revision of the EU (GPP) Criteria for Textile Products and Services[452], the absence of criteria relating to packaging is noted:

"A stakeholder commented that there does not appear to be a requirement of the service provider to assist contracting authorities to reduce environmental impacts on an ongoing basis as part of the service delivery. This could include the production of the textiles, their durability and associated packaging."

Member State GPP criteria for textile product packaging

The JRC Technical Report references examples of Member State GPP packaging criteria for Textiles Products and Services. Examples include:

"A number of the autonomous regions of Spain which retain a significant textile industry have also been active in developing and applying GPP criteria. Novel criteria include dye restrictions based on hazard classifications, the use of re-usable/returnable packaging and award criteria."

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[450] https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-reports/textiles-and-the-environment-in-a-circular-economy/@@download/file/ETC-WMGE_report_final%20for%20website_updated%202020.pdf

[451] http://www.ecap.eu.com/wp-content/uploads/2018/10/ECAP-Workwear-Report.pdf

[452] https://ec.europa.eu/environment/gpp/pdf/criteria/textiles_gpp_technical_report.pdf

Further examples referenced within the JRC Technical Report include Italy, which is relevant since Italian government introduced provisions which require mandatory GPP requirements for all public entities to include Minimum Environmental Criteria (CAM) within procurement actions, covering 16 product and service areas. Whilst Italy's Textiles and CAM reflecting similar criteria to the EU Ecolabel and EU GPP criteria for textiles products, requirements are also specified on the recyclability and recycled content of packaging[453]. Similarly, the Norwegian GPP Criteria Document, Clothing and Textiles also includes criteria aimed at addressing packaging impacts[453].

In addition, PIANOo (Dutch Public Procurement Expertise Centre) has developed environmental criteria for sustainable workwear procurement, which includes packaging criteria focusing on the use of recycled content in packaging and packaging recyclability (Box 4-1).

Box 4-1 Environmental Criteria for Sustainable Workwear[454] (Dutch Public Procurement Expertise Centre)

Use of recycled materials for packaging

Where cardboard boxes are used, they must have a recycled material content of at least 80%. Where plastic bags or plastic sheets are used for the final packaging, they must have a recycled content of at least 75%. This minimum requirement will not apply if bio-based material is chosen.

Verification:

The tenderer may be asked to provide a sample of the product packaging with the proposal, together with an accompanying statement declaring that this criterion has been satisfied.

Packaging recyclability

The greater the provision made by the tenderer for better recycling of the packaging, the higher this component of the tender will be rated. The tenderer may earn points by:

- Avoiding multi-layers, black plastic and combination packaging;
- Using packaging which is readily recyclable.

Verification:

The tenderer may be asked to state:

- Whether multi-layers, black plastic and combination packaging are used;

[453] https://ec.europa.eu/environment/gpp/pdf/criteria/textiles_gpp_technical_report.pdf

[454] https://www.pianoo.nl/sites/default/files/documents/documents/workwear-march2017.pdf

- Whether the packaging is readily recyclable, where "readily recyclable" is defined as: can be separated by hand into elements of a single material and/or packaging which is suitable for multiple use.

The tenderer may be asked to send a sample of the packaging.

4.2 Furniture products

Around a quarter of the world's furniture is manufactured within the European Union – representing a €84 billion market, with European Member States manufacturing 28% of furniture sold worldwide[455], employing approximately 1 million European workers and consisting of, predominantly, SMEs. EU studies indicate that the public sector spend on office furniture represents 15% of the market.[456] In the UK, Government procurement (excluding wider public sector) represents approximately 10% of the office furniture market[457]. A non-exhaustive list of furniture products by CPV code are summarised in Table 4-2.

Table 4-2 Furniture product group by CPV code

Products	CPV code
Furniture	39100000
Bedroom, dining room and living-room furniture	39143000
Office furniture	39130000
Tables	39121200
School furniture	39160000
Furnishings	39200000

Packaging plays an important role in providing product protection in the distribution of furniture products. Product packaging includes:

- Corrugated cardboard boxes – for transport of large furniture items;
- Bubble wrapping, EPS foam and Styrofoam – for product padding;

[455] CSIL processing of data from Eurostat, National Statistical Offices, National Furniture manufacturers associations, cited in the EU Furniture Market Situation Report (2014)

[456] DG Enterprise and Industry (2014) The EU Furniture Market Situation and a Possible Furniture Products Initiative, November 2014 https://www.ceps.eu/system/files/Final%20report_en.pdf

[457] UK Government (2013) Revised Government Buying Standards for Furniture https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341462/Furniture_GBS_impact_assessment_1407.pdf

- Poly furniture covers – used to prevent dust and moisture damaging products during transit;
- Stretch wrapping and tapes – to prevent movement of doors and drawers during transport.
- Pallets and wrapping.

Lost revenue associated with product returns due to product damage can result in significant losses in revenue for furniture manufacturers and suppliers, with the furniture supply chain spending between 1 – 3% of their turnover on packaging[458]. Due to concerns around product damage and product returns, furniture is often over-used – for example, furniture items being completely encapsulated in cardboard and plastic wrapping, rather than considering packing furniture with edge and corner protection[459].

EU GPP Criteria for furniture packaging

The JRC Technical Report[460] which supported the revision of EU Ecolabel and EU GPP criteria for furniture reviewed the life cycle of furniture across the following phases; materials, manufacturing, packaging, distribution, use and end-of-life. Whilst the research identified impact arising from furniture packaging to be minor relative to other life cycle, packaging impacts were not negligible either (total environmental impacts of packaging estimated to be around 6%)[460].

Whilst the earlier (2014) version of the EU GPP criteria for furniture included specific criteria to address environmental impacts arising from packaging (ensuring recyclability and separability of packaging materials, use of packaging materials based on renewable raw materials), there is a noted absence of minimum criteria for packaging in the latest version of the document.

Member State GPP packaging criteria for furniture

Research has identified a number of examples of packaging criteria for furniture products and services developed by Member State governments, including minimum criteria developed by the Italian Government (Box 4-2), and Austrian Federal Government (Box 4-3) – both of which have adopted mandatory approaches to the adoption of core GPP criteria for certain product groups, including furniture.

[458] Invest Northern Ireland – Furniture Manufacturing Resource Efficiency https://www.nibusinessinfo.co.uk/content/furniture-manufacturing-product-assembly-packaging-and-returns

[459] WRAP UK – Managing Packaging Waste on Construction Sites https://www.wrap.org.uk/sites/files/wrap/GG606_final.pdf

[460] JRC (2017) Revision of the EU Green Public Procurement (GPP) criteria for Furniture https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107824/tr_furniture_final_05.09.2017.pdf

Box 4-2 Italian Government Minimum GPP Criteria for Interior Furniture

Packaging:

The packaging must consist of:

a) At least 80% by weight of recycled material in paper or cardboard;

b) At least 60% by weight of recycled material if made of plastic.

Box 4-3 Austrian Federal Government – Mandatory Packaging Requirements for Furniture Procurement[461]

Packaging:

The packaging above a minimum limit of 30g per sales unit must be:

a) made of recycled material; or

b) consist of renewable resources; or

c) be reused (reusable system).

Every packaging material must easily be broken down into usable parts be dismantled, each made of one material (e.g. cardboard, paper, plastic, textile).

Verification:

A description of the product packaging must be submitted and a corresponding declaration stating that the packaging meets these criteria.

4.3 Construction products

Europe's public sector spend on construction works is significant, with analysis of the TED online supplement to the EU Official Journal suggesting that in €733 billion of contracts were awarded in 2018 for construction works across the EU28 countries. Construction works defined within this category comprises a range of services including newbuild construction projects, refurbishment, repair and maintenance works, with an estimated 25-40% of construction contracts relating to

[461] naBe Action Plan http://www.nachhaltigebeschaffung.at/ausschreibungen-m%C3%B6bel

product and material costs[462]. In countries including the UK, public sector accounts for up to 40% of the total expenditure on construction works[463].

In addition to construction works, EU28 public sector expenditure on construction structures, materials, and auxiliary products to construction in 2018 amounted €87.6 billion. A breadth of product and material categories sit within this classification, including products and materials with little or no associated packaging (e.g. bricks, concrete, steel frames), along with wider products and materials which will include packaging (including doors, windows, paint, internal fittings, sanitary ware, plumbing materials and central water heaters etc).

Product packaging for construction products and materials performs a range of functions, including:

- Containment - plastic bags and cardboard prevent corrosion and condensation and, with primary and secondary cardboard packaging, minimise excess moisture;
- Identification - to show the product's function and to ensure health and safety issues are communicated to the user;
- Impact protection and avoiding rubbing and breakage - e.g. shrink-wrap, cardboard or polystyrene is used to minimise movement during transit;
- Securing products;
- Ease of handling.

Packaging accounts for a significant proportion of waste in the construction sector. WRAP UK estimates that as much as 34% of waste (by volume) arising from construction projects is derived from materials used to package the products and materials delivered to sites, [464] with 25% of construction packaging waste by weight being plastic. According to the WRAP Plastics Market Situation Report for 2016, the UK construction and demolition sector was responsible for around 50,000 tonnes of plastic packaging waste in 2014[465].

EU GPP packaging criteria for construction products

EU GPP Criteria that relates to construction products and equipment is confined to a limited number of product groups, including:

- Sanitary ware (including sanitary tapware[466], toilets and urinals[467])

[462] Cost breakdown between labour, materials and contractor profit in construction https://www.a4architect.com/2013/04/percentage-of-cost-breakdown-between-labour-materials-and-contractor-profit-in-construction/

[463] UK Government Construction Strategy 2016 2020 https://www.gov.uk/government/publications/government-construction-strategy-2016-2020

[464] https://www.wrap.org.uk/sites/files/wrap/RTP%20briefing%20note%20for%20suppliers%20-%20Final.pdf

[465] http://www.wrap.org.uk/sites/files/wrap/Plastics_Market_Situation_Report.pdf

[466] https://ec.europa.eu/environment/gpp/pdf/criteria/sanitary/EN.pdf

[467] https://ec.europa.eu/environment/gpp/pdf/criteria/toilets/criteria_Toilets_en.pdf

- Water based heaters[468]; and
- Street light and traffic signals[469].

GPP criteria understandably focuses on mitigation of the key environmental impacts linked to the life-cycle of the above products, with no criteria associated with packaging.

Member State GPP packaging criteria for construction products

A review of national GPP criteria has identified examples of packaging criteria and guidance to support construction product procurement. These include packaging criteria for generic construction product procurement (Zero Waste Scotland, Box 4-4), and packaging criteria for associated with the procurement of wood products (Belgian Federal government, Box 4-5). in addition, the Austrian government[470] has produced mandatory packaging criteria specific to the procurement of building materials used for interior buildings (Box 4-6), which prohibits use of PVC in packaging.

Box 4-4 Zero Waste Scotland - Packaging Criteria for Procurement of Construction Products[471]

Packaging:

A minimum of 70% of the total (construction product) packaging weight should derive from re-used and recycled content (pre-and-post-consumer).

Verification:

Suppliers must provide documentation confirming the percentage by weight of recycled, and re-used content in the product packaging."

Box 4-5: Belgian Federal Government – Packaging Criteria for Wood and Wood Products

"The following requirements apply to the packaging of the wood:

- The amount of packaging is limited as much as possible;
- Packaging is either reusable or consists (partially or completely if paper and cardboard) recycled material and / or materials from renewable sources;
- All packaging materials can be easily separated by hand into recyclable parts of one material (e.g. cardboard, paper, plastic, textile)."

[468] https://ec.europa.eu/environment/gpp/pdf/criteria/water_based/heaters_en.pdf

[469] https://ec.europa.eu/environment/gpp/pdf/toolkit/181210_EU_GPP_criteria_road_lighting.pdf

[470] Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK)

[471] Zero Waste Scotland (2016) Procuring for Repair, Reuse and Remanufacture https://www.zerowastescotland.org.uk/sites/default/files/Procuring%20for%20Repair%20-Re-use%20Reman%20Guide%20June%202016%20v3.pdf

Box 4-6 Austrian Federal Government – Packaging Criteria for Wood and Wood Products[472]

The following key criteria for building construction - There are core criteria for the following 15 building materials for interior construction.

In addition to the criteria mentioned, the requirement that the packaging must not contain polyvinyl chloride (PVC) applies to all building materials.

4.4 ICT products

The public sector in Europe is a major purchaser of ICT products and services, with the TED online supplement to the EU Official Journal indicating EU public sector expenditure on office computing machinery and associated equipment and supplies represented approximately €200 billion in 2018, including personal computers (desktops, laptops, notebooks), computer displays, tablets and other equipment and services. Spending on ICT is estimated to represent approximately 1.8% of central government budgets[473].

The leverage of the public sector over the ICT industry is both a result of its large annual spending on ICT hardware, coupled with the fact that public procurers often purchase ICT products through long-term contracts, which gives an extra economic weight to their tenders[474]. The main products purchased by public procurers include portable computers and printers, followed by display screens, desktop computers, media storage and reader devices and magnetic or optical readers.

Product packaging use for ICT products includes any boxes, wrapping, cushioning and taping used to contain, protect, store and transport a product prior to its use. Whilst ICT hardware manufactures historically relied heavily on packaging materials including expanded polystyrene (EPS), the sector is making progress towards more sustainable packaging solutions. The shift towards cloud computing has also reduced packaging, as a consequence of reduced shipment and distribution of ICT hardware and software alike[475].

Many global ICT manufacturers have pledged to reduce the impact of product packaging. Apple has reduced plastic in its product packaging by 48% between 2016 and 2019, and is working towards eliminating plastics, increase recycled content, and reducing packaging overall[476].

[472] http://www.nachhaltigebeschaffung.at/sites/default/files/nabe-kernkriterien_hochbau_kurzversion_juni_2018_0.pdf

[473] https://www.itpro.co.uk/110257/uk-the-largest-public-sector-ict-market-in-europe

[474] https://electronicswatch.org/the-ict-sector-in-the-spotlight_723519.pdf

[475] https://www.itu.int/dms_pub/itu-t/oth/4B/01/T4B010000060001PDFE.pdf

[476] https://www.apple.com/environment/pdf/Apple_Environmental_Responsibility_Report_2019.pdf

Similarly, Dell has pledged 100% sustainable packaging by 2030, including packaging made from recycled or renewable materials[477].

EU GPP Criteria for ICT Packaging

The 2012 version of the EU GPP criteria EU GPP Criteria for Office IT Equipment advocated approaches to avoid the generation of packaging waste, introducing criteria to ensure the recyclability packaging, and increased use of recycled content in packaging (Box 4-7).

Box 4-7 EU GPP Packaging Criteria for Office IT Equipment (2012)

EU GPP Criteria for Office IT Equipment - core packaging criteria:

Where cardboard boxes are used, they shall be made of at least 50% recycled material. Where plastic bags or sheets are used for the final packaging, they shall be made of at least 50% recycled material or they shall be biodegradable or compostable, in agreement with the definitions provided by the EN 13432.

EU GPP Criteria for Office IT Equipment - comprehensive packaging criteria:

Where cardboard boxes are used, they shall be made of at least 80% recycled material. Where plastic bags or sheets are used for the final packaging, they shall be made of at least 75% recycled material or they shall be biodegradable or compostable, in agreement with the definitions provided by the EN 13432.

Updated versions of the EU GPP EU GPP Criteria for Computers and Monitors do not identify packaging as a key environmental impact specifically, and hence, criteria to mitigate the impacts associated with product packaging is not reflected.

Member State GPP packaging criteria for ICT products

In addition to the earlier noted examples of mandatory packaging criteria adopted by the Dutch government for ICT products, further examples include packaging criteria developed by the Flemish government (Box 4-8), which has resulted in laptops being purchased and deployed staff with zero packaging waste (i.e. laptops delivered in rucksacks, with no primary packaging)[478]. Other examples include packaging criteria developed by the Danish government (Box 4-9) and Zero Waste Scotland (Box 4-10).

[477] https://corporate.delltechnologies.com/en-gb/social-impact/reporting/2030-goals.htm#filter=sustainability

[478] Communication with Melody Van den Acker, Vlaanderen Circular/OVAM, 6th November 2020

Box 4-8 Flemish Government – Packaging Criteria for PCs, Laptops and Monitors[479]

The following requirements apply to any packaging of the ICT equipment:

- The amount of packaging is limited as much as possible.
- Packaging is either reusable or consists (partially or completely if paper and cardboard) consists of recycled material and / or materials from renewable sources.
- All packaging materials can be easily separated by hand into recyclable parts of one material (e.g. cardboard, paper, plastic, textile).

Box 4-9 Danish Government – Packaging Criteria for Laptops

If cardboard boxes are used, they must be made of at least 50% recycled material. If plastic bags or foil are used for final packaging, they must be made of at least 50% recyclable material or be biodegradable or compostable, in accordance with the definitions in EN 13432.

Box 4-10 Zero Waste Scotland – Packaging Criteria for ICT Equipment[480]

A minimum of 70% by weight of the total EEE packaging should derive from re-used and recycled content (pre- and post-consumer).

Packaging must be at least 90% recyclable or compostable (to BS EN 13432) under in-vessel conditions.

4.5 Cleaning products

Cleaning products are purchased by the public sector directly, but most indirectly through public sector cleaning contract services. Analysis of the TED online supplement to the EU Official Journal (2018) indicates more than €129 billion on cleaning services, including cleaning and sanitation services and building cleaning services. A non-exhaustive list of CPV codes of relevance are summarised in Table 4-3.

[479] https://overheid.vlaanderen.be/overheidsopdrachten-en-raamcontracten/duurzame-en-innovatieve-overheidsopdrachten/pcs-laptops-en

[480] Zero Waste Scotland (2016) Procuring for Repair, Reuse and Remanufacture https://www.zerowastescotland.org.uk/sites/default/files/Procuring%20for%20Repair%20-Re-use%20Reman%20Guide%20June%202016%20v3.pdf

Table 4-3 Cleaning services by CPV code

Services	CPV code
Cleaning services	90910000
Cleaning and sanitation services	90900000
Building-cleaning services	90911200
Office, school and office equipment cleaning services	90919000
Accommodation, building and window cleaning services	90911000
Office cleaning services	90919200

Cleaning products categories typically used in cleaning service contracts include laundry detergents, industrial and institutional laundry detergents, dishwasher detergents, industrial and institutional dishwasher detergents, hard surface cleaners and hand dishwashing detergents, sanitary, window and all-purpose cleaning products.

The key environmental impacts associated with cleaning products arise through product formulation and raw material use, manufacturing and end-of-life, energy consumption in the in-use phase and discharge of the waste water and waste product. Yet for some cleaning products and detergent, plastic packaging represents up to impact 36% of the overall product environmental impact[481] with opportunities to address these impacts including packaging minimisation (including undiluted/bulk purchase, packaging light-weighting), design for recyclability, packaging take-back systems, and specification of recycled content.

Cleaning product manufacturers and cleaning service providers are increasingly under pressure to lower environmental impacts. The EU Ecolabel User Manuel for Detergents and Cleaning Products[482] includes guidance for both applicants and competent bodies through the process applying for an Ecolabel, and includes criteria and sub-criteria for product packaging. Criteria and guidance cover:

- Products sold in spray (refillable) bottles;
- Packaging take-back systems;
- Calculation of the weight/utility ratio (WUR) – noting that primary packaging made of more than 80 % recycled materials is exempted from the calculation of the WUR.

[481] EU Ecolabel Network Toolkit (2018) Cleaning https://ec.europa.eu/environment/ecolabel/documents/Cleaning_Services_Toolkit_Final.doc

[482] JRC (2018) The EU Ecolabel User Manuel for Detergents and Cleaning Products https://publications.jrc.ec.europa.eu/repository/bitstream/JRC114089/jrc114089_um_3.1_pubsy_format_with_identif.pdf

- Design for recycling.

EU GPP Criteria for Cleaning Services

The EU Ecolabel for Cleaning Services and Products is highly promoted within the EU GPP Criteria for Indoor Cleaning Services. Whereas earlier versions of the GPP Criteria for Cleaning Products and Services included core and comprehensive criteria for product packaging (with products carrying a relevant Type I Ecolabel fulfilling the listed criteria deemed to compliant), the latest version of the GPP Criteria does not include the criteria for packaging as set out in the correspondent Ecolabel for Detergents and Cleaning Products.

Member State GPP packaging criteria for cleaning products

As described earlier in Section 2, the Dutch Government has introduced mandatory minimum packaging criteria for product groups, including cleaning products which includes:

- Minimum criteria – use of secondary / tertiary packaging made from recycled material.
- Minimum criteria – mandatory explanation of packaging choice in accordance with Essential Requirements arising from the European Packaging Directive and the Packaging Management Decree.
- Award criteria - reusability and recycling of packaging.
- Award criteria - higher collection and recycling of packaging.

In addition to the above, refillable cleaning bottles are mandatory, and all cleaning products purchased by the Dutch government are required to carry the EU Ecolabel to hard surface cleaning products, or equivalent Milieukeur environmental quality label (Box 4-11).

The Italian government has introduced minimum mandatory criteria for cleaning product and services for public procurement over and below OJEU threshold.[483] This requires that cleaning products purchased by public sector meets correspondent criteria of the EU Ecolabel for Cleaning Products.

Box 4-11 Dutch Government Cleaning Products Packaging Criteria – Minimum Requirements

Milieukeur cleaning products for hard surfaces is mandatory

All-purpose cleaners, sanitary cleaners and window cleaners will meet the requirements set out in Commission Decision (EU) 2017/1217 of 23 June 2017 establishing the criteria for awarding the EU Ecolabel to hard surface cleaning products, or equivalent.

Verification:

[483] Ministry of the Environment and the Protection of the Territory and the Sea – Minimum GPP Criteria https://www.minambiente.it/pagina/i-criteri-ambientali-minimi#1

The tenderer may be asked to submit an annual overview of the cleaning agents used.

Refillable bottles are mandatory

Refillable bottles are always used for the cleaning products, with refilling being made from bulk packaging such as jerry cans or comparable packaging that contributes to reducing packaging waste.

Verification:

The tenderer may be asked to submit an annual overview of the cleaning agents used and the method of packaging.

4.6 Catering and food products

The public sector is a significant purchaser of food, beverages, and catering related products and services. Analysis of the TED online supplement to the EU Official Journal suggested that for 2018, approximately €49.1 billion of contracts were awarded for food, beverages and related products across the EU28 countries.

In addition, a further €16 billion of public sector expenditure relates to hotel, restaurant and retail trade services, which includes meal preparation services, canteen, restaurant and catering services.

The largest segments of European public sector purchasers within this product and service areas (in terms of purchase volume and value) include health/welfare (42.7% of the total meals served), education (31.4% of the total meals served) and business & industry (17.8% of the total meals served) [484].

Packaging is an integral part of the food and drink supply chain, from the production stage to the consumption stage[485]. Packaging in food products plays an important role in providing product barrier protection and product life extension. Packaging is also required in many product groups to ensure food safety.

[484] JRC Technical Reports (2019) EU GPP criteria for food procurement, catering services and vending machines, accessed https://ec.europa.eu/environment/gpp/pdf/191106_JRC118360_EU%20GPP%20Food%20catering%20criteria_TR5_final2.pdf

[485] European Commission (2019) Science for Environment Policy, Food packaging: a practical guide to environmental footprint labelling, accessed https://ec.europa.eu/environment/integration/research/newsalert/pdf/food_packaging_environmental_footprint_labelling_535_na4_en.pdf

Packaging use for food products include: [486]

- Plastics - with the most common polymers being Polyvinyl chloride (PVC), Polyethylene and its varieties (PET, HDPE, LDPE), Polystyrene (PS), and Polypropylene (PP). Of these, PET, HDPE, and PP are often easily recyclable, with PS, LDPE and PVC often problematic to recycle[487];
- Metals - including steel, tin and aluminium;
- Glass;
- Wood, cardboard and paper.

8 million tonnes of plastic are used for food and drink packaging in Europe.[488] In comparison with other food packaging materials such as glass, cans and cardboard, the use of plastic is growing relatively strongly. Plastic is the most commonly used packaging material for fruit and vegetables.

The environmental impacts from food packaging varies significantly across different food product and packaging types. A 2019 study[489] shows the distribution of GHG emissions across cradle-to-grave life cycle stages for the common food/package combinations. This shows that packaging impacts as a ratio of total environmental impacts are greatest for:

- Spinach in virgin PET or rPET clamshell bag;
- Not-from-concentrate orange juice in virgin PET or rPET bottle;
- Chopped tomatoes in steel can.

Packaging impacts as a ratio of total environmental impacts are smallest for:

- Beef and pork in a PS tray with LDPE wrap;
- Cheese in virgin PET or rPET bag.

Optimal packaging of foodstuffs can be achieved so that unnecessary packaging is avoided without bringing the safety of the food into danger and to incur the minimal amount of food loss as possible.

[486] BTSA (no date) Types of packaging material used in food, accessed 10/11/2020 https://www.btsa.com/en/packaging-material-food/

[487] Houses of Parliament (2019) PostNote: Plastic food packaging waste file:///C:/Users/Alice.Johnson/Downloads/POST-PN-0605.pdf

[488] https://think.ing.com/uploads/reports/ING_-_The_plastic_puzzle_-_December_2019_%28003%29.pdf

[489] Heller, Martin C. and Selke, Susan and Keoleian, Gregory A., Mapping the Influence of Food Waste in Food Packaging Environmental Performance Assessments (April 2019). Journal of Industrial Ecology, Vol. 23, Issue 2, pp. 480-495, 2019, Available at SSRN: https://ssrn.com/abstract=3365177 or http://dx.doi.org/10.1111/jiec.12743

EU GPP Criteria for food product packaging

The previous (2008) EU GPP criteria for catering and food[490] included core and comprehensive packaging criteria to incentive the supply of product packaging with renewable and recycled content, and discourage the supply of single portion products (Box 4-12).

Box 4-12 EU GPP Food Catering and Food Packaging Criteria[491]

Packaging

Additional points will be awarded for the percentage of products that:

- Are supplied in secondary and/or transport packaging with more than 45% recycled content.
- Are supplied in packaging materials based on renewable raw materials.
- Are not supplied in individual portions (single-unit packages).

Verification:

Suppliers must provide a signed declaration indicating which of these criteria their products are able to meet. The contracting authority will verify compliance during the contract period, and appropriate penalties will be applied for non-compliance.

As part of the revision of EU GPP criteria for food procurement, catering services and vending machines, the findings of the Technical Report[492] considered that there were too many trade-offs and different situations that should be analysed case-by-case to be able to estimate the environmental benefits of using packaging.

It was further considered that the GPP should not favour or penalise the packaging material used as this varies significantly, based on the requirements of different products and the specifications of different packaging materials. Single-use packaging restrictions were not included, since it was considered that the use of reusable packaging only brings environmental benefits under certain conditions, with several challenges relating to any assessment of whether single or reusable packaging is most beneficial environmentally. For these reasons, packaging criteria for food procurement was not included, with the exception of catering services (Box 4-13).

[490] https://ec.europa.eu/environment/gpp/pdf/toolkit/food_GPP_product_sheet.pdf

[491] Catering & Food Green Public procurement (GPP) Product Sheet https://ec.europa.eu/environment/gpp/pdf/toolkit/food_GPP_product_sheet.pdf

[492] JRC Technical Reports (2019) EU GPP criteria for food procurement, catering services and vending machines https://ec.europa.eu/environment/gpp/pdf/191106_JRC118360_EU%20GPP%20Food%20catering%20criteria_TR5_final2.pdf

Box 4-13 EU GPP Criteria for Food, Catering Services and Vending Machines[493]

Catering services

Core selection criteria:

The tenderers must have relevant expertise and experience in each of the following areas for which they would be responsible under the contract

Staff training on environmental aspects that are to be annually renewed/reviewed policies, and supporting management systems to ... maximise the reuse or recycling of packaging and/or other waste and ensure their safe disposal.

Verification:

Evidence in the form of information and references (such as documented feedback from customers) related to the relevant contracts in the previous 5 years in which the above elements have been carried out. This must be supported by records of training activities.

Waste prevention technical specification:

The tenderer must implement a plan for reducing the generation of waste in accordance with the waste hierarchy of Waste Framework Directive 2008/98/EC. The plan must at least include:

- Selecting recyclable packaging where possible provided the packaging guarantees for food safety and hygiene. Recyclable packaging includes compostable packaging
- Returning packaging for reuse when possible.
- Avoiding items with unnecessary or excessive secondary packaging according to the needs of the catering service
- Returning packaging for reuse when possible and environmentally relevant.

Verification:

The tenderer must supply the waste prevention plan. The tender must supply a list of disposable and non-disposable items that will be used in the execution of the contract. The tenderer must provide information about the material the disposable items are made of, indicating specifically if the items are recyclable or compostable in accordance with EN13432.

493 https://ec.europa.eu/environment/gpp/pdf/190927_EU_GPP_criteria_for_food_and_catering_services_SWD_(2019)_366_final.pdf

Whilst there are inherent challenges associated with inclusion of packaging criteria for food products (as outlined above), it is considered that high-level or generic packaging criteria could be included, to allow the market to apply product-specific solutions.

Member State GPP packaging criteria for food and catering services

Examples where Member States have developed GPP packaging criteria for food products and catering services includes Austria (Box 4-14), where application of the criteria is mandatory for central government procurement. Further examples of packaging criteria are included from Finland (Box 4-15), where the government decision to promote environmental solutions through public procurement is binding for central government bodies. The Netherlands have included more extensive mandatory requirements for food product packaging (Box 4-16).

Box 4-14 Austria – GPP Packaging Criteria for Food and Catering services[494]

Recycled content:
Products in which the outer packaging and / or transport packaging has a recycled content of more than 45%.

Packaging minimisation:
Products that are not delivered in portions (in individual packaging).

Packaging material type:
Products that are supplied in packaging material based on renewable raw materials.

Verification:
The tenderer must provide a signed declaration stating which of these criteria are met. During the term of the contract, the advertising agency checks compliance with the requirements; appropriate sanctions are imposed in the event of violations.

Box 4-15 Finland – GPP Packaging Criteria for Food Products[495]

Transport and packaging:
Core competency: The products offered must be primarily in bulk.

Recycled content:
Advanced competency: packaging should include recycled content, in such a way that packaging functional features to protect the product do not weaken and there is no danger packaging breakage or food pollution. Recycled content percentage shall be specified on a contract-by-contract basis.

[494] http://www.nachhaltigebeschaffung.at/ausschreibungen-lebensmittel

[495] https://www.motiva.fi/julkinen_sektori/kestavat_julkiset_hankinnat/tietopankki/elintarvikkeet

Verification:
Supplier confirmation.

Box 4-16 Netherland – GPP Packaging Criteria for Food Products

Recycled content in secondary and tertiary packaging:
When cardboard boxes are used for secondary and / or tertiary packaging, they must consist of at least 80% recycled cardboard.
When plastic foil or sheets are used for secondary and / or tertiary packaging, they must consist of at least 75% recycled material.
If the packaging material is in direct contact with a packaged food product, this requirement does not apply for safety reasons.

Increased reusability/recyclability of packaging:
Where the tenderer ensures better possibilities for reuse or recycling of the packaging, this part of the tender will be valued higher. This includes:

- Use of packaging that is suitable for multiple use;
- Use of packaging that can be recycled well, avoid composite packaging and use "lower rate" plastics as much as possible, according to the definition of the Waste Fund[496].

Verification:

The tenderer may be asked to indicate:

- What percentage of the packaging is suitable for multiple use;
- What percentage of the packaging is suitable for recycling;
- Which system is in operation for multiple use of the packaging (think, for example, of a pool system or deposit system);
- What system is in place to properly recycle the packaging;
- Whether multilayers and composite packaging are used;
- Whether plastics are used at a 'lower rate', according to the definition of the waste fund.
- The tenderer may be asked to provide technical data of the packaging with which the above aspects are demonstrated.

[496] The Waste Fund has a differentiated rate for plastic as of 1 January 2019. A lower rate applies to packaging that can be properly sorted and recycled with a positive market value. This type of material is called "Plastic lower rate". The conditions for eligibility for the differentiated rate are detailed in a separate regulation. For more information see: https://afvalfondsverpakkingen.nl/verpakkingen/alle-tarieven

5.0 Preliminary findings and next steps

5.1 Preliminary questionnaire analysis

In parallel with the above literature review, a questionnaire was issued to Member States and Commission advisory and expert groups[497] with the aim of seeking views on areas of public procurement which represents the highest priority for inclusion of additional packaging criteria, along with particular product categories where mandatory requirements on packaging in public procurement might be particularly impactful and suitable.

Findings from the questionnaire indicate that those areas of public procurement considered by stakeholders representing the highest priority for inclusion of additional packaging criteria include:

- Construction materials and products;
- Cleaning products;
- Electrical and Electronic Equipment;
- Food and catering services;
- Furniture;
- Office consumables, paper products and print services;
- Transport and logistics services;
- Workwear.

Additional packaging criteria deemed by stakeholders to increase waste prevention and enhance circularity include:

- Limitations on single use packaging;
- Requirements for one-component/single material packaging;
- Requirements for returnable/reusable packaging;
- Requirements for recyclable (and compostable) packaging;
- Mandatory take back and recycling of packaging.
- Requirements for packaging made from recycled/renewable materials.
- Preventing single portion packaging where possible.
- A full analysis of the questionnaire findings will be undertaken as part of the next steps.

[497] The Commission GPP Advisory Group, Expert Group on Waste (Packaging), Government Experts Group on Public Procurement, and Stakeholder Expert Group on Public Procurement.

APPENDIX H – IMPACT ASSESSMENT OF WASTE PREVENTION MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Waste Prevention, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 to 6.0 contain the impact assessments of the selected measures;
- 7.0 shows a brief description of how the selected measures work together; and
- 8.0 contains the description of the discarded measures.

Unless otherwise indicated, the impacts of the assessed measures are described as a change in 2030 with respect to the 2030 baseline.

This appendix is linked with the rest of the report as follows:

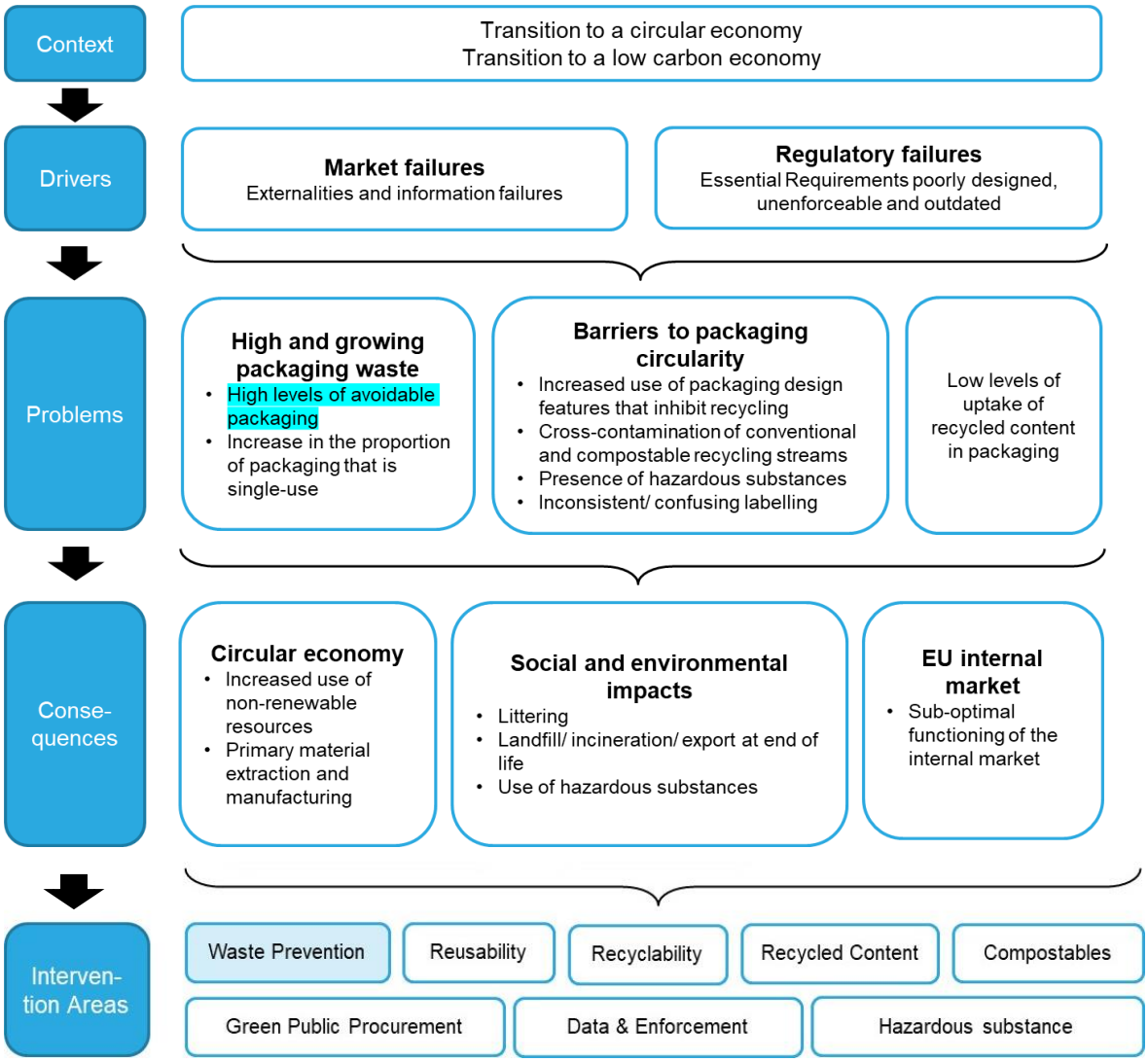
- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 1.1 describes the problem "High levels of avoidable packaging" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario, which describes expected changes in packaging waste composition and unit weights.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. In this document the quantitative impacts are presented in relation to the baseline and, unless otherwise indicated, for the year 2030. Impacts are described qualitatively where quantitative analysis was not feasible.
  - Appendix D – Impact modelling methodology describes how the impacts for each measure were calculated and the underlying assumptions. Section 2.1 specifically discusses the waste prevention measures.

1.1 Intervention logic

As shown in

Figure A-1 below, Waste Prevention is one of the eight intervention areas identified in the intervention logic, and it is directly linked to one of the identified problems: High levels of avoidable packaging.

Figure A-1 Intervention Logic diagram



1.2 Problem Definition

Despite regulatory and industry's previous effort to light-weight and minimise packaging, the absolute quantities of packaging on the EU market continue to grow, showing that full decoupling from economic growth has not occurred (See Appendix A – Problem Definition). Glass, plastic and cardboard packaging have the potential for further light-weighting and/or volume reduction, while aluminium and steel cans are thought to have less potential.

1.3 Measures assessed

All measures, both assessed and discarded, are described in full detail in section 8.0.

- Measure 1. Over-arching changes to limiting criteria approach
- Measure 2. Mandatory Member State reduction targets
  - Measure 2a – Unit weight reduction

- Measure 2b – Packaging waste per capita reduction (low)
- Measure 2c - Packaging waste per capita reduction (high)

- Measure 3. Best-in-Class weight limits (bottles and jars)
- Measure 5. Void space threshold limit for selected sectors
- Measure 7. Phase out Avoidable / Unnecessary Packaging

1.4 Measures discarded

The following measures were included in the shortlist but were not taken forward to the impact assessment.

- Measure 4. Pack-to-Product weight ratios
- Measure 6. Eco-modulation to incentivise light-weighting

2.0 Measure 1. Over-arching changes to limiting criteria

2.1 Problem definition

The current Directive/Essential Requirements require packaging to be minimised in weight and volume terms, as the top of the waste hierarchy, however there is no clear definition of over-packaging and the related Harmonised European Standard (EN) on reduction at source, EN 13428:2004, which use remains voluntary.

Standard EN 13428 provides a procedure for assessing compliance on prevention by source reduction. This procedure relies on identifying a 'critical area', which is a specific performance criterion or criteria (more accurately a limiting factor or factors) that prevent/s further reductions in the weight and/or volume of packaging within a given category/material. There is little detail in the Standard about how to test and verify the 'critical area', but the performance criteria are specified as follows (with no further definition):

- Product protection
- Manufacturing process
- Packing/ filling process
- Logistics
- Product presentation and marketing
- User/ consumer acceptance
- Information
- Safety
- Legislation
- Other issues

As noted in previous studies[498], this list has no hierarchy or weighting within the criteria, all being considered equal, and consequently product presentation and marketing are considered as important as product protection or safety, for example. This wide range of criteria, which are open to subjective interpretation has effectively made this Essential Requirement almost impossible to enforce in a meaningful way. The approach taken by the Standard also effectively ranks packaging reduction at source below even subjective criteria like consumer acceptance and marketing considerations.

In summary, the EN standard allows almost all conceivable reasons, including marketing and product presentation, consumer acceptance and a catch all 'other' category, to be used to justify large and heavy packaging. Consequently, there is no firm basis for regulatory (market surveillance) authorities in Member States and there has been very little enforcement action in just a handful of Member States since the late 1990s (see Annex A – Problem Definition).

2.2 Baseline

The current situation is governed by:

[498] Packaging Waste - Consumer Council of the Austrian Standards Institute, March 2005

- the PPWD's essential requirement to minimise packaging, which lacks detail (see Appendix A – Problem Definition) and has no clear definition of 'over-packaging'; and
- EU standard EN 13428:2004, which – while having the effect of presumption of compliance with the Directive - is both voluntary and also offers loopholes for producers, making enforcement close to impossible for Member State authorities.

2.3 Objectives

The key objective of this measure is to provide a clear and unambiguous definition of over-packaging. This will provide a basis to facilitate appropriate prevention action by producers (in designing and specifying packaging) and enforcement action by market surveillance authorities.

2.4 Description of the measure

As described in section 2.1, two of the performance criteria/factors used in determining the 'critical area' (so-called under the standard, i.e. one or more of the criteria/factors that limit the producers ability to minimise further) are 'Product presentation and marketing' and 'Other'. While clearly these two characteristics are very important to the brand and retailer, for example to differentiate the brand and command 'on-shelf presence' or improve customer convenience (even of a small proportion of the market), should these reasons alone be considered more important than sustainability considerations, i.e. enough to allow packs that are bigger and heavier than they would otherwise need to be (accepting the other functional necessities), having in mind the climate and resource use objectives of the Green Deal?

It is therefore suggested that the performance 'criteria' included in EN 13428 on prevention by source reduction should be revised to focus only on core functionality factors that reflect product protection, safety and legal requirements, e.g. for information labelling, and hence to reduce emphasis on more subjective criteria that it is believed are allowing some excessive packaging to be produced, and inhibiting the ability to enforce the Essential Requirements in regard to reduction at source.

It is therefore suggested that the Directive should include core performance (fitness for purpose) factors within it, as an Annex, rather than under a voluntary standard as currently done under EN 13428, and that the core list of performance factors is reduced to the following:

1. Product protection to prevent significant product waste, including measures to prevent damage and preserve the product, as appropriate for the product and supply chain in question
2. Manufacturing processes regarding the pack itself (i.e. converting) and in pack-filling of the pack (e.g. related to handling and line speed issues)
3. Logistics to allow safe handling in distribution (transport and warehousing) and adequate handling and display in retail settings (for physical demands, e.g. the strength to act as shelf-ready packaging, rather than purely for sales and marketing purposes) by staff in the supply chain
4. Information requirements that are essential for those in the supply chain and consumers, for example in regard to safety and marking of ingredients (rather than just for sales and marketing purposes)
5. Handling and safety considerations, in regard to handling and pack opening by consumers, during and after a product purchase

6. Legislation, i.e. other legal requirements, such as those required for pharmaceutical products

We would suggest that all of the above would be subject to consideration of industry norms, to prevent very unusual production and distribution methods, for example, being used as an excuse for over-packaging when compared to the majority of similar products on the market.

By reducing the list of performance factors to those above, marketing and consumer acceptance (or convenience) alone should no longer be allowed to be the limiting factor/s that cause a pack to be larger or heavier than they would otherwise be. This is clearly a critical point that governs any further potential to further reduce packaging waste. This approach would reduce some of the subjectivity faced by enforcement authorities in Member States, and hence allow the ability to be firmer in enforcing the Directive requirements on minimisation, prosecuting as appropriate and hence creating a greater need for businesses to focus more seriously on minimisation.

It should be noted that producers will still be able to use evidence (in the form of documentation, including relevant calculations), in regard to which of these performance factors limits any further reduction in volume and weight, to demonstrate the reason for their pack being as it is, and hence to allow its continued use, should they be challenged by market surveillance authorities in regard to why they cannot minimise further. This mechanism allows producers to ensure that 'under-packaging', which could cause increased product waste for example, can be avoided, whilst placing the burden of proof on producers.

The French Authorities are already taking steps in this direction for single use plastic packaging under Article L. 541-10-17 of the Environmental Code, where the text includes what the authorities regard as 'essential technical function' (underline added):

> *"A goal to work towards a 100% reduction in unnecessary single-use plastic packaging, defined as those that do not have an essential technical function, such as a product protection, health and integrity function, transport, or regulatory information support, is set by 31 December 2025".*

It has been noted by stakeholders, however, that including high levels of recycled content can increase pack weight, as can the need to make an item reusable or fully recyclable. It is suggested, therefore, that these three factors, Recycled Content, Reuse and Recyclability, are added as performance criteria that can be considered when determining the 'critical area' that limits minimisation. The full list would therefore become:

1. Product protection to prevent significant product waste, including measures to prevent damage and preserve the product, as appropriate for the product and supply chain in question
2. Manufacturing processes regarding the pack itself (i.e. converting) and in pack-filling of the pack (e.g. related to handling and line speed issues)
3. Logistics to allow safe handling in distribution (transport and warehousing) and adequate handling and display in retail settings (for physical demands, e.g. the strength to act as shelf-ready packaging, rather than purely for sales and marketing purposes) by staff in the supply chain
4. Information requirements that are essential for those in the supply chain and consumers, for example in regard to safety and marking of ingredients (rather than just for sales and marketing purposes)
5. Handling and safety considerations, in regard to handling and pack opening by consumers, during and after a product purchase
6. Legislation, i.e. other legal requirements, such as those required for pharmaceutical products

7. Recycled Content, Reuse and Recyclability, where the product weight or size may have to be increased, beyond what would otherwise be possible in regard to the other six performance factors, to facilitate inclusion of recycled content, to enhance recyclability (e.g. when moving to a mono-material) and in particular when the system is specifically designed to be refilled many times in an established reuse system in the Member State in question.

It is also suggested that the current definition (Annex II of the Essential Requirements) regarding minimisation is adapted as follows with the underlined portion being the major change:

> *"Packaging shall be manufactured and used such that the packaging volume and weight be limited to the minimum amount that still allows that the core areas of functionality (set out in Annex X as performance factors) are maintained. An excess packaging is defined as one where there is inadequate evidence that one or more core performance factors limit the ability to reduce pack size and/or weight further, subject to an exemption being granted for a given pack type, or where a reusable or refillable alternative can adequately replace a single use pack with a resulting reduction in overall packaging use (whilst maintaining the core areas of functionality).*

We believe that this approach, whilst reducing the current uncertainty for enforcement bodies, and improving the harmonisation and streamlining of market surveillance approaches (which have been identified as a significant issue[499]), would not have sufficient effect on its own. This is because market surveillance authorities across the EU are already very stretched in meeting given the wide range of enforcement activities they have to undertake (not least ensuring product safety, the meeting of other environmental standards, and preventing counterfeiting and misuse of CE marking), on billions of products made in, and imported into, the EU. This is an ever-increasing burden, with new legislation, such as Regulation (EU) 2018/858 on vehicle testing, being brought onto the statute books, whilst market surveillance bodies are often under-resourced and having to conduct inspection activities on a limited risk-based basis. While the changes proposed will help reduce ambiguity and subjectivity, the resources required to identify, investigate and prosecute potential offenders across billions of items of packaging placed on the market, would remain huge. It is quite rightly argued that the focus of these organisations should be on "product safety rules and the market surveillance that underpins them .. the basis of the single market for goods"[500] not on minimising packaging waste.

Consequently, further measures are considered and proposed a) to proactively 'drive' action, with the emphasis on producers and Member States taking responsibility, rather than the only mechanism being a reactive enforcement one, and b) to make the job of market surveillance authorities easier where enforcement action is still required as a back-stop (e.g. giving them reference points to help identify and evidence overpackaging more easily). Measure 1 is an important pre-requisite for these additional measures, which still require a firm legal basis in regard to what constitutes over-packaging, and a mechanism for producers to defend their packaging choice. These additional measures are set out below.

[499] More Product Safety and better Market Surveillance in the Single Market for Products, COM (2013)

[500] More Product Safety and better Market Surveillance in the Single Market for Products, COM (2013)

2.5 Links to other measures

While important in itself, Measure 1 is also seen as a necessary pre-requisite for the more direct Measures 2 "Mandatory Member States 'top-down' % reduction targets", 3 "Best-in-Class weight limits", 5 "Void space threshold limits" and 7 on specific bans.

2.6 Assessment of Measure 1

2.6.1 Effectiveness

This measure should be effective in reducing the current uncertainty for producers and enforcement bodies alike regarding over-packaging issues, and enable more enforcement activity where there is currently very little. We do not believe, for the reasons noted above at the end of Section 2.4, that this measure would have sufficient effect on its own, and consequently further measures are considered and proposed to 'drive' proactive efforts by producers and Member States. Measure 1 remains important to establish a more concrete legal basis where enforcement is necessary and to also provide producers with a clearer basis for making their packaging choices and defending them if challenged to do so.

2.6.2 Ease of implementation

The measure itself can be easily implemented through the change to the Directive, without the need for standards for example, and should enable market surveillance authorities to undertake their role more-easily regarding enforcing packaging minimisation as required by the Directive.

2.6.3 Administrative burden

This measure should not, in theory, impose any significant administrative burden on producers or Member States or the Commission since it is largely clarifying the law, that should already be enforced, and removing ambiguity for producers and enforcers alike, actually reducing the burden. It is noted, however, that making this aspect of the Essential Requirements more easily enforceable should increase the willingness of market surveillance authorities to take action, which would require more resources in practice. We are, however, also suggesting complementary measures that would help to counter this potential additional burden, placing greater emphasis on producers and Member States (more generally than the market surveillance authorities).

2.6.4 Economic impacts

As an umbrella measure aimed at supporting packaging minimisation at source, provided that enforcement is harmonised and effective, this will result in packaging material reduction, which in turn will mean reduced costs for producers.

Producers note that packaging is a sales and marketing instrument, and hence restricting packaging choice, by not allowing marketing and presentation to dictate the form it takes where this is counter to minimisation efforts, could hinder sales for some brands and retailers. The aim (through the additional Measures 2 "Mandatory Member State 'top-down' targets", Measure 3 "Best-in-Class weight limits", Measure 5 "Void space limits" and Measure 7 on specific bans), would, however, be to ensure a harmonised approach across the EU that would provide a level

playing field for producers and hence no disadvantage to any particular group (assuming that imported packaging is properly held to the same standards).

Finally, since the measure will make enforcement action by Member State market surveillance authorities more feasible, resources will be required to undertake that activity. Measures 3 "Best-in-Class weight limits" and Measure 5 "Void space threshold limits" are intended to help make the process simpler and less ambiguous by providing specific reference weights for certain packaging and void space limits for other packaging.

2.6.5 Social impacts

Minimisation, by its very nature, means that less packaging material is made and sold. Consequently, this could negatively impact on jobs, although the scale of the reductions at source that are achievable are likely to be relatively small for most materials, and to a significant extent outside of the EU (packaging imported into the EU on products).

2.6.6 Environmental impacts

This measure has not been assessed as it is an over-arching measure that enables the other measures (2,3 and 4) which are assessed further below.

2.6.7 Stakeholder views

The following views summarise the key points raised at the stakeholder workshop of 28th January 2021, and subsequent submissions by e-mail:

- It was noted that over-packaging should be clearly defined, as packaging is sometimes designed for technical or acceptance reasons that are not always identifiable for the final consumer.
- "Fitness for purpose", around core criteria, prevents waste and should be introduced as the key approach for all packaging, following the ISO 18602:2013(E) concept for "optimum pack design". Underpackaging should be considered as well as over-packaging.
- It was also noted that a fixed definition could have the unintended consequence of acting as a significant barrier to future packaging product applications and functions, which may in the future be necessary, but are currently unforeseen.
- An alternative definition was suggested as: "Packaging which is not required for the purpose of making sure that the product it contains arrives in its intended form to the consumer, taking into account the updated performance criteria."
- Several stakeholders accepted that the need for sustainability should be prioritised before marketing (although not all), however it was pointed out that packaging can play a critical role in changing consumer behaviour via the messaging they contain. Some participants pointed out that there were many messages that needed to be displayed on packaging to convey information regarding health and safety, ingredients, and other legislative requirements. Some noted that the different criteria could be weighted or prioritised, so that marketing is still accepted, but not at the detriment of quantity of packaging used.
- A majority of participants thought that the approach to minimisation (by defining a critical (limiting) area (parameter)) should be material neutral and should be applied to each packaging material/pack type in isolation.

- It was also noted that the drive towards higher recycled content, 100% recyclability, and further reuse targets, may affect the ability to lightweight within a particular product type. As such, these aspects should be also considered as core criteria that could potentially limit the ability to optimise by weight.

After the presentation of the measures in the webinar in June 2021, stakeholders shared the following:

- requested a clear definition for both overpackaging and underpackaging and argued that they cannot be discussed in isolation from each other;
- some stakeholders supported the exclusion of product acceptance and marketing, while others insisted that it should remain in the list of criteria;
- some stakeholders requested a clear definition of each of the criteria – and some further requested that these definitions should be part of the primary legislation;
- some stakeholders objected to the exclusion of the two criteria from the core list, arguing that presentation / marketing is a core functionality of packaging; and
- some stakeholders expressed their concerns that excessive light-weighting might hinder reusability and/or recyclability.

2.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 1

Impact category	Measure 1
Effectiveness	Reduce the current uncertainty regarding over-packaging issues and enable more enforcement activity. However, not sufficient effect on its own.
Ease of implementation	Change in Directive
Administrative burden	No direct impact
Economic impacts	Likely cost savings from packaging material reduction. Could affect sales & marketing negatively due to restrictions. More resources in Member States for enforcement.
Social impacts	Likely negligible
Environmental impacts	Not applicable
Stakeholder Views	Wide array of concerns regarding over-packaging definition, fitness for purpose, the use of packaging to convey messages and change behaviour, material neutrality and other intervention areas affecting light-weighting.

3.0 Measure 2. Mandatory Member State reduction targets

3.1 Problem definition

A significant element of the over-packaging is caused by sales and marketing concerns, particularly amongst premium and traditional brands that perceive a commercial advantage in using heavier packaging to project a higher quality look and feel to products, and regarding the use of standardised pack sizes for economy of scale reasons, and large e-commerce boxes (and to a lesser extent bags) to facilitate high packing speeds in fulfilment centres. More details can be found in Annex A – Problem Definition.

There is therefore the potential for Member States to work with their PROs (Producer Responsibility Organisations), sector organisations and producers to optimise packaging through a range of mechanisms.

3.2 Baseline

As also mentioned in the baseline for Measure 1 (section 2.2), the current situation is the Directive's requirement to minimise packaging, which lacks detail and has no clear definition of 'over-packaging', and the voluntary EU standard, EN 13428, which offers loopholes for producers and makes enforcement close to impossible for Member State authorities.

Some Member States are already taking this approach of setting reduction targets, e.g. as described below for France[501] in regards to plastic packaging:

> *"The reduction objective under Article L. 541-10-17 of the Environmental Code is set collectively, for all single-use plastic packaging marketers, at 20%, of which at least 50% are obtained through the reuse of packaging, by 31 December 2025, taking into account the specific potential of the product categories for which this packaging is intended.*
>
> *This objective is calculated based on the tonnage of plastic incorporated into the single-use packaging put on the market, compared to the 2018 reference year. From 1 January 2023 a complementary indicator is set up to monitor the evolution of the number of Consumer Sales Units marketed in household single-use plastic packaging and of the number of units marketed in industrial and commercial single-use plastic packaging."*

Finally, in terms of trends, our forecasting model shows that plastic, and to a lesser-degree paper-based packaging quantities, will continue to grow quite quickly in absolute terms to 2030, while glass and metal packaging quantities will remain relatively static.

[501] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000041555598/

3.3 Objectives

The objective of this measure would be to reduce absolute packaging waste quantities and ensure a level-playing field.

3.4 Description of the measure

A relatively simple approach to packaging reduction, from the perspective of the Commission, is to **set waste prevention targets for Member States** – some are already taking this approach (see section 3.2). This type of measure seems sensible in that it allows Member States freedom to decide how such reductions might be achieved; however, our analysis and stakeholder consultations have identified a number of concerns:

- Packaging market trends are already driving a move away from glass and metals to plastic and this trend is expected to continue, although perhaps at a slower pace due to the current concerns over plastic pollution, which may also result in an increased use of paper-based packaging. An over-arching weight-based target would potentially accelerate a move to plastic which may not be considered desirable in-light-of the Commissions Plastics Strategy and approach to Single Use Plastics. In addition, a small overall absolute Member State weight-reduction target for glass and steel would be easily met due to natural market trends, whilst a small reduction in overall plastic packaging weight may be very difficult to meet due to general trends increasing the number of units of plastic packaging on the market.
- Member States have a limited number of 'levers' with which to influence, let alone mandate and hence ensure, packaging reduction. For example, they are not allowed to ban packaging from the market although they could potentially tax or eco-modulate based on weight for example. Eunomia work for the Commission on recommendations in regard to the Minimum Requirements for EPR under Article 8a of the revised Waste Framework Directive, suggest that eco-modulation only focuses on packaging recyclability in the short to medium term, so as not to dilute the effect of eco-modulation across the EU, i.e. with all Member States modulating on the same criteria to provide impact at scale, and to ensure a good degree of harmonisation in the EU to reduce the burden on multi-national businesses.
- Member States may choose to allow industry sectors or PROs to take a lead, whereby the group would be asked or mandated to reduce the packaging placed on the market. In this instance it is difficult to see how this could be made mandatory in a fair way (across a wide range of businesses), and the lead organisation may not be able to sufficiently drive action within its business cohort unless they were contractually obligated (which would be complex). Individual businesses could not be expected to all meet the reduction target since some will have done far more already than others, or may use a particular material more than others, and may not have the potential. This then risks putting too much pressure on some brands to reduce packaging which in turn could result in product waste, which is clearly counter-productive in environmental and commercial terms. The responsibility would probably have to fall on the collective cohort through a voluntary and collaborative approach (as per the current Plastic Pacts). Voluntary agreements, however, are not generally considered reliable enough to ensure sufficient progress in reasonable timescales.

The considerations above potentially lead to a great deal of variation in approach by Member States, and the potential for single market distortion, and a lack of harmonisation across the EU which multi-national producers are always eager to see, so as to reduce administration burdens and enable medium-term planning.

Whilst we believe that the issues noted above are problematic, their effects can be mitigated to a degree through careful design, as follows:

- The material targets are set conservatively, given that Member States will be relatively constrained in the available means at their disposal to meet the targets, and may not have adequate data to effectively target reductions.
- The risk of market distortion would suggest that the target should be the same for every Member State.
- The detail of how the target is disseminated to sectors or other cohorts could be through negotiation between the Member State authorities and the lead organisation, to establish a figure that is deemed reasonable for the sector/cohort as a whole. Hence the food and drink sector may be given a different target than cosmetics for example, although again there is risk of market distortion.

3.4.1 Measure 2a: Unit weight reduction target

Member States are given a target to reduce **the average unit weight of packaging placed on the market** (total weight divided by total units) by 2030 (relative to 2018). It is important that this does not cause any EU single market distortions or inherently causes further movement into plastic. Hence it is proposed that, in addition to the principles set out above in the A3.4 introduction:

- An achievable target is set by material type, rather than across all material types.
- The target for each packaging type should be in relation to the average unit packaging weight, of each material type put on the market (i.e. the total tonnage of that material divided by the number of items placed on the market), rather than as an absolute value (i.e. the total tonnage of the material placed on the market).

In terms of this last point, the CBA (Cost-Benefit analysis) model shows that plastic, and to a lesser-degree paper-based packaging quantities, will continue to grow quite quickly by 2030 (see Appendix B – Baseline Report), while glass and metal packaging quantities will remain relatively static. Consequently, a small absolute target relative to 2018 levels would be easy to achieve for some materials (e.g. glass) but becomes a very large target for others (particularly plastic). For example, a percentage reduction of 5% vs 2018 levels would require a 35% reduction in absolute terms for plastic packaging. This would be unrealistic, and hence the target is set in terms of the average unit weight of a packaging type placed on the market in 2030 vs 2018.

The following targets are proposed:

- 7% reduction for glass and plastic;
- 5% reduction for paper-based packaging (where paper/card is the predominant materials); and
- 1% reduction for steel, aluminium and wood packaging (given the far more limited potential to reduce material gauge/weight or void space compared with glass/plastic and cardboard respectively).

This approach should be achievable through at-source reduction (reuse/refill would be treated separately), should minimise material switching and market distortion, and allow simple monitoring using existing weight data by material, as already reported to PROs.

These target levels have been established through consideration of the remaining potential in each packaging material category. This data is discussed in regard to Measure 3 (best-in-class

weight limits), Measure 5 (void space limits) and related sections of Appendix A where we discuss the available evidence (including overseas assessments and legislation) and analyse the variation in pack weights, particularly within the glass and plastic bottle categories, where reasonably reliable data is available (including some through our own primary research).

We know that unit bottle weight reductions (glass and plastic) far greater than 7% should be easily achievable, given known variations for identical products under different brands, and noting the Measure 1 approach which would eliminate the use of sales and marketing alone to justify heavy-weight packs. The data around other forms of plastic packaging (e.g. pots, tubs and trays) and glass packaging (notably jars) is less readily available, however, and hence we have set a conservative target of 7% for the material categories as a whole.

The potential within paper and board packaging is less certain, in terms of the sheet weight of the material itself, although we have demonstrated under Measure 5 (see Appendix A for details) that excess void space is a significant issue, particularly in e-commerce applications which is the largest growth area for paper-based packaging. Consequently, by assessing the potential weight reduction associated with void space reduction, combined with a small amount of reduction in the weight of the material itself (e.g. through modernisation and optimisation of corrugated board production), we have established that a 5% unit reduction should be achievable.

Metal cans are known to have far less potential for weight reduction. Only two major aluminium can manufacturers exist in the world and, given the high value of the material, extensive light-weighting has been achieved. Similarly for steel. Unlike glass and plastic beverage containers, metal can weights are not driven by brand image considerations and hence are all very similar in weight for a given volume. Aluminium cans, for example, are nearly all identical in weight; approximately 13g for a standard 330ml can and 11g for 250ml.

Wood packaging, largely pallets plus some crates, is more difficult to judge in regard to single use packaging as a) the lines are blurred in terms of what is reusable and what is not and b) the single trip packaging is of many kinds (e.g. lightweight softwood, chipboard etc.) with hundreds of different specifications across various industries (even though sizes are largely standardised). The weight data 'spectrum' is not readily available for even single trip pallets, and hence we have not therefore been able to assess the potential unit weight reduction. 1% was therefore assigned as a very conservative estimate of what may be possible. Further analysis could potentially help to refine this target upwards.

As noted earlier, the detail of how the target is disseminated to sectors or other cohorts could be through negotiation between the Member State authorities and the lead organisation, so as to establish a figure that is deemed reasonable for the sector/cohort as a whole, and the specific types of packaging.

3.4.2 Measures 2b and 2c – Packaging waste per capita reduction (low and high)

It would seem sensible to normalise the targets as a kg per capita figure, to take out the effects of population growth or decline in the EU. Under this approach, Member States would be given a target to reduce the absolute packaging waste figure in terms of the **kg/person of packaging waste** (which we might call packaging waste 'intensity'), relative to a 2018 baseline, and to be achieved in 2030:

- Measure 2b) a 5% absolute 'intensity' reduction as a lower ambition target; and
- Measure 2c) a 10% absolute 'intensity' reduction as a higher ambition target.

The intention is not to vary the target by MS, and since it can be argued that those with a lower 'intensity' should be required to do less than those with a high 'intensity', a percentage reduction approach (rather than an absolute kg per person) is used.

Our forecast models shows that meeting the target of 5% (Measure 2b) would mean an overall absolute reduction of around 27% on average across the EU, and meeting the target of 10% (Measure 2c) would mean an overall absolute reduction of around 32%. It should be noted that taking out population growth effects, through using the 'intensity' approach, makes little difference overall (although it will by country) since Eurostat data for the EU27 shows population growth of only about 0.5% from 2019 to 2030. What seem modest targets (5% and 10%) are actually very significant in weight reduction terms relative to a 2018 baseline whilst taking into account expected (counter-factual) growth in packaging use. This is clearly a good thing in carbon terms, but their feasibility has to be considered.

This target could be met through:

- **Unit weight reduction at the MS level.**
  - A 'best-in-class' (Measure 3) approach should be able to provide at least 20% weight reduction, and quite possibly 30% overall in glass and plastic bottles (as a whole category), through unit weight reduction.
  - Paper and card packaging unit weight can be reduced in part through optimised construction (e.g. of corrugated board), however there is also good potential for reduction through limiting void space (Measure 5) which we estimate would result in a saving of around 15% by weight in carboard packaging overall across the applicable sectors.
  - Aluminium and steel cans are only a small part of the overall packaging market, and are already very well optimised with very little variation (for example the vast majority of aluminium cans are 330ml and weigh 13g). The potential contribution from metals is therefore small.
  - Assuming that the potential in other product categories (the data for which is not available) is not as great as the bottles and card examples noted above, suggests that less than 15% in unit weight reduction overall, i.e. across all packaging, is likely to be achievable in practice. This means that unit-weight reduction would help to counter growth but not achieve the absolute reduction required under 2b or 2c.
- **Reuse/refill at the MS level.** As part of the overall approach, sector specific reuse targets would be set as per Measure 8 (see Impact Assessment on Reuse measures).
- **Specific bans at the EU level.** See Measure 7 (section 6.0).

This overall MS target approach is helpful in that no separate overarching reduction and reuse targets need to be set, just an overarching prevention target that allows Member States flexibility in meeting that target through some combination of reuse and unit-weight reduction that suits the market specifics for that particular country.

3.5 Links to other measures

Measure 1 "Over-arching changes to the limiting criteria", would be a pre-requisite for this measure. This over-arching 'top-down' Measure 2 for Member States could be implemented on its own, or could be combined with other measures.

Measure 3 Best-in-Class weight limits and Measure 5 Void space limits would provide clear reference points for businesses and enforcement bodies, and so bring more targeted action to certain sectors and pack types (where the potential for optimisation is clear) and greater certainty of outcome. Combining with Measures 3, 5 and 7 (specific bans) could also help to reduce variations in implementation from one Member State to another, and hence improve harmonisation and reduce the risk of market distortion.

Finally, Measure 8 would set sector-specific reuse targets (see Impact Assessment on Reuse measures), that would contribute to meeting the overall Member State reduction targets.

3.6 Assessment of Measure 2a

3.6.1 Effectiveness

Although the target is a relatively small percentage change per unit, this is spread across all packaging (excluding wood). The CBA model assumes that the targets are met, since the absolute targets are relatively modest (although not when compared to the projected growth in some materials), although there is uncertainty around this given the somewhat constrained means available to Member States. Overall, the CBA model shows that the measure could (if the targets are met) achieve a 4.1% reduction in packaging waste in 2030 compared to the 2030 baseline, and a 3.753 million tonnes packaging reduction in absolute terms. When comparing to 2018 levels, however, there would still be a 13.9% increase in packaging waste (10.839 million tonnes), hence this measure alone would slow rather than stop growth.

3.6.2 Ease of implementation

This measure is simple to implement from the Commission perspective, however Member States have a limited number of 'levers' with which to influence, let alone mandate and hence ensure, packaging reduction. For example, they are not allowed to ban packaging from the market although they could potentially tax or eco-modulate based on weight for example, or use national versions of the 'best-in-class' and 'void space' limitations approaches (Measures 3 and 5) to help drive action.

Eunomia's work[502] for the Commission on recommendations in regard to the Minimum Requirements for EPR (Extended Producer Responsibility) under Article 8a of the revised Waste Framework Directive, suggest that eco-modulation only focuses on packaging recyclability in the short to medium term so as not to dilute the effect of eco-modulation across the EU, i.e. with all Member States modulating on the same criteria to provide impact at scale, and to ensure a good degree of harmonisation in the EU to reduce the burden on multi-national businesses.

Member States may choose to oblige market operators along the entire value chain, or potentially just one element such as retailers, to reduce packaging placed on the market, or alternatively to require industry sectors or PROs to take a lead, whereby the group would be mandated (or asked under a voluntary arrangement) to reduce the packaging placed on the

[502] Eunomia (2020), *Study to support preparation of the European Commission's guidance on the implementation of the general minimum requirements for extended producer responsibility schemes* at https://www.eunomia.co.uk/reports-tools/ec-waste-framework-directive-epr-recommendations-for-guidance/

market. Either may require legislation at the MS level. In Belgium for example, the largest 20% of packers/fillers and importers by packaging placed on the market must introduce a packaging prevention plan every three years, with the aim of committing to packaging waste prevention measures. Belgium have also introduced a tax on single use beverage packaging and through the Producer Responsibility Organisation, Fostplus, operates a platform where consumers may report instances of over-packaging.

It should be noted, however, that it may be difficult for any industry lead organisation to sufficiently drive action within its business cohort unless the latter are contractually obligated (which would be complex). Individual businesses could not be expected to all meet the reduction target since some will have done far more already than others, or may use a particular material more than others, and may not have the potential. This then risks putting too much pressure on some brands to reduce packaging which in turn could result in product waste, which is counter-productive in environmental and commercial terms.

The responsibility may have to fall on the collective cohort through a voluntary and collaborative approach (as per the current Plastic Pacts). Voluntary agreements, however, are not generally considered reliable enough to ensure sufficient progress in reasonable timescales, and thus may not deliver the set targets. Member States can potentially assist this process, however, through establishing national 'best-in-class' unit-weight limits (equivalent to Measure 3 at the national level) and/or void space limits (equivalent to Measure 5) to help provide clarity for producers, as well as through establishing and enforcing reuse initiatives (Measure 8).

The considerations above potentially lead to a great deal of variation in approach by Member States, and the potential for single market distortion, and a lack of harmonisation across the EU which multi-national producers are always eager to see (to reduce administration burdens and enable medium-term planning). Combining this top-down measure with Measures 3 on Best-in-Class weight limits, 5 on Void-space limits, and 7 on bans, at the EU level rather than separate national approaches, would reduce the level of uncertainty in achieving the outcomes, increase EU harmonisation and reduce the risk of market distortions.

3.6.3 Administrative burden

As noted above, this measure has a low administrative burden for the Commission, but a significant potential burden for Member States and potentially PROs or sector organisations in co-ordinating action.

3.6.4 Economic impacts

From a producer point of view, material reduction (per unit of packaging) will save money, according to the CBA model:

- 1,645 € million in 2030
- 2,178 € million in 2050

Some premium brands see a marketing advantage in heavier packaging, and unless the approach is reasonably harmonised across the EU, there could be a disadvantage to some producers in some countries from being required to reduce packaging weight. Conversely, more cost-effective packaging could improve the competitiveness of EU brands compared with non-EU producers, improving economic outcomes. It has not been possible to model these effects due to the complexity of global markets.

From a packaging waste perspective this measure will save waste management and EPR fees (which would be spread across producers and waste disposers), totalling approximately:

- 575 € million in 2030
- 779 € million in 2050

Additionally, this measure will entail costs for Member States, which will vary depending on how they implement actions to achieve the target. If these targets are effectively passed on to PROs or sector organisations, the burden will then fall on them to help, or make, producers take action collectively. This is likely to require several full-time equivalent posts in each Member State, and potentially extra administration within producer organisations, depending on how the measure is implemented.

3.6.5 Social impacts

While less material being used in EU packaging will potentially result in fewer EU jobs, such manufacturing tends to be highly automated and not labour intensive, while a significant proportion is imported in any case. The suggested reductions are also relatively small scale, and more cost-effective packaging may also help to give EU businesses a slight commercial advantage in the markets in which it operates.

In terms of the reduced waste that will result, the modelling suggests that this measure would result in the loss of approximately 9,800 jobs in 2030 and 13,000 in 2050. The vast majority would be losses in recycling jobs and the remainder in Residual Treatment jobs.

3.6.6 Environmental impacts

Based on the quantitative tonnage reductions noted above, significant environmental benefits are expected to result as indicated in the table below.

Table A-1 Summary of Environmental Impacts for Measure 2a

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-2,486
Change in water use, thousand m^3	-93
Change in GHG/Air Quality (AQ) externalities, € million	-488

3.6.7 Stakeholder views

There was some qualified support for the idea of top-down reduction targets (e.g. from NGOs and one PRO), although significant opposition from some stakeholders (mostly producer businesses).

Some stakeholders suggested a voluntary target approach although with the acceptance that this may not be as effective as a mandatory one.

It was noted that a harmonised approach would be needed across the EU to allow the single market to function. Allowing Member States to determine how to reach a reduction target would

potentially lead to market distortions and would require increased market surveillance inspections, adding costs.

It was also noted that Member States have no simple mechanisms available in terms of influencing the design of packaging, although some stakeholders noted that EPR (including Eco-modulation) is appropriate as an existing mechanism on the basis that most fees are already dependent on weight. They also advocated for infrastructure improvements, further harmonisation between Member States the development of EU guidelines for DRS. Other stakeholder proposed using levies and/or taxes (as for plastic bags) while others commented on the disparity of application of EPR and also noted that new taxes would not be welcome in an EU recovering from Brexit and Covid.

One suggested approach was to require national legislation (at the MS level) to oblige all market operators along the entire value chain, i.e. product producers, wholesale and consumer-facing companies, to reduce packaging placed on the market (for retail, this is apparently planned for Austria) by a certain percentage, accompanied by effective sanctioning mechanisms.

It was noted that in order to avoid unequal targets in different MS, waste prevention targets should be set relative to the EU average per capita packaging waste production (174 kilograms in 2018).

Some stakeholder noted concerns that a top-down target could lead to pressures on some sectors to reduce packaging that could lead to underpackaging and greater product waste which would be counter-productive.

It was also noted that an over-arching target should not merely encourage the switch from heavier to lighter single use materials. It was suggested that this can be prevented by adding sub-targets for the reduction of plastic and composite as well as metal and glass packaging, although it may not be simple to establish what level of reduction is reasonable for each.

It was also noted that very light packaging can have worse recycling performance than heavier packaging although no examples were given.

With regards to target setting, there were very diverse opinions: some stakeholders considered them too high and others, too low. There were also diverging opinions on the materials, with both requests to have the same target for all material and requests to increase the target for materials difficult to collect and recycle, such as plastics.

Some stakeholders claim that the measures are focusing on preventing packaging as opposed to preventing packaging waste, and that the measures should be targeted at waste that ends up in landfill or incineration which cannot be reused or recycled.

3.7 Assessment of measure 2b

3.7.1 Effectiveness

Table A-2 shows the avoided packaging waste generation vs the 2030 baseline, as a result of the waste prevention targets, resulting in a -**19.1% reduction**. The greatest impacts would take place for wood, paper/board and plastic packaging.

Table A-2 Summary of packaging waste generation changes for measure 2b

	2030 - measure	Change vs 2030 baseline (%)
Glass	13,026	-12.4%
Steel	2,667	-0.2%
Aluminium	903	-9.6%
Paper / board	29,189	-22.7%
Plastic	17,549	-16.4%
Wood	11,211	-24.9%
Other	204	0.0%
Total	**74,749**	**-19.1%**

3.7.2 Ease of implementation

Similar to Measure 2a (see section A.3.6.2), however this is a more open-ended approach and potentially more onerous, given the need (as indicated in A3.4.2) for multiple initiatives on unit weight reduction and reuse measures, combined with EU-level bans, to achieve ambitious targets in absolute terms.

3.7.3 Administrative burden

Very similar to Measure 2a (see section 3.6.3), although likely to have a higher administrative burden than 2a due to the need for a range of approaches as mentioned in A3.7.2.

3.7.4 Economic impacts

Qualitatively, the impacts are similar to those described to Measure 2a (see section 3.6.4). However, the quantitative impacts modelled are significantly higher:

- Savings of 3,993 € million in waste management costs;
- Avoided costs of DRS of 345 € million;
- Loss of producer revenues of 49,549 € million;
- Savings of 6,677 € million in material costs; and
- Costs of 4,349 € million in reuse schemes.

As with Measure 2a, how these impacts fall on different sectors (and packaging materials) will depend on how Member States choose to implement to meet the targets.

3.7.5 Social impacts

This measure would result in a loss of 442 thousand jobs as a result of the overall packaging being placed on the market, the vast majority (92%) coming from manufacturing and the remaining 8% from the waste management industry – recycling and residual waste treatment.

However, this measure is also expected to generate around 2,336 thousand jobs in the reuse sector, thus leaving a **net job creation of 1,894 thousand jobs**.

3.7.6 Environmental impacts

Based on the quantitative tonnage reductions noted above, significant environmental benefits are expected to result as indicated in the table below.

Table A-3 Summary of Environmental Impacts for Measure 2b

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-9,701
Change in water use, thousand m^3	-403
Change in GHG/Air Quality (AQ) externalities, € million	2,076

3.7.7 Stakeholder views

General comments about targets (section 3.6.7) are also applicable here. Some stakeholders had expressed preference for a per capita target compared to unit weight reduction. It is worth noting that a country that already has a small packaging waste 'intensity' (kg/capita) will have less to do in absolute terms than one with a high 'intensity' because of the use of a % reduction target. Similarly a country with expected population growth will have this taken into account by the nature of the per capita 'intensity' target, and hence will not have more to do in absolute terms as a result of that growth.

3.8 Assessment of measure 2c

3.8.1 Effectiveness

Table A-4 shows the avoided packaging waste generation vs the 2030 baseline, as a result of the waste prevention targets, resulting in a -**23.4% reduction**. Similarly as in measure 2b, the greatest impacts would take place for wood, paper/board and plastic packaging.

Table A-4 Summary of packaging waste generation changes for Measure 2c

	2030 - measure	Change vs 2030 baseline (%)
Glass	12,429	-16.4%
Steel	2,660	-0.5%
Aluminium	886	-11.3%
Paper / board	27,375	-27.5%

	2030 - measure	Change vs 2030 baseline (%)
Plastic	16,697	-20.4%
Wood	10,564	-29.2%
Other	204	0.0%
Total	**70,815**	**-23.4%**

3.8.2 Ease of implementation

Very similar to Measure 2b, although the higher target will of course increase the pressure on the various elements (noted in A3.4.2) to perform.

3.8.3 Administrative burden

Very similar to Measure 2b given that the initiatives that need organising will likely be the same and will need the same resources to run irrespective of the target.

3.8.4 Economic impacts

The qualitative impacts will be very similar to those described for Measure 2a and Measure 2b (see section 3.7.4), however quantitatively they are significantly higher:

- Savings of 4,253 € million in waste management costs;
- Avoided cost of DRS of 354 € million;
- Loss of producer revenues of 58,132 € million;
- Savings of 8,121 € million in material costs; and
- Costs of 5,187 € million in reuse schemes.

3.8.5 Social impacts

The qualitative impacts will be very similar to those described for Measure 2a and Measure 2b (see section 3.7.4), however quantitatively they are significantly higher:

This measure would result in a loss of 521 thousand jobs as a result of the overall packaging being placed on the market, the vast majority (92%) coming from manufacturing and the remaining 8% from the waste management industry – recycling and residual waste treatment. However, this measure is also expected to generate around 2,745 thousand jobs in the reuse sector, thus leaving a **net job creation of 2,224 thousand jobs**.

3.8.6 Environmental impacts

Based on the quantitative tonnage reductions noted above, significant environmental benefits are expected to result as indicated in the table below.

Table A-5 Summary of Environmental Impacts for Measure 2c

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-11,921
Change in water use, thousand m^3	-495
Change in GHG/Air Quality (AQ) externalities, € million	2,536

3.8.7 Stakeholder views

As per Measure 2a and 2b.

3.9 Summary and conclusion

Table A-6 Summary of Impacts for Measure 2

Impact category	Measure 2a	Measure 2b	Measure 2c
Effectiveness	-4.1% reduction in packaging waste	-19.1% reduction in packaging waste	-23.4% reduction in packaging waste
Ease of implementation	Easy for the Commission, however Member States have a limited number of 'levers', with some risk to the single market and concerns over its applicability.		
Administrative burden	Low for the Commission with significant potential burden for Member States and potentially PROs or sector organisations in co-ordinating action		
Economic impacts	1,645 m€ savings in material costs and 575 m€ savings in waste management. Loss of heavier packaging as marketing advantage. Several FTEs at Member State level and PRO or sector organisations (depending on implementation).	3,993 m€ savings in waste management, loss of producer revenues of 49,549 m€, savings of 6,677 m€ material costs and costs of 4,349 m€ in reuse schemes.	2,253 m€ savings in waste management, loss of producer revenues of 58,132 m€, savings of 8,121 m€ material costs and costs of 5,187 m€ in reuse schemes.
Social impacts	Loss of approximately 9,800 jobs in waste management	Net job creation of 1.9 million jobs	Net job creation of 2.2 million jobs

Impact category	Measure 2a	Measure 2b	Measure 2c
Environmental impacts	Savings of 2,486k tonnes CO2e, 93k m3 waster use, 488 m€ in GHG/AQ externalities	Savings of 9,701k tonnes CO2e, 403k m3 waster use, 2,076 m€ in GHG/AQ externalities	Savings of 11,921k tonnes CO2e, 495 thousand m3 waster use, 2,536 m€ in GHG/AQ externalities
Stakeholder Views	Different range of opinions and concerns, namely: need for a harmonised approach, application of EPR, fairness in target-setting and risks of light-weighting. Overall preference for measures 2b/2c rather than 2a.		

4.0 Measure 3. Best-in-Class weight limits

4.1 Problem definition

It is known that some packaging formats, and particular packs, are heavier than other whilst fulfilling the same function and being of the same material and volume. Glass containers and some plastic and cardboard packaging often shows considerable weight variation within a particular size and style of pack, quite often caused by brand demands related to sales and marketing of more premium products. Glass containers in particular, including bottles and jars, are known to have a very wide weight range even within a particular size (e.g. 75cl) for a given product (e.g. still wine). This is in part due to traditional bottle shape variation, brand considerations that equate higher bottle weight with premium quality, and variations in manufacturing (some being less modern/optimised than others). Similarly, plastic bottles can be optimised further, utilising the latest manufacturing techniques, and in regard to reducing 'premium' brand pack weights. This is a parallel problem to that of excess void space which is considered under Measure 5.

4.2 Baseline

As also mentioned in the baseline for Measure 1 (section 2.2), the current situation is the Directive's requirement to minimise packaging, which lacks detail and has no clear definition of 'over-packaging', and a voluntary standard, EN 13428, which offers loopholes for producers and makes enforcement close to impossible for Member State authorities.

There is a Commission's initiative to promote digital product passports for packaging which could be an important tool to provide product information and allow manufacturers to avoid "over-reporting" that creates needless administrative burden; however, this is not likely to happen in the short-term.

4.3 Objectives

The objective is to set maximum weights, related to actual 'best-in-class' data for the EU, for a range of items that are a) known to a wide weight range within a given category and b) can be defined clearly in regard to their type and size. The aim is to provide a single point of reference for producers and enforcement bodies and a means to exclude the heaviest packaging from the market. Consequently, the measure is aimed at bottles (and potentially jars), so as to eliminate the worst offenders in this regard, and hence reduce packaging material use significantly and thereby carbon and packaging waste quantities.

4.4 Description of the measure

Measure 3 sets out to define 'best-in-class' benchmarks – the lowest weight, and potentially mean/median or potentially quartile data, for a given category of pack, as a means to define over-packaging thresholds within a sub-category, and provide a single point of reference for

producers and enforcement bodies and a means to exclude the heaviest packaging from the market.

We believe this approach is a targeted and powerful one that could progressively reduce packaging unit weights, starting with glass and plastic bottles and jars, and potentially being utilised to address far wider range of packaging types beyond 2025 should this approach prove successful.

4.4.1 Operationalisation

The measure would set a maximum weight for a range of bottles, and potentially jars, made of plastic and glass (sees section 4.4.2 below for a discussion of the items in scope). The aim would be to move all these containers to a weight no greater than the best-in-class (minimum) weight (for a given size and type of bottle/product – e.g. 75cl sparkling wine; 50cl still water etc.) plus a reasonable % extra weight to allow flexibility for producers, over a period of several years to allow market adjustment.

The data sources for the calculation of the 'best-in-class' weights are describe in section 4.4.3 below; however, whatever the source of data, it would be necessary for the Commission to develop an EU-wide tool that uses such data, to provide the benchmark data in an easily accessible format for PROs, producers and regulators. The 'best-in-class' benchmark weight would need to be updated quite regularly (e.g. every two years), providing a dynamic 'top-runner' approach, i.e. a benchmark that is occasionally refined in a semi-automatic way, minimising bureaucracy. This EU wide approach would also allow the single-market to operate without hinderance or risk of market distortion.

It would not be reasonable to expect every business to be able to reach the very lowest packaging 'best-in-class' weight for their packaging, given that they may have particular production or distribution constraints, or may not easily (e.g. as an SME) be able to procure the lightest packaging, which may only be available at a viable cost for the largest brands. Consequently, these thresholds would be set at a relatively comfortable level (minimum 'best-in-class' weight plus 20% is suggested), the aim being to eliminate only the worst offenders that are responsible for a disproportionate share of the over-packaging problem.

It is therefore suggested that:

- The threshold weight limit be set as a percentage over and above the minimum best-in-class benchmark weight so to allow some flexibility. Based on the data we have available for glass and plastic containers, it is proposed that a figure of 20% above the minimum best-in-class figure is set as the legal threshold value.
- Reusable packaging, designed for and used within a well-defined reuse system, would have its own category within the system.
- Some variations could potentially be utilised to allow for plastic packaging with high levels of recycled content, which may increase its weight to meet equivalent performance levels.

Alternative approaches to threshold setting could involve consideration of percentiles or standard deviations away from the mean or median, where the data allows a weight distribution to be defined in a statistically valid way. This aspect could be consulted upon, with the onus placed on industry to demonstrate that a set threshold was too burdensome, requiring them to reveal their own data to support their claims.

The best-in-class weights would apply to any entity placing relevant packaging items on the EU market, and so would apply to importers as well EU-based producers. To minimise the

administration burden on the Member State regulatory authorities, a requirement could potentially be made for packaging EPR schemes (PROs) to ensure that the best-in-class threshold is checked when compiling the annual data for their member producers.

The measure would involve the exclusion from the market of items exceeding the legal threshold by 2030, with updates thereafter (suggested every two years). We would suggest that this is done through an implementing act that would have direct effect across the EU and place an obligation on producers directly without the need for Member States to transpose anything into national law, and ensuring EU harmonisation.

4.4.2 Items in scope

To simplify things, it is therefore being suggested that the measure only focuses on packaging items that are:

- easy to define and relatively simple in their nature, i.e. with little variation apart from size; and
- known to have good weight reduction potential (see Problem Definition and related Appendices in the Synthesis Report).

As such it is proposed that this measure is only initially targeted at bottles, with the possible addition of jars, made of plastic and glass, across all the standard sizes, with allowances to reflect the heavier weight of bottles required to contain the pressure exerted internally in sparkling and carbonated drinks. The table below gives an indication of the key items:

Table A-1 Key items and packaging sizes for Measure 3

	100ml	250ml	330ml (drink) 300 to 340 ml (food)	500ml	700ml (spirit) 750ml (wine)	1,000ml
Beer			x	x		
Spirits					x	x
Still wine					x	x
Sparkling wine					x	x
Still soft drinks	x	x				
Carbonated Soft drinks	x	x				
Food jar (as a possible addition)			x			

4.4.3 Data sources

The data for this reduced set of items could be provided by various means:

- Through harmonised reporting requirements under EPR, such that the PROs would be required to provide the weight-based data for the particular bottles (and potentially jars) defined. This would have the advantage of providing comprehensive data for the EU market and hence very accurate benchmarks but would still require considerable effort for producers and PROs (describe in more detail in section 4.4.4 below).

Two simpler fall-back options are therefore suggested that would not require harmonised PRO reporting:

- That the annual data already acquired by PROs, such as CITEO and Fost-Plus, is used as a proxy for the EU-wide data, to establish benchmarks; and/or
- That the Commission purchases commercial packaging weight data (e.g. that already held by Valpak) annually as stand-alone data or to complement the existing PRO data.

The CITEO CSU data declaration by producers already makes the distinction between wine, and sparkling wine/champagne, for example, and so is already sufficiently detailed in terms of judging appropriate best-in-class weights by these categories. The PRO data would, of course, be aggregated to make it anonymised so as not to disclose confidential information from brands and retailers.

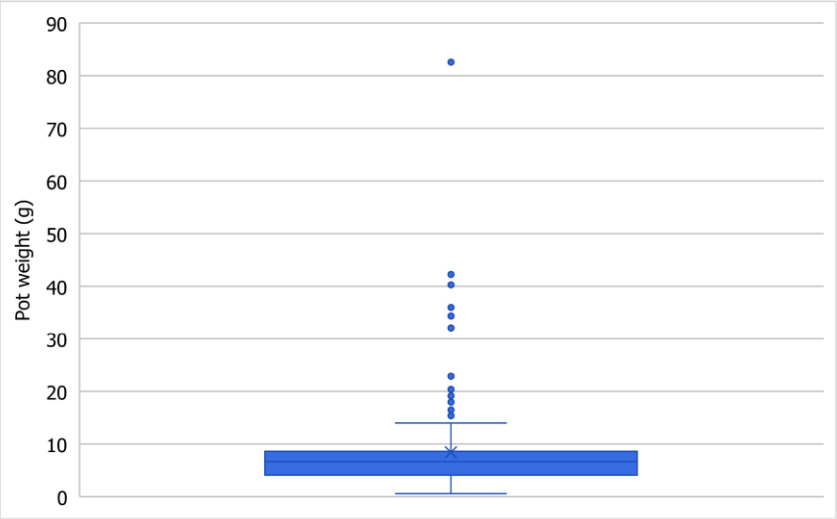
4.4.4 Data available from PRO

Producers in most Member States have to report packaging weight placed on the market to their national PRO under EPR, and this is often done bottom-up by brands and retailers, from the individual sales unit level (known as a CSU or SKU), or utilising commercial databases (e.g. Valpak in the UK operates a Packaging Data Suite with packaging data for around 20 million SKUs).

Some PROs, including Citeo in France and Fost-Plus in Belgium, already require a good degree of granularity in the data from suppliers. Fost-Plus requires a detailed data declaration, the latest of which (for 2020) contain unit quantities and detailed packaging data for about 150K one-way packaging items. The availability of this type of weight-based data makes it theoretically possible to minimise packaging in a systematic and targeted way, working steadily to bring the whole market towards 'best-in-class' (minimum weight) benchmarks. This would have to be done for a very particular product sub-group, e.g. 75cl glass wine bottles or 150g plastic yoghurt pot.

By way of illustration, Eunomia asked Valpak (the largest UK PRO), to provide an example of yoghurt pot weight variation utilising their commercially available database. Over 1,000 SKUs were analysed with a total sales volume of over 600 million units. This provided a median yoghurt pot weight of 6.7g and an average pot weight of 8.5g. Figure A-5 illustrates the spread of weights. The coloured box shows the spread (upper and lower quartile) of pot weights around the median value. The 'whiskers' show the minimum and maximum values excluding outliers, with the dots representing the outliers.

Figure A-1 Yoghurt pot weight variation (all pot sizes)



Source: Valpak

The initial thinking was that all data be collated by the PROs in each Member State and that this would then be collated in a central EU Registry to allow benchmarks to be defined for all packaging on the EU market based on all the data for that packaging. This would need to effectively reflect (for example as minimum, mean, median, and maximum values) every single SKU on the market, and all nuances of packaging combinations, for example products packaged in a combination of plastic and card materials, and in all key sizes.

Whilst this would be an incredibly powerful proposition, and the source data is already available at the producer level, this approach has been deemed too complex given that it would involve a huge data collation task, producers feeding all their data via PROs to a central registry, and would require an extremely large and relatively complex EU database and related 'best-in-class' tool to be maintained by the Commission.

4.5 Links to other measures

This measure is complementary to Measure 5 Void space limits, since this measure (Measure 3) deals with items that have weight reduction potential (but are already optimised in volume terms, i.e. bottles), whereas Measure 5 focuses on sectors that have volume reduction potential, which in turn will also lead to weight reduction. Measure 3 and 5 could also be used as the EU wide instruments to support wider national initiatives under Measure 2 Mandatory Member State 'top-down' targets, helping to increase EU harmonisation and reduce the risk of market distortion due to variable approaches across Member States.

4.6 Assessment of Measure 3

4.6.1 Effectiveness

From the evidence available, the CBA model assumes (we think conservatively) that a 15% reduction in glass bottle weight and a 5% reduction in plastic bottle weight would be possible, and thereby this measure in isolation would result in a **2.7% reduction in packaging waste in 2030 compared to a 2030 baseline**, and 2.484 million tonnes of avoided packaging waste. It is worth noting that when combined with Measure 5, the two measures would provide a 4.4% reduction, in line with the modelled outcome of the more general (cross sectoral/cross material) target under Measure 2. This is largely the result of a greater emphasis on glass containers under this measure, given that the best-in-class approach provides the sound evidence base for that emphasis. Table A-2 below shows the reduction in packaging waste generation per material type, compared to 2030 baseline.

Table A-2 Summary of packaging waste generation changes for Measure 3

	2030 - measure	Change vs 2030 baseline (%)
Glass	12,668	-14.8%
Steel	2,674	0.0%
Aluminium	999	0.0%
Paper / board	37,747	0.0%
Plastic	20,694	-1.3%
Wood	14,927	0.0%
Other	204	0.0%
Total	**89,912**	**-2.7%**

4.6.2 Ease of implementation

The main objection to this approach is the potential complexity in gathering the data to establish the 'best-in-class' benchmarks, however producers in most Member States have to report packaging weight placed on the market to their national PRO under EPR, and this is often done bottom-up by brands and retailers, from the individual sales unit level (known as a CSU or SKU, Stock Keeping Unit), or utilising detailed commercial databases (e.g. Valpak in the UK operates a Packaging Data Suite with packaging data for around 20 million SKUs[503]). Some

[503] see example data at:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj3m-Sf-

PROs, including Citeo in France and Fost-Plus in Belgium, already require a good degree of granularity in the data from suppliers. Fost-Plus, for example, requires a detailed data declaration, the latest of which (for 2020) contain unit quantities and detailed packaging data for about 150K one-way packaging items[504].

Given that this measure is only focusing on a relatively small number of well-defined packaging items (i.e. bottles and potentially jars in the first instance), and can utilise existing packaging weight data, the main issues would be:

- Gathering representative data from PROs or otherwise; and
- Establishing a relatively simple tool at the EU level to analyse the submitted data.

The data for this reduced set of items could be provided by various means:

- Through harmonised reporting requirements under EPR, such that the PROs would be required to provide the weight-based data for the particular bottles (and potentially jars) defined. This would have the advantage of providing comprehensive data for the EU market and hence very accurate benchmarks, but would still require considerable effort for producers and PROs.

Two simpler fall-back options are therefore suggested that would not require harmonised PRO reporting:

- That the annual data already acquired by PROs, such as CITEO and Fost-Plus, is used as a proxy for the EU-wide data, so as to establish benchmarks; and/or
- That the Commission purchases commercial packaging weight data (e.g. that already held by Valpak and other, EU, organisations) annually as stand-alone data or to complement the existing PRO data.

4.6.3 Administrative burden

The administrative burden (and economic costs) would depend on the source of benchmark data; comprehensive EU data or more limited from a few Member State PROs and/or commercial sources. Some additional effort may be required by the PROs, to extend their reporting requirements, and by producers to provide more granular data for bottles (as already done to a degree in some Member States, e.g. France and Belgium).

It is worth noting that the 'best-in-class' benchmark weights would need to be updated quite regularly (e.g. every two years), but would provide a dynamic 'top-runner' approach[505], i.e. a benchmark that is occasionally refined in a semi-automatic way (utilising the tool), minimising bureaucracy. To minimise the administration burden on the Member State regulatory authorities, a requirement could potentially be made for packaging EPR schemes (PROs) to

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O7uAhXFQUEAHf4QC18QFjAGegQICxAC&url=https%3A%2F%2Fwww.valpak.co.uk%2Fdocs%2Fdefault-source%2Fdata-services%2Fpackaging-single-use-plactics-data-collection-templatee7b10cc1a5336c89be6fff0000348758.xlsx%3Fsfvrsn%3Db8826010_0&usg=AOvVaw0t9vzhG4NdSkJZcl5OGarK)

[504] Fost-Plus, information sheet *The fixed-price declaration and the detailed declaration* at https://www.fostplus.be/sites/default/files/Files/Bedrijven/Verpakkingstypes/infofiche_fixedpriceanddetaileddeclaration.pdf

[505] As used in Japanese energy efficiency limits for EEE (electrical and electronic equipment)

ensure that the best-in-class threshold is checked when compiling the annual data for their member producers.

This EU wide approach would also allow the single market to operate without hinderance or risk of market distortion, and the potential administrative impact of dealing with any such Member State infringements.

4.6.4 Economic impacts

The potential economic effects of light-weighting in global markets is difficult to assess, but various factors can be identified:

- Light-weighting of a current design (or selecting a lighter standard bottle) saves material costs which offers a small competitive advantage, especially for large producers where the aggregate saving can be very large. The CBA model indicates:
  - 294 million EUR in 2030
  - 393 million EUR in 2050
- There may the need for some industry investment in new tooling, although in terms of glass, we know that the range of bottles currently available in container manufacturer catalogues includes light-weighted bottles; i.e. they are available off the shelf from existing manufacturing facilities. In terms of plastic bottles, the issue is often optimisation in pre-form production and blowing, rather than the replacement of equipment. Any extra capital/one-off cost here are generally paid back quickly through material cost savings.
- Some premium brands see a sales and marketing advantage of heavier bottles, however if this measure is applied across the EU, there will be no disadvantage to any single EU producer as all will be treated equally, so long as imported bottles are also treated the same way and enforcement is effective.
- For the glass container sector, which has steadily lost market share to plastic containers and aluminium cans, a further legislative-driven move to lightweight will increase the sustainability of the packaging and may help to counter this trend, helping the sector to compete.
- EU SMEs could also struggle to obtain the very lightest bottles, however there is a significant margin proposed (+20%) to allow for any such difficulties, or other peculiarities of production (e.g. filling line limitations) and distribution (e.g. around robustness) in all companies no matter of what size.
- In terms of waste management and EPR cost savings (which would be spread across producers and waste disposers), the CBA model indicates:
  - 81 million EUR in 2030
  - 113 million EUR in 2050
- In terms of ongoing costs, the Commission would develop and maintain an EU-wide tool, so as to provide the benchmark data in an easily accessible format for PROs, producers and regulators. This would probably require one or two FTEs in terms of staff resources. Member States would also potentially need to undertake awareness raising around the measure, although this obligation could be placed on PROs.

4.6.5 Social impacts

As noted above, there are uncertainties in regards to the economic outcome for the producers of the packaging and the brands using the packaging. The suggested weight reductions are relatively small scale, however, and will not reduce the number of bottles, but just the material going into those bottles. Consequently the measure only affects raw material suppliers in the EU, and the impact on jobs in the EU should be very small. More cost-effective packaging may

also help to give EU packaging and product brand businesses a slight commercial advantage in the markets in which they operate, helping to increase EU jobs.

In terms of the reduced waste that will result, the CBA model indicates that this measure would result in the loss of around 3,700 FTEs in 2030 and 4,700 in 2050. The vast majority would be losses in recycling jobs and the remaining in residual Treatment jobs.

4.6.6 Environmental impacts

Based on the quantitative tonnage reductions noted above, significant environmental benefits are expected to result as indicated in the table below.

Figure A-2 Summary of Environmental Impacts for Measure 3

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-766
Change in water use, thousand m^3	-39
Change in GHG/AQ externalities, € million	-104

4.6.7 Stakeholder views

The use of a 'best-in-class' reference threshold (a weight-based measure at a packaging sub-type level) had 'in-principle' support among some stakeholders, noting that it could be a powerful approach. However, there was general concern regarding the availability of the data required for such a measure at the EU-level and the need to keep that data up-to-date.

Furthermore, it was noted that the 'best-in-class' dataset would have to be *very* granular if it is to effectively deal with the same packaging type being used for different products with different needs. An example given was carbonated water which places increased functional requirements on the bottle, and should not be compared to bottles of the same size designed for still water.

It was suggested that there is complexity in how a measure of this type may be applied:

- Firstly, it would need to take into account the variations in international supply chains and distribution channels.
- Secondly, it would need to ensure brand intellectual property rights and confidentiality is protected (e.g. which brands have the lowest weight packs and how).
- Thirdly it would need to be able to account for cultural differences which affect packaging design and now this may impact the 'best-in-class' limits.
- It was also noted that non-EU suppliers may have limited ability to reduce their packaging weights to the required threshold.

Several stakeholders questioned how the impacts on SMEs of this measure would be minimised, pointing out that they in particular would not have access to the innovative packaging designs and technologies needed to meet any best-in-class thresholds. SMEs in particular have limited influence to change packaging design as they a) may not have access to the most innovative suppliers and b) are often not able to invest in new production lines suitable for a different packaging type.

It was noted that care needs to be taken to avoid pressure to under-package and so creating more product (e.g. food) waste.

Several stakeholders questioned the appropriateness of a legislation-driven approach, noting that efforts already made by the packaging industry to minimise packaging should be better acknowledged and that there was already enough economic incentive to reduce packaging (in material weight terms). It was also noted, however, that the benefit of marketing and extra sales (driven by size, e.g. in toys, or weight in premium products) can be far greater than the cost of additional material, significantly weakening this effect. This is particularly true where the value of the product is high compared to that of the pack itself (which is often just a few €uro cents in cost).

It was also noted also that such weight-based optimisation has to be within a material/pack category or it will lead to a further switch to plastic. Furthermore, it was noted that changes for recyclability reasons (e.g. 100% mono-polymer in plastic) should not be penalised if this approach makes a pack heavier. Similarly the use of recycled content in cardboard can make material heavier for the same level of performance and this also needs to be taken into account.

One stakeholder noted that it should be recognised that the most effective design may not always be compatible with the minimum weight for example a square bottle which offers transport and logistic advantages generally requires more glass than round bottles.

One stakeholder noted that creating pressure to drive more packaging suppliers to reduce weight would require considerable investment in new manufacturing facilities – investment that could potentially be used to create a more significant shift to reuse and refill. It could also be used as a means to greenwash – legitimising single use over reuse.

Some stakeholders are in favour of measure 3 and some even say that it could be extended to the other major packaging types. A stakeholder suggested that a corporate best-in-class would be preferrable to a sectoral approach. Other stakeholders would exclude packaging that is reusable and/or contains recycled content. Other stakeholders highlight the need for the classes to be well defined.

There was more agreement around the possibility of setting such 'best-in-class' thresholds first as voluntary/advisory approach, allowing the gathering of further data before setting a mandatory limit to prohibit placing on the market.

With regards to the threshold, some stakeholders argued that the proposed 20% benchmark would have a disproportionate impact on the market, as the best-in-weight bottles are not necessarily representative of the market.

4.7 Summary and conclusion

Table A-3 Summary of Impacts for Measure 3

Impact category	Measure 3
Effectiveness	2.7% reduction in packaging waste
Ease of implementation	Complexity of gathering data and establishing a EU analysis tool. Data gathering recommended via PROs or acquisition.

Impact category	Measure 3
Administrative burden	Additional effort on PROs for reporting (if this is the chosen implementation)
Economic impacts	Material cost savings of 294m€ and EPR fees (waste management) of 81m€ Loss of heavier packaging as marketing advantage 1 or 2 FTEs at EU level for maintenance
Social impacts	Loss of around 3,700 FTEs in waste management
Environmental impacts	Savings of 754 thousand tonnes CO2e, 38 thousand m3 waster use, 96m€ in GHG/AQ externalities
Stakeholder Views	'in-principle' support among some stakeholders with concern on data gathering, granularity required and maintenance. Some agreement around starting with a voluntary approach. Other concerns around material neutrality, impact to SMEs, need for legislation, risk of greenwashing and cost of opportunity (investments).

5.0 Measure 5. Void space limit

5.1 Problem definition

While over-weight packaging is a problem in some packaging types (e.g. bottles), as discussed under Measure 3, excess volume, with substantial 'empty' (non-product) space, is a problem in certain other product areas. The following sectors are of particular concern in this regard: e-commerce/distribution (a fast-growing sector that is causing large volumes of waste cardboard), electronics, toys, hardware/DIY and cosmetics. While extra pack material costs brands more in packaging terms, this is often very marginal compared to the real (or perceived) benefit in terms of sales and marketing – either in terms of shelf presence in physical retail (e.g. toys) or in terms of the customer experience when receiving a premium product (such as a mobile phone or laptop). In e-commerce distribution, the large packaging used is often the result of the economy of scale benefits of buying large quantities of a relatively small number of box sizes, and the need for high packing rates at packing stations, where large numbers of box sizes (to allow more optimised fit to product) slows the largely manual process.

5.2 Baseline

The current situation is the Directive's requirement to minimise packaging, which lacks detail and has no clear definition of 'over-packaging', and a voluntary standard, EN 13428, which offers loopholes for producers and makes enforcement close to impossible for Member State authorities.

In Germany there is a reference value of an administrative guideline which specifies that there should not be more than 30 percent void in a package. South Korea and China have adopted regulations setting limits on the amount of empty space and the number of layers that consumer product packaging can have. These limits depend on the categories of products, thus taking into account the specific constraints that exist for each category (e.g. in South Korea the empty space ratio is 35% for electronic products, 15% for processed food products, 10% for beverages as well as for cosmetics and clothes). In China, the focus is on foods and cosmetics (primary sales packaging) by setting thresholds for the void space to product volume ratio (referred to as 'interspace' ratio). A standard is being produced which uses a formula to calculate the ratio by product type (a coefficient being used in the equation for each product group).

Amazon uses an approach of this kind in its Frustration Free Packaging programme, whereby it works with manufacturers and brands to certify packaging that has minimum void space and does not need further transit packaging (i.e. is fit to despatch on its own without an outer box). Amazon has been working with various product groups, but most notably toy manufacturers. E-commerce offers an advantage over bricks and mortar retail here in that the way the product physically looks on a shelf is not important, and images can be used as necessary on a web site to display the product 'virtually' and encourage purchases.

Amazon Frustration Free Packaging Programme

The Amazon frustration free packaging (FFP) program certification establishes several requirements, including those leading to packaging reduction, based on the product

measurements.[506] According to the guidelines for this program certification, the product to packaging ratio or box-utilization score must be greater than 50% for non-fragile products and greater than 30% for fragile products such as glass, porcelain, ceramic, clay, liquids, etc. The packaging certification program defines also minimum packaging dimensions for the EU market, i.e. larger than 203.2 mm (length) x 119.9 mm (width) x 9.5 mm (height). Any products with smaller packaging in any dimension cannot qualify for FFP, as it will require additional secondary packaging for handling in a fulfilment centre.

In some countries, restrictions on the amount of headspace or concealed empty space in packaging can also be found in consumer protection regulations. For example, both New Zealand and Canada have regulations that forbid deceptive packaging that mislead the consumer with respect to the quantity of product. The EU consumer protection laws are only general in nature and do not specify any particular requirements for packaging, although something more explicit has been suggested previously by the European Parliament[507].

5.3 Objectives

The objective is to set a maximum void (empty) space limit for certain sectors, where excess pack volume is known to be a problem, so as to eliminate the worst offenders in this regard, and hence reduce packaging material use significantly and thereby carbon and packaging waste quantities.

5.4 Description of the measure

Another area of concern is excess packaging volume and void (empty) space (including that in e-commerce and distribution packaging), and while the detailed data may be difficult to establish en-masse across the market, having a maximum volume ratio (pack to product), or void space threshold, would be an extremely useful reference point for enforcement bodies, and one that compliments a weight-based threshold. This is also something that could be roughly assessed visually, in the first instance to identify likely exceedances, and checked in more detail subsequently during regulator investigations.

5.4.1 Definitions

It is suggested that a void space limit is a better measure than pack to product volume since the product could in some cases be a multitude of odd-shaped items that are difficult to measure.

The void space ratio would be defined as:

> *"The ratio between the void (empty) volume (or planar area for 2D packaging and bags) in the pack, and the total volume (or planar area for 2D packaging and bags) of the pack, including the void and the space occupied by the product."*

[506] Amazon (2019), Amazon Frustration-Free Packaging Program Certification Guidelines.

[507] Misleading packaging practices, Briefing Paper, European Parliament, January 2012

Furthermore, to simplify the calculation and make allowances for products with complex 3D shapes, we propose that the void space be defined as:

> *"The volume in the pack not occupied by a virtual rectangular envelope/s (i.e. a virtual box/es), that touch the product (or product items) on all sides, with an orientation to minimise its volume."*

We believe that this approach makes the visual inspection and assessment of void space easier to undertake, and for more specific calculations to be readily made. This would be the virtual equivalent to the physical box-in-a-box found in many e-commerce scenarios. It should be noted that where there is more than one distinct item in the pack, each item or element of the product would be treated individually (in terms of the virtual box approach) within the pack as a whole.

For a pack of cereal, for example, this would be the clear headspace (ullage) left in the outer box once the product has settled. For an electronic product it would be the space around the product elements (including a charger as a separate item, and the instructions leaflet where included). For several toy figures in a box, separated by a plastic moulding in which they rest, each figure would be treated as one element.

The definition of void would also include any space between double wall layers, false bottoms etc. (e.g. in cosmetics packaging) but excluding the air-space within any material that is by nature multi-skinned, e.g. within corrugated board or insulating extruded PP sheets.

In addition, it should be noted that where a 2D packaging is used, such as a card with a blister pack on it, the volume ratio or void space argument is difficult to apply. In this instance, to simplify things, it is suggested that a planar (plan view) surface area 'void' space approach is used for such items. Bags within bags, or boxes within bags, could be dealt with in a similar 'planar area' way.

Areas of packaging (whether 2D or 3D) required for consumer information, and to fulfil other functional requirements (e.g. a hanger for display) set out under the criteria under Measure 1, would not be considered as void.

The measure would involve fines in the case of e-commerce and distribution packaging exceedances and otherwise the exclusion from the market of items exceeding the legal threshold by 2030.

5.4.2 Thresholds

The void space limits would need to be set by broad product category, however, with particular care needed for products that don't tessellate quickly or easily, i.e. the shape of the product parts, and packaging line processes, are such that the product takes some time to settle, certain breakfast cereals being a well-known example, screws in a pack being another.

The % void thresholds could be set in such a way as to eliminate the worst offenders, and hence the thresholds can be set with quite a large tolerance to allow for some variety within a product category, distribution conditions etc. It is therefore proposed that there is a maximum allowed void space ratio (void as a proportion of the whole pack) of:

- 40% for e-commerce and distribution packaging;
- 25% for loose products that need to settle after packing in production, or multiple items that need to be separated within the pack for reasons other than sales and marketing; and

- 15% for other products, including electronics.

For e-commerce and distribution packs the limit would apply to the outer packaging applied by the fulfilment/distribution/logistics company, around the original product packaging. For other packaging, the limit would apply to the primary pack, or where there is more than one layer, the outer layer of the primary pack.

We would suggest that the product categories and thresholds are implemented through an delegated act that would have direct effect across the EU and place an obligation on producers directly without the need for Member States to transpose anything into national law, and ensuring EU harmonisation. Other products, notably non-liquid food items, could be added at a later stage.

We believe this approach is a targeted and powerful one that could progressively reduce packaging volumes (and hence also material weight and transport impacts). Should it prove successful, the items and threshold limits could be updated, through a Regulation, every two to four years.

5.5 Links to other measures

This measure is recommended as a complement to Measure 3 "Best-in-Class weight limits", which deals with items that have weight reduction potential (but are already optimised in volume terms, i.e. bottles), whereas Measure 5 focuses on sectors that have volume reduction potential, which in turn will also lead to weight reduction. Measure 3 and 5 could also be used as the EU wide instruments to support wider national initiatives under Measure 2 "Mandatory Member State 'top-down' targets", helping to increase EU harmonisation and reduce the risk of market distortion due to variable approaches across Member States.

5.6 Assessment of Measure 5

5.6.1 Effectiveness

With a focus on cardboard packaging, and to a lesser degree plastic packaging (e.g. blister packs and plastic mouldings used within boxes), a reduction in void space is modelled to show an overall reduction of **1.7% in packaging waste in 2030 compared to the 2030 baseline**, or 1.562 million tonnes in absolute numbers. It is worth noting that when combined with Measure 3, the two measures would provide a 4.4% reduction, in line with the modelled outcome of the more general (cross sectoral/cross material) target under Measure 2.

Table A-1 Summary of packaging waste generation changes for Measure 5

	2030 - measure	Change vs 2030 baseline (%)
Glass	14,873	0.0%
Steel	2,674	0.0%
Aluminium	999	0.0%

	2030 - measure	Change vs 2030 baseline (%)
Paper / board	36,417	-3.5%
Plastic	20,742	-1.1%
Wood	14,927	0.0%
Other	204	0.0%
Total	**90,835**	**-1.7%**

5.6.2 Ease of implementation

This measure is only complex to implement in terms of the definitions of void space ratios and how these are measured for different pack types. It is suggested that the void space ratio would be defined as:

> *"The ratio between the void (empty) volume (or planar area for 2D packaging and bags) in the pack, and the total volume (or planar area for 2D packaging and bags) of the pack, including the void and that space occupied by the product."*

Furthermore, to simplify the calculation and make allowances for products with complex 3D shapes, we propose that the void space be defined as:

> *"The volume in the pack not occupied by a virtual rectangular envelope/s (i.e. a virtual box/es), that touch the product (or product items) on all sides, with an orientation to minimise its volume."*

This would be the virtual equivalent to the physical box-in-a-box found in many e-commerce scenarios. We believe that this approach makes the visual inspection and assessment of void space easier to undertake, and for more specific calculations to be readily made, for example by enforcement (market surveillance) authorities.

It will be necessary, however, to establish CEN standards to define the terms and measurement approaches. Otherwise, implementation is down to the enforcement effort required to ensure compliance in the sectors targeted.

5.6.3 Administrative burden

The administrative burden would relate largely to the setting of standards by CEN, in terms of Member State awareness raising of the void space limits, and for producers in assessing their packaging against the new standards and re-specifying their packaging.

It is worth noting that the void space limits approach will need to be evaluated at some point and the limits potentially adjusted, although this is not something that should need regular updating. To minimise the administration burden on the Member State regulatory authorities, a requirement could potentially be made for packaging EPR schemes (PROs) to ensure that the void space thresholds are communicated clearly to their members every year.

This EU wide approach would also allow the single-market to operate without hinderance or risk of market distortion, and the potential administrative impact of dealing with producer complaints and any Member State infringements.

5.6.4 Economic impacts

The potential economic effects of reducing pack void space in economic terms is relatively complex, but various factors can be identified:

- Reducing the volume of the pack reduced material use, which saves costs which offers a small competitive advantage, especially for large producers where the aggregate saving can be very large. The CBA model indicates material savings of 983 million EUR in 2030 and 1,368 million EUR in 2050.
- Reducing material use in packs does not involve investment by industry, the same equipment being used to convert sheet materials, for example, into boxes as before. While smaller boxes will be made, the number of units will remain the same, and the implications are only therefore for the sheet material makers (paper mills), although the impact would be small since the factories are largely automated, producing very large quantities of product.
- Some premium brands see a sales and marketing advantage of larger packs, to improve shelf-presence (e.g. for toys) or to provide an enhanced customer experience, however if this measure is applied across the EU, there will be no disadvantage to any single EU producer as all will be treated equally, so long as imported packs are also treated the same way and enforcement is effective.
- In terms of waste management and EPR cost savings (which would be spread across producers and waste disposers), the CBA model indicates 235 million EUR in 2030 and 335 million EUR in 2050.

5.6.5 Social impacts

The economic and jobs impact should be negligible for box convertors who will still be making the same number of units, just slightly smaller ones. Theoretically there would be a very small impact on the sheet material suppliers, predominantly paper mills, but as noted above, it is very unlikely that this would result in job losses since large paper mills produce large quantities of material with very few staff.

In terms of waste management, this measure would result in the loss of around 3,300 FTEs in 2030 and 4,700 in 2050. The vast majority would be losses in recycling jobs and the remaining in residual treatment jobs. This is a direct result from the reduced generation of packaging waste.

5.6.6 Environmental impacts

A reduction in material use, predominantly cardboard (corrugated and carton board) with a smaller amount of plastic, results in good environmental savings.

Table A-1 Summary of Environmental Impacts for Measure 5

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-1,162
Change in water use, thousand m^3	-33
Change in GHG/AQ externalities, € million	-231

5.6.7 Stakeholder views

Some stakeholders supported the idea of void space limits alone or as a complement to the use of 'best-in-class' thresholds in Measure 3.

Various stakeholders agreed that void space is an issue that needed resolving, however in order to do this, the concept of void space needs to be clearly defined and transparent measurement methods developed. Significant research would be needed to account for factors such as delivery route, product shape, product performance.

It was noted that goods that settle, such as dry foods after packing, would need an allowance making for this settlement as it can only be accurately monitored in production before full settlement occurs.

It was also noted that void space in e-commerce and other distribution packaging would need to only consider the space between the primary product pack and the outer box or bag, given that any void within the primary pack is without the control of the fulfilment company.

It was pointed out by various stakeholders that detailed limits for various products may be difficult to implement and a more general "common sense" target, with a quite large tolerance band (e.g. 30% void space) would be sufficient. It was noted, however, that a target could in some cases encourage more void space than necessary (i.e. where it was less than the target value beforehand).

Some stakeholders raised that this measure could require customised packaging which can disproportionately target smaller businesses. There were suggestions for a voluntary approach and the setting of recommendations instead of mandatory targets. Other stakeholders believe that this measure can be addressed as part of either measure 1 or measure 2 instead.

There were requests from some stakeholders for clarification on how this measure will be enforced both within and outside the EU to ensure a level playing field and the protection of products. There was also concern around consumers reporting excessive void space as it may not be reliable or accurate.

Some stakeholders argued that there are conflicting objectives such as recycled content and smaller food portions to combat food waste and portion control, so some packaging should be exempt from measure 5. Fragile products or multiple products sent in one package require sufficient filling to protect them, so there are questions around how void space will be calculated in these cases.

Finally, some clarifications were required around how the threshold was determined, the definition of void space and the methods used to calculate it, the role of void fillers and how measure 5 interacts with measure 1.

5.7 Summary and conclusion

Table A-2 Summary of Impacts for Measure 5

Impact category	Measure 5
Effectiveness	Reduction of 1.7% in packaging waste

Impact category	Measure 5
Ease of implementation	Proposed definitions should make visual inspections and assessments easy to undertake + CEN standards to define the terms and measurement approaches + enforcement
Administrative burden	Setting of CEN standard + awareness raising (could be done via EPR schemes)
Economic impacts	Material cost savings of 983m€ and EPR fees (waste management) of 235m€ Loss of heavier packaging as marketing advantage
Social impacts	Loss of around 3,300 jobs in waste management
Environmental impacts	Savings of 1,109 thousand tonnes CO2e, 31 thousand m3 waster use, 217m€ in GHG/AQ externalities
Stakeholder Views	Some stakeholder support with concerns around defintion/measurement of void space, good settling after packing, the division of responsibilities and the need for a target.

6.0 Measure 7. Phase out Avoidable / Unnecessary Packaging

6.1 Problem definition

A significant element of over-packaging is caused by what might be regarded as 'unnecessary' packaging, including additional packaging layers that aren't always necessary (e.g. a plastic tray within a card pack, a cardboard outer on a robust tube such as toothpaste), certain forms of collation/multi-pack packaging which are there primarily for the convenience of consumers in handling (and to encourage multi-buys – which can lead to over-consumption), single-serve/use items (such as hotel miniature shampoos or jam portions), and the use of single use packaging (such as cups) for eating in, where reusable and refillable items are perfectly practical. The scale of the problem is indicated by the potential impact of the proposed bans (see A6.6).

Businesses themselves acknowledge the use of 'unnecessary' packaging in their agreement to plastic pact commitments. For example, the Ellen MacArthur Foundation's Global Commitment includes a commitment to reduce unnecessary plastic packaging if *"It can be avoided (or replaced by a reuse model) while maintaining utility"* and over a third of relevant signatories have active reuse pilots[508]. The UK Plastics Pact includes a similar pledge, and focuses in on the following areas of plastic use (through consultation with signatories):

- **Multi-packs** – such as packs of beer, snack foods, confectionery, tins of food etc.
- **Fruit and vegetable punnets/trays**, e.g. grape, tomato, mushroom etc. Plastic could be avoided in some instances where food waste would not increase.
- **Internal plastic trays (within card)**, e.g. trays for premium biscuits. Sometimes avoidable.
- **Milk and salad dressing jiggers, single serving pots and sachets**, e.g. on-the-go salads, milk sticks, condiments, cosmetics and samples. Potentially avoidable.

Greenpeace[509] examined companies' commitments relating to packaging and points out that "at least three companies have mentioned that they will be committed to 'take action to eliminate problematic or unnecessary plastic packaging by 2025'". In the Essential Requirements scoping study completed in 2020, a majority of stakeholders agreed that although difficult to define, there are instances where packaging goes beyond what is necessary to protect the product.[510]

It is worth noting that in France, the Anti-Waste Law of 2020[511], which aims to phase out single use plastic packaging by 2040, has already introduced bans on a variety of everyday plastic

[508] NEW PLASTICS ECONOMY GLOBAL COMMITMENT PROGRESS REPORT OCTOBER 2019

[509] Greenpeace (2018). *A Crisis of Convenience: The corporations behind the plastics pollution pandemic*, https://www.greenpeace.org/international/publication/19007/a-crisis-of-convenience-the-corporations-behind-the-plastics-pollution-pandemic/

[510] European Commission (2020) *Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement : final report and appendices.*, accessed 16 September 2020, http://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[511] LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire, available at https://www.legifrance.gouv.fr/eli/loi/2020/2/10/TREP1902395L/jo/texte

items, beyond those covered by the SUP Directive[512], by banning fruit and vegetable packaging (being phased in from hard to soft fruit) and requiring public institutions to be equipped with water fountains (to negate the need for bottled water), fast-food restaurants to provide reusable tableware, and the use of reusable containers and bulk sales in retail stores.

In addition, the European Parliament has noted the following issues, in regard to packaging that may be considered misleading for consumers:[513]

- False bottoms;
- Double wall thickness;
- Larger than necessary caps; and
- Outsized outer box.

Finally, it is important to remember that single use transit packaging is used widely in the EU, primarily in the business to business (B2B) context, and often involves heavy items such as wooden pallets, cardboard boxes and large quantities of plastic (LDPE) pallet wrap. While logistical complexity and backhauling costs can inhibit the use of reusable transit packaging (RTPs) over large distances (e.g. from China to the EU), and potentially negate the carbon benefits through reverse logistics, RTPs (and particularly nesting or collapsible systems, and those leased through 'pool' systems) can be effectively and practically deployed to reduce carbon impact in the EU (with an overall carbon benefit being achieved after a small number of return trips), and significantly reduce the cost per trip of the packaging used, hence offering an economic benefit. On this basis, it makes sense to ban the use of some single-use transit packaging journeys within the EU.

More details of many of the issues noted above can be found in Annex A – Problem Definition.

There is therefore the potential for the Commission to follow the French lead and impose bans (at the EU level) on certain categories of packaging, in a similar fashion to that undertaken through the SUP Directive. It is worth noting that this would assist Member States in delivering the targets suggested under Measure 2, and hence reduce (although not negate) the need for independent action by MSs, thus helping to minimise market variations for producers.

6.2 Baseline

At present there are only bans, at the EU level, of certain types of plastic takeaway food packaging, for example those made of EPS, through the SUP Directive.

6.3 Objectives

To eliminate, through a gradual phasing out at the EU-level, packaging that performs none of the essential core functions set out under Measure 1, and that can be removed altogether

[512] DIRECTIVE (EU) 2019/904 of 5 June 2019 on the reduction of the impact of certain plastic products on the environment

[513] *Misleading packaging practices, Briefing Paper: European Parliament. IP/A/IMCO/NT/2011-19 JANUARY 2012*

without risk of additional product damage or loss, or that can be replaced 100% by a practical reuse/refill system, provided or facilitated by a retailer.

6.4 Description of the measure

There are a number of packaging items that are already being removed by some of the more pro-active brands and retailers in the EU, with a significant degree of consensus for example in relation to signatories to the various Plastic Pacts and the Ellen MacArthur Global Commitment. In these cases, where the packaging is not seen as being strictly necessary to protect and preserve the product, it seems appropriate to aim for an outright elimination, to be phased in over time.

It is therefore suggested that the following items, which have some precedent for removal already, could be gradually eliminated from the EU market:

- **Transit packaging**
  1. Single-use transit packaging used between sites and subsidiaries of a company, or group of companies, within the EU. This measure would include, but not be limited to, pallets, pallet systems, boxes, trays, crates, intermediate bulk containers (IBCs) (rigid and flexible), drums and cannisters of all sizes and materials.
  2. Single-use large transit packaging, notably pallets, pallet systems, boxes, IBCs, drums and crates, above a certain size (to be determined), used between companies for deliveries within a Member State.
- **Retail packaging**
  3. Single use plastic multi-pack collation/secondary packaging for cans, tins, pots, tubs, and packets (e.g. for snacks), where these are predominantly designed for the convenience of final domestic consumers to take them away from retail (rather than primarily to facilitate handling in distribution). This would include can rings, sometimes called hi-cones or yokes, and collation films and shrink wrap for example. It should be noted that this would not prevent multi-buy discounts, with consumers using their own reusable packaging;
  4. Single use multi-item collation packaging (e.g. netting) for fruit and vegetables, where there is less than 1.5kg of produce (to reflect the difficulty for consumers of handling large quantities of items using no packaging or their own packaging);
  5. Single use plastic bags for in-store loose fruit and vegetable picking by domestic consumers;
  6. All single-use packaging for the HORECA sector where the food and drink is filled and consumed on the premises, including at tables, stools and standing areas both inside and immediately outside the premises.
  7. All single use packaging for the HORECA sector (for eating in or takeaway) used for condiments, preserves, sauces, milk, sugar, and seasoning.
  8. Single use hotel 'miniatures' for bathroom hygiene / toiletry products, including but not limited to liquid hair shampoo, hair conditioner, shower gels, hand and body lotions, etc. and miniature bar soap and other hygiene products.
  9. EPS packaging layers used in retail pizza or other retail food packaging.
  10. Packaging with double walls, false bottoms and other means to create the impression that the product volume is greater than it is.

Such a list could be reviewed and potentially added to on an annual basis as new examples of packaging avoidance are proved by best-practice initiatives by retailers and brands. Should these lists need to be amended, this should be possible via delegated acts.

With regard to Items 1 and 2, the main barrier to the wider uptake of returnable/reusable transit packaging (RTPs) is the feasibility and cost of tracking and reverse logistics, with losses of RTPs (theft and misplacing) being a significant issue as well as the transport impacts of returning bulky transit packaging. These issues can be dealt with effectively through the use of 'pooling' to avoid the need for back-haul (as already done with pallets and pallet systems for example), collapsible systems to simplify return where that is necessary, and RFID chips and digital systems to aid tracking and charging for lost units. RTPs, however, can be logistically challenging to use where a) distributing items outside of continental Europe and b) where multiple companies, including third party hauliers working for multiple producers and retailers, are involved.

This measure, banning some single use transit packaging, is therefore limited to (Item 1) RTP use within companies, and groups of companies, within the EU, while Item 2 is limited to large packaging systems used for deliveries within Member State boundaries. These are seen as practical possibilities, with imported and exported packaging being exempt.

Item 3 would not include items that are necessary for distribution handling reasons, e.g. to facilitate palletisation. Shelf-ready collation packaging, which is used both for distribution and retail shelf display, would also be exempt. In terms of how this measure might affect retail check-out times, it should be noted that increasingly grocery stores are moving to smart checkout systems where the item is scanned by the shopper as it goes into the basket or trolley. Amazon, and Tesco in the UK, now operate stores (on a trial basis in London for example) where no scanning of individual products is necessary, the item being detected automatically as the shopper removes the item from the shelf and leaves the store, with them being billed electronically.

It is also worth noting that for many stakeholders, the issue with Item 3 (and Item 4) is not over-packaging, but rather their potential for littering and their recyclability. Various alternatives to plastic multi-pack collation packaging have already been developed, mainly involving cardboard solutions or glue-dots (e.g. to hold cans together). It may only be necessary to ban the plastic collation items that can have a serious impact on wildlife if discarded as litter, e.g. beer can collars/rings that can ensnare animals and birds.

Items 4 and 5 are considered unnecessary single-use items since they can be easily replaced by a reusable item that the consumer would bring to a retailer. These are already available, for example as reusable netting bags.

Items 6, 7 and 8 are regarded as unnecessary since they can be readily replaced by reusable containers that are refilled, from bulk dispensers, by the HORECA business. Note that Item 6 does not include single use packaging filled at a separate location, e.g. by a brewery that fills single use bottles for sale in HORECA.

Item 9 is included since corrugated cardboard and more recyclable plastics are now widely used as a replacement for EPS in retail packaging (e.g. under pizzas to provide additional cushioning and support within a box).

Finally, in regard to Item 10, if not considered appropriate to be dealt with as unnecessary packaging, this could be dealt with by a tightening of consumer protection law or through the use of void space limits (addressed by Measure 5, section 5.0).

6.5 Links to other measures

Measure 7 is closely linked to Measure 8 (sector by sector reuse targets) in that all-material bans (as in Items 1,2,4,6,7 and 8) are equivalent to 100% reuse targets. Bans on plastic items are complemented in Measure 8 by reuse targets on remaining materials, to avoid material switching over waste reduction. The measures are designed to be complementary and not overlapping in terms of the categories in scope.

6.6 Assessment of Measure 7

6.6.1 Effectiveness

The modelled impacts of this measure show an **overall reduction of 4.4% in packaging waste** in 2030 compared to the 2030 baseline, or 4.093 million tonnes in absolute numbers. As shown in Table A-61 below, the biggest changes per material would be for wood, followed by paper/board, plastic and finally aluminium.

Table A-61 Summary of packaging waste generation changes for Measure 7

	2030 - measure	Change vs 2030 baseline (%)
Glass	14,875	0.0%
Steel	2,681	0.3%
Aluminium	970	-2.9%
Paper / board	35,824	-5.1%
Plastic	20,174	-3.8%
Wood	13,584	-9.0%
Other	204	0.0%
Total	**88,311**	**-4.4%**

6.6.2 Ease of implementation

In line with the approach taken with the SUP Directive, this measure would require the PPWD to include an article setting restrictions on placing on the market. The determination of the list would of items to be restricted would require some effort and, as described in section 6.4, the list could be reviewed and potentially added to after the implementation.

6.6.3 Administrative burden

The burden would be on Member State market surveillance authorities to ensure that banned packaging is not being used. The most complex enforcement issue here would in relation to the

use of transit packaging which requires consideration of the types of use, and travel parameters, rather than the use of a type of packaging.

As described in section 6.6.2 above, the list would need to be reviewed and potentially updated after the implementation.

6.6.4 Economic impacts

This measure would result in avoided packaging placed on the market, with the following impacts:

- Savings of 1,243 € million in EPR fees due to reduced waste management costs;
- Loss of producer turnover of 15,380 € million;
- Material cost savings of 1,676 € million; and
- Costs of 979 € million in reuse schemes.

It is worth noting that this measure could have a negative impact on SMEs; however, as described in section 6.4, the removal from the market would be gradual, allowing enough time for businesses to adapt.

6.6.5 Social impacts

Similar to measures 2b and 2c, this measure would result in a loss of 133 thousand jobs from manufacturing (mostly), recycling and waste treatment, and at the same time a creation of 623 thousand jobs in the reuse sector. Thus, the **net results would be the creation of around 490 thousand jobs**.

6.6.6 Environmental impacts

Measure 7 would result in environmental savings due to the avoided packaging.

Table A-2 Summary of Environmental Impacts of Measure 7

Summary of Environmental Impacts, change in 2030 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-2,177
Change in water use, thousand m^3	-91
Change in GHG/AQ externalities, € million	-516

6.6.7 Stakeholder views

This measure was not presented in the webinar in June 2021 so most feedback reflected below was gathered during the two previous workshops:

- There were very polarised opinions on this approach with NGOs generally in strong support, industry strongly against.
- One stakeholder noted that bans on certain packaging would contribute to the image of an over-regulating EU that dictates to citizens what is "unnecessary". Introducing the

notion of "avoidable" packaging and defining a list of packaging which is to be phased out will set an extreme precedent in EU legislation that would hinder market freedom and consumer choice, create discrimination and limit business innovation (misaligned with the Innovation Principle, a requirement of the Union's Better Regulation Agenda).

- Several stakeholders raised the point that many of the categories problematically focused on plastic packaging. However, other participants commented that this is just that the material used is often plastic shrink wrap, beverage can rings, or other flexible plastic packaging that cannot easily be recycled at home. It was also noted, however, that a move to carboard collation packs is unlikely to reduce weight.
- There was a general desire that these measures make use of LCA data to ensure that the changes driven by these measures had a positive impact on GHG emissions and do not result in increased product waste.
- Regarding the phasing out of single-serve food packaging, there is a concern about hygiene with regards to reusable alternatives. However, other participants pointed out that these items presented no greater hygiene problems and any reusable food serving crockery, and the risk could be managed.

6.7 Summary and conclusion

Table A-3 Summary of Impacts for Measure 7

Impact category	Measure 7
Effectiveness	4.4% reduction in packaging waste
Ease of implementation	Same approach as SUP directive for market restrictions
Administrative burden	Ensure banned packaging is not used
Economic impacts	Loss of producer turnover of 15,380 € million and material cost savings of 1,676 € million.
Social impacts	Net job creation of 490 thousand jobs
Environmental impacts	Savings of 2.18m tonnes CO2e, 91k m3 waster use, 516m€ in GHG/AQ externalities
Stakeholder Views	There were very polarised opinions on this approach with NGOs generally in strong support, industry strongly against

7.0 Links between selected Waste Prevention measures

The selected measures (1, 2 3 and 5) can be seen as independent measures, however we see them as a complementary set.

Measure 1 "Over-arching changes to limiting criteria" is a pre-requisite for all measures in that it establishes a clear and unambiguous basis for packaging minimisation, offering a better definition and related performance criteria that can be taken into consideration as limiting factors preventing further minimisation. This should help enforcement, although we believe that the market surveillance authorities would also benefit from clear reference limits, as provided by Measures 3 and 5, to simplify and strengthen their hand.

Measure 3 "Best-in-Class weight limits", which deals with items that have weight reduction potential (but are already optimised in volume terms, i.e. bottles), strongly complements Measure 5 "Void space threshold limits", which focuses on sectors that have volume reduction potential, which in turn will also lead to weight reduction. We believe that these two 'bottom-up measures' could be very effective as a targeted way of achieving significant packaging reduction.

Measure 7 "Bans - Restricted from the EU Market", while only addressing a small part of the packaging market, will offer a clear stand-alone measure that is easily enforceable for market surveillance authorities (aside from complication in regard to transit packaging) and will also assist Member States in achieving the targets set under Measure 2.

Measure 2, "Mandatory Member State 'top-down' targets", is essentially open-ended in that it will be for the Member States to determine how the material targets are translated into real reductions by producers. Measures 3, 5 and 7 could, however, also be used as the EU wide instruments to support wider national initiatives under Measure 2, helping to increase EU harmonisation and reduce the risk of market distortion due to variable approaches across Member States.

8.0 List of discarded measures

8.1 Measure 4. Pack-to-Product weight ratios

Another possible approach would be to define limiting pack-to-product ratios by weight, excluding or otherwise penalising, those that exceed these thresholds. This approach would be either an alternative to Measure 3, or a compliment, where the whole sub-category of products is considered excessive (e.g. hospitality single serve items) and a 'best-in-class' benchmarking approach within that sub-category would not be very effective.

This type of ratio has already been used as criteria under the EU Eco-label for Household Detergents and is being considered for Rinse-Off Cosmetics, based on research by JRC.

Examples of packs that employ a heavy pack for a lightweight object, such as a small amount of shampoo or food in a single-serve pack (plastic or glass - an extreme example being dried saffron in a glass jar), or a small plastic product in a cardboard box, are examples of packs that can have a higher pack weight than product weight, which seems inherently wasteful and high carbon impact. Clearly this relates to the relative pack and product size, as well as the product and pack materials, but offers a potentially way to screen for some extreme examples of packaging excess.

Products are generally sold by weight and packaging weights are (relatively) well-known and reported in regard to compliance with packaging legislation and weight-based EPR fees as applied in most EU countries. Defining suitable ratios is complex, however, as this would need to be done by packaging material, as material choice has a very significant effect on this ratio, and by product type since product weights vary greatly and hence this affects the product to packaging weight ratio. It is worth noting that these thresholds could be set at a relatively comfortable level, the aim being to eliminate only the worst offenders, e.g. the 25% percent of items that are responsible for a disproportionate share of the over-packaging problem.

This approach is far more complex than the 'best-in-class' approach (Measure 3), as it requires far more data on product weights as well as pack weights, and hence would involve a high administrative burden for producers, PROs and the Commission, given the need to define a potentially very large range of threshold ratios by product/material combinations, and potentially in setting exemptions for certain very lightweight products. There is also a potential cross-over here with reuse options (e.g. in this case refilling a shampoo dispenser in a hotel room rather than providing small single-use bottles) and with items that could be considered entirely avoidable as a category (see Measure 7).

This measure is therefore not recommended to be taken forward.

8.2 Measure 6. Eco-modulation to incentivise light-weighting

Rather than excluding products, or fining threshold exceedances, the approach could alternatively be used to modulate fees under EPR, complementing recyclability criteria for example. This is, however, seen as a complicating factor for administering eco-modulation, and while some PROs already have complex eco-modulation schemes with multiple criteria (notably CITEO with multiple bonus and malus factors), we believe that this is generally not desirable since having multiple criteria within a Member State, and differing criteria from one Member State to another, sends a confusing message to producers selling across the EU. One criteria,

where a producer scores a bonus or a malus, may not be present in another country, and hence the producer is not as incentivised as might be the case if all EU countries focused on the same criteria, and ideally just one criterion. In the recommendations made by Eunomia for the Commissions Guidance for Member States on the Waste Framework Directive Minimum Requirements for EPR (yet to be published), we strongly recommended that the short to medium term focus in terms of eco-modulation should be on packaging recyclability, with other approaches, such as mandatory Essential Requirements or taxes, used to address other issues such as the inclusion of recycled content.

In addition, while charges under EPR in the EU are already weight-based, however the cost of packaging is often a very small fraction of the product cost. For example, many rigid pack types cost in the region of only €0.05 to €0.15 per unit, with product costs often being at least 10 times that figure and often 20 times or more. Consequently, while it is cheaper to use lighter material (both from a material cost perspective and to reduce EPR fees), this is only likely to be a significant incentive for very large producers where the product value (and profit margin) is low relative to the packaging costs.

For these reasons we are not recommending the use of eco-modulation to address over-packaging. Under Measure 2, however, it would be for Member States to decide whether they wish to take this approach as part of their efforts to meet their targets.

APPENDIX I – IMPACT ASSESSMENT OF REUSE MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Reuse, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 to7 .0contain the impact assessments of the selected measures; and
- 8.0 contains the description the discarded Reuse measures.

All impacts shown, unless otherwise stated, are referring to the effects of the measure in 2030 compared to the baseline in 2030.

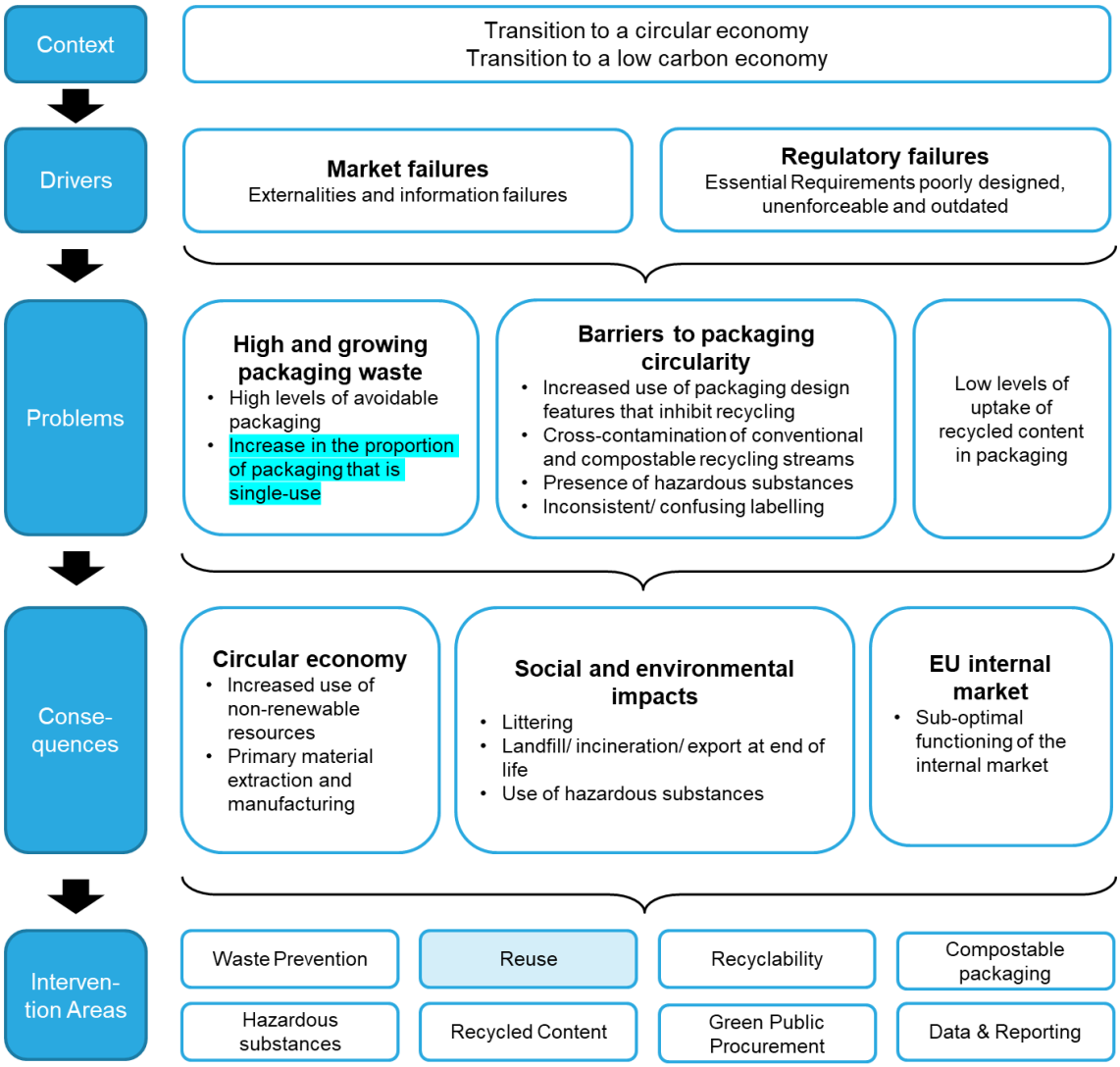
This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 1.2 describes the problem "Increase in the proportion of packaging that is single-use" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario, and section 2.4 specifically discusses multi-use packaging parameters.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. In this document the quantitative impacts are presented in relation to the baseline and, unless otherwise indicated, for the year 2030. Impacts are described qualitatively where quantitative analysis was not feasible.
  - Appendix D – Impact modelling methodology describes how the impacts for each measure were calculated and the underlying assumptions. Section 2.2 specifically discusses the reuse measures.

1.1 Intervention logic

As shown in Figure A-1 below, Reuse is one of the eight intervention areas identified in the intervention logic, and it is directly linked to one of the identified problems: Increase in the proportion of packaging that is single-use.

Figure A-1 Intervention Logic diagram



1.2 Measures assessed

[*MS* will be used as an acronym for Member State]

- Measure 8: MS level sector by sector reuse targets
  - 8a. Voluntary targets
  - 8b. and 8c. For selected product/packaging groups, mandatory reuse targets as % product sales/trips in reusable packaging, in number of items. All materials as a group. MS level, set within EU legislation, same for all MS. Lower set and higher set.
- Measure 9: Mandatory MS level overarching cross-sectoral waste reduction targets
  - 9b. Mandatory MS overarching cross-sectoral % reduction targets – General target. kg per person per year. 5% reduction to be met by reuse
  - 9c. Mandatory MS overarching cross-sectoral % reduction targets – General target. kg per person per year. 10 % reduction to be met by reuse

- Measure 10: Standardisation of reusable packaging and effective reuse systems
    - 10a. Commission to issue standardisation request to CEN. Commission to publish guidance on implementation of reuse systems that makes reference to CEN standard.
    - 10b. Definition and standardisation for reusable packaging (formats) on EU level - (mandatory - specified in legislation)
    - 10c. Definition and standards for a reuse system - (mandatory - specified in legislation)
- Measure 11a: Business advisory body for reusable products and packaging: Advisory bodies mandated formally at EU or national level
- Measure 12: Requirement for all reusable packaging to be labelled as reusable using a harmonised European approach / logo
- Measure 19: Harmonisation of when reusable packaging (including returnable transport packaging) is classified as waste

1.3 Measures discarded

- Measure 8: MS level sector by sector reuse targets
    - 8d. Voluntary targets must be set
    - 8e. Mandate reuse of some tertiary packaging (as standalone measure)
    - 8f. Target for reuse of some E-commerce packaging (as standalone measure)
    - 8g. Mandating reuse of tertiary packaging within businesses or groups of businesses that constitute closed loops (as standalone measure)
    - 8h. Targets for reuse within supply chains or within a specific sector such as the retail sector (whether voluntary or mandatory) (as a standalone measure)
- Measure 9. Mandatory MS level overarching cross-sectoral reduction target
    - 9a. For all products/packaging as a group. % reduction in weight packaging PoM. Proportion to be met by reuse not specified. Mandatory target. MS level, same for all.
- Measure 10: Standardisation of reusable packaging and effective reuse systems
    - 10d: Informal guidance issued by informal forums
- Measure 11: Implementation of a business advisory body for reusable products and packaging
    - 11b. Forum: informal EU or national level groups
- Measure 13: Create a single market for reusable packaging
- Measure 14. Updates to the essential requirements and EPR considerations for reuse
    - Measure 14a. Updating the essential requirements to better align with the waste hierarchy
    - Measure 14b. EPR fee modulation for reusable packaging
    - Measure 14c. Reusable packaging exempt from licensing obligations/EPR fees
- Measure 15. Reuse reporting in selected product/packaging groups
- Measure 16. Incentives for reusable models

- Measure 16a. Taxes on single use items (all materials),
- Measure 16b. Levies and charges for single use packaging items at point of sale,
- Measure 16c. Subsidies or tax breaks for reusable items such as reduced VAT on refillable/reusable items.
- Measure 16d. Competition/lottery entry with prizes to reward consumer use and adoption of reuse schemes could drive up number of reuses, with a variety of ways these can be implemented.

- Measure 17. Provision of funding for research and development
- Measure 18. Information campaigns on reuse
  - Measure 18a. Promotion of specific reusable items to consumers
  - Measure 18b. Promotion of reusable packaging items in general
  - Measure 18c. General campaigns on environmental costs of single-use packaging and how to reduce packaging consumption
- Measure 20. Reusable tableware mandated in HORECA sector

1.4 Definitions

The following terms are used to delineate different modes of reuse which are used in this document:[514]

- Refill at home e.g.
  - Auxiliary, concentrated products which are reconstituted by the consumer at home in reusable containers – e.g. sodastream, detergent concentrates.
- Refill on the go
  - Covers retail models such as consumers bringing own containers to fill in bulk stores
  - Also refers to HORECA sector food and beverage containers that are consumer owned.
- Return from home
  - An example includes the Loop grocery model where online grocery purchases are delivered and collected at the user's home
  - Business to consumer (B2C) packaging for large white goods constitutes another example.
- Return on the go
  - HORECA schemes for food and beverage containers that are reconditioned by a central facility fall into this category
  - Beverage containers with deposits are another widespread example
  - B2C e-commerce packaging that is posted back to the retailer is another example.
- B2B – business to business – reuse. All industrial primary, secondary and tertiary packaging.

[514] Ellen MacArthur Foundation (2019) *Reuse - Rethinking Packaging*, 2019, https://www.ellenmacarthurfoundation.org/assets/downloads/Reuse.pdf

- Returnable transport packaging (RTP) is the major format here and B2B packaging includes pallets, kegs, drums, boxes and crates, wrappings and straps.

2.0 Measure 8: MS level sector by sector reuse targets

2.1 Problem definition

There are no additional considerations with regards to problem definition beyond what is described in Annex A – Problem Definition. In brief, product sales/trips or trips in single-use packaging are increasing as a proportion of the total, both because of declining absolute usage of reusable packaging, and because consumption of single-use packaging is increasing at a faster rate than reusable packaging use (which in some cases, is stable), depending on the sector and packaging format. This has been driven by production, retail, marketing and consumption trends. These generally leverage the inadequate internalisation or intentional neglect of environmental costs, that are largely external, in favour of efficiencies with respect to manufacturing and sales costs for producers and retailers, or maximising convenience for the consumer in order to create and grow markets for products and packaging (such as 'on-the-go' consumption). There has been a general lack, aside very few exceptions, of broader legislative endeavours to address this.

2.2 Baseline

No reuse targets are currently mandated by EU; a few examples have however been implemented independently by a small number of MS (e.g. Germany for the HORECA Sector),[515] or are being developed, as in France in the 'Anti Gaspillage pour une Économie Circulaire' (AGEC) law.[516] The relevant provisions in the Waste Framework Directive (WFD) and the Packaging and Packaging Waste Directive (PPWD) as follows:

- WFD, Article 11(2) and (3) (c), (d) and (e); 11a (1)(c): Preparation for reuse is allowed to contribute to recycling targets for all waste;
- PPWD, Article 5(2): reuse of sales (primary) packaging as % PoM (placed on the market) is allowed to contribute up to 5% to recycling targets for packaging, (overall and material specific targets listed in Article 6).[517]

In addition, under the WFD, Member States must take measures to "encourage" reuse and setting up of reuse systems for products and packaging. Similarly, under the PPWD, MS shall take measures to "encourage the increase" in the share of reusable packaging placed on the market and of systems to reuse packaging. This "may include", among others:

- the setting of qualitative or quantitative targets;

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[515] VerpackG, Section 33: Mandatory use of reusable packaging: From 1 January 2023, the amended Act requires sector businesses to offer reusable packaging as an option for packaging takeaway food, so as to reduce the consumption of non-reusable packaging. A partial exemption applies to small businesses with up to five employees and retail space not exceeding 80 m². These retailers are not required to offer a reusable packaging option but must provide a filling service for receptacles brought by consumers

[516] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/

[517] Article 5(2) of the PPWD states "A Member State may decide to attain an adjusted level of the targets referred to in points (f) to (i) of Article 6(1) for a given year by taking into account the average share, in the preceding three years, of reusable sales packaging placed on the market for the first time and reused as part of a system to reuse packaging. No more than five percentage points of such share shall be taken into account for the calculation of the respective adjusted target level."

- the setting up of a minimum percentage of reusable packaging placed on the market every year for each packaging stream.

Member States must do this in "environmentally sound manner and in conformity with the Treaty, without compromising the hygiene and safety of consumers". However neither the targets nor the minimum percentages are mandated at EU level.

The reporting of data on preparation for reuse is covered by Article 37 of the WFD, which states that MS shall report the amount of waste prepared for re-use separately from the amount of waste recycled. The WFD provides for examination of preparation for reuse data by the end of 2024, with a view to understanding the feasibility of setting quantitative reuse targets. The data is expected by mid-2022.

The reporting of data on reuse is covered by **Article 12 of the PPWD**:

- "2. The databases referred to in paragraph 1 shall include the data based on Annex III" [which includes general data on reusable packaging, see below]
- "3a. Member States shall report the data concerning the implementation of points (a) to (i) of Article 6(1) and data on reusable packaging, for each calendar year to the Commission."
- Annex III: "Data To Be Included By Member States In Their Databases On Packaging And Packaging Waste (In Accordance With Tables 1 To 4)"
  - 1. For primary, secondary and tertiary packaging: b) quantities reused (Table 2).
  - Table 2 requires, for primary, secondary and tertiary packaging, for the reporting of the "quantity of packaging reused" by means of recording of "Tonnage of packaging placed on the market for the first time"; "Reusable packaging (in Tonnage and Percentage)"; and "Reusable sales packaging (in Tonnage and Percentage)".

In addition, **Commission Implementing Decision (EU) 2019/665** stipulates in Article 6a how the recycling rates can be adjusted taking into account the average share of reusable sales packaging "placed on the market for the first time and reused as part of a system to reuse packaging" in the preceding 3 years. Annex I provides for the related reporting format (Table 2), while Table 3 provides for a format for reporting on reusable packaging. Member States are required to report on reusable packaging for the first time for reference year 2020. The reports are due at the end of June 2022. The reference to a reuse system[518] is ambiguous in that it could be interpreted as including each rotation, but it is likely it is intended to qualify the items placed on the market for the first time – which must *also* enter into a reuse system; this is confirmed by the statement that follows: "As provided for in Article 5(2) of Directive 94/62/EC, the amount of reusable sales packaging which is discarded after its first rotation shall be deducted from the total amount of reusable sales packaging placed on the market for the first time in a given year".

Reporting in Table 2 is only obligatory where Member States have chosen to take advantage of the possibility to adjust targets as per Article 5(2) of the PPWD. As reporting on reuse according to Table 3 is a new obligation stemming from the 2018 revision of the PPWD, only very few

[518] ("'a system to reuse packaging' means organisational, technical or financial arrangements which ensure that reusable packaging performs multiple rotations)"

countries have been collecting and reporting data on reuse. Reporting as per Table 3 is for all types of reusable packaging, not just sales packaging, and total number of rotations should also be reported, as well as packaging placed on the market for the first time. Some countries report data on beverage packaging. More comprehensive reuse data is provided in only very few cases, such as Finland which also provides data on reuse of transport packaging.[519] The reporting as defined by Table 3 would be able to track reuse levels for an overarching target (as per Measure 9) but, being on a material by material basis, would not be able to track reuse levels for specific sectors (as per Measure 8).

Echoing the WFD, the PPWD provides for examination of reusable packaging data by the end of 2024, with a view to understanding the feasibility of setting quantitative reuse targets for packaging. As pointed out above, the first mandatory data on reuse of packaging is expected by mid-2022.

2.3 Objectives

The aim of mandating reuse targets is to drive an increase in use of reusable packaging in appropriate sectors, and thus reduce the consumption of single-use packaging and achieve an overall decrease in material and resource use. By setting sector-/product-specific targets, the development of reuse is promoted in a variety of sectors rather than being focussed on increasing reuse only in already well-established sectors. Binding targets, as opposed to voluntary targets, provide a policy framework which incentivises reuse, thereby creating favourable conditions for investments in the relevant technology and infrastructure for deployment of reusable packaging systems.

2.4 Description of the measure

Reuse targets for packaging are goals for how much reusable packaging is being used. Quantitative reuse targets would help drive the introduction of more reusable packaging into the market.

- Measure 8a: Voluntary targets are set by the Commission which encourage MS to deploy more reusable packaging, but no sanctions are applied if they are not met. The targets are the same for each MS.
- Measure 8b: Binding targets and corresponding sanctions for failing to meet targets are set within EU legislation. Lower level. The targets are the same for each MS.
- Measure 8c: Same as previous, with higher level of ambition.

The targets are proposed **as % product sales/trips in reusable packaging in number of items** as this is the most intuitively interpreted (i.e. gives a clear indication of how much reuse is actually taking place) and hence the most effective for engaging consumers and producers and sends appropriate signals to the market. Trips is included as an option for the units for tertiary packaging particularly, where sales would not be an appropriate or intuitive unit. For the HORECA sector, to cover instances where reusable tableware for food and beverage strictly do

[519] Oeko-Institut for the European Commission (2019) *Study to establish a methodology for the reporting of re-use of products and rules for the reporting of reusable packaging*, September 2019, https://op.europa.eu/nl/publication-detail/-/publication/9878e12a-1bc4-11ea-8c1f-01aa75ed71a1

not qualify as 'packaging' the unit should be read as "sales served in reusable packaging or tableware", but this idiosyncrasy should not be used as a reason to exclude this category from the scope of the Measure in that it is nevertheless directly related to the reduction of packaging waste by avoidance. If % sales is not deemed practicable as a unit, for example where there is neither a transaction involved nor any way of registering the refill/reuse, the reduction in the number of SU items can be used as a proxy (rather than weight, which can also be achieved by lightweighting, leaving only avoidance in terms of absence of use of packaging/tableware of any kind as a conflating driver). Given that true avoidance however would have a more limited potential and hence influence than reuse, this could be an acceptable compromise. The units proposed differ from the one currently proposed in PPWD, which for the purposes of contributing to meeting targets, required MS to record the tonnage of all packaging placed on the market for the first time and the tonnage of reusable packaging placed on the market for the first time and entering into a reuse system (see Section 2.2). Measuring reuse by weight rather than number of items does not provide an accurate picture of waste reduction, as reusable alternatives may be of a different material/heavier than the single-use options they replace (but will be reused, so lead to a decrease in material use over time). And secondly, measuring the amount of reusable packaging POM does not provide data on how many rotations are being achieved, and thus how much reuse is actually taking place. Additionally, there are reports that some sectors and countries do report reuse in terms of rotations and not when reusable packaging is placed on the market for the first time only.

The targets are material neutral as the best type of material and container for reusable packaging have yet to be established with respect to system performance and environmental benefits and varies for each application.

2.4.1 Targets and product/packaging groups

A scoping exercise was used to select product/packaging groups on the basis of impact, precedent and feasibility for reuse. This took into account, for each group under consideration,

- Existing consumption of single-use packaging as a proxy for environmental impacts in general,
- Excessive use of single use packaging, which is a function of consumption levels as well as reuse precedence and prevalence which were also evaluated,
- What could be considered 'easy wins' in terms of feasibility,
- Whether concessions would need to be made to take into account existing high recycling rates for single-use packaging,
- Containment (including ability of reuse to meet functional requirements and not increase wastage),
- Ability of reuse to meet safety requirements,
- Number of applicable reuse models,
- Feasibility and likely uptake of reuse models (based on costs, space and convenience for retailers, convenience for consumers, and durability of formats).

This produced a ranking for general feasibility and potential for positive impact of reuse across a broad range of packaging categories.

This has resulted in a list of **20 categories of products shortlisted across three sectors**: HORECA, Grocery/Retail and Commercial and Industrial (C&I) packaging, for which separate targets have been proposed. Target levels were based on:

- the ranking produced by the scoping exercise, which therefore includes a variety of considerations around impact and feasibility;
- existing performance data on reuse (% reuse);
- existing and future legal commitments/proposals on reuse, especially where quantitative; and
- considering what sizeable action with system change in mind could achieve by 2040, given current technical, economic challenges, and how likely it was these could be resolved.

Further to this, feedback from stakeholders obtained subsequent to the June 2021 webinars was used to sense check the target levels (quantitative suggestions are summarized below in 2.4.2).

An interim target has been specified for 2030 and a longer-term target for 2040. This is to allow an adequately long time period to allow for adaptation of existing supply chains to a greater proportion of reusable packaging, given the considerable change and investment this will require in most cases. Table A-1 shows the full panel developed for the impact assessment for Measure 8b (lower ambition) and 8c (higher ambition). For Measure 8a, voluntary targets, it was considered that the lower ambition levels would be set by the Commission in a harmonised approach for all Member States, to avoid each country setting divergent ones; and given the voluntary nature of the targets, for the purposes of modelling the impacts, performance would reach half of the percentage share indicated by 2030 and 2040. The targets are set at the same level for all Member States. There are only a few countries with significantly higher market shares of reuse for restricted product/packaging categories (e.g. Germany for bottles), so the playing field is relatively evenly poorly developed across most product categories, and the targets do not, as a result, need to be set differently for each Member State. Those countries which do not use as much packaging as others owing to different purchasing habits (e.g. tendency to buy more unprocessed food versus pre-prepared and on the go food), should still be able to meet the targets as easily, if not more easily, as other countries for any of the following reasons:

- where packaging is used, reuse performance is already good and so there is a shorter "distance" to target;
- where packaging is used, the proportional rather than absolute nature of the target means that a smaller market needs to adapt in order to meet the target, which is fair.

Table A-1 Illustrative target levels, % sales /trips in reusable packaging

Sector	Packaging Type	Product sub-category	Measure 8 - low ambition		Measure 8 - high ambition		Target band based on normalised score
			2030	2040	2030	2040	
C&I	Tertiary	B2C: secondary/tertiary - boxes - for large white goods	90%	90%	90%	90%	High
C&I	Industrial Primary/ Secondary/ Tertiary	Remaining B2B/B2C industrial primary/secondary/tertiary e.g. crates, pallets, kegs, drums (excluding boxes, wrappings and straps), excluding closed loop packaging, and large formats within a Member State	30%	90%	50%	90%	
Horeca	Primary	Beverages, take away, filled at point of sale	20%	80%	30%	95%	
Grocery/ Retail	Primary	Fresh Fruit and Vegetables, picked in store, NON PLASTIC	15%	60%	25%	90%	Medium
C&I	Tertiary	B2C: Tertiary: E-commerce, non-food, non large white goods	10%	50%	20%	80%	
Horeca	Primary	Food, take-away	10%	40%	20%	75%	
Grocery/ Retail	Primary	Cleaning and detergents	10%	40%	20%	75%	
C&I	Tertiary	B2B: Wrappings and straps, excluding closed loop packaging	10%	30%	20%	75%	

Sector	Packaging Type	Product sub-category	Measure 8 - low ambition		Measure 8 - high ambition		Target band based on normalised score
			2030	2040	2030	2040	
C&I	Secondary/ Tertiary	B2B: secondary/tertiary - boxes - (excl white goods, excl B2C (E-commerce)), excluding closed loop packaging	8%	25%	15%	50%	
Grocery/ Retail	Secondary	B2C:Secondary packaging - for display and uniting multi-buy items, which is normally taken home with consumer, NON-PLASTIC	10%	30%	10%	50%	
Grocery/ Retail	Primary	Non-alcoholic beverages: Soft drinks and juices, including milk	10%	25%	20%	75%	
Grocery/ Retail	Primary	Alcoholic beverages (excl wine and spirits)	10%	25%	20%	75%	
Grocery/ Retail	Primary	Health and beauty: Soaps, shampoos, lotions	5%	25%	10%	50%	
Grocery/ Retail	Primary	Dry foods: Cereals, pasta, grains, tea, sugar, flour, nuts etc excluding crisps	5%	15%	10%	30%	Low
Grocery/ Retail	Primary	Wine and spirits	5%	15%	10%	30%	Low
Grocery/ Retail	Primary	Confectionary : sweets, chocolate, sugared fruits and nuts	5%	15%	10%	30%	Low
Grocery/ Retail	Primary	Baked goods including baked confectionary: bread, pastries, cakes	Option provided	Option provided	10%	10%	Nominal

Sector	Packaging Type	Product sub-category	Measure 8 - low ambition		Measure 8 - high ambition		Target band based on normalised score
			2030	2040	2030	2040	
Grocery/ Retail	Primary	Fresh meat and fish	Option provided	Option provided	10%	10%	Nominal
Grocery/ Retail	Primary	Chilled food including pre-prepared meat, dairy, ready meals and on-the-go foods	Option provided	Option provided	10%	10%	Nominal

With respect to the scope of specific categories, further work would have to be carried out to

a. define the categories to the extent necessary for implementation, and
b. determine whether a limited set of further subdivisions is appropriate for best implementation, either with the same target level, or, adjusted target levels, to achieve the same overall effect.

However the guiding principle should be to determine the fewest categories necessary for practical implementation, to avoid unnecessary delay in establishing a workable method. Commentary to provide further explanation on why certain categories have been delineated at this time is as follows:

- **Soft drinks and alcoholic beverages** were split into three categories to set the same target for specific segments for which targets were deemed equally feasible in each; and take into account different market structures and existing packaging types used in others. Specifically, reuse was assessed broadly equally feasible in the alcoholic (mostly carbonated) beverage segment, and the soft drinks, water, milk and juice segment, given past performance and product characteristics. Wine and spirits were deemed to have a significantly different market, with much longer supply chains, length of consumer use phase, and prevalence of presentation packaging, making reuse a longer-term transition or more difficult for many product classes within the category. Because of this and further differences in the supply chain length, vending points, bottling, format and plant requirements for refill for specific products between and within the three categories and subcategories, the beverage sector particularly will benefit from closer attention in terms of scoping categories and more specific target levels. This should be, as mentioned above, with a view to achieve a practicable outcome with the fewest categories necessary.
- There are **6 categories dealing with predominantly C & I packaging**: primary industrial, secondary and tertiary packaging. These include B2B and B2C models and there is also a grocery/retail category in this general grouping.
  - Large white goods (a B2C mode) falls between E-Commerce and other retail outlets. The supply chain is distinguished from other E-Commerce or secondary/tertiary packaging by it being mostly intercontinental, with specific packaging solutions available with reverse logistics available at delivery.
  - E-commerce tertiary packaging (also a B2C mode) excludes large white goods, as these have their own category for sales via both e-commerce and other retail outlets (see above) and being quite distinct from other E-Commerce solutions (like reusable pouches) which have multiple return options being piloted. Food is excluded because the primary packaging is included in the scope of the other grocery/retail categories in the above schema; the tertiary packaging is covered by the catch-all B2B/B2C category below.
  - There are two classes of secondary packaging to take into account: collation packaging that travels home with the consumer and packaging which never leaves store (like a box or crate used for transit and display). The first is B2C; the second B2B. They both have different functions and different return routes, which affects their general feasibility for reuse and/or solutions required; hence they have been split into two distinct categories. The B2C secondary packaging category is non plastic only to take into

account the inclusion of plastic items falling into this category in Measure 7 (see below)
    - Wrappings and straps, all B2B, do not include closed loop packaging as this is included in Measure 7 (see below). This is a category for which the form and function is distinct enough, and the alternatives available such, that it merited its own category immediately.
    - There are two remaining catch-all categories intended to drive reuse in all other formats/applications for industrial primary/secondary/tertiary packaging. They are intended to separate out boxes and non-boxes, to recognise the high recycling rate for corrugated card secondary/tertiary packaging in general, so that different target levels can be specified for each. Closed loop packaging is excluded from both, and large format packaging (i.e. that above a certain, large volume, typically used for industrial packaging) is excluded from the non-box category as these are included in Measure 7. Like beverages, these categories will benefit from closer attention in terms of scoping categories and more specific target levels.
- With regards to the **HORECA sector:**
    - for takeaway beverages, this is further qualified as being for those filled at point of sale. Those not filled at point of sale are covered by the beverages category in Grocery/Retail.
    - for takeaway food, this includes that filled at point of sale and that filled elsewhere, as it was not wished to exclude business models where there is centralised food preparation from having to address their use of single-use packaging. On-the-go food sold by the grocery sector is included in the separate category "Chilled food including pre-prepared meat, dairy, ready meals and on-the-go foods".

2.4.2 Additional considerations

As explained above, these categorisations take into account the interface between Measure 7 (Phase out avoidable/unnecessary packaging) and Measure 8. Restrictions on single-use products under Measure 7, where applying to all materials, can be viewed as equivalent to 100% reuse targets; they are simply alternative means of achieving the same goal. Categories to which Measure 7 applies (for ease of reference) are:

- Transit packaging used between sites and subsidiaries of a company, or group of companies, within the EU.
- Large transit packaging used between companies for deliveries within a Member State.
- Pre-packed fresh fruit and vegetables <1.5kg
- Toiletries in the hotel sector
- Single serve condiments in the HORECA sector, eat-in and takeaway
- Food and beverage containers filled at point of sale in the HORECA sector

In addition, restrictions on the following items:

- Plastic bags for fresh fruit and vegetables picked in store; and
- Plastic collation packaging travelling home with the consumer

are complemented by reuse targets, within Measure 8, on the remaining material types that can satisfy these functions, so that the restriction does not only result in a material switch without waste reduction.

With respect to specific target levels (as well as categories), these can be refined further in collaboration with stakeholders. Some industry stakeholders were able to provide specific suggestions for targets in response to webinars conducted in June 2021 introducing the measures; or for specific category breakdowns, for example:

- RTPs such as crates and boxes (a FMCG (fast-moving consumer goods), product-specific categorisation and corresponding targets levels, overall in keeping with the lower targets for 2030)[520]
- Pallets be split into two categories, for FMCGs and non-FMCGs, with separate, different targets
- the HORECA sector – suggestions commensurate with the lower targets for beverages and food
- E-commerce – a suggestion it be split into clothing, and non-clothing, with 50% reuse targets for each, was made as a result of research by NGOs.
- Research by NGOs and contributions from government stakeholders aligned with higher target levels, in general

If it was deemed useful to present targets in a more simplified way, detailed analysis to determine the ideal number of categories and the most appropriate target levels is still required to support the drawing up of quantitative levels for broader target bands that different categories could fall into. Each category would have to meet the specified target level, and an Annex revised periodically could add new categories or move categories between the target bands. To illustrate, based on the medians and averages from the above table the banding would look like the following:

Table A-2 Illustrative target levels, % sales /trips in reusable packaging, in a more simplified format based on target banding

Target band	Low ambition		High ambition	
	2030	2040	2030	2040
High	30%	80%	50%	90%
Medium	10%	35%	20%	70%
Low	5%	15%	10%	30%
Nominal	Option provided	Option provided	10%	10%

Another approach, following the appropriate in-depth scoping activity, would be to set broader sector specific target levels based on an estimate of what each sector could achieve collectively. Again, to illustrate, based on the median/averages of the sector categories, this would look as following:

[520] (i) Fruits & Vegetables 50% - 2030, 60% - 2040, (ii) Meat 40% - 2030, 50% - 2040, (iii) Fish 30% - 2030, 40% - 2040, (iv) Eggs 30% - 2030, 40% -2040, (v) Bread 50% - 2030, 60% - 2040 (vi) Dairy 15% 2030, 30% 2040 (vi) Non-Perishable Goods 20% - 2030, 30% - 2040.

Table A-3 Illustrative target levels, % sales/trips in reusable packaging, in a more simplified format, based on sector

Sector	Low ambition		High ambition	
	2030	2040	2030	2040
C&I	25%	50%	40%	75%
HORECA	15%	60%	25%	85%
Grocery/retail	10%	25%	15%	40%

The panel of targets could be provided in an Annex to the Directive and updated periodically. Alternatively, they can be published in an Implementing Act in order to give time to stakeholders to conduct the relevant scoping work on categories and target levels and feed this in. In this case, the revised Packaging and Packaging Waste Directive should stipulate that quantitative reuse targets could be set by a Delegated Act by a certain date (e.g. 2024), with provision for periodic revision made if desired. Even if provision for periodic revision is made, long-term targets to give a clear direction of travel should still be set.

Although the legal responsibility for the targets will lie with the Member States, they must delegate it to those actors who are responsible for making decisions on whether products are sold using reusable or single-use packaging – mostly packaging users rather than suppliers, in a departure from the general approach for packaging EPR in many countries. This is HORECA businesses, brand owners and potentially retailers, or tertiary packaging service users and potentially third-party logistics providers, as appropriate to the sector.

- One approach would be to require every packaging user within the sector to meet the proposed targets;
- another approach would be to apply the obligation to the larger actors that make up a majority of the market share (e.g. 80% of the market share) by applying a de minimis threshold for the size of business obligated.

As per Measure 2, it may be challenging to delegate the obligation to a group of businesses to collaboratively and voluntarily meet the target, for example coordinated by a PRO, and coming up with a contractual basis for collective responsibility may also be difficult. Different approaches may be more or less feasible for different sectors. For example, the obligations for the HORECA sector could likely be met by each individual business with no de minimis threshold, owing to the market maturity of a range of existing modes for delivering reuse in the sector. For grocery and retail, an alternative approach would be for retailers to have the obligation in terms of their product ranges, with or without de minimis threshold. The disadvantage of the obligation being on brand owners coupled with a de minimis threshold is that the market for smaller suppliers to specialise in product ranges delivered in reusable packaging, or smaller third-party reusable packaging suppliers, is not influenced, and the chance for these smaller businesses to contribute to meet the target is lost without efforts to engage them directly in the process of meeting a Member State level target. If the obligation is placed on retailers, these benefits can still be gained. In addition, where the target states "option provided" – the responsibility would have to lie with the retailer. The *de minimis* threshold could be set very low such that the synergy between smaller retailers and smaller suppliers would be encouraged, and only the smallest convenience stores and kiosks need be

exempt on the grounds of space limitations. For tertiary packaging, either individual businesses or a cohort of businesses would need to have the responsibility for meeting the targets, but depending on the market structure, third party logistics companies could also be effective points of 'ownership' for delivering the targets.

2.5 Links to other measures

Measure 8 – implementing sector by sector reuse targets as a % of product sales/trips – has the major distinction, compared to overarching waste reduction targets with reference to a baseline year (as per Measure 2 or Measure 9), that it does not necessarily constrain total packaging waste generation to produce an absolute reduction. At lower levels of reuse, the total waste generated can still grow, but will do so at a slower rate. For there to be an absolute reduction in waste generated, the sector by sector reuse targets would have to be set more ambitiously, if they are used alone to drive an absolute reduction in packaging waste generation.

However the sector by sector reuse targets have the advantage that they spread action across different sectors for which a diverse range of reuse packaging formats and systems would need to be developed; giving a clearer signal as to where action must be taken and investment and development made, and ensuring a harmonised approach between MS. In this sense, they can be considered to complement an overarching cross-sectoral target. When implemented together, Measure 8 is one of the key mechanisms by which the targets in Measure 2 would be achieved; and would provide the key guidance required for Measure 9 to be successfully implemented.

Measure 8 is linked to Measure 7 in that all-material bans are equivalent to 100% reuse targets. Bans on plastic items in Measure 7 are complemented in Measure 8 by reuse targets on remaining materials, to avoid material switching in preference to waste reduction. As detailed above, the measures are designed to be complementary and not be overlapping in terms of the categories in scope. Measure 8 is linked to measures 10, 11 and 12, on reuse guidance/standards, reuse advisory bodies, and labelling respectively, in that they are all considered to be supporting measures to enable the significant transition in how products are supplied and transported for successful delivery.

2.6 Assessment of Measure 8a: Voluntary reuse targets (as % product sales/trips in reusable packaging, in number of items), EU level

2.6.1 Effectiveness

Table A-4 shows the effect on packaging waste generation of voluntary sector by sector reuse targets as specified in the impact assessment, for 2030 and 2040. For reference, the quantity of packaging waste generated in EU in 2018 is estimated to be 77.8mt.

Relative to the 2030 baseline, the measure achieves a modest reduction of 2.2mt of packaging waste, 2.4% less than would otherwise have been generated. By 2040, this becomes a reduction of 6.9mt – this is 6.4% less than the counterfactual in 2040.

Table A-4 Changes in Packaging Waste Generation [thousand tonnes] by Material, Measure 8a

Material	Change in 2030	Change in 2030 (%)	Change in 2040	Change in 2040 (%)
Glass	-113	-0.8%	-393	-2.5%
Steel	13	0.5%	22	0.8%
Aluminium	-5	-0.5%	-23	-2.2%
Paper / board	-1,931	-5.1%	-5,665	-13.0%
Plastic	-137	-0.7%	-792	-3.0%
Wood	0	-	0	-
Other	0	-	0	-
Total	**-2,173**	**-2.4%**	**-6,851**	**-6.4%**

Table A-5 shows the overall outcome of voluntary sector by sector reuse targets in terms of percentage of product sales/trips in reusable packaging. Relative to the baseline, where a decreasing share of reused packaging is modelled by 2030 and 2040 compared to 2018 (from 3.5% down to 2.4% and 2.2% respectively), the measure achieves an increase. By 2030 and 2040, the share of reused packaging is 4.1% and 6.1%.

Table A-5 Percentage of product sales/trips in reusable packaging (in number of items), Measure 8a

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Glass	41.7%	30.9%	31.8%	+0.9%	26.7%	30.0%	+3.2%
Steel	0.1%	0.0%	9.2%	+9.2%	0.0%	16.7%	+16.7%
Aluminium	0.7%	0.5%	0.5%	-	0.4%	0.4%	-
Paper / board	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Plastic	1.8%	1.8%	4.1%	+2.3%	1.8%	7.0%	+5.2%
Wood	69.0%	69.0%	69.0%	-	69.0%	69.0%	-
Other	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Total	**3.5%**	**2.4%**	**4.1%**	**+1.7%**	**2.2%**	**6.1%**	**+3.9%**

2.6.2 Ease of implementation

This may be addressed from two points of view; one is the feasibility of implementing the targets as a command-and-control measure, and one is the feasibility of how the targets may be met. However there are underlying factors at play that produce a correlation in the feasibility of both, so they are both touched on below.

The major challenges for this measure in terms of the implementation are:

- Setting up appropriate reporting on % sales/trips in reusable packaging, which is novel
- Establishing the best economic actors to assign the responsibility for meeting targets and how, such that responsibility and competence are aligned, to produce a workable chain of management for the measure.
- Ensuring widespread participation in action to meet voluntary targets.

For Measure 8a, the latter is a key consideration: as these targets are voluntary, knowing that no sanctions will apply should they be missed, many stakeholders may not engage with the objectives. They would not therefore experience any implementation difficulties. However this is also a key problem with voluntary approaches – as stakeholders cannot be obligated, none wish to bear a cost that competitors do not, leading to reduced participation, making meeting targets very challenging if not impossible. In this sense, voluntary targets can be more difficult to implement. However, for the purposes of the present discussion, we shall assume that stakeholders attempt to try to meet these targets in good faith, because having clear expectations made public creates a defined path of action, which may overcome a barrier to action, a moral imperative to participate, and public accountability with respect to outcomes. The absence of the need to enforce the measure will make it easier to implement from the perspective of the Commission.

For sectors where return-on-the-go or return-from-home systems are most likely to be the predominant reuse system, this measure is likely to be seen as particularly challenging to meet for those product manufacturers who have typically not been taking their products to market in reusable packaging, and do not have experience of the format, and where systems for handling the packaging and returning it to use either do not yet function at scale or are not widespread across MS. This will also be the case for retailers that currently have no exposure to take-back systems. Even where reusable packaging formats and systems are well established, the reconfiguration of supply chains (in particular, increasing the number and distribution of pack-filling/bottling plants, and developing pathways for shipping in bulk) and the need for reconditioning plants/equipment, is likely to be received as an unwelcome or even considered an impossible to meet requirement for investment. The increased allocation of retail space for take back and interaction with reverse logistics requirements will also involve significant effort from retailers. For refill on the go in retail premises, reconfiguration of the store for dispensing purposes for bulk sales, will also involve significant effort. However, the lower level of ambition and the targets' voluntary nature may mitigate these concerns.

For some sectors, especially those that maybe easily served by consumer-led systems (refill on the go for HORECA sector, particularly), meeting any voluntary target set at a modest level, should not be very difficult and can be done with minimal investment.

For sectors where reuse is better established at scale and in a full range of supply chains lengths (i.e. long supply chains being the most difficult), like for tertiary packaging, these targets are not likely to be perceived as so challenging, especially given their voluntary nature.

The ease of monitoring and reporting is also sector and product dependent. Different sectors are likely to collect and collate information on transactions that may be harnessed for the purposes of the reporting envisaged here, to differing extents and in different ways.

Based on existing sources of data on reuse, some sectors and product/packaging groups already collect the data required to report on reuse (e.g. primary packaging – from refillers; and tertiary packaging – via packaging owners and leasers, or reconditioners, which also maybe the same economic actors). This may be true of other stakeholders, but only for internal purposes. Where data is already collected, the additional step necessary is the collation of data on trips in reusable packaging and its aggregation with the remainder of the market (i.e. single-use packaging), for which packaging PoM by number of items reports number of uses directly, and which is already collected for commercial purposes and some of which is reported (e.g. under the provisions of the SUPD), or is used as the basis of weight based reporting (e.g. under the provisions of the PPWD). The task required subsequently is to develop a platform and method for aggregating the units for the correct product/packaging categories (as, for example, a module of an EU or national packaging register). Sectors which participate in return on the go already are likely to be able to report on pack filling/bottling in reusables through existing information flows (e.g. beverages – either refilling statistics recorded by the bottler or collection statistics recorded by the collection operator), that can be combined with data on the whole market for that product group, in a similar way.

For other sectors or product/packaging groups, appropriate channels for information flow may be in place but one or more additional 'attributes' need to be added to it in order to report on reuse. And for others, data collection may be more of a capacity that would need to be developed *de novo*.

For example, in order to understand how different reuse systems could be monitored, one way of approaching this is to determine how sales in e.g. the HORECA sector are tracked and how they can be disaggregated into eat-in and takeaway food transactions, and then for takeaway food, how these transactions can be further disaggregated into those delivered via either reuse (both consumer-led or industry led systems), or, single-use packaging. A precedent of relevance already exists in some countries where eat-in, hot takeaway and cold takeaway food is registered at the till for the application of different VAT rates. The system could be extended to understand reuse rates. For grocery/retail, a similar exercise would be needed so the most suitable ways of attributing the transaction to packaging type can be found, for each reuse mode and product class.

An alternative approach would be to base the data structure entirely on packaging PoM for both reusables and single-use items, and then use an auditing strategy to estimate the average number of rotations for different packaging types for the relevant product/packaging categories, in different MS. This may be a more cost-effective approach, especially in the interim. However it will not yield as accurate data. Or for some items, especially for those which refill may not be registered with a transaction, relying on reduction in SU item PoM as a proxy may be a useful fallback.

From the Commission's point of view, a Directive would place the obligation upon the Member State, representing a simple implementation approach. However because of how key this is to the success of the measure, to help protect the single market and harmonise activities, it may wish to participate in the development of further guidance on who the obligated parties should be, which will be more challenging. The best economic actors upon which to place obligations will depend on the product/packaging group and they may each have different, complementary

responsibilities with regard to that group. In general, it is end users of the packaging such as logistics companies, product manufacturers, and HORECA businesses, that unite purchasing decisions around single-use versus reusable packaging in a single group, and hence may represent the most powerful point of leverage for implementing reusable packaging and in turn reuse targets. In addition, they also have the ability to provide many of the types of data required for reuse reporting. In addition, retailers in particular would likely need to be subject to an obligation to support this for some product/packaging groups, whether to provide dispensing infrastructure or take-back facilities in store as appropriate to the reuse system, or as the best point of collation of data on share of reusable packaging. It may be decided that retailers would be suitable actors upon which to place reuse obligations for certain product/packaging categories, as they also make stock and purchasing decisions that can significantly influence this.

2.6.3 Administrative burden

Costs incurred for meeting legal obligations to provide information, for this measure are expected to derive from monitoring progress with respect to the targets. This would lead to some new regulatory burdens on business.

In general, the Directive can specify what is to be achieved and issue guidance or decisions on options for reporting and delegation of responsibilities; but ultimately it is usually up to Member States to decide how to achieve the goals of the Directive. Therefore the method for implementing reporting requirements is still to be determined; e.g. whether it is done via an auditing process (which samples a subset of business for compliance) or obligated reporting (where a whole market estimate is made), which in turn could be done by an auditing approach (quantifying performance for a representative subset of business that is then grossed up to the whole market) or a 'big data' approach (where every business reports). Likewise, who these obligations fall to is still to be determined; the burden could fall entirely on businesses, or on public authorities, or a mixture of both, depending on the method. Ultimately the information would be transferred to public authorities, or potentially this could be part of the role of advisory bodies (qv Measure 11), who would have to evaluate the information supplied.

Distinguishing the business as usual element from the administrative burden within the total administrative costs is challenging as different sectors are likely to collect and collate information that can contribute to reuse reporting to differing extents and in different ways.

2.6.4 Economic impacts

The economic impacts that have been quantified for Measure 8a in the impact assessment are summarised in Table A-6. As for other intervention areas, these do not represent costs that can be summed, but are in the main, an indication of how costs are redistributed between economic actors in different sectors. Some costs have not been quantified directly but the nature of and magnitude of these, and the relationship between different costs, where of note, is also discussed in the text.

***Waste management*.** A saving on EPR fees and one-way DRS, owing to the reduction in the growth of waste packaging brought about by the use of reusable packaging, is calculated to be -€308m by 2030 and -€1,109m by 2040, relative to counterfactuals in the same years. This is replaced instead with increased costs as a result of the setting up and operating of reuse schemes, "**Capital and operating costs of Reuse systems**" at €1,027m and €2,766 in 2030 and 2040 respectively. This however may also be viewed as the basis of revenue for reusable

packaging operators and reconditioners, as this amount, plus profit, also represents a service sold.

Turnover for packaging producers. The net change is calculated to be -€11.2bn in 2030 and -€35.5bn in 2040. This takes into account a decrease in the sales of single-use packaging and a smaller increase in sales for reusable packaging (the first time it is placed on the market, and not for subsequent rotations). This is a large sum, but it must be noted that this is turnover, rather than profit. It also represents, to an extent, the cost saving to reusable packaging users from not having to buy single use packaging on an ongoing basis.

Material savings. These are calculated to be -€1,138m in 2030 and -€3,414m in 2040 and represent the value of raw material that is no longer utilized as a result of reduction in packaging manufacture. For some intervention areas, this is a saving that accrues to packaging producers (for example when incorporating recycled content into an item, or lightweighting it). However for reuse, the benefit of this avoided cost is not captured by packaging producers, but instead is countered by the value that reusable packaging owners can generate from selling packaging multiple times as a service (accruing to reuse system operators), or the cost saving from not having to buy single use packaging on an ongoing basis (which accrues to reuse system users such as packfillers or consumers, depending on the reuse system in question). In both cases, material savings represent a loss to economic actors who produce and trade primary materials.

Table A-6 Summary of Economic Impacts for Measure 8a

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – EPR fees	-266	-953
Waste management – one-way DRS costs	-42	-156
Packaging Producers – SU Packaging Turnover loss	-11,189	-35,533
Packaging users – Material savings	-1,138	-3,414
Capital and Operating costs of Reuse schemes (including refillable DRS)	1,027	2,766

Each of the above categories capture the main drivers of cost, however, there are further elements that are not yet quantified. They are either considered smaller in magnitude, or the research effort required to quantify them where there is such limited data availability was considered to be a level of analysis disproportionate to the task in hand. They are discussed below.

Operating costs

- Transition to reusable packaging systems will incur costs for research and development of reusable packaging and infrastructure, supply chain design and development, training

for and adoption of new practices. These would be borne by packaging manufacturers, reuse system operators, and reuse system users. The quantified costs relate to the implementation of a system once designed or optimised.

- Some businesses – reuse system users e.g. in retail, HORECA or logistics – may require different or more warehousing and retail space, although much can be done to adapt existing space and it is not clear what the net effects will be as there are also negative drivers of space requirements (such as for handling and storage of waste).
- Related to this, the reduced labour requirement for these users for the handling waste at the point of generation is not captured, though this is replaced by handling for return of reusable packaging (which is captured).

Capital costs

- There will be opportunities to offset some of the potentially increased capital costs for reusables (such as plant requirements for packfilling/bottling and reconditioning) by leveraging the existing investment cycle when plant for single-use packaging packfilling/bottling would come to the end of its life. This depends on the timescales for investment in capacity for single-use plastic packaging manufacture compared to the timeframe envisaged/required for transition to reusable packaging.

General considerations with respect to economic impacts on businesses

Opportunities for new business and risk of business closure. There are risks but also opportunities for businesses involved in the packaging supply chain associated with a transition to reusable packaging. These are less pronounced for low levels of adoption of reusable packaging and increase as the percentage share increases. They are also product and packaging group dependent. For the manufacture of reusable packaging and the operation of reuse systems, there will be both opportunities for new businesses, and there should also be ample opportunity for existing businesses to adapt their business models and approaches. Some business may be at risk of closure, depending on what their specific portfolio of packaging products is. For example, where businesses only supply single-use packaging of a type where re-use was mandated at 100%, with alternative re-usable packaging requiring a completely different type of manufacturing process, the business may be at risk of closure. This is not likely to be an issue for any of these voluntary targets, as there is more leeway to arrive at a level somewhat below the highest suggested targets, and no target is proposed at 100%.

SMEs. SME retailers may find it more difficult to accommodate particular reuse systems (because of space limitations). In addition, SME producers of products have less ability to absorb investment costs internally or to drive economies of scale and are more likely to have to pass more of any increase in cost onto consumers in the product price. This risks putting them at a competitive disadvantage, at least initially when capital investments are taking place or reuse systems are not yet widely operated at scale. For lower levels of percentage share of reuse, such as those expected to be arrived at under a voluntary system, these factors are expected to be less of an issue and these small businesses may simply not participate in the effort if they do not want to or cannot bear the costs. It is worth bearing in mind that some reusable packaging formats and systems in some sectors presently do or will constitute a cost saving and so are not always more problematic for SMEs (e.g. customer led refill for HORECA businesses).

Distribution of impacts between MS. Under a voluntary target regime, there would be more divergence between Member States and between competing business in terms of activities and

progress to target, and this could disrupt the single market more than a mandatory regime; this is mitigated by the expected lower attainment of percentage share of reusable packaging under the voluntary regime. In terms of how effects on packaging manufacturers and producers of products would be distributed across Member States, aside from the variation introduced by the voluntary nature of the targets, those countries where a high volume of single-use packaging is manufactured, or products are sold in single-use packaging, will be more affected than those for which this is not the case, assuming equal participation. Businesses that manufacture reusable packaging that would expect to grow their market share may also not be evenly distributed across Europe.

Effect on product choice as marketing strategy. There are potentially negative implications for the range of products that it would be possible to market and sale within a given unit of retail space, if percentage share of reusable packaging use increases. This is highly product/packaging group and reuse system dependent, and also depends on the extent to which space is a limiting factor for the reuse system user (retail/HORECA). Innovations in bulk delivery at point of sale may also help mitigate these effects, especially for liquid products. Again, given the voluntary nature of these targets, overall, these effects are not expected to be as pronounced as for other measures, but the divergence of participation and hence performance between actors will lead to exposure to this being more unevenly distributed between producers of products. This possibility is likely to contribute to reluctance to participate in the transition to reusable packaging at all – which would jeopardise the meeting of any target.

Implications for imported goods. With regards to the playing field for imported goods versus EU products, packaging options possible may not be consistent between them, in terms of the feasibility of transition to reuse, leading to less adoption in the case of voluntary targets, for producers of imported products and their retailers. For voluntary targets therefore, they may be advantaged by reduced participation in meeting any target. For example, if some of the relevant reuse systems are not as feasible with intercontinental supply chains, participation would fall disproportionately in the segment of the market with intra-EU supply chains. The extent to which these issues would occur is all however highly speculative at present, as the feasibility of reusable packaging deployment in different contexts will change over time. A good proportion of product groups under consideration are already shipped in bulk intercontinentally or EU-wide and packed/bottled nationally either as widespread practice or as well-established precedents. This lends itself to adaption to environmentally sound return on the go/return from home models with more distributed and local packing/bottling facilities, or refill on the go models particularly – but even refill at home could grow by supply chain restructures of this type. The range of products for which this is practiced can be expected to increase over time.

Implications for longer versus shorter supply chains intra-EU. Because returnable reusable packaging often tends to operate in smaller geographic areas, with shorter supply chains, related to the need to keep the financial and environmental costs of return within reasonable limits, it is often assumed that this is an intrinsic property of the systems. If this was the case, it could affect competitiveness of goods with short versus long supply chains, or national and international supply chains, favouring shorter or more local supply chains (under mandatory targets particularly, as under voluntary targets those at a competitive disadvantage may not participate). However the considerations above show that this association between reuse and short supply chains is not inevitable, and that supply chain length is not necessarily correlated with feasibility of reusable packaging use, but depends on other features of supply chain structure, such as a distributed network for reconditioning and packfilling/bottling that is

close to the end user/customer that can interface *either* with a local point of manufacture (as in short, local supply chains), *or* crucially, a bulk distribution element of the supply chain (as in intra and intercontinental supply chains).

Implications for exported goods. With regards to exported goods, no market barrier is posed if other markets have less stringent packaging requirements with respect to reusable packaging, as would likely be the case. If an external market had more stringent requirement for lightweighting of packaging that did not make an exemption or allowance for reusable packaging, this could pose a market barrier. If a large proportion of a particular product is exported, and return of packaging was not feasible, the product manufacturer might struggle to meet reuse targets. This would not be so problematic under a voluntary system because of the lower percentage shares in question and the option not to participate in target achievement.

Impacts on consumers and households. The measure constitutes both positive and negative drivers of different aspects of consumer choice; it can be expected to increase the availability of reusable packaging options for consumers who want more sustainable packaging choices. However, as mentioned above, there may in some cases be a smaller range of products available for consumers per unit area of retail space (for refill on the go, grocery). Prices may be affected by different packaging modes (with initial costs expected to be higher but to reduce over time for reusable packaging). For some refill systems in particular there may be cost savings owing to reduced requirements to purchase single-use packaging on an ongoing basis, so higher initial outlay for purchase of reusable packaging is offset by longer term savings. For refill on the go systems there will be a small increase in cost related to reconditioning (washing) of reusable packaging; at the same time, the non-monetized benefit of saved time on household waste management could offset this.

2.6.5 Social impacts

This measure would result in a net creation of 335k jobs in 2030, relative to the counterfactual in 2030, arising from:

- Creation of 433k jobs in the reuse sector
- Loss of 98k jobs in manufacturing, recycling and waste treatment industries, due to the reduced generation of packaging

Table A-7 Summary of Change of Employment for Measure 8a

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	2040
Manufacturing	-95.3	-295.3
Recycling (incl. collection)	-2.7	-11.5
Residual Treatment (incl. collection)	-0.3	-0.9
Reuse	432.9	1,001.8
Net Change in Employment	**334.6**	**694.1**

By 2040 this reaches a net creation of 0.7m jobs as a result of the creation of 1.0m jobs in the reuse sector and the loss of 308k jobs in manufacturing and waste management.

The types of jobs created for the reuse sector would be in logistics and reconditioning, as well as maintenance of infrastructure for take-back, dispensing and refill in retail. The majority of the job types affected might be classed as low skilled. There will be higher skilled jobs created in design of packaging and supply chains (which are not included in the above table). Jobs in logistics involving management or vehicles would be classed as higher skilled. In reconditioning and maintenance, there would be higher skilled roles in management.

General considerations with respect to the geographic distribution of changes in jobs

- The distribution of changes in employment geographically relating to packaging manufacture between MS will depend on the market structure across Europe – i.e. the geographic distribution of businesses of different sizes that manufacture packaging across Europe, as well as their ability to adapt to manufacturing reusable packaging. For the other relevant sectors (logistics, reconditioning, infrastructure maintenance), this would be fairly evenly spread between countries.
- The supply chain reconfiguration likely associated with some reuse systems (return on the go and return from home in particular) would lead to a more even spread of jobs, nationally. This would be highly beneficial for regional development and the equitable distribution of economic opportunities within a country, though it would come at a cost for the employees of the manufacturers or operators of centralised plants. In turn, where packaging/bottling is centralised on an EU scale, there could be expected to be a more even spread of these jobs between MS, which is beneficial, however this could be at the expense of specific MS where larger plant currently operates.

General considerations with respect to other social impacts

Public health

- The measure can and should be implemented in such a way as to not impact the safety or quality of consumer goods.
- If reusable packaging is properly regulated with regard to food safety, there should be no change in health risks due to substances detrimental to health or the environment
- Positive health benefits will directly accrue from reduced pollution associated with avoided production of single-use packaging items. This will be offset to an extent by the production and reconditioning of the reusable packaging necessary to replace them.
- Health benefits will indirectly accrue from reduced GHG emissions and air pollution (see section 2.6.6) and improved local environmental quality (reduction in litter and plastic pollution).

Non-discrimination, equal access to opportunities, and rights of persons according to gender, ability, socio-economic status and location.

- Disabled or elderly consumers may find behaviour change required to participate in reuse systems more challenging, however there should always be options available for provision of goods such that impacts are minimised, whether in terms of reuse mode (for example return from home could be made available for those unable to

access return points), reusable packaging type (for example MU plastic tableware for those for whom it is not as safe to use metal), or the ability to procure and use single use items if necessary on medical grounds (like bendable straws); good format and system design should also mitigate most of this issue – for example in the ease of opening and closure of packaging. Therefore there should be little difference in access to goods and services for any groups of individuals based on these characteristics as a result of transition to reusable packaging.

- There have been concerns that consumers in rural settings may have less access to products if reuse is more difficult in remote places. Under a voluntary approach, this is unlikely to become an issue. And even if targets were mandated at a higher level, particular reuse systems, leveraging reverse logistics (if you can ship packaging out you can ship it back), could lend themselves to these contexts to mitigate any issue of this kind.

Personal data

- The collection of personal data would likely only be a feature of some reuse systems for management of deposits and other incentivisation schemes and is not an intrinsic feature.
- Where applicable it should be done in a way that meets data processing law/requirements and hence is not considered a significant impact.

2.6.6 Environmental impacts

The changes in GHG/AQ externalities (i.e. monetized costs) associated with manufacturing, recycling, incineration, landfill and reuse-associated activities (logistics and reconditioning) are shown in Table A-8. The values estimated by the CBA model do not include GHG/AQ externalities for transport (from manufacturer to packaging user) or collection and sorting.

For these waste management activities, it is interesting to note that the change in GHG/AQ externalities are the same order of magnitude as reduced waste management costs themselves.

Table A-8 Summary of Environmental Impacts for Measure 8a – restricted scope

Environmental impact	Estimated impact (relative to baseline)	
	Change in 2030	Change in 2040
Change in water use, thousand m^3	-47	-146
Change in GHG/AQ externalities, € million	-305	-1,234

In Table A-9, changes in GHGs are presented for the full scope of activities. By 2030, the increase in reusable packaging is estimated to lead to a net decrease in emissions of -882kt, increasing to -3,905kt in 2040. The greatest emissions savings come from the reduction in manufacturing emissions. The additional transport and washing required for reuse systems is the most emissions intensive sector.

Table A-9 Summary of change in GHGs for Measure 8a – full scope

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Manufacturing	-1,122	-3,912
Transport	-391	-1,233
Collection	-98	-308
Sorting	-7	-21
Recycling	-277	-71
Incineration	-160	-647
Landfill	-60	-157
Reuse (Transport and Washing)	1,232	2,444
Total	**-882**	**-3,905**

In general, the measure should lead to more sustainable production and consumption, and the quantitative assessment indicates that it will lead to businesses becoming less polluting. It should reduce the use of non-renewable resources (principally oil feedstock for plastic). There is the additional benefit of a high likelihood of reduced packaging pollution (litter), especially deriving from on-the-go items, which can be expected to lead to reduced water pollution. The measure may also affect the flow and quality of waste sent to third countries for recycling, and therefore the resultant environmental impacts from its management.

2.6.7 Stakeholder views

Many stakeholders (mostly industry) rejected targets entirely, or stated that not enough information was available to set targets at this point in time; though some industry stakeholders provided suggestions for targets that are outlined in section 2.4.2. Most stakeholders, especially NGOs, advocate for mandatory targets as opposed to voluntary targets, on the grounds of the better harmonisation in the single market for mandatory targets, as well as efficacy. One industry stakeholder explicitly states that reuse systems should be encouraged but not mandated, especially not at the cost of the overall carbon footprint of the packaging model.

2.7 Assessment of Measure 8b: Mandatory reuse targets (as % product sales/trips in reusable packaging, in number of items), MS level – low.

2.7.1 Effectiveness

Table A-10 shows the effect on packaging waste generation of the lower-level mandatory sector by sector reuse targets, for 2030 and 2040 respectively. For reference, the quantity of packaging waste generated in EU in 2018 is estimated to be 77.8mt.

Relative to the 2030 baseline, the measure achieves a reduction of 4.5mt of packaging waste, 4.9% less than would otherwise have been generated. By 2040, this becomes a reduction of 14.2mt – or 13.3% less than the counterfactual in 2040.

Table A-10 Changes in Packaging Waste Generation [thousand tonnes] by Material, Measure 8b

Material	Change in 2030	Change in 2030 (%)	Change in 2040	Change in 2040 (%)
Glass	-324	-2.2%	-1,138	-7.2%
Steel	23	0.(2%	34	1.3%
Aluminium	-17	-1.7%	-70	-6.5%
Paper / board	-3,865	-10.2%	-11,334	-26.1%
Plastic	-313	-1.5%	-1,693	-6.5%
Wood	0	-	0	-
Other	0	-	0	-
Total	**-4,495**	**-4.9%**	**-14,201**	**-13.3%**

Table A-11 shows the overall outcome of the lower-level mandatory sector by sector reuse targets in terms of percentage of product sales/trips in reusable packaging. Relative to the baseline, where a decreasing share of reused packaging is modelled by 2030 and 2040 compared to 2018 (from 3.5% down to 2.4% and 2.2% respectively), the measure achieves an increase. By 2030 and 2040, the share of reused packaging is 5.9% and 10.3%.

Table A-11 Percentage of product sales/trips in reusable packaging (in number of items), Measure 8b

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Glass	41.7%	30.9%	33.5%	+2.5%	26.7%	36.0%	+9.2%
Steel	0.1%	0.0%	16.9%	+16.9%	0.0%	28.8%	+28.8%
Aluminium	0.7%	0.5%	0.5%	-	0.4%	0.4%	-

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Paper / board	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Plastic	1.8%	1.8%	6.4%	+4.6%	1.8%	12.2%	+10.4%
Wood	69.0%	69.0%	69.0%	-	69.0%	69.0%	-
Other	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Total	**3.5%**	**2.4%**	**5.9%**	**+3.5%**	**2.2%**	**10.3%**	**+8.2%**

2.7.2 Ease of implementation

The considerations with respect to ease of implementation are very similar to those for Measure 8a (Section 2.6.2). The major contrast is that Measure 8b consists of mandatory versus voluntary targets. The expected percentage share of reuse attained is therefore higher.

The additional consequences of these two points are as follows:

- There will be a need to enforce the attainment of targets at MS level, which will place more burden on the Commission
- The threat of sanctions will provide a bigger impetus for all relevant stakeholders to participate in meeting the target, representing a more reliable mechanism for implementation, which can be viewed as making implementation easier.
- On the other hand, in contrast to the voluntary approach, given the obligated actors cannot choose not to comply, performance against the targets, and corresponding effort required, can be expected to be greater, which will be more challenging for obligated actors.

2.7.3 Administrative burden

As for Measure 8a (see Section 2.6.3).

2.7.4 Economic impacts

The economic impacts quantified for Measure 8b are summarised in Table A-12. See the description for Measure 8a for an explanation of the cost breakdown (Section 2.6.4).

Table A-12 Summary of Economic impacts for Measure 8b

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – EPR fees	-533	-1,913

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – one-way DRS costs	-126	-444
Packaging Producers – SU Packaging Turnover loss	-22,601	-71,756
Packaging Users – Material savings	-2,318	-6,941
Capital and Operating costs of Reuse schemes (including refillable DRS)	2,113	5,716

Each of the above categories capture the main drivers of cost, however, there are further elements that are not yet quantified. They are either considered smaller in magnitude, or the research effort required to quantify them where there is such limited data availability was considered to be a level of analysis disproportionate to the task in hand. They are identical in nature to those for Measure 8a, to which the reader is referred for details (Section 2.6.4). However, because the level of percentage share of reused packaging attained will be greater than the voluntary approach, they will be greater in magnitude, in what is expected to be a proportionate relationship.

Additional considerations for Measure 8b, owing to their mandatory rather than voluntary nature are as follows:

Market restrictions and risk of business closure. 100% targets under a mandatory regime constitute the restriction of certain single-use packaging items from certain applications. If a business only produced single-use packaging for the market in question, and could not adapt to producing reusable packaging, it would be at risk of closure. However, 100% targets have not been specified in this measure, and the categories for which very high (80-90%) targets have been specified do not match this scenario, by design (e.g. B2B packaging, beverage containers). Additionally, only products that could be sold in reusable packaging and hence single-use packaging was not considered a necessity were included in the scoping exercise, so likewise there should not be a threat to producers of products that for some reason must be sold in single use packaging.

SMEs. In relation to the challenges faced by SMEs with respect to accommodating reuse systems, achieving economies of scale, or absorbing investment costs, these are more acute under a mandatory regime. The measures may require some *de minimis* threshold for obligation to allow for better establishment of systems in the market prior to mandating a particular level of adoption for SMEs. However this would be sector specific and would be more necessary for SMEs that are producers of products; for retailers and the HORECA sector, appropriate choice of reuse system and optimisation of the system can obviate the need for derogations on the grounds of space; for users of reusable packaging already operating at scale (e.g. some types of tertiary packaging, refill on the go in the HORECA sector), the cost differential is already advantageous to end users. As obligated parties are likely to be determined by Member States, such thresholds if deemed necessary should also be determined by Member States, however this could be the subject of guidance issued by the Commission (e.g. as part of Measure 10).

Distribution of impacts between MS. For mandatory targets, there would be less divergence of activities and progress to target between Member States and also competing enterprises than under a voluntary regime. In terms of how effects on packaging manufacturers and producers of products would be distributed across Member States, those countries where a high volume of single-use packaging is manufactured, or products are sold in single-use packaging, will be more affected than those for which this is not the case. Businesses that manufacture reusable packaging and who stand to gain market share may also not be evenly distributed across Europe.

Effect on product choice as marketing strategy. With respect to the influence of increasing the share of reusable packaging formats/systems on product range and marketing opportunities afforded by this, the more harmonised approach to implementation associated with a mandatory approach maintains a level playing field, so that no producers are disadvantaged relative to others in this respect both between and within MS.

Implications for imported goods. The influence of mandatory reuse targets on goods imported to the EU depends firstly on whether deployment of reusable packaging is less feasible for them; and secondly whether they are excluded or included within the scope of a mandatory target. In the cases where deployment of reusables is less feasible, exclusion from the obligation may give producers of imported products and their retailers a competitive advantage, if deployment of reusables entails more cost for EU users. Inclusion in the obligation, may constitute a barrier to market, at least until solutions are found. However it could have the benefit of driving the development of intercontinental reuse systems. This in turn would make it easier to operate an inclusive system for requirements with respect to exports. Current essential requirements and EPR requirements are all applied to importers of packaging and packaged products, and so there is a general precedent for this mode of implementation.

Implications for longer versus shorter supply chains intra-EU. As introduced in Section 2.6.4, there is the possibility that some businesses could be at a competitive disadvantage when adopting reuse systems based on the length of their supply chain generally, it being an observation that many current systems operate on a more local basis. The concern is that longer supply chains are less amenable to application of reusable packaging formats/systems. This would be more of an issue under a mandatory target where there is less leeway not to participate in efforts to meet the target for businesses with longer supply chains. In the short term, businesses that already operate on a more local scale might find there to be less cost involved in adapting their supply chain to reuse systems, whereas businesses operating longer supply chains will face a more costly task. However in the long run, even long supply chains can be adapted to reuse systems through bulk shipping and increasing the number and distribution of packing/bottling centres, and costs could be mitigated by taking advantage of the existing investment cycle.

Implications for exported goods. No market barrier is posed if extra-EU markets have less stringent packaging requirements with respect to reusable packaging, as would likely be the case. If a large proportion of a particular product is exported, and return of packaging was not feasible, the product manufacturer might struggle to meet reuse targets. Under a mandatory target, there could be a blanket exemption for exports to deal with this – but alternatively, if *imports* were dealt with in a more inclusive way, as per EPR requirements at present, then this can drive both broader change in extra-EU markets and, could also make requirements on exports more feasible.

2.7.5 Social impacts

This measure would result in a net creation of 1.2m jobs in 2030, arising from:

- Creation of 867k jobs in the reuse sector
- Loss of 199k jobs in manufacturing, recycling and waste treatment industries, due to the reduced generation of packaging

Table A-13 Summary of Change in Employment for Measure 8b

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	**2040**
Manufacturing	-192.1	-595.1
Recycling (incl. collection)	-5.8	-24.2
Residual Treatment (incl. collection)	-0.6	-2.0
Reuse	866.6	2,006.0
Net Change in Employment	**668.1**	**1,384.8**

All other considerations for which qualitative discussion appears in Section 2.6.5 for Measure 8a, apply here. All the impacts are expected to increase in magnitude in keeping with the higher percentage expected under this mandatory set of targets. The additional considerations are:

- For mandatory targets, under an inclusive system for imported goods, jobs would be likely to increase for to packing/bottling imported products at the expense of those extra-EU. This shift is unlikely to be seen under a voluntary scheme, in which importers and sellers of extra-EU goods are unlikely to participate.
- Although there are concerns that mandating re-use could result in a *de facto* ban for certain types of businesses that currently rely on single-use packaging, and could lead to closure of business and hence change in employment levels for this reason, these product/sector groups are either not included in the targets, or proposed targets are not set at 100% for these expressly to allow adaptation and still maintain a level of choice for the consumer while alternative modes of product delivery are in development.

2.7.6 Environmental impacts

Table A-14 presents a summary of the environmental impacts for Measure 8b associated with manufacturing, recycling, incineration, landfill and logistics and reconditioning for reuse. See Section 2.6.6 for details on this classification. Table A-15 provides the changes in GHGs for the full scope of activities.

Table A-14 Summary of Environmental Impacts for Measure 8b – restricted scope

Environmental impact	Estimated impact (relative to baseline)	
	2030	2040
Change in water use, thousand m^3	-99	-304
Change in GHG/AQ externalities, € million	-610	-2,468

Table A-15 Summary of change in GHGs for Measure 8b – full scope

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Manufacturing	-2,433	-8,410
Transport	-809	-2,556
Collection	-202	-639
Sorting	-14	-44
Recycling	-370	424
Incineration	-328	-1,319
Landfill	-120	-313
Reuse (Transport and Washing)	2,485	4,947
Total	**-1,791**	**-7,910**

There are no additional considerations regarding this Measure than those presented for Measure 8a in Section 2.6.6, save for that fact that the impacts are all greater in magnitude in keeping with the larger percentage share of reused packaging expected to be achieved under a mandatory regime.

2.7.7 Stakeholder views

There is consensus among stakeholders that there cannot be an overall reuse target, but that it must be differentiated by sector, packaging type and purchasing model (e.g. physical vs online retail). Industry stakeholders, in particular, state that the suitability of reuse, and any associated targets, should be assessed through rigorous and comparable life cycle assessments, regardless of the feasibility of doing this. Some sectors, such as the beverage industry or transport logistics, are considered obvious candidates for reuse targets, whereas others (e.g. food, cosmetics) are less well developed and would require more development before any targets could be set. One sector that was mentioned as deserving particular attention is the e-

commerce sector. It is described by many stakeholders as the fastest growing retail sector, responsible for large quantities of packaging and surveys are highlighted that indicate that consumers are increasingly keen for reusable packaging alternatives for their online purchases.

NGOs are very supportive of ambitious mandatory reuse targets, as they see targets as the main mechanism by which to drive innovation, investment, and commitment from industry to move up the waste hierarchy towards reuse.

PROs and trade associations voiced concerns that it is too early to set targets however and that such measures should only be considered further down the line, once the updated Essential Requirements and definitions around reuse create a clearer market in Europe and start driving more innovation in this field.

Industry groups also highlighted the risk of conflicting policy measures between the measures proposed for reuse, and those set out in the SUP Directive and recommended that care be taken not to confuse industry or put them in an impossible bind (e.g. increased reuse leading to effective ban on single-use items, leading to lack of supply of high quality materials to meet recycled content targets).

With regards to the product categories, there were diverse views, for example:

- On the food sector:
  - Some stakeholders were strongly against any food-contact packaging being made reusable, primarily due to food safety concerns;
  - Some stakeholders were more concerned about food requiring cold chain handling (e.g. fresh or frozen food);
  - Some stakeholders considered that wine and spirits should be excluded, as they are often shipped over long distances, and the reverse logistics would not make sense;
  - Some stakeholders recommended that products with distinct characteristics (e.g. milk and soft drinks) should not be grouped under the same category as they will require different processes.
- On the level of granularity of the product categories:
  - One idea was to expand the grocery category to include canned food (in tins and jars) as this is already done quite successfully in Germany;
  - Other stakeholders recommended that secondary and tertiary packaging be further broken down to account for different types of transport packaging (by material and function).

2.8 Assessment of Measure 8c: Mandatory reuse targets (as % product sales/trips in reusable packaging, in number of items), MS level – high

2.8.1 Effectiveness

Table A-16 shows the effect on packaging waste generation of the upper-level mandatory sector by sector reuse targets, for 2030 and 2040. For reference, the quantity of packaging waste generated in EU in 2018 is estimated to be 77.8mt.

Relative to the 2030 baseline, the measure achieves a reduction of 7.2mt of packaging waste, 7.8% less than would otherwise have been generated. By 2040, this becomes a reduction of 28.1mt – or 26.4% less than the counterfactual in 2040.

Table A-16 Changes in Packaging Waste Generation [thousand tonnes] by Material, Measure 8c

Material	Change in 2030	Change in 2030 (%)	Change in 2040	Change in 2040 (%)
Glass	-636	-4.3%	-4,395	-27.8%
Steel	43	1.6%	7	0.3%
Aluminium	-34	-3.4%	-272	-25.5%
Paper / board	-5,624	-14.9%	-18,275	-42.0%
Plastic	-951	-4.5%	-5,193	-19.9%
Wood	0	-	0	-
Other	0	-	0	-
Total	**-7,202**	**-7.8%**	**-28,128**	**-26.4%**

Table A-17 shows the overall outcome of the upper-level mandatory sector by sector reuse targets in terms of percentage of product sales/trips in reusable packaging.

Relative to the baseline, where a decreasing share of reused packaging is modelled by 2030 and 2040 compared to 2018 (from 3.5% down to 2.4% and 2.2% respectively), the measure achieves an increase. By 2030 and 2040, the share of reused packaging is 8.6% and 19.2%.

Table A-17 Percentage of product sales/trips in reusable packaging (in number of items), Measure 8c

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Glass	41.7%	30.9%	35.9%	+4.9%	26.7%	57.6%	+30.9%
Steel	0.1%	0.0%	27.9%	+27.9%	0.0%	45.5%	+45.5%
Aluminium	0.7%	0.5%	0.5%	-	0.4%	0.6%	+0.2%
Paper / board	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Plastic	1.8%	1.8%	9.9%	+8.1%	1.8%	21.9%	+20.1%
Wood	69.0%	69.0%	69.0%	-	69.0%	69.0%	-
Other	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Total	**3.5%**	**2.4%**	**8.6%**	**+6.2%**	**2.2%**	**19.2%**	**+17.0%**

2.8.2 Ease of implementation

In the main, this is as per Measure 8b (Section 2.7.2), with the main distinction being that Measure 8c consists of a set of targets which are a higher level of ambition, and the expected level of percentage share of reuse attained is therefore higher. The additional consequence of this is that meeting the targets will be more challenging for obligated actors.

2.8.3 Administrative burden

As for Measure 8a (see Section 2.6.3).

2.8.4 Economic impacts

The economic impacts quantified for Measure 8c in the impact assessment are summarised in Table A-18. See the description for Measure 8a for an explanation of the cost breakdown (see Section 2.6.4).

Table A-18 Summary of Economic impacts for Measure 8c

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – EPR fees	-976	-3,948
Waste management – DRS costs	-242	-1,738
Packaging Producers – SU Packaging Turnover loss	-34,584	-124,037
Packaging users – Material savings	-3,559	-12,388
Capital and Operating costs of Reuse schemes	3,173	10,949

Each of the above categories capture the main drivers of cost, however, there are further elements that are not yet quantified. They are either considered smaller in magnitude, or the research effort required to quantify them where there is such limited data availability was considered to be a level of analysis disproportionate to the task in hand. They are identical in nature to those for Measure 8a, and Measure 8b, to which the reader is referred for details (Section 2.6.4 and 2.7.4). However, because the level of percentage share of reused packaging attained will be greater than the levels likely achievable under Measure 8a and set in Measure 8b, they will be greater in magnitude, in what is expected to be a proportionate relationship.

2.8.5 Social impacts

This measure would result in a net creation of 1.6m jobs in 2030, arising from:

- Creation of 1.2m jobs in the reuse sector
- Loss of 302k jobs in manufacturing, recycling and waste treatment industries, due to the reduced generation of packaging

Table A-19 Summary of Change in Employment for Measure 8c

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	2040
Manufacturing	-290.0	-1,100.7
Recycling (incl. collection)	-11.3	-57.7
Residual Treatment (incl. collection)	-1.1	-4.0
Reuse	1,188.4	3,344.0
Net Change in Employment	**885.9**	**2,270.8**

All other considerations for which qualitative discussion appears in Section 2.6.5 for Measure 8a and in Section 2.7.5 for Measure 8b, apply here. All the impacts are expected to increase in magnitude in keeping with the higher percentage share of reused packaging expected under this higher, mandatory set of targets.

2.8.6 Environmental impacts

Table A-20 presents a summary of the environmental impacts for Measure 8c associated with manufacturing, recycling, incineration, and landfill. See Section 2.6.6 for details on this classification. Table A-21 provides the changes in GHGs for the full scope of activities.

By 2030, the increase in reusable packaging is estimated to lead to a net decrease in emissions of -3,687kt, increasing to -14,169kt in 2040.

Table A-20 Summary of Environmental Impacts for Measure 8c

Environmental impact	Estimated impact (relative to baseline)	
	2030	2040
Change in water use, thousand m^3	-169	-645
Change in GHG/AQ externalities, € million	-1,006	-4,459

Table A-21 Summary of change in GHGs for Measure 8c – full scope

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Manufacturing	-4,613	-20,557
Transport	-1,296	-5,063

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Collection	-324	-1,265
Sorting	-22	-86
Recycling	227	6,808
Incineration	-701	-3,239
Landfill	-174	-505
Reuse (Transport and Washing)	3,546	8,8882
Total	**-3,358**	**-15,027**

There are no additional considerations regarding this Measure other than those presented for Measure 8a in Section 2.6.6, save for that fact that the impacts are all greater in magnitude in keeping with the larger percentage share of reused packaging expected to be achieved under this higher ambition, mandatory regime.

2.8.7 Stakeholder views

See Section 2.7.7. Further to this, predominantly industry stakeholders, found the higher set of targets too high; but these received support from other quarters such as NGOs or national government departments.

2.9 Summary and conclusion

A comparison of the impacts between Measures 8a-c is presented in Table A-22 and shows that each measure produces a progressively greater reduction in waste generation relative to the counterfactual in 2030.

Net lost turnover from sales of packaging (first time PoM) ranges from -11€bn to 35€bn; the gain in turnover from sales of reusable packaging for subsequent rotations is not included but could be in the order of magnitude of the cost to set up and run reuse schemes – so a smaller offset.

Although voluntary targets may be viewed as easier to implement in some regards, requiring no enforcement and allowing for mitigation of potential disadvantages by there being more leeway for producers not to participate, on the other hand it is hard to implement in that there is no way to obligate producers to participate, putting at risk the achievement of any significant progress. Diverging approaches between Member States expected under a voluntary regime also risk fragmenting the single market. Mandatory targets require tighter controls and meeting the targets is more challenging for producers, but in other ways the measure is more effective. All the measures will entail similar administrative burden owing to reporting costs, but the magnitude of this will depend on the method chosen, which will still need to be defined.

Table A-22 Summary of Impacts for Measure 8 [all data refers to changes in 2030 relative to the baseline, unless specified]

Impact category	Measure 8a (voluntary targets)	Measure 8b (mandatory – low)	Measure 8c (mandatory – high)
Effectiveness	-2.4% tonnes packaging waste +1.7% in % product sales/trips in reusable packaging By 2040 6.1% product sales/trips in reusable packaging	-4.9% tonnes packaging waste +3.5% in % product sales/trips in reusable packaging By 2040 10.3% product sales/trips in reusable packaging	-7.8% tonnes packaging waste +6.2% in % product sales/trips in reusable packaging By 2040 19.2% product sales/trips in reusable packaging
Ease of implementation	No enforcement requirement. Harder to ensure participation. Easier for producers to avoid challenges of deploying reuse.	Enforcement required. More efficient. More effort required to meet targets.	
Administrative burden	Some additional burden expected – similar cost for each. Extent dependent on method selected and product/packaging category.		
Economic impacts	-308 €m waste management costs +1,027 €m capital and operating costs, reuse -11,189 €m turnover	-679 €m waste management costs +2,113 €m capital and operating costs, reuse -22,601 €m turnover	-1,218 €m waste management costs +3,173 €m capital and operating costs, reuse -34,584 €m turnover
Social impacts	+0.335 million jobs	+0.668 million jobs	+0.886 million jobs
Environmental impacts	-0.9M tonnes CO_2e -47k m3 water use -305 €m GHG/AQ externalities	-1.8M tonnes CO_2e -99k m3 water use -610 €m GHG/AQ externalities	-3.4M tonnes CO_2e -169k m3 water use -1,006 €m GHG/AQ externalities

Impact category	Measure 8a (voluntary targets)	Measure 8b (mandatory – low)	Measure 8c (mandatory – high)
Stakeholder Views	Only few stakeholders support voluntary targets, while reuse systems are still being developed.	Most stakeholders support mandatory targets that are sector/product specific, with more work required on specifying the products involved and measurement methods.	Same as 8b. Some stakeholders stressed the need to consider differences between MS when setting the level of target.

3.0 Measure 9: Mandatory MS level overarching cross-sectoral waste reduction target

3.1 Problem definition

There are no additional considerations with regards to problem definition beyond what is described in Annex A – Problem Definition. Total waste generation per capita continues to increase over time, driven by trends such as higher levels of economic development and growth in disposable income, as well as the proliferation of single-use packaging and products (owing to the reasons described for Measure 8, Section 2.1). This has led to the consumption of more material goods. There has been a general lack, aside very few exceptions, of broader legislative endeavours to address this.

3.2 Baseline

No waste generation reduction target is mandated by EU; a few examples are however to be implemented independently by a few MS. The Green Deal "aims to…transform the EU into a...society...where economic growth is decoupled from resource "se", which at its most successful, should entail absolute waste generation reduction. The CEAP has an implicit objective to "significantly reduce total waste generation" and also commits to set sector-specific waste reduction targets e.g. for plastic or packaging by 2022. With regards to waste prevention more generally, provisions in the WFD and PPWD currently require MS to "implement measures" to prevent packaging waste over and above what the Essential Requirements stipulate, and to report what has been undertaken in this regard. The WFD provides for examination of preparation for reuse data by the end of 2024, with a view to understanding the feasibility of setting quantitative waste reduction targets.

3.3 Objectives

The aim of waste reduction targets is to drive a reduction in total waste production, and specifically packaging waste, thus leading to a decrease in material and resource use, as well as limiting leakage of packaging into the environment and damaging ecosystems. Waste reduction can be achieved through avoidance, reuse or lightweighting of packaging.

3.4 Description of the measure

The target is termed "overarching" in that it is specified in terms of waste reduction – this could be achieved via any or all of the three waste prevention pathways – avoidance, reuse and lightweighting. In order to promote reuse over lightweighting, which is the predominant waste prevention method under current conditions, a target quantifying the proportion of waste reduction to be met by reuse is specified. It is termed cross-sectoral because it does not set specific targets for specific sectors but should be achieved within the packaging industry as a whole. Requiring targets to be met by each material stream would mean that there are fewer market distortions away from denser materials like glass and metal, this does not allow the

optimal material for specific reuse systems and formats in terms of environmental performance to be ascertained and emerge. A cross-sectoral target also has the advantage that is it simpler to communicate than a panel of targets for different product/packaging groups and different waste prevention pathways.

Mandatory packaging waste reduction targets are set as a general target for all products/packaging as a group, measured in kg per person per year.

- Measure 9b: lower level of ambition – 10% waste reduction target, of which 5% by reuse.
- Measure 9c: higher level of ambition – 20% waste reduction target, of which 10% by reuse.

3.5 Links to other measures

Measure 9 is closely linked to Measure 8. In addition, as for Measure 8, it is also linked to Measures 10, 11 and 12; all relevant description of these links can be found under Measure 8, in section 2.5. In brief, as Measure 9 specifies that reduction in waste generation must be achieved by reuse, many of the considerations associated with the outcome of sector by sector targets apply to Measure 9. If Measure 9 were however to be implemented alone, there is a risk of divergence of approach between Member States and disruption to the single market. However it has the advantage that it constrains total waste generation to produce an absolute reduction in waste generation in a way that sector by sector reuse targets do not necessarily do (especially when set at a low level). Therefore implementing a cross-sectoral target such as Measure 9 is highly complementary to sector by sector targets such as those specified in Measure 8.

3.6 Assessment of Measure 9b: Mandatory MS 'overarching cross-sectoral' % reduction targets – General target (kg per person per year) – less ambitious - 5% reduction to be met by reuse.

3.6.1 Effectiveness

Table A-1 and Table A-2 show the effect on packaging waste generation of the less ambitious overarching cross-sectoral waste reduction targets, for 2030 and 2040 respectively. For reference, the quantity of packaging waste generated in EU in 2018 is estimated to be 77.8mt.

Relative to the 2030 baseline, the measure achieves a reduction of 17.6mt of packaging waste, 19.1% less than would otherwise have been generated. By 2040, this becomes a reduction of 21mt – or 19.7% less than the counterfactual in 2040.

Relative to 2018, packaging waste reduces by 3.9% instead of growing by 18.8% in 2030. By 2040, there is once more growth in packaging waste, however at a rate of 10.1% instead of 37%.

Table A-1 Packaging Waste Generation in 2030 in Thousand Tonnes by Material, Measure 9b

Material	2018	20–0 - baseline	20–0 - measure	Change		
				Baseline to measure in 2030		2018 to measure in 2030
Glass	14,493	14,873	12,110	-2,762	-18.6%	-16.4%
Steel	2,935	2,674	2,822	149	5.6%	-3.8%
Aluminium	970	999	829	-170	-17.0%	-14.6%
Paper / board	31,817	37,747	27,893	-9,854	-26.1%	-12.3%
Plastic	14,797	20,974	17,761	-3,212	-15.3%	20.0%
Wood	12,574	14,927	13,129	-1,798	-12.0%	4.4%
Other	218	204	204	0	0.0%	-6.3%
Total	**77,805**	**92,397**	**74,749**	**-17,648**	**-19.1%**	**-3.9%**

Table A-2 Packaging Waste Generation in 2040 in Thousand Tonnes by Material, Measure 9b

Material	2018	20–0 - baseline	20–0 - measure	Change		
				Baseline to measure in 2040		2018 to measure in 2040
Glass	14,493	15,812	12,841	-2,971	-18.8%	-11.4%
Steel	2,935	2,703	2,895	192	7.1%	-1.4%
Aluminium	970	1,066	873	-193	-18.1%	-10.0%
Paper / board	31,817	43,507	31,806	-11,701	-26.9%	0.0%
Plastic	14,797	26,049	21,914	-4,135	-15.9%	48.1%
Wood	12,574	17,271	15,105	-2,167	-12.5%	20.1%
Other	218	212	212	0	0.0%	-2.4%
Total	**77,805**	**106,621**	**85,646**	**-20,975**	**-19.7%**	**10.1%**

Table A-3 shows the overall outcome of the less ambitious cross-sectoral overarching waste reduction targets in terms of percentage of product sales/trips in reusable packaging.

Relative to the baseline, where a decreasing share of reused packaging is modelled by 2030 and 2040 compared to 2018 (from 3.5% down to 2.4% and 2.2% respectively), the measure

achieves a considerable increase. By 2030 and 2040, the share of reused packaging is 20.3% and 20.5%.

Table A-3 Percentage of product sales/trips in reusable packaging (in number of items), Measure 9b

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Glass	41.7%	30.9%	50.7%	19.8%	26.7%	48.6%	21.9%
Steel	0.1%	0.0%	62.9%	62.8%	0.0%	66.9%	66.9%
Aluminium	0.7%	0.5%	0.6%	0.1%	0.4%	0.5%	0.1%
Paper / board	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Plastic	1.8%	1.8%	22.7%	20.9%	1.8%	22.4%	20.6%
Wood	69.0%	69.0%	73.1%	4.1%	69.0%	73.3%	4.3%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**3.5%**	**2.4%**	**20.3%**	**17.9%**	**2.2%**	**20.5%**	**18.3%**

3.6.2 Ease of implementation

In the main, this is as per Measure 8b (Section A.2.7.2), with the main distinction being that Measure 9b consists of a target with a higher level of ambition as regards absolute waste reduction and timeframe, and the expected level of adoption of reusables in order to achieve the required reduction in waste generation is therefore higher, sooner. The additional consequence of this is that meeting the target will be more challenging for obligated actors.

For Measure 9b, the second major distinction is that if implemented alone, as a cross-sectoral target, change will be driven by sectors where reuse is already well established. Those facing greater research, development and investment needs to optimise and deploy reusable packaging are unlikely to have the impetus to act in a way that anticipates the scale of change needed to meet the targets. Progress towards the targets then risk stalling when the necessary groundwork has not been done. In this sense, successful implementation is more challenging than under Measure 8. For the purposes of modelling, the assumption is that the target is successfully met by a spread of transition to reuse in different sectors. However, in reality, there is a risk of a severe implementation gap, which could be mitigated by implementing alongside sector by sector targets.

Different options for reporting on the target are possible, some are easier to implement than others. Ultimately, waste packaging generation in kg per capita would be the key indicator, and this is already reported in the EU (and hence does not represent additional burden). However there is the additional requirement that this should be attributable to reuse, so as to be sure of driving action via this waste prevention pathway rather than lightweighting. The requirement to report on reusable packaging and number of rotations in total under the Implementing Decision of the PPWD will support this. However a data collection effort as described in 2.6.2 and 2.6.3 to report directly on reuse may still be necessary to meet the existing reporting requirement under

the PPWD. However, because the prospects for achieving an absolute reduction in waste generation per capita could probably not be driven by lightweighting alone, it may not be strictly necessary. That said, without collecting data on reuse, there would be very little understanding of what was driving progress towards meeting the target – or failure to do so. This in turn would make it more difficult to direct appropriate action for meeting the target. Reporting directly on reuse is more challenging for an overarching cross-sectoral target, which captures the whole market, in theory. This is another reason why implementing sector by sector targets alongside cross-sectoral targets is complementary. In the absence of this, a defined scope of items for which reuse was to be calculated could be developed, and this is harder to do the broader or more complete the scope needs to be.

An alternative approach would be, as for Measure 8, to report reusable packaging PoM for the first time, as is already required under the packaging waste legislation. Monitoring reusable packaging in this way has the disadvantage that it does not reflect the real number of rotations or uses of an item of packaging, and hence can conceal ineffective reuse efforts (although it could be a useful interim approach while new systems for reporting are being developed). In summary, implementation of this target alone could pose some difficulties in terms of establishing reporting which provides adequate insight, however it is supported by reporting efforts about to be established under revisions to the PPWD.

Establishing the best economic actors to assign the responsibility for meeting targets in a way that is effective is also more challenging for Measure 9 than Measure 8. Typically, packaging waste generation is reported on by packaging manufacturers who monitor packaging placed on the market as a proxy for waste generation, and the responsibility for meeting targets on waste lies with them. For reusable packaging, this is however not the economic actor for whom responsibility and competence would be best aligned, to produce a workable chain of management for the measure, as discussed for Measure 8a; a similar proposal for effective delegation of responsibility is proposed for Measure 8b (qv Section 2.6.2).

3.6.3 Administrative burden

Costs incurred for meeting legal obligations to provide information, for this measure are expected to derive from monitoring progress with respect to the targets. This could lead to some new regulatory burdens on business and administrations.

There are a few different options for reporting on this target as described in 3.6.2, yet to be determined, and the additional costs are dependent on the option, ranging from no additional costs if existing packaging waste generation statistics were used as the only indicator, to more additional costs than Measure 8, if the obligated reporting approach was taken for the whole market, for % product sales/trips in reusable packaging to attribute waste reduction with certainty to reuse activities.

3.6.4 Economic impacts

The economic impacts quantified for Measure 9b in the impact assessment are summarised in Table A-4 below. See the description for Measure 8a for explanation of the cost breakdown (Section 2.6.4).

Waste management

- Saving on EPR fees and one-way DRS: -€4,039m by 2030 and -€4,893m by 2040, relative to counterfactuals in the same years.
- Replaced instead with increased costs of setting up and operating of reuse schemes: €7,515m and €8,858m in 2030 and 2040 respectively. This however may also be viewed as the basis of revenue for reusable packaging operators and reconditioners, as this amount, plus profit, also represents a service sold.

Turnover for packaging producers

- Net change: -€71.3bn in 2030 and -€85.9bn in 2040. This takes into account a decrease in the sales of single-use packaging and a smaller increase in sales for reusable packaging (the first time it is placed on the market, and not for subsequent rotations). This is a large sum, but it must be noted that this is turnover, rather than profit. It also represents, to an extent, the cost saving to reusable packaging users from not having to buy single use packaging on an ongoing basis.

Material savings

- -€7,688m in 2030 and -€9,339m in 2040 and represent the value of raw material that is no longer utilized as a result of reduction in packaging manufacture. For reuse, the benefit of this avoided cost is not captured by packaging producers, but instead is replaced by the value that reusable packaging owners can generate from selling packaging multiple times as a service (accruing to reuse system operators), or the cost saving from not having to buy single use packaging on an ongoing basis (which accrues to reuse system users such as packfillers or consumers, depending on the reuse system in question). In both cases, material savings represent a loss to economic actors who create and trade primary materials.

Table A-4 Summary of Economic impacts for Measure 9b

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – EPR fees	-3,054	-3,797
Waste management – DRS costs	-985	-1,096
Packaging Producers – SU Packaging Turnover loss	-71,283	-85,875
Packaging users – Material savings	-7,688	-9,339
Capital and Operating costs of Reuse schemes	7,515	8,858

Each of the above categories capture the main drivers of cost, however, there are further elements that are not yet quantified. They are either considered smaller in magnitude, or the research effort required to quantify them where there is such limited data availability was considered to be a level of analysis disproportionate to the task in hand. They are identical in nature to those for Measure 8a, and Measure 8b, to which the reader is referred for details (Section 2.6.4 and 2.7.4). However, because the level of percentage share of reused packaging

attained will be greater than the levels likely achievable under Measure 8a and set in Measure 8b, they will be greater in magnitude, in what is expected to be a proportionate relationship.

Other general considerations are that for a cross-sectoral target, in practice, change will be distributed more unevenly in the economy across different sectors and these economic impacts will also be spread more unevenly.

3.6.5 Social impacts

This measure would result in a net creation of 2.5m jobs in 2030, arising from:

- Creation of 3.1m jobs in the reuse sector
- Loss of 615k jobs in manufacturing, recycling and waste treatment industries, due to the reduced generation of packaging

Table A-5 Summary of Change in Employment for Measure 9b

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	2040
Manufacturing	-580.3	-695.3
Recycling (incl. collection)	-31.5	-39.0
Residual Treatment (incl. collection)	-3.3	-4.0
Reuse	3,129.3	3,598.6
Net Change in Employment	**2,514.2**	**2,860.3**

The types of jobs created for the reuse sector would be in logistics and reconditioning, as well as maintenance of infrastructure for take-back, dispensing and refill in retail.

By 2040 this reaches a net creation of 2.8m jobs as a result of the creation of 3.6m jobs in the reuse sector and the loss of 738k jobs in manufacturing and waste management.

All other considerations for which qualitative discussion appears in Section 2.6.5 for Measure 8a and in Section 2.7.5 for Measure 8b, apply here. All the impacts are expected to increase in magnitude in keeping with the higher percentage share of reused packaging expected under this target.

3.6.6 Environmental impacts

Table A-6 presents a summary of the environmental impacts for Measure 9b associated with manufacturing, recycling, incineration, and landfill. See Section 2.6.6 for details on this classification. Table A-7 provides the changes in GHGs for the full scope of activities.

By 2030, the increase in reusable packaging is estimated to lead to a net decrease in emissions of -6,949kt, increasing to -9,774kt in 2040.

Table A-6 Summary of Environmental Impacts for Measure 9b

Environmental impact	Estimated impact (relative to baseline)	
	2030	2040
Change in water use, thousand m^3	-395	-476
Change in GHG/AQ externalities, € million	-2,107	-3,646

Table A-7 Summary of change in GHGs for Measure 9b – full scope

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Manufacturing	-11,600	-13,760
Transport	-3,177	-3,775
Collection	-794	-943
Sorting	-50	-60
Recycling	2,735	3,248
Incineration	-1,438	-2,558
Landfill	-198	-266
Reuse (Transport and Washing)	7,573	8,341
Total	**-6,949**	**-9,774**

There are no additional considerations regarding this Measure than those presented for Measure 8a in Section 2.6.6, save for that fact that the impacts are all greater in magnitude in keeping with the larger percentage share of reused packaging expected to be achieved under this target.

3.6.7 Stakeholder views

Stakeholders mostly refer to reuse targets, not waste reduction targets. One NGO recommends the use of both, and one PRO (Producer Responsibility Organisation) describes the process by which France is linking reuse targets to its waste prevention targets.

3.7 Assessment of Measure 9c: Mandatory MS 'overarching cross-sectoral' % reduction targets – General target (kg per person per year) – more ambitious - 10% reduction to be met by reuse

3.7.1 Effectiveness

Table A-8 and Table A-9 show the effect on packaging waste generation of the more ambitious overarching cross-sectoral waste reduction targets, for 2030 and 2040 respectively. For reference, the quantity of packaging waste generated in EU in 2018 is estimated to be 77.8mt.

Relative to the 2030 baseline, the measure achieves a reduction of 21.6mt of packaging waste, 23.4% less than would otherwise have been generated. By 2040, this becomes a reduction of 25.5mt – or 24% less than the counterfactual in 2040. Relative to 2018, packaging waste reduces by 9% instead of growing by 18.8% in 2030. By 2040, there is once more growth in packaging waste, however at a rate of 4.2% instead of 37%.

Table A-8 Packaging Waste Generation in 2030 in Thousand Tonnes by Material, Measure 9c

Material	2018	20–0 - baseline	20–0 - measure	Change		
				Baseline to measure in 2030		**2018 to measure in 2030**
Glass	14,493	14,873	11,402	-3,471	-23.3%	-21.3%
Steel	2,935	2,674	2,856	182	6.8%	-2.7%
Aluminium	970	999	793	-205	-20.5%	-18.2%
Paper / board	31,817	37,747	26,231	-11,517	-30.5%	-17.6%
Plastic	14,797	20,974	17,012	-3,962	-18.9%	15.0%
Wood	12,574	14,927	12,317	-2,610	-17.5%	-2.0%
Other	218	204	204	0	-	-6.3%
Total	**77,805**	**92,397**	**70,815**	**-21,582**	**-23.4%**	**-9.0%**

Table A-9 Packaging Waste Generation in 2040 in Thousand Tonnes by Material, Measure 9c

Material	2018	20–0 - baseline	20–0 - measure	Change		
				Baseline to measure in 2040		2018 to measure in 2040
Glass	14,493	15,812	12,100	-3,712	-23.5%	-16.5%
Steel	2,935	2,703	2,938	234	8.7%	0.1%

Material	2018	20–0 - baseline	20–0 - measure	Change		
				Baseline to measure in 2040		2018 to measure in 2040
Aluminium	970	1,066	833	-233	-21.9%	-14.1%
Paper / board	31,817	43,507	29,854	-13,652	-31.4%	-6.2%
Plastic	14,797	26,049	20,977	-5,072	-19.5%	41.8%
Wood	12,574	17,271	14,170	-3,101	-18.0%	12.7%
Other	218	212	212	0	-	-2.4%
Total	**77,805**	**106,621**	**81,084**	**-25,536**	**-24.0%**	**4.2%**

Table A-10 shows the overall outcome of the more ambitious overarching cross-sectoral waste reduction targets in terms of percentage of product sales/trips in reusable packaging.

Relative to the baseline, where a decreasing share of reused packaging is modelled by 2030 and 2040 compared to 2018 (from 3.5% down to 2.4% and 2.2% respectively), the measure achieves a considerable increase. By 2030 and 2040, the share of reused packaging is 24.4% and 24.6%.

Table A-10 Percentage of product sales/trips in reusable packaging (in number of items), Measure 9c

Material	2018	2030			2040		
		Baseline	Measure	Change	Baseline	Measure	Change
Glass	41.7%	30.9%	54.8%	+23.8%	26.7%	52.9%	+26.2%
Steel	0.1%	0.0%	68.1%	+68.1%	0.0%	71.8%	+71.7%
Aluminium	0.7%	0.5%	0.6%	+0.2%	0.4%	0.6%	+0.2%
Paper / board	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Plastic	1.8%	1.8%	27.1%	+25.3%	1.8%	26.7%	+24.9%
Wood	69.0%	69.0%	75.0%	+6.0%	69.0%	75.2%	+6.2%
Other	0.0%	0.0%	0.0%	-	0.0%	0.0%	-
Total	**3.5%**	**2.4%**	**24.4%**	**+22.0%**	**2.2%**	**24.6%**	**+22.4%**

3.7.2 Ease of implementation

In the main, this is as per Measure 9b (Section 3.6.2), with the main distinction being that Measure 9c consists of a target with a higher level of ambition, and the expected level of percentage share of reuse attained is therefore higher. The additional consequence of this is that meeting the targets will be more challenging for obligated economic actors.

3.7.3 Administrative burden

As per Measure 9b, Section 3.7.3.

3.7.4 Economic impacts

The economic impacts quantified for Measure 9b in the impact assessment are summarised in Table A-11. See the description for Measure 8a for explanation of the cost breakdown.

Table A-11 Summary of Economic impacts for Measure 9c

Category	Estimated economic impact (relative to baseline), €m	
	2030	2040
Waste management – EPR fees	-3,885	-4,794
Waste management – DRS costs	-1,230	-1,361
Packaging Producers – SU Packaging Turnover loss	-84,606	-101,831
Packaging users – Material savings	-9,143	-11,082
Capital and Operating costs of Reuse schemes	8,909	10,302

Each of the above categories capture the main drivers of cost, however, there are further elements that are not yet quantified. They are either considered smaller in magnitude, or the research effort required to quantify them where there is such limited data availability was considered to be a level of analysis disproportionate to the task in hand. All these and further considerations as per Measure 9b, see Section 2.6.4 – but greater in magnitude in proportion with the effects on % share reuse and waste generation.

3.7.5 Social impacts

This measure would result in a net creation of 2.9m jobs in 2030, arising from:

- Creation of 3.6m jobs in the reuse sector
- Loss of 730k jobs in manufacturing, recycling and waste treatment industries, due to the reduced generation of packaging

Table A-12 Summary of Change in Employment for Measure 9c

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	2040
Manufacturing	-687.5	-821.7

Employment sector	Change in FTE (thousands), relative to baseline	
	2030	2040
Recycling (incl. collection)	-38.2	-47.0
Residual Treatment (incl. collection)	-4.2	-5.0
Reuse	3,605.8	4,142.3
Net Change in Employment	**2,875.9**	**3,268.5**

The types of jobs created for the reuse sector would be in logistics and reconditioning, as well as maintenance of infrastructure for take-back, dispensing and refill in retail. By 2040, this reaches a net creation of 3.3m jobs as a result of the creation of 4.1m jobs in the reuse sector and the loss of 874k jobs in manufacturing and waste management.

3.7.6 Environmental impacts

Table A-13 presents a summary of the environmental impacts for Measure 9c associated with manufacturing, recycling, incineration, and landfill. See Section 2.6.6 for details on this classification. Table A-14 provides the changes in GHGs for the full scope of activities.

By 2030, the increase in reusable packaging is estimated to lead to a net decrease in emissions of -8,436kt, increasing to -11,834kt in 2040.

Table A-13 Summary of Environmental Impacts for Measure 9c

Environmental impact	Estimated impact (relative to baseline)	
	2030	2040
Change in water use, thousand m^3	-482	-579
Change in GHG/AQ externalities, € million	-2536	-4,376

Table A-14 Summary of change in GHGs for Measure 9c – full scope

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Manufacturing	-14,128	-16,697
Transport	-3,885	-4,597
Collection	-970	-1,148
Sorting	-61	-72

Change in GHGs, thousand tonnes CO_2e	Estimated impact (relative to baseline)	
	2030	2040
Recycling	3,538	4,171
Incineration	-1,715	-3,062
Landfill	-213	-302
Reuse (Transport and Washing)	8,998	9,873
Total	**-8,436**	**-11,834**

3.7.7 Stakeholder views

See section 3.6.7.

3.8 Summary and conclusion

A comparison of the impacts between Measures 9b and 9c is presented in Table A-15 and shows the extent to which, as expected, Measure 9c, as the more ambitious target, produces a greater reduction in waste generation relative to the counterfactual, than 9b. By 2030, a 5% absolute reduction in waste in kg per capita on 2018 levels produces a -19.1% reduction on packaging waste relative to the counterfactual in the same year while the 10% reduction target translates into a -23.4% reduction in packaging waste relative to the counterfactual in 2030. Compared with Measure 8 (see Section 2.9), which produces reductions of -2.8% to -9.5% of packaging waste relative to the counterfactual, in 2030, depending on the level of ambition, this is a significantly better outcome in terms of waste prevention by this time. However this is partly a product of the shorter timeframe specified for the overarching cross-sectoral target. By 2040, the mandatory sector by sector targets are high enough to exceed this outcome, with reductions of -26.2% and -41.2% for Measures 8b and 8c respectively.

The percentage share of sales/trips in reusable packaging reaches 20.5% (M9b) and 24.6% (M9c) of the packaging used to deliver products, by 2040, from a level of 3.5% estimated in 2018. Compared with Measure 8, better performance is achieved by 2030 but in 2040 this is exceeded by Measure 8c (at 26.9%).

An overarching cross-sectoral target has the significant risk that diverging approaches between Member States expected under a cross-sectoral also risk fragmenting the single market. Like any mandatory target, it requires tighter controls and meeting the targets is more challenging for producers. The two measures will entail similar admin burden owing to reporting costs but the magnitude of this will depend on the method chosen.

Table A-15 Summary of Impacts for Measure 9

Impact category	Measure 9b – 5% waste reduction target met by reuse	Measure 9c – 10% waste reduction target met by reuse
Effectiveness	19.1% reduction in packaging waste relative to baseline 17.9% increase in % product sales/trips in reusable packaging relative to baseline By 2040 20.5% product sales/trips in reusable packaging	23.4% reduction in packaging waste relative to baseline 22% increase in % product sales/trips in reusable packaging relative to baseline By 2040 24.6% product sales/trips in reusable packaging
Ease of implementation	Enforcement required More efficient More effort required to meet targets	
Administrative burden	Some additional burden expected – similar cost for each. Extent dependent on method selected and product/packaging category.	
Economic impacts	-4,039 €m waste management costs +7,515 €m capital and operating costs, reuse -71,283 €m turnover	-5,115 €m waste management costs + 8,909 €m capital and operating costs, reuse -84,606 €m turnover
Social impacts	+2.51 million jobs	+2.86 million jobs
Environmental impacts	-10.5M tonnes CO_2e -395k m3 water use -2,107 €m GHG/AQ externalities	-12.5M tonnes CO_2e -482k m3 water use -2,536 €m GHG/AQ externalities
Stakeholder Views	Mostly concerned about reuse targets rather than waste reduction targets. Some concern that waste reduction targets are too general.	

4.0 Measure 10: Standardisation of reusable packaging and effective reuse systems

4.1 Problem definition

As a result of the proliferation of single-use packaging, owing to drivers described for Measure 8, Section 2.1, and Annex A – Problem Definition, reusable packaging formats and systems are not widely implemented for most product groups. This means that there is still much untapped potential regarding system and product optimisation. A lack of standardisation of packaging formats and systems is seen as a barrier to upscaling certain reuse systems, especially regarding products with longer supply chains. Current legislative mechanisms and definitions do not guard sufficiently against packaging placed on the market designated as reusable which is however not reused in practice. This is to the extent that current reporting could give no real indication of what progress is actually being made, and can lead to unintentional consequences (such as increased resource use), and therefore cannot be relied on to drive progress.

4.2 Baseline

Existing CEN[521,522,523,524] and ISO[525] standards cover some types of tertiary packaging, or limited attributes of reusable packaging. None are mandatory, by nature, but the harmonised EN standards can be relied upon by producers to show compliance with the PPWD. MS have mostly transposed the PPWD definition of reusable packaging ("*packaging which has been conceived, designed and placed on the market to accomplish within its lifecycle multiple trips or rotations by being refilled or reused for the same purpose for which it was conceived*" under Article 3(2a) of PPWD), which has no safeguard against poorly performing packaging with low or no rotations being classed as reusable. There are emerging proposals for definitions in some MS associated with reuse *systems* rather than reusable formats. In German legislation, the reuse definition from Section 3 (3) of the Packaging Act (VerpackG), is to the effect that *"Reusable packaging is packaging that is intended to be reused several times for the same purpose after use and whose actual return and reuse is made possible by adequate logistics and promoted by suitable incentive systems, usually by a deposit."* In this, intention for the packaging and existence of reuse systems

[521] CEN (2000), *EN 13117-1: Transport Packaging – Reusable, rigid plastics distribution boxes – Part 1: General Purpose application*, 22 April 2000

[522] CEN (2004), *EN 13429: Packaging - Reuse*, 5 May 2004

[523] CEN (2004), *EN 13427: Packaging – Requirements for the use of European Standards in the field of packaging and packaging waste*, 5 May 2004

[524] CEN (2007), *EN 14520: Packaging – Reuse – Methods for assessing the performance of a reuse system*, 25 May 2007

[525] E.g. ISO (2013), *ISO 18603:2013(E): Packaging and the environment – Reuse, ISO 18616:2016(en) Transport packaging — Reusable, rigid plastic distribution boxes — Parts 1 & 2:*

and associated incentives are used to define the packaging itself.[526] The Implementing Decision 2019/665 currently defines "a system to reuse packaging" as "organisational, technical or financial arrangements which ensure that reusable packaging performs multiple rotations."

4.3 Objectives

The aim of standardising reusable packaging formats and effective reuse systems would be to optimise reusable packaging with regards to function and environmental performance and accelerate its scale-up in the market. This in turn would lead to economies of scale and increase the rate of adoption by consumers. Moreover, standardisation at a European level would support the smooth functioning of the internal market.

4.4 Description of the measure

Given the limited implementation of reusable packaging systems for many product groups and packaging types, there is considerable scope for their development and optimisation, particularly in terms of environmental performance, consumer behaviour and product protection (the key characteristic being an optimized number of rotations). Standardisation provides a means to drive this optimisation and three types are envisaged:

4.4.1 Measure 10a: the Commission publishes guidance on implementation of reuse systems that makes reference to a CEN standard.

Commission guidance could cover many aspects of reuse system implementation and monitoring to support harmonised approaches across the EU, taking the form of 'minimum requirements' for reusable packaging and the associated reuse system. There are several outcomes of importance to optimise, such as:

- Environmental performance
- Consumer behaviour
- Product protection – for the optimized number of rotations

These in turn are related to the following, which should all be given consideration in the new or updated standards:

- Definition of reusable packaging
- Packaging format and design
- Reuse system
- Return infrastructure and incentivisation
- Supply chain and logistics
- Public Engagement

[526] VerpackG 2017 "(3) Mehrwegverpackungen sind Verpackungen, die dazu bestimmt sind, nach dem Gebrauch mehrfach zum gleichen Zweck wiederverwendet zu werden und deren tatsächliche Rückgabe und Wiederverwendungdurch eine ausreichende Logistik ermöglicht sowie durch geeignete Anreizsysteme, in der Regel durch ein Pfand, gefördert wird."

Being guidance rather than a definition allows for development over time, as the most important elements for each type of reuse system emerge. The Commission can request CEN to develop a standard, but the mandate has to be accepted by CEN before it can proceed; and the adoption of the standard cannot be mandated as is - as it is voluntary by nature. The CEN standard – be it as a voluntary standard or a harmonised standard if the Commission later decided to reference it in the OJ - would provide a reference point for industry to enable improved performance of reuse systems and facilitate their adoption. Working with a voluntary standard, also provides the opportunity for innovation in reusable packaging formats and systems, and establishment of harmonised systems over time, such that best practice can then be fed back into the standards. This is appropriate especially given the early stage of development of many types of reuse system; however it also benefits more mature systems in leaving the door open for improvements in outcomes delineated above. Standards, which are regularly reviewed and developed over time, also mean that variances in systems across the EU can be more easily taken into account. Many stakeholders have indicated the necessity of allowing time for research, development and implementation of reuse systems.

Even though CEN standards cannot be mandated, - but can be requested - they can be expected to lead to better harmonisation and improved performance. In time, elements which have been established as optimal features for all or some reuse formats and systems could be brought into the Directive itself (e.g. as per Measures 10b and 10c).

4.4.2 Measure 10b: the Commission formulates a definition and requirements for reusable packaging formats at the EU level, which are mandatory and specified in legislation

There has been interest in some quarters in improving definitions around reusable packaging in the legislation, the main criticism being that a minimum number of rotations is not specified, and hence poorly performing formats and systems are not excluded from these definitions. Any definition of 'reusable packaging' should be unambiguous and should include a level of detail, potentially quantitative, to provide clarity on what qualifies as reusable and avoid mislabelling and misreporting. Requirements might include the number of rotations for different packaging groups or specific types of packaging. Some characteristics of reusable packaging formats could be defined for some product/packaging groups where the reuse systems are widespread in the market, or where research was undertaken to establish optimal parameters. These would need to be determined through additional research in order to be harmonised at the European level. An Annex to the Directive containing these requirements could be updated on a periodic basis.

An alternative approach altogether is to couple the existing definition of reusable packaging with a requirement that reuse systems be in place for the achievement of reuse; coupled with the definition of minimum requirements for reuse systems (as outlined in Measure 10c). Rationales for suggested wording as outlined below are provided for a definition featuring minimum rotations and a definition relying on the existence of reuse systems for the packaging in question.

It is considered very difficult at this time to comprehensively specify optimal packaging formats, materials or minimum rotations, in the legislation, without data on systems operating at scale, with monitoring of outcomes, or modelling of optimal systems. These parameters may be different for select product/packaging groups (bottles, tertiary). With respect to minimum

rotations in particular, it is useful to bear in mind two different rationales which may be followed for specifying a particular threshold.

The first is to consider that the minimum has to be enough to exclude the most egregious examples of 'pseudo-reuse' (for example, where single-use packaging is provided in combination with bulk dispensing facilities in retail outlets, or where refill packs only provide two refills).

The second is to consider the minimum number of reuses has to be enough to achieve a particular environmental outcome (like, a benefit relative to a single use packaging item – i.e. at a minimum, the break-even point for emissions, or some desirable outcome such as a halving of the emissions incurred). Given that, as stated above, settling on one threshold or a set of optimal minimum rotations with respect to environmental impact is difficult at this time, the first purpose for specifying minimum rotations is considered here – i.e. to exclude pseudo-reuse.

To fulfil this purpose, it would be sufficient to find a low number that would be unlikely to be achieved without purposeful activity to achieve good functioning of the format and a reuse system together. The existing definition uses the word "multiple", which strictly speaking means "more than one" – i.e. two or more. An alternative word could be "several" which means "more than two" i.e. three or more; however this has the disadvantage that it also has the connotations of having an upper limit – several is not very many, which could be perceived as being unencouraging and perhaps limiting with respect to design for good performance. If it was used in the form of

> "*conceived, designed and placed on the market to accomplish within its lifecycle* ***at least*** *several trips or rotations*",

this could be an improvement (if it was interpreted as intended, which is not a given, as it requires a very nuanced understanding of the words used). A more direct and explicit wording taking into account the meaning of the word 'several', less open to misinterpretation, would be

> "*to accomplish within its lifecycle at least three or more trips or rotations*".

This is still however a rather low number that could be achieved by a poorly designed format and system.

Taking the precedent of work to support reuse labelling in the UK (which proposed 10 rotations as a minimum suggestion), the California 1991 Rigid Plastic Packaging Container law (which had a threshold of 5 rotations) as well as existing EU data on rotations (e.g. not high-performing bottle return systems achieving 5-10 rotations on average), a nominal number such as 5 is considered to be appropriate, as in:

> "*packaging which has been conceived, designed and placed on the market to accomplish within its lifecycle at least five trips or rotations by being refilled or reused for the same purpose for which it was conceived*"

A further tightening of the definition would be to add "and which achieves on average":

> "*packaging which has been conceived, designed and placed on the market to accomplish and which achieves on average within its lifecycle at least five trips or rotations by being refilled or reused for the same purpose for which it was conceived*"

This could be monitored, similarly to an approach outlined in Measure 8, by auditing that samples a number of users. Where the packaging is used for product/packaging categories falling under targets specified under Measure 8, the reporting obligation could be leveraged to enforce this requirement also.

An approach that does not rely on specifying a number of rotations as a threshold for definition as a reusable packaging item is to require that a system for reuse is in place. This follows the precedent in German law. It is important that this avoids being overly prescriptive such that customer led refill is not excluded from the definition of reuse in general as a result. This can be done by not specifying that the system is for return or that it needs to involve infrastructure for return; but rather in more general terms, referencing instead, a reuse system. For example:

> *"packaging which has been conceived, designed and placed on the market to accomplish within its lifecycle multiple rotations by being refilled or reused for the same purpose for which it was conceived and which is made possible by reuse systems operating at scale"*

The qualifier "at scale" is included to ensure that well established systems need to be in place for packaging to qualify as reusable. This can then be coupled with the minimum requirements outlined in Measure 10c to provide a good basis for well-functioning reuse systems, and the uptake of those in place.

If the definition of "at scale" proves too difficult, the following wording, coupled with the minimum requirements outlined in Measure 10c, could suffice:

> *"packaging which has been conceived, designed and placed on the market to accomplish within its lifecycle multiple rotations by being refilled or reused for the same purpose for which it was conceived and which is made possible by the existence of reuse systems for them"*

4.4.3 Measure 10c: the Commission formulates a definition and standards for reuse systems, in terms of incentives, infrastructure, logistics, required reporting etc., which are mandatory and specified in legislation

Stipulating requirements for reuse systems, ('minimum requirements'), used as a way of defining reusable packaging better could exclude poorly performing systems and packaging with respect to actual reuse from the market, and from the current type of reporting. It would also lead to improvement in the performance of existing reuse systems.

Because of the range of reuse systems possible (i.e. consumer led (refill) vs industry led (return), B2C vs B2B, home vs on-the-go, and further subdivisions of these main groups), it is not possible to define a single set of definitions or requirements for all these systems. However it may be possible to specify some elements for some of them, as shown in Table A-1.

Table A-1 Suggested elements for the definitions/requirements according to the reuse model

Reuse model	Sector / Product type	Infrastructure in place	Incentives in place
Industry led ("return based" systems)		Yes	Yes, for return
Consumer led - refill on the go	Some product categories (grocery/retail – i.e. bulk dispensing)	Yes	Yes, for refill

Reuse model	Sector / Product type	Infrastructure in place	Incentives in place
Consumer led - refill on the go	HORECA sector		Yes, for refill[527]
Consumer led - refill at home			

There are some additional considerations with regards to these elements:

- **Incentives.** The considerations in Measure 16 "Incentives for reusable models", described in Section 8.8, all apply – i.e. that incentives alone cannot drive reuse; but targets (specified in terms of % product sales/trips) can, and that therefore, these types of definitions could be seen as redundant, even though they are necessary for legal clarity and they are legitimate requirements for high uptake of reuse. If however targets were measured in terms of % packaging items PoM, these stipulations could become much more important.
- **Infrastructure.** There has been the long-standing issue that in part the decline of reusables, particularly in grocery/retail, has been because of the unwillingness of retailers to provide space, infrastructure and staff time and training for return. For this reason, a stipulation that retailers must accommodate return infrastructure can be seen as following on from the minimum requirement that "infrastructure for return must be in place". This would also support Measure 8. If Measure 8 was implemented, the responsibility for meeting reuse targets is likely to be delegated to some retailers who are also brand owners - in this case, Measure 8 alone provides sufficient motivation for retailers to participate in return schemes. However it would be unfair if they only provided facilities for their own brand products. Member States may choose delegation to retailers directly, as appropriate, in some circumstances and for certain product/packaging groups. In this instance, retailers would be required to provide return facilities for all reusable packaging in which products in their stores are sold. However it would be more harmonised and, in general, facilitative to the implementation of reuse schemes, to make a separate provision for this i.e. a requirement for retailers to provide take-back facilities where necessary –in the Directive itself (see below).

Suggested text is as follows,

"*The minimum requirements for a reuse system are:*

Incentives for refill or return must be in place

This includes but is not limited to: financial and non-financial incentives, penalties and rewards (such as a deposit refund scheme or favourable pricing for refill that reflects reduced packaging requirement)

A system for refill or return must be in place

[527] The incentive could be further specified that the net cost of product supply should not be greater for those supplied in reusable versus single use packaging

This includes but is not limited to: infrastructure for refill, infrastructure for return, or other established pathway by which refill and return can be achieved.

Retailers must provide facilities for return of reusable packaging to the extent necessary for the good operation of the system"

Considerations around the wording are as follows:

- The text is intended to include the elements listed in the simplest and most concise way;
- The text is intended to be inclusive and as widely applicable to all reuse systems in question as possible;
- The wording "*Other established pathway*" is intended to bring consumer led refill on the go in the HORECA sector or consumer led refill at home or return from home (which both may rely on e.g. post for refill and return) into the scope of the provision.
- Alternatively, specific reuse modes and sectors would need to be defined and minimum requirements specified for each. The disadvantage is that these definitions do not currently exist and would need to be drafted, without leading to unintended consequences, such as the exclusion of a legitimate reuse system from the scope of the provisions or indeed, the scope of the legislation in general.

4.5 Links to other measures

As a supporting measure for reuse targets (Measure 8 - Section 2.0) for waste reduction targets to be met by reuse (Measure 9 - Section 3.0), and for Measure 2, an overarching waste reduction target (see Waste Prevention Intervention Area Impact Assessment Annex), it has significant potential to accelerate progress and increase the likelihood of the targets being met. Moreover, standardised, mandatory reporting would ensure transparent recording of reuse data that would provide an accurate view on progress to target.

4.6 Assessment of Measure 10a: Commission to publish guidance on implementation of reuse systems that makes reference to CEN standard

4.6.1 Effectiveness

Commission guidance would support harmonised approaches across the EU and support the single market but cannot guarantee this.

Being guidance rather than legal definitions/requirements allows leeway for development in reuse systems over time to diverge from the guidance, and this should help avoid the risk of unintended/counterproductive consequences reducing effectiveness if mandatory stipulations were put in place before the necessary information was available.

It also means that ultimately the content will be more comprehensive because a potential outcome of committing prematurely to legal definitions and standards (the mechanism of Measures 10 b and c) means they will be very narrow in order to avoid that risk. And in general

the scope of this sort of guidance and standards would be much broader, covering a wider variety of formats, applications and systems, in more detail, than would appear in a Directive – this may correlate with its effectiveness.

The CEN standard would provide a reference point for industry, providing a basis for how reuse formats and systems should be designed and thus encouraging the development and roll-out of systems that would not necessarily be otherwise implemented due to lack of knowledge and understanding.

However, as by definition, guidance and standards would not be mandatory, their effectiveness in driving adoption of reuse packaging systems, alone, would be limited. This is why it is considered a supporting measure for Measures 8 and 9. As such, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

4.6.2 Ease of implementation

The Measure, being voluntary, entails more flexibility with respect to development of guidance/standards over time, which means that development effort can also be spread over time. This timescale allows more input from industry, which will increase acceptance and consensus, which also facilitates implementation. Resource requirements for development are also less front-loaded than for Measures 10b and c, and this may be advantageous.

The scope of the measure is expected to be broader in terms of numbers and types of formats, applications and systems, and this may increase the challenge associated with its implementation, as it would be more complex to develop.

As a voluntary measure, no enforcement or sanctions can be applied, which makes it simpler to implement. However this means it is not possible to drive adoption of the standards. This would however be countered by association with reuse targets which would be likely to provide a fair amount of impetus for their adoption.

4.6.3 Administrative burden

This measure does not in itself constitute a legal obligation to provide information, though it is likely to influence the type of information that may be required under reporting obligations for Measures 8 (see Sections 2.6.2 and 2.6.3) and 9 (see Sections 3.6.2 and 3.6.3).

4.6.4 Economic impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Economic impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

Additional considerations are as follows:

- Standardisation is expected to drive cost efficiencies and this would reduce the manufacturing costs of multi-use items, as well as capital and operating costs of reuse schemes. Standardisation may in turn reduce costs for the consumer. There will be an increase in costs for research and development in standardisation of reusable packaging and infrastructure, supply chain design and development.
- Standardisation might reduce demand for certain types of reusable packaging for which there is a market, albeit this would not be the case under this measure, which is

voluntary. It may also make impacts of trends in material switches that may be associated with packaging optimisation, more acute – if particular materials were favoured in the standards, it will reduce the market for them; though this leads to growth in the market for others. Again this is mitigated by the voluntary nature of the standard. The single market however would be supported by standardisation with impacts on access to market more evenly distributed between Member States.

- Standardisation will make reusable packaging systems more easily deployed for some systems and stakeholders owing to increased familiarity and reduced cost, especially SMEs in retail/HORECA sectors. However for some SMEs that provide reusable packaging as a service, who have invested in a stock of reusable packaging already, standardisation may entail investment and adaptation costs should they choose to align with the standard right away; this can be mitigated by aligning with natural investment cycles e.g. in replenishing or growing packaging stock.
- Product manufacturers use packaging to market their products, establishing brand recognition, and for provision of information. These opportunities are more restricted the more packaging is standardised, although there is scope for brand recognition even within a standardisation framework. On the other hand, standardisation might provide the optimisation necessary to mitigate reduced product choice per unit retail area for the affected product/packaging groups.
- Standardisation is likely to contribute to the amenability of longer supply chains to deployment of reusable packaging systems and hence support the single market.
- If importers of packaging and packaged products are included in obligations on reuse, packaging standardisation could increase the barrier to market. However, it could also facilitate the adaptation to and adoption of reusable packaging for importers to have an established system ready to integrate into. This in turn could make it easier for exports to be included in requirements on reusable packaging.

4.6.5 Social impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Social impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

An additional consideration with respect to standardisation of packaging formats follows on from impacts on manufacturers of specific packaging types that could result from the constraining effect standardisation has on access to market. The distribution of job losses and creation by packaging type and material could be influenced, depending on the exact nature of the standards.

4.6.6 Environmental impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Environmental impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

The additional consideration with respect to standardization is that it should contribute to optimisation of performance with regard to environmental impacts, and therefore should provide additional benefit. This is dependent on the exact nature of the standards.

4.6.7 Stakeholder views

Stakeholders across the board mention the importance of clearer guidance and a framework around reuse, whether it be to guarantee conditions in which reusable packaging is compliant with the internal market, as highlighted by one PRO and one trade association, or whether it be to bring unbiased guidance on issues often discussed as limiting factors for reuse (e.g. food waste prevention, hygiene, transport emissions) as mentioned by one NGO. One trade association mentions the need for central data management for any guidance to be properly followed.

There is no strong opinion as to what form this guidance should take, apart from one PRO stating that standards should be set at a national not a European level.

General feedback on standardisation

There is broad support for standardisation from across the spectrum of stakeholders, as long as it takes into account current standards (e.g. around safety and hygiene), allows for regional variability depending on consumer preferences and takes into consideration reusable formats already in use so as not to disadvantage them.

Overall, there is greatest support for Measure 10a (standardisation request to CEN) as businesses are used to dealing with CEN standards, and this standard would provide best-practice guidance but would still allow businesses to innovate. Moreover, some stakeholders are concerned there is not enough data or practical experience yet to determine robust standards for reuse packaging formats (10b) or systems (10c).

One industry stakeholder representative stresses the need for LCAs to be applied in the process of creating harmonised standards.

One PRO objects to EU-wide standardisation however as it believes the elaboration of standards should be the remit of national EPR organisations. The main objections presented are that a European standard system would add a regulatory layer already covered by national frameworks or voluntary initiatives, and that it would fail to allow for differences at a national level depending on local industries and methods.

Many suggestions were made about what should and shouldn't be included in the criteria, and opinions diverged on how comprehensive the standard should be. While some stakeholders do not want too prescriptive a standard (or any standard at all) to allow for necessary innovation, brand specificity and competition in the market, others advocate for a detailed standard that aims to uniformise and simplify packaging and harmonize systems between operators of all sizes. Two criteria that stood out as being of importance to many stakeholders were the recyclability of reusable packaging and the minimum number of rotations required.

Several stakeholders stress the importance of consulting with a wide range of stakeholders, leaving enough to time to develop a strong set of standards and considering the costs and time required for industry to adapt to these standards.

It is also highlighted that for standards to be meaningful, a form of digital tracking will be required so performance can be monitored, and businesses can demonstrate compliance.

4.7 Assessment of Measure 10b: Definition and standardisation for reusable packaging (formats) on EU level - (mandatory - specified in legislation)

4.7.1 Effectiveness

Because of the early stage of implementation or low market share of most reuse systems, and that optimal packaging formats are not yet established for most packaging/product groups, there is a risk that it will not be possible to arrive at appropriate definitions or standards for most groups, and committing prematurely to legal definitions and standards will lead to unintended/counterproductive consequences. As a result, the expected scope of such definitions is likely to be very narrow and apply only to very well-established markets. While this could improve adoption and performance in those markets, it will not be able to drive change in any of the others. Alternatively, in order to have broad scope, definitions and standards may be so general they are not able to drive the change intended. If the definition is restricted to the definition of reusable packaging in general, it may help to eliminate from the market and prevent the proliferation of poorly performing reuse systems.

Alone, this Measure may contribute to improving the accuracy of current reporting on reuse, and would improve the performance of existing reuse systems, but would not necessarily a strong driver of a transition to reuse in the market. It is hence considered a supporting measure for Measures 8 and 9. As such, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

4.7.2 Ease of implementation

Resource requirements for development are more front-loaded which may be a barrier to implementation but if the measure involves periodic revision it still may require ongoing effort.

This time profile for implementation may allow less initial input from industry, which might reduce acceptance, which will hinder implementation, but this also depends on the inclusion of periodic revision or not.

Getting the scope and the stringency of definitions and standards right is likely to be much more challenging than for Measure 10a and may increase the resource requirement significantly, or jeopardise the implementation of the Measure entirely. It may be that the information necessary to do this is, in most cases, is simply not available, given the early stage of implementation or low market share of most reuse systems. However it may be possible to define some requirements for some of the formats/systems.

In consequence, but also because of the extent to which a Directive might be expected to legislate on these matters, the scope of the definitions and standards is likely to be narrower than Measure 10a, which may make it easier to implement, but may make it less effective.

Legal definitions and standards are associated with a level of surveillance and enforcement that is an additional requirement, and in this sense, is more complex to implement, however it provides more impetus for adoption of standards, and in another sense, makes implementation easier.

4.7.3 Administrative burden

As per Measure 10a, Section 4.6.3.

In addition, enforcement requirements induced will incur some administrative burden for reporting of non-compliance, or to demonstrate compliance.

4.7.4 Economic impacts

See Measure 10a (see Section 4.6.4).

4.7.5 Social impacts

As per Measure 10a (see Section 4.6.5).

4.7.6 Environmental impacts

As per Measure 10a (see Section 4.6.6).

4.7.7 Stakeholder views

Standardisation of formats

This is the most contentious proposition, especially for stakeholders from the food and beverage industry who fear it might reduce the variety of packaging needed to meet quality and performance requirements for their goods. There is agreement that such standards should be carefully considered, on a case-by-case basis depending on the sector and the type of reuse.

That being said, stakeholders from France and Germany highlighted that standards on reusable food and beverage reusable packaging are already in development in their countries. NGOs are very keen on standardisation of reusable packaging formats at an EU level, as they understand this to be the most effective way of creating a scalable model for major product groups (e.g. beverages, transport packaging). One NGO highlights the need for standardisation to avoid the risk of competition between different reuse systems which would lead to negative environmental impacts and contribute to consumer confusion.

4.8 Assessment of Measure 10c: Definition and standards for a reuse system (in terms of infrastructure, incentives, logistics, required reporting etc) - (mandatory - specified in legislation)

4.8.1 Effectiveness

Determining standards of reuse systems shares many of the issues as for reusable packaging formats (with respect to which the reader is referred to Section 4.7.1), however it is more amenable to the definition of a number of minimum requirements for specific types of reuse systems that could raise performance and adoption of these systems, as described in Section 4.4.3.

Alone however, this measure would contribute to the reliability of current reporting on reuse and the performance of *existing* reuse systems, but it would not be a strong driver of a

transition to reuse in the market where it is not currently implemented. It is hence considered a supporting measure for Measures 8 and 9. As such, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

4.8.2 Ease of implementation

As per Measure 10b (see Section 4.7.2)

4.8.3 Administrative burden

This measure is likely to influence the type of information that may be required under reporting obligations for Measures 8 (see Sections 2.6.2 and 2.6.3) and 9 (see Sections 3.6.2 and 3.6.3).

In addition, enforcement requirements induced will incur some administrative burden for reporting of non-compliance, or to demonstrate compliance.

4.8.4 Economic impacts

As per Measure 10a (see Section 4.6.4).

4.8.5 Social impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Social impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general. (The considerations around effects on packaging formats made for Measure 10b do not apply here as they are not in the envisaged scope of the standardisation for Measure 10c).

4.8.6 Environmental impacts

As per Measure 10a (see Section 4.6.6).

4.8.7 Stakeholder views

See 4.7. No specific comment is made with regards to standardisation in terms of reuse systems or logistics.

Standardisation of reuse systems

Industry representatives from the reusable transport packaging industry were highly in favour of standardisation of reuse systems in the tertiary packaging sector, as this would provide businesses with legal certainty and confidence in investing in these systems. The issue of how legal ownership of reusable packaging could be asserted was explicitly cited, as this has been a problem for some packaging formats such as pallets.

In general, there were conflicting views on whether standardising reuse systems would simplify the logistics around packaging, or whether it would increase the burden on businesses to adapt to ill-fitting systems. These views were correlated with how well optimised existing formats were i.e. whether in innovation phase, optimisation phase or established phase. Although there is a one common viewpoint that in innovation phase, standardisation can be premature, for some

well established formats it was held that further specifications would be obstructive and actually cause established systems to work less well. In addition, some stakeholders pointed out that clear criteria for performance can aid innovation and optimisation by providing suitable outcomes to aim for, and in this sense, standardisation helps guide innovation.

4.9 Summary and conclusion

A comparison of the impacts of Measures 10a to 10c is shown in Table A-2 (next page).

Table A-2 Summary of Impacts for Measure 10

Impact category	Measure 10a – Guidance and CEN voluntary standard	Measure 10b – Reusable packaging format legal definitions and standards	Measure 10c - Reusable packaging system legal definitions and standards
Effectiveness	Broader but less strong driver for improvements to existing reuse systems and maintenence of harmonised approach/single market. Some influence on adoption of reuse where not already applied.	Narrowest but potentially strong driver for improvements to existing reuse systems and maintenence of harmonised approach/single market. Little influence on adoption of reuse where not already applied. Risk of unintended consequences higher.	Narrower but strong driver for improvements to existing reuse systems and maintenence of harmonised approach/single market. Little influence on adoption of reuse where not already applied.
Ease of implementation	Long timescale, distributed time profile, higher expected industry involvement/acceptance, no enforcement requirement, flexibility to wait until necessary is available = easier implementation. Broader scope can also be a challenge Lack of enforcement can lead to implementation gap.	Shorter timescale, frontloaded time profile, need for enforcement = be more challenging (but depends on revision schedule if stipulated) Hardest to implement owing to lack of necessary information. Enforcement can make implementation easier	Shorter timescale, frontloaded time profile, need for enforcement = more challenging (but depends on revision schedule if stipulated) Easier to implement, more amenable to the development of broader principles. Enforcement can make implementation easier
Administrative burden	No direct implication as does not constitute a legal obligation to provide information, indirect influence on obligations under Measures 8 and 9	Reporting of non-compliance, demonstration of compliance	As per 10b

Impact category	Measure 10a – Guidance and CEN voluntary standard	Measure 10b – Reusable packaging format legal definitions and standards	Measure 10c - Reusable packaging system legal definitions and standards
Economic impacts	Drives cost efficiency Potential restriction of access to market for some packaging producers; growth in market for others Increased cost for R&D	As per 10a	Drives cost efficiency Increased cost for R&D
Social impacts	May influence distribution of job creation and loss in different sectors	As per 10a	No further effects beyond general influence on growing % share reuse
Environmental impacts	Drives improvement in environmental outcomes	As per 10a	As per 10a
Stakeholder Views	General support for guidance, clarity on access to market, frameworks to support reuse. Although differing, sometimes opposing views, on how prescriptive and detailed the standard should be. Two criteria of importance stand out: recyclability and minimum number of rotations required. Little on the form this standard should take.	Mixed views for and against. Most opposed are stakeholders from the food and beverage industry, although some from France and Germany highlighted that standards on reusable food and beverage packaging are already in development.	Few views overall on this. Some conflicting view on whether standardisation of reuse systems would simplify the logistics around packaging, or whether it would increase the burden on businesses to adapt. Strong support for this measure by returnable transport packaging industry.

5.0 Measure 11: Business advisory body for reusable products and packaging

5.1 Problem definition

As elaborated in Measure 10, Section 4.1, many reuse systems are at pilot scale, and monitoring and reporting is not well established at the national level. A considerable amount of system development and optimisation both regarding operations and reporting is required, for many of the products and packaging types, and the reuse systems best to deliver them (which in most cases has yet to be established). This is a significant barrier to widespread deployment of reusable packaging.

5.2 Baseline

The only relevant provisions in the WFD are that MS must take measures to "encourage" reuse and setting up of reuse systems for products and packaging, and in the PPWD, that MS shall take measures to "encourage the increase" in the share of reusable packaging placed on the market and of systems to reuse packaging. These both could include the setting up of advisory bodies but it is not explicit in such a recommendation and this has not been a widespread mechanism for implementation. A small number of MS have advisory bodies on reuse. Most are independent and are either NGOs (e.g. Stiftung Institut Mehrweg in Germany, Circular Economy Portugal) or industry-based (e.g. Réseau Vrac and Réseau Consigne in France, Cradlenet in Sweden). To date there are no existing governmental advisory bodies, though France is due to set one up. In Article 9 of the anti-waste law (loi AGEC n°2020-105), there is a stipulation to set up a "reuse observatory". It was due to be created in January 2021 by Ademe (the French environment management agency) and will submit its first quantitative summary by 31 December 2023. Another flagship initiative is **the European Plastics Pact** which has brought together players across the packaging sector to pledge to reducing plastic waste. One of their targets is to design all plastic packaging and single-use packaging placed on the market to be reusable, where possible, and in any case recyclable by 2025.[528] As of August 2021, there are 147 signatories from 21 countries in Europe (including 15 national governments, 17 packaging manufacturers, 11 waste management businesses, 9 plastics manufacturers, 9 brands (non-food), 8 brands (food), 4 retailers).

[528] https://europeanplasticspact.org/targets/

5.3 Objectives

The aim of implementing advisory bodies for reuse is to speed up progress by coordinating the development of reusable packaging systems and sharing best practice, as well as to provide oversight and strategic direction for delivery of progress to targets.

5.4 Description of the measure

An advisory body for reusable packaging systems, operating at EU or Member State level, could be mandated to further the development and optimisation of re-use systems, and their adoption by industry and consumers. Their role could include:

- Monitoring or collating evidence on re-use levels ("Observatory" role)
- Primary research and evaluation of the cost and performance of different reusable packaging systems
- Supporting the creation of standards for reusable packaging systems
- Offering advice and guidance to producers on the implementation of reusable packaging systems
- Provide strategic direction to support meeting of the reuse targets (e.g. defining pathways and milestones, whether operational or outcomes based)
- Engage industry and consumer stakeholder groups

This measure could either apply at an EU level, or could require Member States to initiate national observatories. If set at an EU level, the advisory body's role would be to consider Member State differences in consumption, manufacturing and consumer habits, while ensuring harmonisation of approaches to the extent possible. It would be advisable for there to be a high level involvement of Producer Responsibility Organisations, so as to achieve effective buy-in from producers. The financing of the body or bodies could be met through Extended Producer Responsibility fees.

5.5 Links to other measures

As a supporting measure for Measure 8 - reuse targets (Section 2.0), for Measure 9 - waste reduction targets to be met by reuse (Section 3.0),), and for Measure 2, an overarching waste reduction target (see Waste Prevention Intervention Area Impact Assessment Annex), it has significant potential to accelerate progress and increase the likelihood of the targets being met.

5.6 Assessment of Measure 11: Advisory bodies mandated formally at EU or national level

5.6.1 Effectiveness

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

If set up at MS level (instead of or in addition to an EU wide body) it may be a more effective way of garnering more nationally relevant information and coordination for different MS.

5.6.2 Ease of implementation

The practicalities of setting up such an organisation are not challenging, although some of the tasks assigned are more so. If set up at MS level there would be more overall resource required – the setup of 27 national advisory bodies would require more resources than a single European advisory body.

Of the tasks the most challenging technically might be primary research and evaluation of the cost and performance of different reusable packaging systems, and supporting the creation of standards for reusable packaging systems

5.6.3 Administrative burden

. Public authorities carrying out market surveillance and enforcement where relevant may incur a small burden for involvement with any advisory body, depending on how the schemes are implemented.

5.6.4 Economic impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Economic impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

In addition, its role in identifying and supporting sharing of best practice will support the optimisation of reuse systems which should improve their economic performance. An EU- level organisation with or without a network of MS level bodies may help to keep approaches harmonised and support the functioning the single market.

5.6.5 Social impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Social impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

A small number of jobs would be created in the setting up of advisory bodies.

The measure would be expected to foster improved governance and participation with regards to implementation of Measures 8 and 9 on reuse, by making the chain of management more robust, improving provision of information for industry and consumers, and through facilitation of stakeholder engagement.

5.6.6 Environmental impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Environmental impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

In addition, its role in identifying and supporting sharing of best practice will support the optimisation of reuse systems which should improve their environmental performance.

5.6.7 Stakeholder views

A few stakeholders recommend the creation of advisory bodies to promote a common approach and avoid market distortions. One packaging trade association advocates for an advisory body at a European level, although it states that even a European-wide approach would not guard against the challenges of imported/exported goods, which would need to be addressed separately. Another PRO argues that the responsibility for designing and evaluating reuse systems should remain at the national level, where EPR organisations can play a more effective role in shaping the systems.

One PRO is strongly in favour of national-level standards being set and of guidance being issued by a national body responsible for accompanying and evaluating reuse programmes alongside EPR organisations. One trade association stresses the importance of industry involvement in any national advisory body.

There was broad support for an advisory board to be set up as a supportive measure. A few stakeholders questioned its necessity on top of the standardisation or suggested that the two measures could be merged.

There were many views on what the role of such a body should be. Overall, the consensus was that it should be used to coordinate the development of reusable packaging systems, share best practice, monitor, and report data on reuse, and provide strategic direction. Several stakeholders stressed that it should not create more administrative burden for businesses and that its financing should be carefully considered. There were differing views on whether it should operate at national or EU level:

- National level: greater granularity and sensitivity to local considerations.
- EU level: better oversight of how to bridge the knowledge between the packaging value chain, regulators, and consumers. And would in turn provide a more effective and coherent system throughout the EU.

One stakeholder stated that the two aren't mutually exclusive and that an EU advisory board should work closely with national bodies.

Stakeholders stated that the advisory body should be fully independent and should include representatives from across the board: from the packaging and materials industry, national authorities and PROs, consumer representatives, and retailers.

5.7 Summary and conclusion

A summary of the impacts expected is provided in Table A-1.

Table A-1 Summary of Impacts for Measure 11a

Impact category	Measure 11a
Effectiveness	› Strong support for achievement of Measure 8 and 9 targets on % share reuse and waste reduction attributed to reuse. › MS level bodies more effective for understanding national context › EU level body supports harmonised approach/single market
Ease of implementation	› Highly feasible to set up › MS level bodies likely require greater total resource › EU level bodies may find it harder to access national level information and stakeholders › Specific responsibilities more challenging depending on exact remit e.g. evaluation of cost and performance, supporting creation of standards
Administrative burden	› Small amount for collation and validation of data from reporting requirements. › Small amount for interacting with public authorities carrying out market surveillance and enforcement.
Economic impacts	Supporting optimisation of reuse systems improves economic impacts
Social impacts	› Small amount of employment generated for staffing advisory bodies. No further impact beyond what contributes to achievement of targets in general. › Improved governance and participation on reuse
Environmental impacts	Supporting optimisation of reuse systems improves environmental impacts
Stakeholder Views	Broad support for fully independent advisory bodies to promote harmonised approaches. Some support for EU level bodies, some support for national bodies.

6.0 Measure 12: Requirement for all reusable packaging to be labelled as reusable using a harmonised European approach / logo

6.1 Problem definition

Related to the problem outlined for Measure 10, Section 4.1., i.e. that packaging placed on the market as reusable may not be reused sufficiently in practice, owing to systems for reuse not actually being available for reusing the format; or because of inadequate consumer adoption. Labelling contributes to addressing these two problems by informing consumers, encouraging participation in reuse schemes and encouraging an increase in the number of uses of an item, as well as potentially providing a mechanism for some aspects of standards to be implemented and enforced.

6.2 Baseline

No labelling currently exists for denoting or supporting reusable packaging systems EU-wide. A proposal has been developed by On-Pack Recycling Label (OPRL) in the UK for select product categories. A trademark-protected sign for reusable packaging and a certification process was developed in Germany and is used in the beverage sector, and recently was approved for use on other reusable packaging in the FMCG sector, as well as outside Germany – in Austria and France. In response to the French Anti-Waste Law (AGEC, Article 17), labelling for reusables is being developed in France in conjunction with Citeo, a PRO.

6.3 Objectives

The aim of a harmonised European labelling system is to increase the uptake of reusable packaging options by providing consumers with clear guidance on reusability options and criteria.

6.4 Description of the measure

A symbol denoting reusable packaging, clearly distinguishable from disposal or EPR-scheme labelling, could help inform the consumer about the availability of reuse systems. The inclusion of information on the optimal number of rotations, for example, would help inform consumers as to the proper use of reusable packaging to optimise its performance. Labelling should clearly only be used if the packaging meets certain reusability criteria, and hence could also help drive manufacturer compliance with standards on reusability once these emerge.

Consumers' adoption of reusable packaging systems generally requires a high level of engagement and understanding, depending on the model. A symbol denoting reusable packaging could help inform the consumer about the availability of a reuse system and help them optimise its performance by promoting a high number of rotations. It should clearly only be used if the packaging met certain reusability criteria, and hence could also help drive

manufacturer compliance with standards on reusability (once these emerge). The options could be:

- Reusable vs Single-Use OR Reusable vs no labelling
- Location of refill and/ or return point as relevant to the particular reuse scheme
- Minimum number of re-uses to achieve a particular environmental outcome (like, a benefit relative to a single use packaging item – i.e. the break even point).
- Optimal number of reuses to achieve a particular environmental outcome relative to a single use packaging item
- Expected lifespan of packaging item

6.5 Links to other measures

This measure is related to Measure 10 (Section 4.4), both on the creation of standards for reuse based on the findings of research and piloting schemes, and on the establishment of definitions for reuse and reusable packaging. These will define the eligibility of packaging for the reuse label and/or content of the label.

As a supporting measure for Measure 8 "reuse targets" (Section 2.0) and for Measure 9 "waste reduction targets to be met by reuse" (Section 3.0), or Measure 2 "an overarching waste reduction target" (see Waste Prevention Intervention Area Impact Assessment Annex), a labelling system would support an increase in participation in reuse systems by consumers and thus increase the likelihood of the targets being met.

6.6 Assessment of Measure 12

6.6.1 Effectiveness

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general, by improving the performance of reuse systems.

6.6.2 Ease of implementation

Labelling schemes are already widespread for a variety of environmental purposes, so the general pathway for implementation should not be novel. The major challenges would be:

- Developing the optimal content and visuals for effectiveness
- Ensuring that labelling provides accurate information and is not misleading
- Minimising contribution to over-proliferation of green labelling

Further work is required to meet these challenges.

6.6.3 Administrative burden

Administrative burden for this measure would result from meeting legal obligations to provide information. These efforts are expected to be born by:

- Obligated producers who need to develop and implement labelling;
- Obligated producers who need to undergo any certification/validation processes (the magnitude of which will vary according to the exact implementation and according to the capacities of the competent authority); and
- Competent authorities who will certify/validate and enforce the labelling requirements.

6.6.4 Economic impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Economic impacts" to this measure. It is however expected to increase the likelihood of attainment of targets in general.

In addition, to the extent labelling is successful in helping to improve the performance of the relevant reuse systems (by increasing return rates or number of rotations), it will improve economic outcomes.

6.6.5 Social impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Social impacts" to this measure. It would however promote participation of consumers (with outcomes for improved governance and administration) by improving consumer information on reuse.

6.6.6 Environmental impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Environmental impacts" to this measure.

6.6.7 Stakeholder views

In initial feedback, very few stakeholders referred to a harmonised European labelling requirement. It was stated as an essential measure by one NGO to empower consumers and avoid greenwashing through pseudo-reusable packaging. It highlighted that the labelling is closely linked to the definition of reusability and should only be used if the item sold is actually reused multiple times for the same purpose within a reuse or refill system. Furthermore, it recommended that effective sanctioning mechanisms be put in place to deal with packaging without the required labelling or with incorrect labelling.

One trade association, which represents the interests of reusable transport packaging organisations, recognised the need for some form of labelling. However, it raised the issue of labelling for existing reusable packaging containers (RPCs) that are already on the market. It suggested dealing with this by confirming that its members are using reusable RPCs through a certification system, visible via its website.

As a result of subsequent engagement, it is noted that there is general support for some form of labelling, but stakeholders are very aware of the need to keep it simple so as not to overburden

the packaging and confuse consumers. There are many opinions as to which criteria should be included on the label. Many stakeholders suggest that transferring most of the information online and off the label, via QR codes for example, would be a good way of dealing with the amount of information to get across. Dematerialising the information would enable brands to share relevant points in a more engaging, precise and relevant way.

Any labelling standardisation could take into account such labelling initiatives already taking place (e.g. in France and Germany, or Nestlé's eco-labelling trial from autumn 2021). Moreover, such harmonized labelling could be part of a horizontal proposal to provide sorting instructions to consumers in all packaging and not only for reusable packaging.

Finally, for any labelling to be effective, it will need to be coordinated with infrastructure to handle such a labelling system. And most importantly, it will necessitate thorough awareness raising campaigns and consumer engagement.

6.7 Summary and conclusion

The impacts considered are summarised in Table A-1 below.

Table A-1 Summary of Impacts for Measure 12

Impact category	Measure 12
Effectiveness	Improves performance of reuse systems by a) increasing consumer participation and b) mechanism for application of relevant standards for reusable packaging/systems.
Ease of implementation	› Green labelling well established in general › Challenging to develop optimal content and visuals for effective messaging and driving compliance
Administrative burden	› Obligated producers for development and implementation › Competent authorities with regards to compliance
Economic impacts	Improvement of reuse scheme performance improves economic outcomes
Social impacts	› Improves participation of consumers in good governance › Improves consumer information on reuse
Environmental impacts	Not attributable to the measure by itself, this is supporting M8 and M9
Stakeholder Views	General support for some form of labelling, although needs to be rationalised with other information required on label. Potential for information to be accessible digitally mentioned by many.

7.0 Measure 19: Harmonisation of when reusable packaging (including returnable transport packaging) is classified as waste

7.1 Problem definition

Misinterpretation of the definitions in Article 3[529] in the WFD has led to confusion about the difference between reuse and preparing for reuse. In some cases, products which are actually being reused (which does not classify as a waste activity) are being treated as waste because they are interpreted as needing to go through the "preparing for reuse" stage, which is classified as a waste activity in the WFD.[530] This misinterpretation is most common for industrial packaging such as drums and intermediate bulk containers which, like most other reusable packaging, are cleaned and reconditioned before being reused.

The lack of clarity and consistency leads to questioning whether cleaning and reconditioning should automatically confer the status of waste on a product (e.g. refillable bottles which are cleaned after each use are not considered as waste until the end of their useful life). As per Article 3 in the WFD, what should confer the status of waste on something is the intent or requirement for it to be discarded. Whether it is a bottle, a box or a drum, if the user intends for it to be reused rather than be discarded (and it is in a fit state to be reused) then there in argument for the product not being classified as waste.

The classification of a product as waste when it is in fact reusable is problematic because it disincentivises from its being reused. This is because dealing with the product as waste comes with a higher administrative burden and cost (applying for handling and collection licenses) so it is simpler to simply discard the product rather than repeatedly incurring costs each time it is reused. The burden of dealing with a waste item is particularly cumbersome when cross-border transport is involved because of additional steps to notify border authorities of the waste product being transported. Again, this is where industrial packaging encounters more difficulties because it is by nature a product which is transported across borders and thus will come up against this problem more often than most reusable products.

SERRED reports that in Belgium alone, waste licenses need to be applied for in each region for the transport of industrial packaging, which cause delays and puts a huge administrative burden on the industry. Another example was given of a SERRED member in Poland who opened a reconditioning plant for industrial packaging. They were sued for handling 'waste' without a waste license. The SERRED member eventually won the case that they weren't actually handling waste, as the items in questions were being reconditioned to be reused, but by then the plant had had to close and operations cease.

The misclassification of reusable packaging items as waste is more common in open loop systems where the reusable packaging is reconditioned by a third party and not necessarily

[529] Article 3(1) of the WFD: "'waste' means any substance or object which the holder discards or intends or is required to discard"

[530] Article 3(16) of the WFD states "'preparing for re-use' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing".

returned to the same user. In closed loop systems, the packaging filler/reconditioner understands the packaging to be a product in a circular supply chain, not as a waste product at the end of each use. This clarity and understanding are often diluted when it comes to open loop systems, as the circularity of the product may be less obvious.

In the absence of legal consistency in the distinction between reuse and preparing for reuse, the reuse sector will suffer from lack of clarity and undue administrative difficulties for handling reusables. As a result, reusable packaging could end up being discarded as waste before the end of its reusable life, out of convenience. This issue is most prevalent in the RTP sector but it is not difficult to imagine other products for which this misinterpretation could cause issues, especially as reuse becomes more commonplace across a wider variety of sectors.

7.2 Baseline

As described above, there is a common misunderstanding in how Article 3 of the WFD is interpreted for different products and between Member States. In the RTP sector, Germany is the only country which does not treat industrial packaging as waste when it is sent to reconditioning thus making reuse of these products simpler and more efficient. In most other Member States however, and even in between regions within countries, interpretations differ (i.e. RTP is classified as waste after each rotation) and lead to huge difficulties in the sector.

7.3 Objectives

This measure aims at providing consistency across all Member States and across all sectors as to what is a reuse activity versus a "preparing for reuse" activity. Crucially, this will bring to light the distinction between *intent to reuse* and *intent to discard* and will help to remove barriers to reuse. In the RTP industry, which is currently the most affected sector, the clarification will incentivise the uptake of RTP in the tertiary packaging sector by providing industry with a simplified, more cost-effective route to reuse while ensuring consistency with relevant EU policies and legislation. Ultimately, this measure aims to provide legal certainty to allow for the development of a market for reuse across all packaging streams.

7.4 Description of the measure

A clarification is needed to help Member States in their interpretation of Article 3 of the WFD, specifically with regards to reuse versus preparing for reuse. This could take the form of a piece of text inserted into the PPWD explicitly stating the correct interpretation of waste and reuse, as applicable to reusable packaging. Essentially, reusable packaging should not be classified as waste between uses, even if it is cleaned and reconditioned by a third party and is not returned to the same user (i.e. an open loop system). It should only be classed as waste once it has reached the end of its useful life and is discarded.

This measure should be a clarification rather than an exemption, as the problem lies in the interpretation of the WFD more broadly, rather than being an issue with a specific set of products. It shouldn't be the case that certain products (e.g. RTP) undergo different treatment and thus should have an exemption applied. Moreover, creating a specific definition of RTP and

the parameter by which they are defined would likely be difficult, and may create more uncertainty.

What is needed is a better understanding of the distinction between reuse and "preparing for reuse" and that no products which are designed to be reusable should be classified as waste until the end of their life. This universal principle will help prevent future problems with other packaging types.

7.5 Links to other measures

As a supporting measure for reuse targets (Measure 8 - Section A.2), for waste reduction targets to be met by reuse (Measure 9 - Section A.3), and for Measure 2, an overarching waste reduction target (see Waste Prevention Intervention Area Impact Assessment Annex), it has significant potential to accelerate progress and increase the likelihood of the targets being met, in particular in the tertiary packaging sector which is where this measure will have the most immediate impact.

7.6 Assessment of Measure 19

7.6.1 Effectiveness

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Effectiveness" to this measure. It is however expected to increase the likelihood of attainment of targets in general, by improving the uptake and performance of reuse systems.

7.6.2 Ease of implementation

Amending the legislation to include a clarification on reuse should not be an onerous task. What may prove more difficult and lengthier is the transposition of this clarification into MS law, especially where this legislation has been interpreted differently down to the regional level.

Once the clarification has been made, it should greatly simplify the process for companies who deal in reusables to do so, so this measure is anticipated to be easy to implement at that level.

7.6.3 Administrative burden

As described above, the administrative burden on actors in the reuse supply chain will be reduced, by not needing to apply for waste licenses each time the product is reused. This will be particularly noticeable for products which must undergo cross-border transport as the number of licenses is greater. The greater number of reuses, the more the administrative costs would be reduced on average.

The reduction in costs is likely to be felt most by producers/fillers of RTP (as the product group most likely to be affected by this measure), and to a smaller extent by the authorities which monitor cross-border shipments.

7.6.4 Economic impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Economic impacts" to this measure. It is however expected to increase the likelihood of the attainment of targets in general.

In addition to the administrative burden mentioned above, this measure is likely to produce a reduction in costs for producers/fillers who have to apply for waste licences for their products. Moreover, an example was given in Section 7.1 where an operator had undergone legal costs to challenge the claim that they were operating unlawfully. These types of costs, and the resultant loss in employment and revenue from such businesses being closed down, will be avoided by this measure.

7.6.5 Social impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Social impacts" to this measure. As it will probably improve the uptake of reuse through providing greater clarity, it will likely lead to an increase in employment in the reuse sector, for example in the reconditioning sector for RTPs.

7.6.6 Environmental impacts

As a supporting measure for Measures 8 and 9, it is not possible to attribute any particular share of the outcomes assessed under "Environmental impacts" to this measure. In principle however, prolonging the life of products should entail the more efficient use of resources and the avoidance of landfilling of these materials, so will have a beneficial impact on the environment.

Moreover, by making reuse a clearer and easier process to use, this measure will help optimise reuse systems which will likely have a positive impact on the environment by closing material loops and creating more efficient supply chains.

7.6.7 Stakeholder views

Several packaging trade associations supported the idea that "reusable packaging should only be considered as waste at its end of life and not each time it is placed on the market after a new rotation, noting that "the current definition of packaging waste fails to make this distinction". This is also recognised by a recycling trade association, who commented "reusability does not represent the end of life management of packaging, recycling does, especially for waste packaging". Stakeholders from a sector of the industrial/tertiary packaging industry welcomed an approach extending the clarification around the definition of waste to all reusable packaging, agreeing that it would meet their specific need.

7.7 Summary and conclusion

The impacts considered are summarised in Table A-1 below.

Table A-1: Summary of Impacts for Measure 19

Impact category	Measure 19
Effectiveness	Improves performance of reuse systems by providing greater clarity.
Ease of implementation	Will be dependent on the mechanism the Commission chooses to issue clarification.
Administrative burden	Obligated producers/fillers will see administrative burden reduce.
Economic impacts	Improvement of reuse scheme uptake improves economic outcomes.
Social impacts	Improvement of reuse scheme uptake improves social impacts, for example through job creation in the RTP reconditioning sector.
Environmental impacts	Improvement of reuse scheme uptake improves environmental outcomes.
Stakeholder Views	Some support for greater clarity on reuse and fairer playing field for RTP industry in particular.

8.0 List of discarded Reuse measures

8.1 Measure 8: MS level 'sector by sector' reuse targets

Reuse targets for packaging are goals for how much reusable packaging is being used. Quantitative reuse targets would help drive the introduction of more reusable packaging into the market. Binding targets and corresponding sanctions for failing to meet targets would provide a policy framework which incentivises reuse, thereby creating favourable conditions for investments in the relevant technology and infrastructure for deployment of reusable packaging systems.

A scoping exercise was used to select product/packaging groups on the basis of impact, precedent and feasibility for reuse. This has resulted in a list of 24 categories of products across three sectors: HORECA, Grocery and Secondary/Tertiary packaging, for which targets have been proposed. The level of target proposed was related to the results of the scoring in the scoping exercise. Two sets of targets have been proposed – a lower set (8b) and a higher, more ambitious set (8c), for consultation with stakeholders. The targets are proposed as % product sales/trips in reusable packaging in number of items as this is the most intuitively interpreted and hence the most effective at engagement and sends appropriate signals to the market. In contrast, measurement in terms of items placed on the market was discarded as it is not easy to interpret and does not signal appropriately to the public or producers. It is not an accurate proxy for performance or environmental benefits of reuse systems (which relates to the number of rotations achieved in the system and cannot be captured by this unit).

It is material neutral as the best type of material and container for reusable packaging is yet to be established with respect to system performance and environmental benefits and varies for each application; this allows for faster optimisation over time.

8.1.1 Measure 8d. Voluntary targets must be set

This measure stipulates that voluntary targets must be set but does not stipulate what level. It has been dismissed at an early stage as it is considered that it would lead to different targets being set at different Member States and this would fragment the single market. It is also considered that thy would lead to a widely varying range of ambition and nature that would lead to less favourable outcomes environmentally.

8.1.2 Measure 8e. Mandate reuse of some tertiary packaging

As a standalone measure, given how well-developed reuse systems are in some areas of returnable transport packaging, 100% targets are proposed for selected groups of tertiary packaging such as B2C packaging for large white goods; crates, pallets, kegs and drums.

8.1.3 Measure 8f. Measure Target for reuse of some E-commerce packaging

As a standalone measure, given the fast growth in this sector and development of reuse schemes, targets are proposed specifically for certain types of E-commerce packaging, specifically non-food (as online food delivery product groups are dealt with under the general

targets package for groceries) and non-large white goods (as white goods are dealt with in the general targets packaging under secondary/tertiary packaging, above).

8.1.4 Measure 8g. Mandating reuse of tertiary packaging within businesses or groups of businesses that constitute closed loops

As a standalone measure, reuse within closed systems can be achieved easily and hence should be made mandatory. There is a wide range of single use packaging used unnecessarily in these situations for palletising goods or bagging up items for transport between sites and depots.

8.1.5 Measure 8h. Targets for reuse within supply chains or within a specific sector such as the retail sector (whether voluntary or mandatory)

The question of who to obligate under reuse targets is left to the Member State to determine the best solution, perhaps different for different product groups. This may mean that responsibility for meeting targets is given to different actors or groups of actors in specific cases. Obligation of supply chains for particular products or retailers of specific products is not precluded.

The question of whether higher targets for particular supply chains could be warranted in that they might constitute closed systems is separate and is dealt with by the preceding measure.

8.2 Measure 9: Mandatory MS level 'overarching cross-sectoral' reduction targets

8.2.1 Measure 9a. Target as % of reduction of SU items.

One of the drawbacks of targets expressed in terms of waste reduction is that they can be met by a variety of actions – i.e. avoidance and lightweighting as well as reuse. By measuring in numbers of items, confounding actions are limited to avoidance, rather than lightweighting (which tends to be most predominant). The total market scope in terms of sectors and product/packaging types means there is the risk that meeting the target will be driven by the easiest to achieve and will stall when the necessary preparatory activity has not been carried out in other sectors. Transition to reuse would be dominated by areas in which it is already well established (like B2B tertiary packaging). Reuse would plateau as the necessary development of new systems across a wider range of sectors would not have been stimulated. This then delays progress. Sector by sector targets in contrast set the stage for widespread change across a broad variety of products and increase the number of types of reuse systems developed, increasing innovation and best practice that can be shared between different sectors. It also maximises consumer exposure, engagement and behaviour change.

8.3 Measure 10: Guidance on effective reuse systems

8.3.1 Measure 10d. Guidance on best practise for reusable packaging (issued by informal national or EU level groups)

As a contrast to official guidance, an alternative measure considered was the formation of more informal groups to provide forums for e.g. conducting the gathering of supporting information on reusables and sharing of best practice nationally or at EU level.

8.4 Measure 11: Business advisory body for reusable products and packaging

8.4.1 Measure 11b. Forum: informal EU or national level groups

As a contrast to an advisory body or bodies required in legislation, an alternative measure considered was the formation of more informal groups to provide forums for e.g. conducting the gathering of supporting information on reusables and sharing of best practice nationally or at EU level.

8.5 Measure 13. Create a single market for reusable packaging

Commission Communication on harmonisation of reuse systems (e.g. as per on DRS to avoid fragmentation of the single market).

Closely related to the discussion above, standardisation of packaging format has been identified by some stakeholders as necessary to allow:

- Economies of scale
- Smooth functioning of the internal market; and
- Improved rates of adoption by consumers,

and hence improve the feasibility of particular reuse systems. However as mentioned above it is too early to know what the optimal packaging format and reuse system is for particular product groups. Therefore the creation of a single market for reusable packaging by creating standardised, single reuse systems for particular product/packaging or product/packaging groups is not seen as currently feasible. This has therefore not been shortlisted.

8.6 Measure 14. Updates to the essential requirements and EPR considerations for reuse

8.6.1 Measure 14a. Updating the essential requirements to better align with the waste hierarchy

The present Essential Requirements do reference reuse but do not make the hierarchy clear – i.e. that reusable packaging options should be preferred over recyclable single-use packaging options. Revisions to the Essential Requirements have been addressed in the predecessor to this project (Effectiveness of the Essential Requirements for Packaging and Packaging Waste and proposals for reinforcement), namely that:

- Reusable packaging should not be exempt from end-of-life waste management fees as they still incur these. In absolute terms however there are less fees to pay because this is only charged the first time the packaging is placed on the market.
- Reusable packaging should be subject to the same recyclability related modulated fees. This will also be ameliorated by the measure under consideration that 'all reusable packaging should be recyclable' (see Impact Assessment for Recyclability – Measure 21).
- The obligated party should be the 'leaseholder' of the packaging rather than the producer so as to incentivise care of the packaging and high number of rotations so that EPR fees are reduced.

- It was determined that the Essential Requirements, by their very nature a set of conditions according to which packaging may or may not be placed on the market, cannot drive reuse because when packaging is placed on the market, it is not possible to know whether the product sold in it could feasibly be sold in an item of reusable packaging, as this is for many items, dependent on the existing systems. And where the systems do not exist, the use of reusable packaging can simply be deemed not possible. In addition, it is unable to drive reuse in preference to recycling – i.e. to achieve alignment with the waste hierarchy, because the obligated party is in most cases not the one responsible for making choices about whether to packaging a product in single-use or reusable packaging. It is expressly for these reasons that this separate project on waste prevention has been commissioned.

8.6.2 Measure 14b. EPR fee modulation for reusable packaging

Some Member States have independently implemented exemption of reusable packaging from EPR fees. However the proposal that fees should be modulated according to the number of reuses an item of packaging could have were not recommended in the previous project (Effectiveness of the Essential Requirements for Packaging and Packaging Waste and proposals for reinforcement) as they were not considered workable. Feasible versus actual use for any specific packaging item placed on the market was considered too difficult to demonstrate comparatively across all the different reuse systems.

8.6.3 Measure 14c. Reusable packaging exempt from licensing obligations/EPR fees

This measure was discarded as it is inconsistent to exempt packaging, as it still needs to be disposed of at end of life. As stated above, the benefit comes from the fee for reusable packaging only being applied once, the first time it is placed on the market.

8.7 Measure 15. Reuse reporting in selected product/packaging groups

At present, reporting of reuse is very minimal (see Section 2.2). Simply obliging reporting would be a way to make reuse or lack of it more evident and to hold stakeholders to account if they are failing to provide consumers with the choice of using reusable packaging and improve the uptake of this mode of service/product provision. It would also pave the way for voluntary or mandatory targets in the future. There are different ways of measuring reuse with their own pros and cons and different implications (major modes being by weight versus number of items, or, by packaging items PoM vs product sales/trips in reusable packaging). It was considered that this alone would not be a strong driver however for the development and deployment of reuse systems and would be required for the implementation of the proposed reuse targets anyway. Therefore it was not assessed as a separate measure.

8.8 Measure 16. Incentives for reusable models

There are several options for incentivising reuse financially. These include:

- Measure 16a. Taxes on single use items (all materials)
- Measure 16b. Levies and charges for single use packaging items at point of sale
- Measure 16c. Subsidies or tax breaks for reusable items such as reduced VAT on refillable/reusable items

EPR fee modulation is discussed in measure 14b above and is not considered here.

Financial incentivisation is considered to be an effective way of encouraging adoption and use of reuse systems however the price signal is not enough to overcome the barrier presented by investment in development and initial set up costs for all systems. These incentives are best deployed as a way of contributing to the meeting of reuse targets as and where desired and required and therefore it is not necessary to specifically mandate them if there are reuse targets. In addition, taxation as an instrument is considered out of the scope of the PPWD.

However these incentives could all be referenced in the Directive as suggested ways to meet the targets set.

8.9 Measure 17. Provision of funding for research and development

This measure could support the activities of a business advisory body involved in the development of reusable packaging systems and formats and guidance on optimal implementation, for example by supporting the development of methods for collection of data on reuse and conducting data gathering. However alone it was not considered to be adequate to motivate the piloting and scaling up of the required infrastructure and associated systems, and drive the scale of change necessary in terms of adoption.

Many stakeholders (producers and some Member States in particular) have asked that life cycle analysis (LCA) should guide every decision around switching to reuse systems on a case by case basis, and that funding and completion of exhaustive analysis be a prerequisite for deploying reusable packaging systems. It is noted that to require this is however to presume in favour of

the performance of single-use plastic packaging by default, which is inconsistent and in effect, an unfair playing field. To mitigate the fact that the data for optimised reuse systems will not be available until they are implemented at scale, and that LCAs have intrinsic limitations with regard to a) the parameters assessed (e.g. litter is not taken into account) and b) the arbitrary nature of decisions around defining analysis scenarios (for example, in terms of the number of reuses being current averages, best practice or potential future optimal scenarios), the measures provided are designed to be material neutral, not favouring any by material weight or emissions footprint, so that the optimal packaging material for each case can be determined over time. The general principle that a reuse system will outperform single-use packaging environmentally if the number of rotations is high enough is sound. Reuse is only rarely mandated for specific product/item type categories for the precise reason that it will take time to understand where reuse is most favourably implemented at present, and how this might itself change over time as systems develop.

In addition, funding is considered to be more within the scope of other EU programmes, and not most suitably addressed within the PPWD.

8.10 Measure 18. Information campaigns on reuse

The considered measures included:

- Measure 18a. Promotion of specific reusable items to consumers (such as reusable beverage cups)
- Measure 18b. Promotion of reusable packaging items in general, as required by WFD[531]
- Measure 18c. General campaigns on environmental costs of single-use packaging and how to reduce packaging consumption

Awareness and education alone are not sufficient to drive reuse, especially when several modes of reuse (all except refill on the go for the HORECA sector) require the development and scaling up of supply chains and infrastructure to accommodate this change in supply of services and products. They are of course necessary in support of the achievement of reuse targets, but this can be left to the obligated parties to leverage in the most cost-effective way.

8.11 Measure 20. Reusable tableware mandated in HORECA sector

Reusable tableware items would be mandated in the HORECA sector for eat-in purchases. Not all tableware items (such as utensils) are considered to be packaging, and measures with regard to them have therefore been discarded. Although this measure has been promised under the Circular Economy Action Plan through the activities of the Sustainable Products Initiative, and the Commission also committed to carrying out analytical work to scope legislation for

[531] Article 9(d) of the WFD states that "Member States shall take measures to prevent waste generation. Those measures shall, at least: (d) encourage the re-use of products and the setting up of systems promoting repair and re-use activities, including in particular for electrical and electronic equipment, textiles and furniture, as well as packaging and construction materials and products".

substitution of single-use packaging in the HORECA sector for reuse, it is understood that this is not currently being progressed.

APPENDIX J – IMPACT ASSESSMENT OF RECYCLABILITY MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Recyclability, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 to 5.0 contain the impact assessments of the selected measures; and
- 6.0 contains the description of the discarded measures.

All impacts shown, unless otherwise stated, are referring to the effects of the measure in 2030 compared to the baseline in 2030.

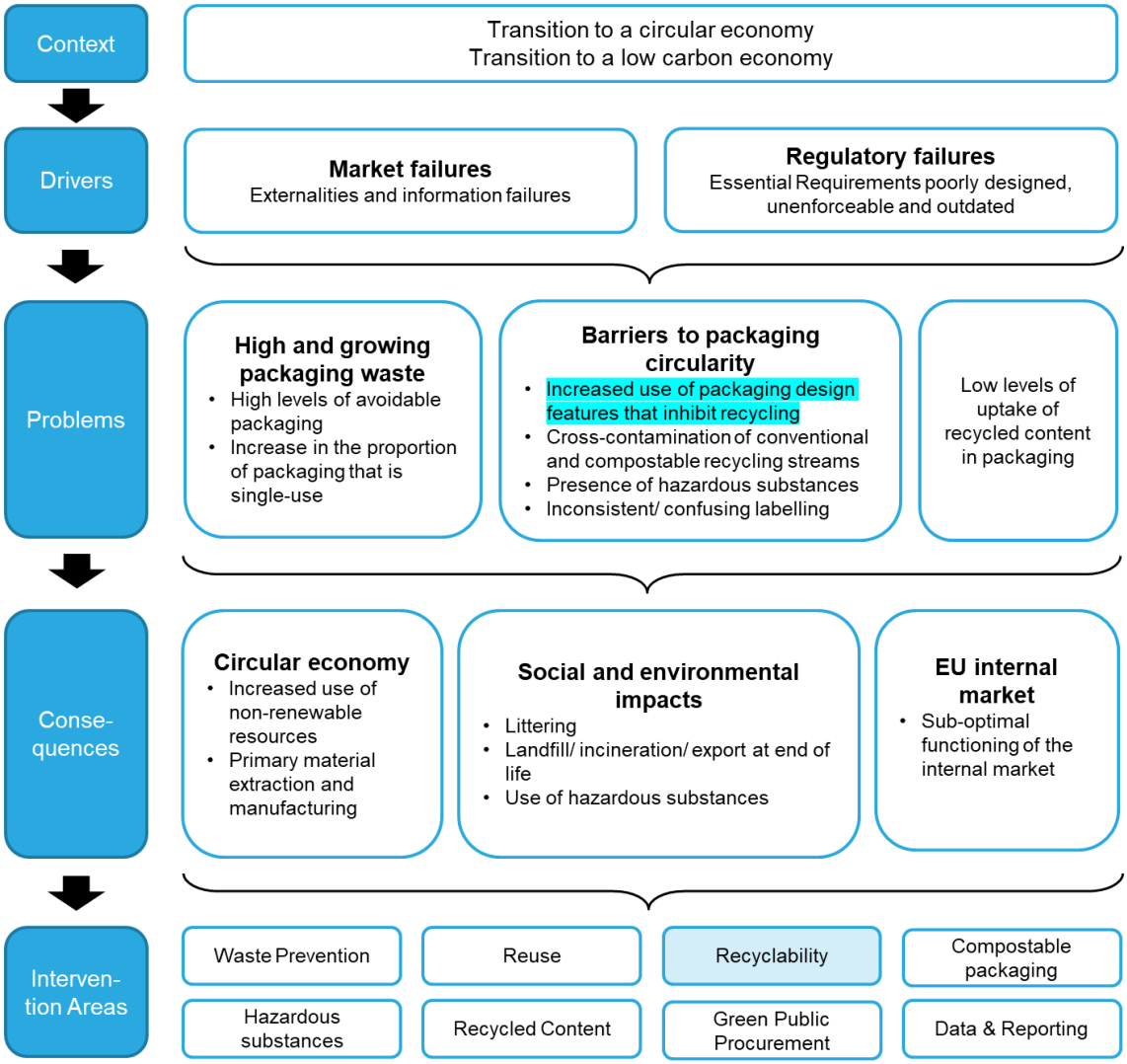
This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 2.1 describes the problem "Increased use of packaging design features that inhibit recycling" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario, and section 5 specifically discusses recycling rates.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. In this document the quantitative impacts are presented in relation to the baseline and, unless otherwise indicated, for the year 2030. Impacts are described qualitatively where quantitative analysis was not feasible.
  - Appendix D – Impact modelling methodology describes how the impacts for each measure were calculated and the underlying assumptions. Section 2.3 specifically discusses the recyclability measures.

1.1 Intervention logic

As shown in Figure A-2 below, Recyclability is one of the eight intervention areas identified in the intervention logic. It is directly related to one of the identified problems: **Increased use of packaging design features that inhibit recycling**.

Figure A-2 Intervention logic diagram



In this regard, there is a need to firstly ensure that the Essential Requirements are updated to align more closely with the requirements of the 2018 revision to the waste legislation. This would ensure that packaging placed on the EU market is designed with recyclability in mind. Secondly, the smooth functioning of the internal market must be maintained, through the development of a common framework of legislative requirements, including clear definitions of what can be considered recyclable and how this can be assessed. And finally, to reduce the impact of packaging on the environment, it is necessary to improve the recyclability of packaging in such a way that that a circular, low carbon economy can be fostered.

1.2 Measures assessed

Many measures for improving the recyclability of packaging have been considered during this study. Of these, several were discarded, either due to a lack of feasibility or overlaps with other measures. Descriptions of these discarded measures and the rationale for their exclusion are provided in Appendix A.6. The measures that were shortlisted for inclusion within the Impact Assessment for recyclability are listed below:

- Measure 21: Updates to the Essential Requirements
  - Measure 21a: All packaging shall be reusable or recyclable by 2030
  - Measure 21b: All reusable packaging must be recyclable by 2035
- Measure 22: Defining Recyclable Packaging
  - Measure 22a: Qualitative definition in PPWD text
  - Measure 22b: Definition, assessment and enforcement via the use of design for recycling criteria
  - Measure 22c: Allowance for definition of recyclable packaging as packaging that exceeds a minimum recycling rate threshold
- Measure 23: Harmonisation of EPR Fee Modulation Criteria
- Measure 27: Harmonisation of labelling requirements for the disposal of recyclable packaging
  - Measure 27c: to include material component information

It is noted that a quantitative assessment of some of the impacts of these measures is hampered by the lack of data at the level of granularity required to estimate the impacts on specific packaging types. A qualitative approach has therefore been adopted to fill the gaps in the quantitative analysis, using four representative packaging types as case studies to build an evidence base, from which the likely impacts of the measure can be analysed. The methodology for this case study analysis is detailed in the next section.

1.2.1 Case Study Methodology

The objective of the case studies was to bring an in-depth understanding of four examples of packaging types that are currently challenging to recycle, how the proposed measures might impact these and in what timeframe. The selection of packaging types chosen for the case studies were those known to be somewhat problematic to recycle at present but also currently used in large volumes. This means that the impacts assessed are representative of the largest group possible. A variety of packaging applications were also sought, though three of the four are food packaging applications, which is indicative of how the challenges of packing food products has led to a high degree of innovation in packaging material construction and packaging design. A summary of the selected case studies is in Table A-1.

Table A-1 Case Study Packaging Types

Case Study Packaging Type	Key Characteristics that inhibit recycling
Beverage Cartons	• Need to separate polymers and aluminium from paper board • Lack of end markets for recovered polyethelene and aluminium mix (PolyAl) materials.
PET Thermoform Trays	• Multi-polymer construction, use of coloured PET • Lower viscosity of material has led to yield issues in recycling process, overcome so far only in trial plants.

Case Study Packaging Type	Key Characteristics that inhibit recycling
Plastic film (excluding tertiary/transport wrapping films)	› Stream is challenging to sort to produce clean stream for recyclers › multi materials within stream › high levels of contamination
Multi-layered flexible packaging	› Multi-polymer construction difficult to separate layers with mechanical recycling.

The intention of the case study work was to understand industry's current work to improve the recyclability of the packaging type, as well as how far they see this going in the next ten years. The focus was on learning from the direct experience of stakeholders who are already innovating, to understand what is technologically feasible and what is likely to be feasible at scale by 2030. For this reason, the interviewees selected were primarily industry stakeholders, including packaging producers, brands, industry associations and recyclers. Interviews were conducted with 25 individuals across 16 organisations and companies. See Table A-2 below.

Table A-2 Summary of interviews for Recyclability measures

Organisation / Company	Description	Interviewees	Date Interview
ACE Europe	Industry Association - Beverage cartons	3	28th Apr 2021
Amcor	Packaging Producer - Flexible packaging	1	22nd Jan 2021
Ceflex	Industry Association - Flexible Packaging	2	10th May 2021
Danone	Brand - Beverage Cartons and PET trays	2	6th May 2021
EXTR:ACT	Industry Association - Beverage cartons	1	28th Apr 2021
Faerch	Recycler - PET trays	1	25th May 2021
Flexible Packaging Europe	Industry Association - Flexible Packaging	1	22nd Jan 2021
Gualapack	Producer - Multi-layer flexible pouches	2	12th May 2021
Industrievereinigung Kunststoffverpackgung E V	German Association for Plastics Packaging and Films	1	22nd Jan 2021
Klochner Pentaplast	Packaging Producer - Film and PET trays	2	24th May 2021
Mondi Group	Packaging Producer - Films	1	22nd Jan 2021

Organisation / Company	Description	Interviewees	Date Interview
PepsiCo	Brand - Flexible snack packaging	2	24th May 2021
Plarabel	Waste Consultancy Belgium	1	20th May 2021
Petcore	Industry Association - PET trays	2	3rd May 2021
Tetra-Pak	Packaging Producer - Beverage cartons	2	28th Apr 2021
Trioworld	Packaging Producer - Films	1	5Th May 2021

1.3 Measures discarded

During the study, the longlist of potential measures to address the root causes of the problem identified was refined through iterative preliminary assessment alongside the Commission. This included consideration of the feasibility of the measures in terms of implementation and enforcement, their potential to address the problems identified and any overlaps with other measures. The measures not included within the Impact Assessment are as follows, with further description and the rationale for exclusion provided in Appendix 6.0:

- Measure 22: Defining recyclable packaging
  - Measure 22d: Industry-led voluntary DfR approach
- Measure 24: Defining high quality recycling
- Measure 25: Reducing packaging material complexity
- Measure 26: Updates to recycling targets
  - Measure 26a: Updates to existing recycling targets (2030)
  - Measure 26b: Proposal for increased recycling targets (2035)
  - Measure 26c: Introduction of collection targets / requirements for deposit return systems for specific materials/ applications
- Measure 27: Harmonisation of labelling requirements for the disposal of recyclable packaging
  - Measure 27a: to include information on whether it is "recyclable" or not (in line with selected definition)
  - Measure 27b: to include information on disposal instructions
  - Measure 27d: to include restrictions on the use of particular confusing labels
  - Measure 27e: to incentivise digital watermarking/ other traceability technologies

2.0 Measure 21 Updates to the Essential Requirements

2.1 Problem definition

The Essential Requirements in their current form are not stimulating the packaging industry to maximise its potential to contribute to the circular economy. The current wording of the Essential Requirements allows for energy recovery as a route to comply with the legislation, contradicting the new Circular Economy Action Plan[532] and the current view of the waste hierarchy in the Waste Framework Directive (WFD), which has been amended since the Essential Requirements were originally developed. The use of harmonised standards to provide a presumption of compliance with the requirements has been criticised, and overall, the vague wording and lack of enforceability of both the Essential Requirements and the harmonised standards is widely accepted by both industry and Member States. The Essential Requirements are therefore not consistent with the wider EU policy landscape regarding recycling and are failing to meet their intended purpose due to their vague wording and openness to interpretation. More details can be found in Appendix A – Problem Definition.

2.2 Baseline

The current trajectory for changes in waste management to divert material to higher levels of the waste hierarchy is being driven by existing legislation, primarily the recycling targets. The 2018 revision to the Packaging and Packaging Waste Directive (PPWD) included several measures that are likely to have a significant impact, although these are still in the process of being implemented. For example, the 2025 and 2030 recycling targets in the 2018 update to the WFD and the PPWD and the requirements for separate collections in Article 11 (WFD) are prompting Member States to improve and increase waste collection services.[533] Secondly, the requirement to introduce modulated EPR fees (Article 8, WFD) for packaging producers covering the costs of end-of-life management of packaging are incentivising producers to increase the recyclability of their products.

The changes observed to date have therefore been focussed on the end-of-life management of packaging, with improvements in the recyclability of packaging (design phase) limited to EPR fee modulation. The latter, however, does not affect all packaging equally, as the impact will depend on the magnitude of the fee relative to the overall value of the product.

Without further incentives for design improvements to make packaging recyclable, meeting the 2030 recycling targets in Article 6 is likely to be challenging, particularly for plastic packaging (see Appendix A – Problem Definition). The quantitative modelling of impact that has been undertaken for this measure therefore assumes that in the baseline the revised packaging recycling targets set for the year 2030 in Article 6 of the PPWD will not be met (see Appendix B – Baseline Methodology), despite some improvement in the design of packaging placed on the market relative to 2018. Such design improvements in the baseline scenario are likely to be the case for those packaging types where the design changes necessary to boost the collection and

[532] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

[533] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018L0851

recycling of packaging are relatively minor, or where alternative formats and materials that are more recyclable are easily available (i.e. the "low hanging fruit"). These therefore represent the most cost-effective changes required to meet the targets.

However, particularly problematic packaging types for recycling are unlikely to be impacted in the baseline, as design changes within these formats are likely to be costly/ require significant investment in R&D or recycling technology. In this respect, as mentioned above, EPR fees will not always provide a sufficient incentive to improve recyclability of packaging. This is because, in some cases, the magnitude of fee modulation relative to the overall value of the product may be low. Therefore, a further incentive is needed to ensure that these packaging types are also being designed to be recyclable or taken off the market.

2.3 Objectives

1. **Outcome:** To achieve consistency in EU legislation intent and wording. This measure is designed to bring the Essential Requirements in line with the current view of the waste hierarchy in the EU policy and legislation. This will reflect several amendments to waste legislation which have been implemented since the Requirements were first developed to ensure smooth functioning of the internal market and reduce impacts on the environment.
2. **Objective:** To maintain a level playing field in which all packaging types are equally encouraged to improve the recyclability of their packaging whilst preserving the smooth functioning of the internal market in an enforceable manner.
3. **Impact:** To reduce the environmental impact of packaging waste management, by driving design for recyclability of packaging to stimulate a circular economy.

2.4 Description of the measure

The following measures are proposed to reinforce the Essential Requirements for packaging in Annex II of the PPWD. It is noted that these two measures (21a and 21b) are complementary and are therefore not proposed as variants of each other.

2.4.1 Measure 21a: All packaging shall be reusable or recyclable by 2030

The overarching requirement for all packaging (i.e., of all materials, irrespective of the material, or combination of materials, they are made of) to be reusable, or recyclable removes the option for energy recovery as a route to comply with the Essential Requirements and means the Essential Requirements are focused on the top three tiers of the waste hierarchy: prevention, reuse and recycling.

This means that **paragraph 3(b)** (relating to packaging recoverable in the form of energy recovery) **would be omitted from the reinforced Essential Requirements**. This is intended to improve the environmental impact of packaging waste management by ensuring it is designed to be recycled or reused, rather than incinerated, and reflects the current view of the waste hierarchy in Directives amended since the Requirements were developed.

This also means that **paragraph 3(a)** – relating to packaging that is recoverable in the form of material recycling – **would need to be amended**, in part to reflect the new definition of recyclable (see Measure 22 below) but also to remove the reference to only "a certain percentage by weight of the materials" being suitable for recycling. Under the reinforced Essential Requirements, all of the packaging – not only an unspecified percentage of some packaging – would need to be recyclable.

Finally, it is noted that the Circular Economy Action Plan 2020 (CEAP 2020) highlights the objective for packaging on the EU market to be reusable or recyclable by 2030 "in an economically viable way". In principle, all packaging might be considered 'recyclable' if enough time and money were available to spend on the process (from collection through to final reprocessing). It may, therefore, be relevant to consider both the economic viability of recycling the packaging item within a given timeframe.

However, reference to the recycling of packaging in an "economically viable" manner would be inappropriate in the context of the Essential Requirements in the PPWD and should therefore be excluded from the wording in the revised legislation. This is because the wording is vague and open to several interpretations.

For example, requiring packaging to be recyclable in an economically viable way may be interpreted as "packaging placed on the EU market must be recyclable, *if* such recycling is economically viable" or that "packaging shall be recyclable if it is economically viable to make it recyclable". This would potentially create a loophole to the requirement for <u>all</u> packaging to be recyclable by 2030. This is relevant for particular types of packaging that are only placed on the market in small quantities, or are difficult to separate into recyclable components. For these packaging types, it may not be cost-effective for businesses to invest in technology to sort or reprocess it at commercial scale, due to insufficient volumes or quality of material throughput and marketable outputs relative to the cost of collection, sorting and recycling. In these cases, even if a process to recycle the packaging did exist in theory, in reality, only a very small proportion of that packaging placed on the market would actually be recycled. The producers of these types of packaging may therefore be exempt from having to design their packaging to be recyclable, since recycling is not deemed "economically viable".

Alternatively, the term "economically viable" could be interpreted to imply that "packaging should be recyclable *and* such recycling must be economically viable in 2030", i.e., that only packaging for which there are established, cost-effective routes for collection, sorting and recycling in 2030 should be deemed recyclable. This would imply that packaging that is technically recyclable but does not actually get collected, sorted, or recycled on a wide scale (e.g., placed on the market in smaller quantities or difficult to separate into recyclable components, as discussed above), would simply be considered unrecyclable and therefore no longer be allowed to be placed on the market. If defined along these lines, the inclusion of the requirement for packaging to be recyclable or reusable in an economically viable way would therefore instead be more stringent, providing grounds for market restrictions in the future. This is the interpretation that most closely aligns with the Commission's ambitions.

Whichever of the above two interpretations is applied, the question of what is economically viable may differ between Member States. Therefore, the decision about what is cost effective or economically viable is not only arguably subjective, but even if interpreted consistently could lead to different answers in different Member States. Including the term "economically viable" in

the Essential Requirement would therefore risk divergent definitions of what is recyclable across the Member States.

If the term "economically viable" is to be included in the legal text, it will therefore be crucial for the Commission to clearly define what is meant by the term "economically viable" to ensure that divergent definitions and an unintended loophole to the recyclability requirements are not instead created. This is likely to be challenging since sorting and recycling systems vary widely across Member States, and gaining consensus on what can be considered economically viable at the level of the EU may mean that packaging which is currently "recyclable" in one or two advanced recycling Member States may no longer be deemed recyclable at the EU level.

Therefore, it is proposed that in the Essential Requirements, the wording should be limited to requiring that packaging should be reusable or recyclable in 2030. This is the measure that has been assessed here. In addition, the underlying principle behind the requirement for packaging to be designed to be recyclable in systems that are currently "economically viable" can be incorporated instead as a part of the definition of "recyclable" that will form the basis for implementing the Essential Requirement. Accordingly, the need for packaging to be recyclable "at scale" in "industrial processes" has been included as part of the definition of the term recyclable discussed in measure 22a, to ensure that the spirit of the CEAP wording is incorporated even if the term "economically viable" is not. In practice, to remain feasible and implementable, this will involve demonstrating the potential for packaging to be recycled in existing and widely used ("at scale") facilities rather than showing that packaging is actually recycled at the end of life.

2.4.2 Measure 21b: All reusable packaging must be recyclable, unless there is a robust demonstrable case for exemption

The CEAP 2020 requires that all packaging should be 'reusable or recyclable' by 2030 – suggesting packaging must be either one or the other, in that if a piece of packaging was reusable, it might not have to be recyclable. There is a risk, therefore, that non-recyclable packaging is placed on the market, claiming to be reusable, even though the number of times the packaging is actually reused is very low. This may be because the item is, for example, not very durable; a term also not defined in the legislation. This risks the creation of unfair advantages to such packaging which would not have to meet the requirements to be recyclable. To maintain a level playing field, therefore, the proposed recyclability requirements are designed to ensure that the negative environmental impacts of all packaging, including reusable packaging, at the end of life are minimised.

Therefore, paragraph 2 in the Essential Requirements would need to be amended to **require that reusable packaging also meets the requirements of paragraph 3 – relating to the recyclable nature of packaging** as specified in measure 21a.

Given that the market for reusable packaging is relatively immature, however, it will be important not to stifle growth and innovation in reuse systems, reflecting the objectives of the waste hierarchy. The market of reusables is at an earlier point of development than that for single use packaging, with a high degree of innovation. Whilst innovation is also present in the market of single use packaging items, this typically concerns innovation to modify an existing packaging type using novel materials. In order to develop widespread reusable systems innovation is required not just in the construction of the packaging item but the system

supporting reuse; collection points, preparation for reuse which may include sanitisation, and redistribution. In addition, it must be noted that assessing recyclability of reusables is a more complex process than for single use items. Reusable items are in use for a much longer time period, perhaps several years, and the waste collection, sorting and recycling markets and infrastructure can change in this time. Assessing a reusable item's recyclability today may not be an accurate indicator or its recyclability at end of life.

It is thus proposed that reusable packaging should be treated as innovative packaging and exempted from the requirement to be recyclable by 2030 (in line with measure 21a above and measure 22 below). To qualify for such an exemption until 2030, packaging must be shown to meet the minimum requirements for reusability (see Impact Assessment on Reuse measures 10b and c).

However, as per the above argumentation, this exemption should be viewed as the first step of a transitionary process to ensuring that reusable packaging is also recyclable, albeit with a longer lead in time reflecting the reusables market's nascence. Accordingly, the proposed updates should give a strong market signal from the outset that will stimulate innovation to improve recyclability, so that new reusable packaging products are designed with recyclability in mind. Therefore, beyond 2030, and up to 2035, it is proposed that the requirements for exemptions to the recyclability requirements for reusables be made more stringent. Beyond 2035, all reusable packaging should also be recyclable in line with the Commission's definition of this term (see measure 22). The proposed approach can therefore be summarised as follows:

- Up to 2030 – reusable packaging exempt from being recyclable (based on minimum reusability criteria)
- Between 2030 and 2035 – reusable packaging exempt from being recyclable requirements (based on stringent reusability criteria)
- After 2035 – All reusable packaging must also be recyclable (no exemptions)

As discussed above, the basis for exemptions until 2030 should be the minimum criteria for packaging reusability (see measures 10b and c in the reuse intervention area).

In terms of the criteria for more stringent exemptions for reusables between 2030-35, it is proposed firstly that the onus of making a case for exemptions for reusables be placed on the producers. Producers of such packaging should not only be required to demonstrate that their packaging meets the minimum criteria for reuse discussed above but must also demonstrate a robust case to continue to be placed on the market alongside recyclable alternatives (which may be single use), while not being recyclable itself. The scope of these criteria would be determined as part of measure 10a in the reuse intervention area. For example, reusable packaging items present a solution to the protection and transportation of certain products that avoids the need for single use packaging. If a reuse system has good reasons for using materials that are not recyclable, then it must show that overall this system is significantly preferable (from an environmental perspective) to either or both the existing single use items or/and a reusable alternative that is also recyclable.

In this regard, many existing definitions of reuse / reusable refer to the multi-use or iterative nature of the item. Accordingly, a more stringent case for exemption between 2030 and 2035 should include as a minimum all of the following:

1. proof of a higher number of rotations on average than reusable alternatives that are also recyclable;,
2. demonstration of reduced environmental impact associated with reconditioning of the item relative to recyclable alternatives (further clarification on distinguishing between

reconditioning and preparation for reuse is provided in measure 19 in the intervention area on reuse).

3. demonstration of reduced environmental impact of the system taking into account also the logistics (e.g. transport distances, mode of transport) of the item relative to reusable alternatives that are also recyclable, or single use items that it replaces.

The exemption would need to be specified in paragraph 2 of the Essential Requirements, referring to the requirements of paragraph 3. The minimum requirements for classification as reusable packaging would need to be specified as per measure 10 in the reuse intervention area (for which a number of variants have been proposed and assessed), as well as the additional criteria for more stringent exemptions between 2030-35. Such an implementing act should also specify the process for granting exemptions, and the verification procedure to be followed (preferably by an independent body, rather than self-certification).

When considering potential exemptions to this requirement that will be allowed between 2030 and 2035 the only example may be where a reusable item is part of a system that significantly improves the environmental performance of the packaging system AND no recyclable reusable alternative exists that could also bring the same environmental benefits. The key factors affecting overall environmental profile of a reusable packaging item are

1. the number of rotations of use (i.e., how many single use items it replaces)
2. the energy, greenhouse gas emissions, water and detergents required in collection, transport and reconditioning of items to enable reuse.

For example, currently within a food box reuse scheme in Germany the items are made from a PBT (polybutylene terephthalate) glass polymer that is not currently recyclable.[534] The material was chosen because it is strong, durable and easy to sanitise at low energy. To remain on the market between 2030 and 2035 the producers would need to demonstrate that the overall performance of the system brings significant environmental benefits compared with single use items AND that there is no recyclable alternative with an equivalent environmental performance. Currently it is very difficult to assess and compare directly the overall environmental performance of a reusable packaging item. By formulating the measure to include a long lead in time to full recyclability this gives time to develop a more robust methodology for this assessment in an implementing act or harmonised standard.

2.5 Links to other measures

- The updates will need to be operationalised by a revised definition of "recyclable" that is being considered under measure 22.
- The implementation of this measure is dependent on the more direct measures operationalising the requirement (measure 22) and supporting measures related to monitoring and enforcement (measure 23, 27) (see Impact Assessment appendix on intervention area Data & Reporting).
- The measure also links to those discussed as part of the reuse and compostable packaging intervention areas, since all packaging is subject to the Essential

[534] https://www.recircle.ch/en/rebox#toc3211

Requirements and should be worded to ensure that these forms of packaging are not inadvertently excluded or disadvantaged.

2.6 Assessment of Measure 21a: All packaging shall be reusable or recyclable by 2030

2.6.1 Effectiveness

Measure 21a will effectively achieve the objective of internal consistency within EU waste legislation by prioritising recycling over recovery in accordance with the waste hierarchy in the Waste Framework Directive (2008/98/EC). The measure is also expected to be effective in creating a level playing field for all packaging types by removing the option for certain packaging to be recoverable via incineration, which is only a viable route for packaging with a significant calorific value such as plastics.

However, in terms of improving the enforceability of the Essential Requirements, this measure alone is unlikely to be effective. This is because the term "recyclable" in the Essential Requirements, if not accompanied by some form of definition and assessment criteria, would likely result in a wide number of interpretations across the 27 Member States, reflecting the current collection, sorting and recycling infrastructure in each (see discussion in 6.2). This would fragment the internal market as producers would be faced with different requirements in different Member States.

The proposed measure implies that in 2030 producers of packaging have to place on the market products that are reusable or proven to be recyclable. Currently, it is estimated that several types of plastic packaging placed on the EU market would not fall into this category, along with semi-rigid and flexible aluminium packaging and non-paper-based parts of beverage cartons, based on an estimate of packaging that is not currently recycled at scale and would require technological advancement to do so (see problem definition in Appendix A, Impact Modelling Methodology in Appendix D). Packaging types that are particularly problematic to recycle at present (as outlined in Appendix A Problem Definition) are not likely to be addressed through actions to meet the recycling targets in the baseline, due to the relatively high economic burden of doing so. This is therefore the segment of the packaging market in which this measure has the most potential for additional impact relative to the baseline.

However, for the reasons outlined above related to the need to implement also other measures in order to support this one, significant impacts on recycling rates even within this category are not anticipated, as indicated in the qualitative assessment carried out for 4 such packaging types (see section A.3.7 for more detail on these). A maximum **increase of 2-3pp in recycling rates relative to the 2030 baseline** for these problematic packaging types was therefore estimated in the model associated with this measure, if it was implemented in isolation, without any operationalising requirements. However, in the absence of these, the **impact of this measure on overall packaging recycling levels relative to the baseline is estimated to be insignificant (<1pp).**

2.6.2 Ease of implementation

Measure 21a will be straightforward to implement, requiring a simple update to the wording in Annex II, particularly in the absence of an accompanying measure to define the term "recyclable", as discussed above. While the implementing burden is likely to be low, if

introduced in isolation, implementation at the Member State level will likely be more challenging, and potentially costly to enforce. This is because Member States may choose to try to enforce based on the wording in the definition, which may be too vague, or may elect to use their interpretation of the definition, potentially resulting in different interpretations being enforced in different Member States. However, this will not necessarily be the case, since the wording alone, without reference being made to an approach to operationalising the definition, could also be assessed by Member States to simply be too vague to enforce against without wasting resources, resulting in an absence of enforcement altogether.

For industry, similarly, the cost of implementation associated with this measure in isolation are likely to be high – since they will be faced with different requirements in different Member States, though this depends on the extent to which Member States implement and enforce the requirement in the absence of any clear operationalisation. Measures 22 a, b and c present different ways of operationalising this measure and should be implemented alongside this one.

2.6.3 Administrative burden

Enforcing this measure in isolation will place some administrative burden on the Commission and Member States, given that to date the vagueness in the Essential Requirements has resulted in very little enforcement action (and administrative burden arising therefrom). However, while this update would address this issue to a degree (particularly removing the option of recovery for plastic packaging waste), the administrative burden of enforcement against this requirement would not likely be significant, since the term "recyclable" would not be operationalised in any way. Similarly, there is likely to be some administrative burden placed on the producers of packaging, though the extent of this is unclear and would depend on the way in which producers and Member States interpret the term "recyclable".

2.6.4 Economic impacts

The proposed measure implies that in 2030 producers of packaging will no longer be able to place on market products that are not recyclable. As mentioned above, we currently estimate that 35% of plastic packaging falls in this category, some of which will be addressed in the baseline by 2030. However, given that the requirement for a percentage of packaging (as opposed to the whole item) to be recyclable will be removed, as well as the option for design for recovery (rather than recycling) of plastic packaging, some additional impact relative to the baseline can be anticipated.

Producers of packaging types that do not meet the new requirements will have to incur costs to change their packaging design, or brands may need to switch to other, more recyclable packaging types (though these will not necessarily be more expensive). Accordingly, the costs of packaging production are expected to increase (**estimated additional cost in the model of ~174m€ in the year 2030)** relative to the baseline. However, it is noted that these are expected to reflect the maximum cost scenario, and impacts in this context are unlikely to be significant, since the costs in the baseline scenario are much higher (~350€ billion) and the term "recyclable" is sufficiently open to interpretation to allow, for example, evidence of a technically feasible recycling process to be construed as evidence of a packaging type being recyclable.

In addition, the removal of the option for plastic packaging to meet the requirements through design for energy recovery should result in some additional costs to the recycling sector

(~86m€) due to additional tonnages being diverted to this stream, offset to some degree by the loss of material from incinerators and landfill (~23m€). The net economic impacts in this regard were estimated in the model to be worth **around 63m€ in additional costs in the year 2030**. Once again, these figures represent the maximum impact anticipated.

In terms of investment in recycling capacity and infrastructure, no additional impact relative to the baseline is anticipated. This is because, as discussed earlier, only a small proportion of packaging placed on the market is likely to be impacted by the measure, with the corresponding quantities diverted to recycling being insignificant to justify large investments in infrastructure.

2.6.5 Social impacts

The social impacts of the measure are unclear – this is because there are likely to be additional employment opportunities associated with the need for new packaging formats, designs and technologies (in the production stage) to meet the requirements, as well as additional quantities of packaging waste diverted to the recycling sector at the end of life. However, these might be offset by some job losses among those packaging categories which are no longer allowed to be placed on the market if they are assessed to be unrecyclable, as well as job losses in the residual treatment sector (including collection). The maximum net impacts estimated in the model in this respect were of the magnitude **of a gain of ~3,800 additional FTEs in 2030 relative to the baseline**.

Additional social impacts observed as shifts in consumer behaviour (e.g., as they adjust to changes in packaging types and increased requirements for sorting of packaging) can be expected, though these cannot be attributed to this measure above and beyond the baseline scenario with certainty.

2.6.6 Environmental impacts

The measure is likely to result in some reduction in the quantity of packaging waste material sent to incineration, diverting this to the recycling stream, with resulting reduction of environmental burdens, e.g., related to GHG emissions, and air and water quality. Similarly, some changes in material choices and packaging design are anticipated to have a positive environmental impact, though not to a significant extent as per the argumentation above. Overall, some positive net impacts were estimated in the CBA (Cost-Benefit analysis) model in this regard, as summarised in Table A-1 below. It is noted that these environmental impacts are uncertain and unlikely to be significant without further direct measures to define the term "recyclable" and create a clear incentive for packaging to be designed along these lines.

Table A-1 Summary of Environmental Impacts for Measure 21a

Summary of Environmental Impacts	
Change in GHGs, thousand tonnes CO_2e	-812
Change in water use, thousand m^3	-29
Change in GHG + AQ externalities, m€	-179

2.6.7 Stakeholder views

In the workshops undertaken for the Essential Requirements Scoping Report participants repeatedly called for the need for improvements to the Essential Requirements including a harmonised approach to enforcement across Member States.[535] There was broad support across all stakeholder groups for aligning the requirements with the waste hierarchy, focussing on making packaging more recyclable and removing confusing / vague references to recyclability in the harmonised standards.

In the online public consultation (OPC), the statement with the most support from the participants was "I want all packaging to be recyclable". In total 86% of participants either agreed or strongly agreed with this.[536]

2.7 Assessment of Measure 21b: All reusable packaging must be recyclable by 2035.

- Up to 2030 all reusable packaging will be exempt from the requirement to be recyclable if it meets the minimum criteria for reusability (see Impact Assessment on Reuse measures).
- In the transition period between 2030 and 2035 reusable items that are not recyclable can still exist on the market as long the producer has provided a robust case for this exemption in addition to meeting the minimum criteria for classification as reusable
- The suggested criteria for these are detailed in the description of the measure.
- This measure does not have any impacts in 2030 relative to the baseline, so all quantitative data from the CBA model is shown with respect to 2040 baseline.

2.7.1 Effectiveness

This measure will be effective at giving a strong market signal that all products should aim to be recyclable as well as reusable, whilst also being mindful not to stifle the development of new forms of reusable packaging and reuse systems in line with the objectives of the waste hierarchy and circular economy. In the short and medium term (5-10 years), the effectiveness of the measure will be closely linked to the development of the minimum criteria for reusability, as well as the more stringent criteria for exemptions in the transitionary period from 2030-2035. It should be noted that there is a risk that if these criteria loosely formulated, some producers may seek to exploit this loophole of exemptions for reusables by claiming a product is reusable in order to sidestep the recyclability requirement of Measure 21a. In the long term, i.e., beyond 2035, the removal of such exemptions will ensure that all reusable packaging is also deemed to be recyclable.

[535] European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[536] Appendix F - Online Public Consultation Report

In addition, the measure will stimulate innovation to improve recyclability in the reusable packaging market. Given the significance of reusables in contributing to the waste prevention intervention area, coupled with the relative immaturity of reuse systems compared to the market for single use packaging formats, there is a need for a longer transitionary period than for other forms of innovative packaging. Beyond the final date of 2035 this measure should prevent any reusable packaging that is not recyclable from entering the market.

It is recognised that there are additional complications in assessing the recyclability of a reusable item, and its environmental impact, and that methodologies for this still need to be developed. These may not, therefore be identical to those explored in measure 22. Further work to develop the criteria for assessing the recyclability of a reusable packaging type, as well as the approach to such assessment will need to be developed in further work by the Commission, to ensure a level playing field between recyclability requirements for reusables and single use packaging formats. This measure aims to put the burden of proof of the need for an exemption onto industry.

Setting out these requirements in the current revision of the PPWD, subject to further detail on criteria for exemptions, recyclability assessment and an approach to such assessments (in implementing acts/ standards), will provide the reusables industry with a long term view of regulations regarding recyclability, ensuring that innovation in the segment is directed accordingly and providing enough lead in tie so as to not stifle the industry which is still currently in its infancy.

Given that the proportion of reusable packaging products on the market is relatively low at present, and even more so for those that are not already made of recyclable materials, the measure is likely to be effective, though impacts on recycling rates of this measure will be low relative to the baseline.

It should be noted that the impacts of this measure have been assessed in isolation, though the measure must necessarily be implemented alongside measure 21a. Therefore, these impacts can be interpreted as additional to those set out for measure 21a, though still in isolation of any operationalising measures for the recyclability requirements in measure 22. Additionally, these impacts are likely to become more significant over time, as the share of reusables on the market increases due to the effects of the measures considered under the reuse intervention area. Therefore, overall, it is recommended that this measure, together with 21a, should not be implemented in isolation. However, in assessing this measure in isolation, a **maximum change of 1.7pp in the recycling rates** associated with certain reusable product groups has therefore been estimated in the CBA model relative to the 2040 baseline.

2.7.2 Ease of implementation

Effective implementation will depend on the minimum criteria for classification as "reusable", the additional criteria for a more stringent case for exemptions in the transitionary period between 2030 and 2035, and how straightforward these are to apply. This is likely to be challenging, since there is currently a lack of standards certifying these items or regulation on the labelling of these products (as discussed in the rationale for Measure 10 Standardisation of reusable packaging and effective reuse systems).

It is likely that in developing the criteria (see previous section 2.4.2) for an exemption for reusable packaging during the transition period there will be technical obstacles in how novel materials are classified, particularly in light of the relatively long life expectancy of many reusable packaging items (recycling streams may therefore become available by the time the

reusable item reaches the end of its life, even though these may not be viable when it is first placed on the market). In addition, further work will be needed to outline the approach to assessing the recyclability of reusable packaging (alongside the approach taken forward in measure 22).

From the perspective of the packaging industry implementation will involve focussing innovation in reusables to materials that are already recyclable or investing in demonstrating the case for exemption. This is not likely to be significant till 2030, when packaging must simply meet minimum requirements for reusability to qualify for exemptions. Beyond 2030, however, the development of a case for exemption is likely to be burdensome for producers, who are likely to have to assess their product's environmental performance against those of recyclable alternatives to continue to qualify for exemptions.

2.7.3 Administrative burden

The administrative responsibility for this measure should be met within the same regulatory structures that will administer measure 21a. Some additional effort will be required to verify and grant exemptions for reusable packaging related to the criteria that are determined, and also for producers of such packaging to develop the case for such exemption (since the burden of doing so is on producers).

2.7.4 Economic impacts

It is noted that, as with measure 21a, in the absence of a definition for the term "recyclable", the impacts of this measure are uncertain. In addition, given the exemptions granted till 2035, the full impacts of this measure are unlikely to be felt till 2040. Given that the period for granting exemptions will close by 2035 it is expected that most producers will choose to design their reusable packaging to be progressively recyclable from the outset, to avoid costs associated with redesign, or removal from the market, that will otherwise be necessitated in 2035.

Regardless, by 2040, packaging producers of some kinds of reusable packaging will have been required to either redesign their packaging or use alternative formats, materials, or invest in recycling infrastructure to enable their packaging to also be classed as recyclable. The net increase in **production costs associated with these changes relative to the 2040 baseline was estimated to be worth ~107m€** in the CBA model.

In addition, such changes will result in some increase in packaging waste diverted from incineration and landfill to recycling relative to the baseline, with increased recycling costs offset by reduced costs of incineration and landfill. The net increase in costs arising from the change in **end-of-life management of these packaging types relative to the 2040 baseline were estimated to be in the order of ~39m€.**

Impacts on investment in recycling infrastructure are expected to be similar to measure 21a.

2.7.5 Social impacts

Based on the changes in production and end of life management of reusable packaging discussed above, some net positive impact on employment levels can be expected relative to

the baseline, estimated to be equivalent to **~2400 additional FTEs in 2040**. This estimate is subject to considerable uncertainty for the reasons highlighted previously.

Additionally, this measure will ensure that consumers can have increased confidence in the environmental benefits of purchasing reusable packaging items; in that the material used in these items can also be recycled at the end of life.

2.7.6 Environmental impacts

Based on the impacts on the production and end of life management of reusable packaging described above, the modelled environmental impacts (relative to the baseline scenario in the year 2040) are summarised in the table below.

Table A-2 Summary of Environmental impacts for Measure 21b

Summary of Environmental Impacts	
Change in GHGs, thousand tonnes CO_2e	-550
Change in water use, thousand m^3	-18
Change in GHG + AQ externalities, m€	- 163

2.7.7 Stakeholder views

Following the webinar in July 2021 a range of stakeholders submitted feedback on this measure.

One stakeholder from the paper industry argued that exemptions for reusables should be allowed and should follow a product specific approach. The majority of stakeholders, including producers, PROs and NGOs expressed concern that allowing exemptions will lead to packaging items being classed as reusables to avoid the requirement to be recyclable. This has been considered by limiting the period in which exemptions are allowed and will be further supported by setting increasingly stringent criteria for exemptions during this transitionary period.

Other stakeholders argued that the reusable packaging market needs longer time to innovate and adjust, and this has been accommodated in this measure.

In the online public consultation (OPC)[537], small operators expressed some concerns regarding the economic costs that may be associated with this measure. No strong stakeholder views were expressed by larger operators either in support of or against this measure.

2.8 Summary and conclusion

Measures 21a and 21b are intended to be mutually supportive rather than presenting distinct options. If measure 21b is not adopted, the effectiveness of measure 21a is likely to be compromised, and in the absence of 21a, measure 21b is meaningless. However, the impacts of both are heavily reliant on measures 22 and 23 and are unlikely to be significant without further intervention to clearly define and operationalise the requirements in terms of packaging that can be considered "recyclable".

[537] See Appendix F – Online Public Consultation report

Table A-3 Summary of Impacts for Measure 21

Impact category	Measure 21a (relative to 2030)	Measure 21b (relative to 2040)
Effectiveness	Basis for clearer, more enforceable EU level requirements on packaging, which will drive design for reuse and recyclability of packaging, though this relies heavily on implementation in combination with measure 22.	Close a loophole in the wording of the Essential Requirements, but the effectiveness depends on the criteria for demonstrating exceptions.
Ease of implementation	Straightforward, involving a change to existing wording. The actual implementation depends on measure 22.	Straightforward for the Commission and Member states, though some effort required to develop criteria for reusables. Onus of demonstrating case for exemption on producers who will be increasingly challenged to justify lack of recyclability.
Administrative burden	Slight additional burden due to increased enforceability.	Slight additional burden in developing case for exemptions and enforcement.
Economic impacts	~174m€ additional costs of packaging production ~63m€ additional costs in waste management	~107m€ additional costs of packaging production ~39m€ additional costs in waste management
Social impacts	Job creation of ~3,800 additional FTEs	Job creation of ~2,400 additional FTEs
Environmental impacts	Savings of 812 thousand tonnes CO2e, 29 thousand m3 water use and 179m€ in GHG + AQ externalities	Savings of 550 thousand tonnes CO2e, 18 thousand m3 water use and 163m€ in GHG + AQ externalities
Stakeholder Views	Strong support for updates to the Essential Requirements to bring consistency across MS.	Some concern amongst smaller companies regarding potential economic costs of applying for exemptions.

3.0 Measure 22: Defining recyclable packaging

3.1 Problem definition

To operationalise the updates to the Essential Requirements described in Measure 21 above, it will be necessary to have a clear definition for the term 'recyclable'. This is a longstanding problem within waste policy with 'recyclability' being described as "the most ambiguous term amongst all packaging circularity terminology".[538]

Existing CEN standards do not adequately provide an agreed method for assessing recyclability. EN 13430 details the requirements for packaging to be recoverable by material recycling.[539] This is supported by EN 13688 covering materials that impede recycling, and EN 13427 detailing the requirements for the use of European Standards in the field of packaging and packaging waste. EN 13430 was approved in 2004 and the collection systems and processing infrastructure has changed significantly since then, rendering this standard outdated. Furthermore, the innovation in packaging materials and design in the past decade demands a more complex assessment of recyclability at the level of packaging type than that included in Annex D of the standard.

For this measure to contribute to the overall objective of supporting the transition to a circular economy, it is necessary that the definition of 'recyclability' includes not only whether the packaging material is technically recyclable, but also considers the likelihood of the item being collected, sorted and processed into a material that can be used in place of virgin material. At each of these stages in the recycling process, changes in design and technology can increase or decrease the value of the material to industry at the next stage. For this reason, a definition of the term 'recyclable' that underpins regulatory requirements on packaging producers must look at those elements of packaging design that can influence the item at every step of end-of-life management. In this way the definition can focus on those aspects that the producer of packaging can control. The latter view regarding the displacement of virgin material is that put forward by the Ellen MacArthur Foundation,[540] and supports the general objective of improving circularity in resource use, based on whether the output does substitute virgin material.

3.2 Baseline

The term recyclable is not defined in the legislation, though a definition of recycling is provided in the Waste Framework Directive (WFD) as well as the PPWD. The Essential Requirements for packaging recoverable by material recycling are currently enforced via harmonised standard EN 13430, and compliance with this standard provides producers with a presumption of compliance with the requirements. As noted in Section 2.1, the requirements at present are vague, open to interpretation and therefore not enforceable.

[538] https://www.newplasticseconomy.org/assets/doc/13319-Global-Commitment-Definitions.pdf

[539] EN 13430:2004 Packaging - Requirements for packaging recoverable by material recycling

[540] https://www.newplasticseconomy.org/assets/doc/13319-Global-Commitment-Definitions.pdf

3.3 Objectives

1. **Outcome:** A clear definition of 'recyclable' that supports the operationalising of the updates to the Essential Requirements in Measures 21a and 21b.

2. **Objective**: To have an easily understood and widely accepted definition of 'recyclable' that creates a level playing field across packaging types and in Member State implementation of the Directive to enable smooth functioning of the internal market.

3. **Impact:** It is expected that defining 'recyclable' clearly will stimulate the flow of material retained within the circular economy by encouraging producers to design packaging with recycling in mind. Improved design should lead to a higher quality and quantity of input to recycling plants (given suitable collection and sorting processes), and this in turn will enable a higher quality output to be produced which is more attractive to end markets, creating a pull mechanism to stimulate the recycling economy.

3.4 Description of the measure

To operationalise the updates to the Essential Requirements described in Measure 21 above, it will be necessary to have a clear definition for the term "recyclable". Three alternative approaches for defining recyclable packaging in order to achieve these objectives are presented below (and a fourth discarded variant is described in section 6.1):

- **Measure 22a: a qualitative definition** of what recyclable packaging is, to enable enhanced enforceability compared to the current wording in the Essential Requirements and associated harmonised standards. The definition could be included within the Essential Requirements themselves or in Article 3 of the PPWD.
- **Measure 22b: a definition that uses mandatory design for recycling (DfR) criteria** to determine whether packaging is recyclable (and, due to the Essential Requirements, can therefore be placed on the EU market) or not. This would build on the qualitative definition in Measure 22a which would provide the underpinning principles for developing the DfR criteria and approach to assessment.
- **Measure 22c: A quantitative definition** of recyclable packaging based on actual recycling rates within a packaging category or packaging level basis. For example, the definition would be 'packaging is considered recyclable where it is recycled over a certain threshold across the EU'.

These three proposals are not strictly alternatives however as each goes some way to tackling elements of this problem. For this reason, a combination of measures may be needed to reinforce the measure.

3.4.1 Measure 22a: Qualitative definition in PPWD text

A minimum requirement is to have a clear as possible qualitative definition of what recyclable packaging is that meets the objectives of the PPWD and is easily understood by a wide audience providing a workable guide to industry.

This would, in theory, set a consistent legal basis for the definition of recyclable across the EU, removing the current presumption of compliance with a voluntary standard. It is noted, however, that the packaging and packaging waste market is a diverse and varied one. There are numerous different packaging materials, types and features that affect recyclability, and a number of different collection, sorting and recycling systems across Member States to deal with them. The development of a standalone qualitative definition that can be applied in a consistent, enforceable way across this market (i.e., without any further measures to operationalise the requirements for recyclability) will be challenging to implement, as discussed below.

If this measure was implemented as a stand-alone definition (i.e., without linking to either measure 22b or c for further operationalisation), it could be implemented in two different ways:

- the definition could be incorporated into the Essential Requirements in the form of criteria to be met, and be made mandatory, as opposed to voluntary through reference to EN 13430; or
- the definition could be set out in Article 3 of the PPWD and referenced in the Essential Requirements.

Building on input from stakeholders, the following is the proposed definition:

> *Recyclable packaging is that which can be effectively and efficiently separated from the waste stream, collected, sorted and aggregated into defined streams for recycling processes, and recycled at scale through relevant industrial processes such that it is turned into a secondary raw material of sufficient quality such that end markets exist in which it is valued as a substitute for virgin material.*
>
> *Innovative packaging placed on the market that requires new infrastructure to be developed shall be recycled at scale within a maximum period of five years.*
>
> *At least 95% of the unit of packaging shall be recyclable according to this definition, and the remainder must be compatible with the relevant collection, sorting and recycling processes without hindering the recyclability of the main components of the unit of packaging.*

There are three key elements of this description which remain open to interpretation but will require significant effort in building industry consensus to define more precisely:

- the term "recycled at scale";
- the classification of "innovative packaging"; and
- clarification of what constitutes a "unit of packaging" to meet the 95% threshold.

While further work is necessary to clarify these points, potentially in the form of Commission guidance to accompany this definition (were it to be taken forward), a summary of the key considerations that could form the basis of such guidance has been provided below.

Firstly, the term '**recycled at scale'** is challenging to define at the EU level. This needs to consider in conjunction: the availability of collection systems, the sorting steps required to produce defined streams for recycling processes, and the available capacity for reprocessing these streams.

As a starting point to defining the term "recycled at scale", it is proposed that an effective collection system should include the following elements:

1. **A minimum standard of provision of collection points per population density.** Some degree of zoning areas into high, medium and low density provides scope for

variation in how the needs of an area can be met. This could build on existing derogations within the WFD for sparsely populated areas,[541] mountainous areas and islands.[542] Within urban areas further zoning is possible where areas of multiple occupancy require different collection systems from suburban areas.

2. **The collection system must be known to the majority of consumers.** The route for collection must be clearly communicable. For example, where industry seeks to set up a product specific collection service such as a DRS or take back scheme, the majority of consumers need to know about the collection route. One example of this is the system being trialled for the take back of coffee pods in the UK.[543] Consumers are made aware that they can have items collected by mail, at the kerbside, or at various drop off points through an online "recycle checker" tool and can register to order (free) recycling bags to access the system.
3. **The collection system needs to be convenient and accessible**, and that this is defined in relation to an agreed benchmark. For example, this could be the provision of a bring point within a certain radius that matches the average distance travelled to the nearest supermarket. In this way returning items is considered as convenient as buying food. In the example of coffee pod return the convenience is similar to posting a letter. Some effort on the part of consumers is expected but there should be no additional cost to consumers.

In order for a packaging type to be recycled at scale there also needs to be evidence that the packaging waste collected has an onward chain to be sorted and recycled. Unlike collection at scale, which must be determined at the level of Member States, this can be assessed at an EU scale to allow market efficiencies to determine the best geographical location of these. Similarly, there needs to be reprocessing capacity sufficient to process the sorted material, again this can be EU wide. Whether exports of waste material for recycling outside of the EU should also be considered here remains a point of contention.

Secondly, the classification of "**innovative packaging**" will be important to ensure that a loophole is not created whereby minor design changes to existing packaging are made in order to claim "innovative" status and thereby avoid meeting recyclability requirements for five years.

In defining the criteria that "innovative" packaging must meet to earn this exemption, it is noted that innovation in packaging may be related to either new materials, or design, or process, or any combination of these, with the former two of these being most closely linked to whether the packaging is recyclable or not.

The same principles underlying the approach used to allow reusables that are non-recyclable to apply for an exemption to remain on the market during a transitionary period should be applied here: (see 2.4.2)

1. The onus of making a case for exemptions for innovative packaging to be classified as innovative should be placed on the producers.

[541] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Sparsely_populated_regions.png

[542] https://ec.europa.eu/regional_policy/sources/policy/themes/sparsely-populated-areas/map_mountains_islands_spas.pdf

[543] https://www.podback.org/

2. For a packaging item that is seeking a 5-year exemption from the requirement to be recyclable to be classified as innovative the producer must demonstrate that the innovation presents a significant improvement over recyclable alternatives, or that no other alternative packaging type or system exists.
3. The improvement relates to a change in the core functions of the packaging – among which containment, protection, handling and delivery, may be suggested for the purposes of this classification, to align with Article 3 of the PPWD.

It is proposed that packaging innovation simply for the purposes of improved presentation of products, or marketing and branding purposes, should not be included in the scope of the key criteria here, though these may be added benefits to improvements in the core functioning of packaging.

Finally, the term '**unit of packaging'** is important when a producer is assessing whether they have met the requirement for 95% of the unit of packaging to be recyclable. EN 13427 defines a packaging component as "a part of packaging that can be separated by hand or by using simple physical means". Following this the functional unit of packaging in described in clause 4.3:

> *The smallest part of a packaging considered in this standard is a component. Usually, a number of components will be brought together to form a functional unit of packaging, and these may in turn be brought together in a complete packaging system which could comprise primary, secondary and tertiary packaging (as defined in article 3 of Directive 94/62/EC).*[544]

This description falls short of a workable definition as the term functional is not elaborated upon. In this measure the term 'unit of packaging' is preferred for its simplicity and refers to the unit of purchase by the consumer, which may be understood in terms of stock keeping units (or SKUs, i.e., a distinct type of item for sale).

The simplest way for a packaging item to meet the 95% criteria is for the item to be made of a single material for which a recycling pathway exists. Where the unit of packaging has several components of different combinations of materials or polymers it can still meet the 95% criteria if these are easy to separate by hand or by simple physical means within a sorting plant, such as density separation of polymers after grinding, and for these separated mono-material components a recycling pathway currently exists. The 5% remaining is to give allowance to the need for the use of materials such as adhesives and inks that are not separable into recycling streams. It is imperative that these do not hinder the recycling of the 95%, by impacting on the quality of the recyclate or increasing the processing costs significantly.

Finally, it is noted that the wording in the above definition pertaining to secondary raw material "of a sufficient quality that it can find end markets in which it is valued as a substitute for virgin material" may be interpreted to exclude composting, which is explicitly included within the definition of recycling in the Waste Framework Directive. Accordingly, additional clarifying text should be considered:

> *"Compostable packaging is considered to be recyclable where it is processed to produce compost, digestate or other output - and that output is subsequently used on land, in line with Article 6a of the PPWD."*

[544] CEN 13437:2004 Packaging - Requirements for the use of European Standards in the field of packaging and packaging waste.

3.4.2 Measure 22b: Defined, assessed and enforced via the use of design for recycling criteria

In order to make the above qualitative definition more enforceable, a complementary measure is the use of mandatory design for recycling (DfR) criteria to determine whether packaging is recyclable (and, due to the Essential Requirements, can therefore be placed on the EU market [POM]) or not. In this case, the qualitative definition above **should not be included as a legal definition in Article 3 of the PPWD**, but rather, as a set of guiding principles to support the development of mandatory DfR criteria in line with the EU's recyclability objectives. The qualitative definition in Measure 22a would therefore only be used to underpin the DfR approach, operationalised by accompanying text in the revised Essential Requirements (see measure 21a) along the following lines:

> *"A packaging item will be deemed to be recyclable only if it meets the established design for recycling criteria for the category to which it belongs, as determined by an assessment of its suitability for recycling at scale in the EU and its recycling performance in practice."*
>
> *"By xxx the Commission shall adopt an implementing act laying down the categorisation of packaging for which mandatory DfR criteria will be developed, the types of criteria that will be included, as well as the assessment, verification and reporting procedure for the DfR assessment.*
>
> *In determining the DfR criteria and assessment methodology to be developed, the Commission will consider the following key principles for assessing the recyclability of packaging:*
>
> *a) Recyclable packaging is that which can be effectively and efficiently separated from the waste stream, collected, sorted and aggregated into defined streams for recycling processes,*
>
> *b) Recyclable packaging is that which can be recycled at scale through relevant industrial processes such that it is turned into a secondary raw material of sufficient quality such that end markets exist in which it is valued as a substitute for virgin material.*
>
> *c) Innovative packaging placed on the market that requires new infrastructure to be developed shall be recycled at scale within a maximum period of five years.*
>
> *d) At least 95% of the unit of packaging shall be recyclable according to this definition, and the remainder must be compatible with the relevant collection, sorting and recycling processes without hindering the recyclability of the main components of the unit of packaging or of any other packaging …." etc.*

This suggests a two-step evaluation process, whereby, in order to determine the DfR criteria that are to be used, packaging must first be assessed to be theoretically recyclable at scale (i.e., industrial processes to collect, sort and recycle the waste currently exist and are in use at scale in the EU). It must further be recyclable in practice and finally, to perform well in existing recycling processes (i.e., without significant losses) such that it is turned into secondary material of a sufficient quality to find end market to substitute primary materials. The approach therefore encourages consideration of the **quality of recycling** in addition to the likelihood of packaging waste successfully entering a recycling operation before the DfR criteria and thresholds are specified and implemented.

It is noted that a testing protocol (whereby recycling performance of packaging is tested in real world processes rather than at laboratory scale) is likely to be needed and developed as part of the accompanying implementing act. Testing would take place at the level of the packaging format / category in order to evaluate the extent to which key design features in a particular format impact the quality of recycling (not just the input to recycling). On this basis, the thresholds for the DfR criteria within each packaging category can then be determined. I

The Recyclass methodology provides an example of the framework of results (including both the key criteria and the different thresholds for assessment) that may be expected from such an assessment below. This is one of several methodologies that should be considered. It is worth noting that in the short term, packaging design features that may inhibit recycling in some cases are likely to persist, though these should be minimised as far as possible without major disruption to the market. The implementation of harmonised fee modulation criteria for EPR schemes based on the DfR criteria established as a part of this measure would be particularly useful in incentivising improvements to packaging design for recyclability by providing an added economic incentive to progressively rule out the worst performing packaging types.

- **Green category:** Recyclable (allowed to POM (Placed on the Market), EPR fees lower, less stringent admin burden):
  - CLASS A: The package does not pose any recyclability issues and it can potentially feed a closed-loop scheme to be used in the same application.
  - CLASS B: The package has some minor recyclability issues but could even potentially feed a closed loop scheme.
- **Amber category:** Neither recyclable/ non-recyclable (allowed to POM, EPR fees higher, more stringent admin burden)
  - CLASS C: The package has some recyclability issues that affect the quality of its final recyclate.
- **Red category:** Not recyclable (not allowed to be POM)
  - CLASS D: The package has some significant design issues that highly affect its recyclability.
  - CLASS E: The package has major design issues that put in jeopardy its recyclability.
  - CLASS F: The package is not recyclable either because of fundamental design issues or a lack of specific waste stream widely present in the EU. If your package obtains this class in one of the question areas, then the analysis is completed.

Further detail (including the final categorisation of packaging for the purposes of assessment, the types of criteria to be included, the levels of the criteria associated with a certain kind of result, and the methodology for assessment and 3rd party certification/authorisation procedure) are anticipated to be developed in subsequent implementing acts, to be adopted by 2025 at the earliest. Initial wording to link this requirement to the principles established in measure 22a has been provided above.

In terms of the other features of the proposed accompanying implementing act, the following packaging categories can be considered as a minimum. This is based on current packaging categorisations used by PROs representing a high degree of granularity in their packaging EPR reporting relative to the rest of the market.

- Glass
- Paper – Carton (>85%)

- Steel - (>50%)
- Aluminium - (>50% and ≥ 50µ)
- PET - Bottles and Flasks - Transparent no colour
- PET - Bottles and Flasks -Transparent blue
- PET - Bottles and Flasks -Transparent green
- HDPE - Bottles and Flasks
- Beverage Cartons
- PP - Bottles and flasks and other rigid
- PS – Rigid packaging except EPS and XPS
- HDPE – Rigid packaging other than bottles and flasks
- PET – Transparent, other than no colour, blue or green
- PET – Rigid packaging other than bottles and flasks, transparent
- PET – Bottles and flasks, opaque
- PE – films
- Other rigid plastics (except EPS, XPS, compostables)
- Other films (except compostables)
- Complex packaging of which the majority is paper – carton (<85%)
- Aluminium packaging < 50µ composed solely of aluminium
- EPS, XPS and compostable plastics
- Complex packaging of which the majority is plastic
- Plastic/aluminium laminates
- Wood, cork, textiles
- Complex packaging of which the majority is glass
- Complex packaging of which the majority is steel
- Ceramics, porcelain

For each of these, the use of criteria for the **traceability of packaging** (e.g., using digital marking technologies) and the **complexity of packaging** (reducing multi-layer/ multi-material complex packaging) will be explored in addition to more conventional design criteria to encourage innovation in these areas. Examples of the more conventional types of criteria that are used by Recyclass for plastic packaging are listed in Table A-1 below, by key packaging component.[545] Note that these criteria tend to relate closely to those used for packaging of other materials and in other voluntary DfR approaches, though not all of these will be applicable to all packaging types.

Table A-1 – Conventional design criteria used by Recyclass

Criteria for Main body	Criteria for Attachments	Criteria for Decoration
Description	Closure systems	Inks
Material	Lids	Labels
Material composition	Liners, seals and valves	Adhesives for labels

[545] https://recyclass.eu/recyclability/design-for-recycling-guidelines/

Criteria for Main body	Criteria for Attachments	Criteria for Decoration
Colours	Tamper evidence wrap	Sleeves
Size	Other components	Direct printing
Product residues (Easy to empty index)		
Barriers		
Additives		

The implementing act may also set out a list of packaging features/ components that can go through a "light touch" assessment/ self-assessment to start with – e.g., PET bottles, cardboard boxes without plastic liners, clear glass bottles, aluminium cans, etc. to be allowed to be POM, while some of the more problematic elements can similarly be ruled off without need for full assessment. In terms of ruling packaging features off the market, a clear timeline must additionally be provided to give producers enough time to implement changes while also adhering to the 2030 deadline for packaging to be recyclable. 2027/28 seems reasonable in terms of allowing for implementation and publication of the criteria, as well as for producers to adopt the new requirements, and enable a review in time for 2030 if need be.

Alternatively, a negative list of packaging features may be included in an Annex to the PPWD itself, to minimise the burden of developing criteria for these types which are widely accepted to be the worst performers. Packaging design features on the negative list would be ruled off the market with immediate effect, allowing for quick environmental gains without the need to wait for the implementing act and DfR criteria to be published.

In terms of the process for implementing this measure**,** the Commission would likely have to establish technical committees to develop the DfR criteria for each packaging category based on the existing work that has already been carried out by industry. The committees in question should comprise of an independent chair, Member State and industry experts representing the entire value chain as a minimum. Alternatively, the criteria could also be developed by the JRC, though ideally in close coordination with industry representatives and Member States. The third alternative, i.e. using CEN standardisation process to develop these criteria is not recommended, as this is likely to be a time-intensive process requiring extensive industry consultation. However, it is noted that some standardisation related to the recyclability of packaging is already ongoing, with several requests from the Circular Plastics Alliance pending development. Therefore, to the extent that the request put forward by the CPA overlaps with that developed by the Commission in the implementing act containing the legally binding DfR requirements, the time requirement associated with CEN procedure (usually ~3 years) may be lower. Should this option be taken forward, the inclusion of a negative list of packaging features in the PPWD is advised to mitigate against the delay in implementation that would result from the lengthy standardisation process.

It is noted that voluntary DfR criteria for packaging are already widely used in the EU. For most packaging types, these tend not to vary significantly across the different Member States/ organisations that develop them. The technical committees should therefore be encouraged to draw upon this existing body of work and avoid duplication of effort as far as possible. Additional effort will instead need to be directed to developing and agreeing DfR criteria for

those packaging types for which disparities in Member State collection, sorting and recycling infrastructure currently hinder harmonisation.

Once the implementing act and DfR criteria have been established, these will be enforced by Member State authorities together with producer responsibility organisations and market surveillance authorities. An evaluation tool will need to be developed to enable producers to complete a self-assessment in the first step, potentially as a part of the conformity assessment required to place goods on the EU market, and reporting to Member States/ PROs for verification as part of this. Spot checks and audits should be carried out periodically to ensure that packaging products have been assessed accurately and to aid enforcement by Member State surveillance authorities and PROs.

Member State databases developed in this way should be linked to an alert system so that each Member State competent authority can alert the others when a particular packaging type has been evaluated. This system will also be used to alert other Member States when an instance of non-compliance is found (to trigger enforcement). In this way, producers need only undergo assessment in one Member State (the Member State in which the packaging is manufactured/ first POM).

Finally, the harmonisation of the criteria for modulated EPR fees is also linked to this concept, whereby fee modulation is used to incentivise a move towards formats scoring highly in terms of DfR. This would provide a dynamic incentive to producers to improve their packaging design, given that updating the DfR criteria will be a time-consuming process relative to the pace of innovation in the packaging market.

The following additional elements should be considered in the implementation and enforcement of the measure:

- The criteria should be checked for the need of revision at least every 5 years to ensure that they adapt to innovation – to either include further items that are not recyclable or remove other items that may now meet the definition of recyclable packaging as recycling system innovation occurs.
- Certain exemptions may need to be provided for by the technical committees within specific categories to ensure that packaging with specialised functionality (e.g., in pharmaceuticals) are not prevented from being placed on the market without a suitable recyclable alternative in place.
- In line with the qualitative definition, new packaging can be allowed to be POM for a maximum of 5 years without undergoing evaluation but will not be classed as "recyclable" and should automatically be placed in the grade associated with the highest EPR fee until the full evaluation process is carried out.
- A risk-based approach could be used to set monitoring/ enforcement requirements described above e.g., as already mentioned above, packaging that is "recyclable" should not have stringent reporting/ monitoring procedures as compared to packaging that is allowed to be placed on the market but may still pose some recyclability issues.

3.4.3 Measure 22c: Defined quantitatively by minimum recycling rate thresholds

A quantitative definition of recyclable could be developed based on actual recycling rates within a packaging category or packaging item level basis. For example, the definition would be

'packaging is considered recyclable where it is recycled over a certain threshold across the EU'. An EU-wide approach only is considered as Member State level recycling rates would be highly variable and their use in operationalising such a definition could therefore distort the single market.

A statement such as the following would be included in the Directive:

> *"By 2030, packaging items shall be classified as recyclable if the specific recycling rate achieved for the packaging item at the EU level exceeds XX %. If producers provide evidence their packaging meets this threshold in practice and at scale within two years of first being placed on the market, it is deemed to be recyclable."*

The recycling rate here is to be determined in accordance with the measurement method for recycling in a given year as set out in Article 6a of the PPWD and the corresponding implementing decision 2005/270/EC (as amended in 2019), i.e.,

> *the weight of packaging that has become waste which, having undergone all necessary checking, sorting and other preliminary operations to remove waste materials that are not targeted by the subsequent reprocessing and to ensure high-quality recycling, enters the recycling operation whereby waste materials are actually reprocessed into products, materials or substances.*

The level of the threshold proposed in the previously completed Essential Requirements scoping study[546] was 20%, however, the figure can be adjusted upwards and progressively increased to better align with the levels of the recycling targets themselves as the recycling systems and overall performance becomes increasingly harmonised across the EU.

It is noted that this approach relies on the capability to calculate recycling rates for specific packaging categories at a much greater level of detail than is currently the case. Extensive waste sampling and reporting requirements would have to be introduced to enable the gathering of data at this level to support the implementation and enforcement of this approach. Alternatively, this may require the use of technologies like digital watermarking (measure 27d) to enable the tracing of specific packaging items throughout their lifecycles, though such technologies are not yet available at commercial scale. In the future, should such technologies become widely used, they could be applied to determine the current recycling rate for specific packaging types, with the need for waste sampling/ testing protocols limited to innovative packaging types looking to be placed on the market for the first time. Alternatively, exemptions could apply to innovative packaging to allow sufficient time for a recycling rate to be calculated to determine whether the threshold is being met.

In principle, an 'EU-wide packaging compliance data portal' and harmonisation of reporting requirements for EPR schemes with a higher degree of granularity (measure 42 in intervention area Data & Reporting) could be used to facilitate the calculation of these format specific recycling rates under a harmonised approach. Producers could then report data on the recyclability rate associated with their particular packaging type to the PROs (in order to determine the level of EPR fees payable), feeding into an EU-wide portal (potentially hosted by Eurostat). The EU wide portal would be accessible to Member State surveillance bodies (to

[546] European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

enable enforcement of the requirement to meet the recycling thresholds in order to be placed the market).

3.5 Links to other measures

- These measures are designed to support the implementation of measure 21, which updates the wording of the Essential Requirements ("all packaging shall be recyclable…by 2030")
- The effectiveness of this measure could be supported by labelling requirements as per measure 27.
- There is a strong link between this measure and measure 23: Harmonisation of EPR Fee Modulation Criteria. By harmonising the way that recyclable packaging is defined, modulating EPR fees consistently across the EU on this basis should provide additional economic incentive to producers to design for increased ease of sorting and recycling. Fee modulation by these DfR criteria should drive up recyclability across the board with the least recyclable packaging items being progressively ruled off the market. Whilst EPR will work best to increase recyclability in those cases where the cost of packaging is high relative to value of the product, in others, the magnitude of the EPR fee and associated cost of packaging relative to the cost of the product will be insufficient to incentivise improvements to packaging recyclability. In these cases, the DfR assessment, and the ability to rule off such forms of unrecyclable packaging will help to ensure that the entire packaging market is sufficiently incentivised to improve recyclability.
- There is a link to the requirements in the compostable packaging theme, in which criteria required for recyclable packaging and those for compostable packaging to be placed on the market need to be reconciled.
- The enforcement of this measure linked to the proposed measures on data gathering and the harmonisation of reporting requirements for EPR schemes (establishing an alert system)

3.6 Assessment of Measure 22a: Qualitative definition in PPWD text

3.6.1 Effectiveness

The qualitative definition proposed (see section 3.4.1) has been carefully worded to capture the important elements of what is commonly understood as recyclable and provide a clear steer to industry to transition towards packaging that can easily be recycled. Ambiguities remain in some key terms such as 'at scale' and 'innovative' because these will require a consolidated effort on the part of industry and policy makers to come forward with workable definitions. In the measures description (3.4.1) the principles that could form the basis for these are proposed.

The effectiveness of this measure will depend on the extent to which certain sectors of the packaging producer market choose to take a lenient interpretation of these terms before they are defined more clearly, and operationalised in an enforceable way. For this reason, the

measure is likely to be most effective if implemented in the form of principles to underpin measure 22b (which establishes clear design criteria to enable the recycling of specific packaging categories) rather than forming a standalone definition that is meant to apply equally to all Member States and all forms of packaging in either the Essential Requirements or Article 3 of the PPWD.

If implemented as a standalone definition, there is also scope for inconsistency in implementation across Member States with different decisions being made on what is recyclable and what is not based on the variations in collection, sorting and recycling infrastructure in their particular country. Relying on what is effectively guidance on recycling processes to inform a legally binding definition could therefore be problematic.

In terms of impacts on recycling levels, given the assumptions underpinning the baseline as discussed in section 2.2 above, **recycling rates for some packaging types[547] may be expected to increase by 3-5pp**, though the **impact on overall packaging recycling levels relative to the baseline in 2030 is estimated to be insignificant (<1pp).**

3.6.2 Ease of implementation

In terms of the approach to operationalising this definition, there is no mechanism in the definition itself to support its implementation. Therefore, although it represents some improvement on the baseline scenario in terms of enhanced enforceability, the success of application relies on how well it is interpreted. This would clearly depend on the nature of the enforcement mechanisms put in place and suggests that the measure may be challenging to implement well.

The implementation challenges for each section of the qualitative definition need to be considered separately.

> *Innovative packaging placed on the market that requires new infrastructure to be developed shall be recycled at scale within a maximum period of **five years***

In section (3.4.1) the principles for applying for an exemption for innovative packaging are proposed. A system will need to set up with a body overseeing the rules and process of applying for an exemption. A second stage of verification process will need to check after five years if the product is now recyclable at scale or has been removed from the market. How straightforward this is will depend on how 'recyclable at scale' has been defined.

> *At least **95%** of the unit of packaging shall be recyclable according to this definition, and the remainder must be compatible with the relevant recycling process without hindering the recyclability of the main components.*

Implementation of this part of the definition relies on clear guidance as to which materials are considered incompatible with the recycling process of the main materials. A list of materials and design features that hinder recycling will be needed for each different packaging type/ recycling stream. One approach could be to make reference to the Technical Report CR 13688, which provides examples of the materials and substances which cause problems in the recycling operations of the main packaging materials. This list is not exhaustive; therefore, to be effective, further elements may need to be clearly defined and updated regularly to take

[547] E.g. rigid food, stand-up pouches, beverage carton. See Appendix D for more details.

innovation in packaging and/or recycling systems into account. Consequently, legally defined lists of disruptive components may need to be implemented (negative list as referred to above).

3.6.3 Administrative burden

The main costs associated with implementing the qualitative definition would be resource from the Commission and input from stakeholders in the form of consultation. The overall impact level would be expected to be low in this regard. This is because the definition of recyclable packaging should be specified in the Essential Requirements itself.

There are different possible ways to implement this measure, as described in Table A-2 below.

Table A-2 Implementation methods for measure 22a

Implementation method	Description	Costs
Remove references to Standard EN 13430	With the definition of recyclable packaging being specified in the Essential Requirements, the use of Standard EN 13430 'Requirements for packaging recoverable by material recycling' is no longer required for such a purpose and reference to it should be removed in this context.	Easiest implementation method
Update Standard EN 13430	There are features of the standard that could still help packaging designers think about design for recyclability so the standard might be updated to remove unnecessary elements (e.g., proving compliance with 'a certain proportion' of the packaging needing to be recycled) and update the design guidance more broadly	Effort to update the Standard
Update CR TR 13688	See section 3.6.2, this is independent from the decision on Standard EN 13430	This would require resource from CEN and related stakeholders. In this case, the impact of the measure and associated administrative burden may be higher, though this would likely be a one-off cost.

At the Member State level, some additional administrative burden would be expected, since the Essential Requirements in the baseline were reported to be too vague, and therefore associated with very little enforcement activity. If differing interpretations of the definition across Member States arose, the administrative burden for producers could increase significantly.

3.6.4 Economic impacts

As the measure relies heavily on the nature of enforcement mechanisms that each Member State puts in place and the differing interpretations of the legislation, the impacts estimated here are uncertain.

- **Packaging producers (including converters, fillers and brands)** -Investment will be required to explore packaging designs that improves recyclability whilst maintaining function of a particular packaging product. Changing design may require adaptations to infrastructure, such as filling processes.
- Where changes to design are not seen as viable or innovative packaging design is used it may also be the case that packaging producers invest in developments further along the recycling chain**.** This could involve advocating for increased collection coverage within Member States, incentivising sorting plants to incorporate new technology, and funding innovation into new recycling technologies.
  Given that brands are increasingly seeking to capitalise on consumer awareness of recyclability and as such are keen to demonstrate this as a selling point, brand owners may therefore be willing to incur higher costs for packaging items that meet this definition prior to 2030. For some product lines, however, this will mean a switch away from packaging types that are unlikely to meet this definition of 'recyclable' by 2030 to packaging that will. One major FMGC Company interviewed for this Impact Assessment reported that ongoing shifts from one packaging material to another have incurred R&D costs, costs of change to production lines, and, in some cases a reduction in sales where the functionality of the new packaging is affected.
  Noting that to some extent, these costs will have already been incurred in the baseline to meet the revised recycling targets, it has been estimated that as a maximum, the additional costs of packaging production **associated with the measure are around ~260m€ relative to the baseline in 2030**.
- **Recycling Industry (sorting and reprocessing infrastructure):** This measure is expected to boost investor confidence in sorting and recycling infrastructure to some extent, given the increased enforceability of the requirement. However, it is not clear to what extent these impacts will be felt over and above those in the baseline scenario, in which there is already considerable pressure for Member States to encourage packaging to be recyclable in order to attain the revised recycling targets and avoid the own resources mechanism (for unrecycled plastic packaging waste specifically). In addition, the persisting ambiguity in the qualitative definition without a mechanism for implementation may serve to reduce any significant economic costs that may otherwise be incurred if a more stringent, unambiguous definition (e.g. quantitative) was implemented. This is due to the risk that elements of the definition may be interpreted differently by Member States and therefore become difficult to enforce. Overall, it is estimated that as a result of any additional packaging waste being diverted to recycling, **increased costs of ~91m€ can be expected relative to the baseline in 2030** (net of reductions due to reduced incineration/ residual treatment).

3.6.5 Social impacts

The social impacts of agreeing a definition of 'recyclable' are likely to be similar to those discussed in measure 21 updated to the Essential Requirements (i.e. a maximum **increase in employment of ~5,700 FTEs relative the baseline in 2030**). Having a common definition of

'recyclable' could increase consumer confidence in this term, if measures to harmonise labelling of recyclability (measure 27) are also adopted.

3.6.6 Environmental impacts

The environmental impacts of the measure are expected to be positive, and similar in magnitude and scope to those described in measure 21a (as shown in the table below). It should be noted that these measures are not likely to be implemented in isolation of one another. However, it is necessary to assess them in isolation of one another for the purposes of the study. If implemented in combination, the impacts described below should not be considered of as additional to those described in measure 21.

Table A-3 Summary of Environmental Impacts for Measure 22a

Summary of Environmental Impacts	
Change in GHGs, thousand tonnes CO_2e	~-1,230
Change in water use, thousand m^3	~-44
Change in GHG +AQ externalities, m€	~-270

3.6.7 Stakeholder views

The need for clarity of definition emerged as a dominant theme in the stakeholder interviews for this impact assessment, with difficulties in the interpretation of the Single Use Plastics Directive cited as a case in point.[548]

In the OPC, many participants (e.g., BASF, DOW, and FEVE) spoke about the need for harmonised definitions across the EU for what constitutes recyclable packaging, proposing definitions they considered particularly suitable. Some organisations highlighted that these definitions must be technology neutral to avoid unintentionally favouring or excluding certain processes (chemical recycling and composting in particular).[549]

3.7 Assessment of Measure 22b: Definition, assessment and enforcement of recyclable packaging via the use of design for recycling criteria

3.7.1 Effectiveness

This measure is likely to be highly effective as it requires the packaging value chain to work together in identifying routes to not only recycling, but higher quality recycling. A key strength

[548] Interview with KP films 24th May

[549] Appendix F - Online Public Consultation Report

of the approach considered here is the more precise and robust nature of the method to defining "recyclable" packaging, which would render it more effective than qualitative statements alone. This would allow detailed consideration of the characteristics of each type of packaging that actually make it recyclable or not. This is important given the wide range of materials, products, recycling processes and compatibility issues that have been identified in the problem definition. Based on existing industry guidelines for DfR, this would involve the development of mandatory DfR criteria for around 20-25 packaging categories.

The approach, therefore, could avoid some of the issues related to ambiguity of broad qualitative definitions, as highlighted above. Recycling rates would likely increase above the baseline in some cases, though this relies on corresponding increases in collection and sorting.

In addition, the development of clear, harmonised criteria would remove the possibility of differing interpretations of recyclable packaging across Member States, and could lead to greater harmonisation in collection, sorting and recycling systems across Member States over time.

It is noted that to some extent, these impacts will be realised in the baseline itself due to the effect of the increased recycling targets. It is anticipated that efforts to reach the higher recycling targets will focus largely on the 'low hanging fruits'; the gains in recycling that can be achieved by increasing collection coverage or scaling up of existing recycling infrastructure, or relatively simple/ cost effective design changes to existing packaging formats. For packaging types that are more challenging to recycle (as outlined in Appendix A – Problem Definition), these are not likely to be addressed through actions to meet the recycling targets, due to the relative economic burden of doing so. This is therefore the segment of the packaging market in which this measure has the most potential for additional impact relative to the baseline.

It has been estimated that for packaging types that are more challenging to recycle, a significant **increase of between 11-20pp in recycling rates relative to the baseline in 2030** may be expected (affecting plastic packaging in particular). In terms of **overall packaging recycling rates, this corresponds to an increase of ~2pp relative to the baseline.**

3.7.2 Ease of implementation

The implementation of this measure will require the establishment of implementing acts and technical committees to agree the criteria that can be applied across the EU (and any exemptions). As this measure is only intended to be enforced from 2030 this gives some time for the challenges of implementation to be overcome, particularly as the criteria can be rolled out sequentially, or in a staged manner.

In the first instance, the implementing act should set out the packaging categories for which criteria will be developed, the criteria against which recyclability will be assessed in each category, and the evaluation procedure to be followed to determine the extent to which a unit of packaging fulfils these criteria, including approaches to verification and/ or certification. This is likely to involve some effort on the part of the Commission, though much work has already been carried out by industry to understand and develop packaging categories, criteria, and evaluation procedures for DfR assessments which can and should be drawn upon.

A more challenging aspect to implement is likely to be the establishment of technical committees to develop the criteria in line with the implementing acts, as well as their ongoing

work to grant exemptions, assess the need for revisions, and so on. This is likely to be resource intensive. The less challenging alternative, in the form of CEN standardisation requests is also appropriate, though the process is equally time consuming and lacks the dynamism required to keep up with packaging and recycling innovations. To mitigate against this, a negative list of packaging features to be ruled of the market with immediate effect should accompany the requirements in the PPWD itself, to ensure that the worst performers can be regulated despite the absence of standardisation in the short term. Note that the development of this negative list will require further effort, as will any updates that become necessary (involving legislative revision should the need arise).

Finally, it is not anticipated that the development of the mandatory criteria (by either technical committees or through CEN standardisation), will be particularly challenging. For the majority of packaging types there is already a high degree of agreement on the DfR criteria since a range of such criteria in the form of guidelines, standards and tools have already been developed by industry and are in use at present.[550] For a small proportion of packaging types on which there is currently no consensus across industry regarding recyclability criteria, developing agreed DfR criteria could be more challenging. In the table below, case study interviews were used to explore the ease of implementation with regard to specific packaging types that are currently challenging to recycle so will be strongly impacted by the measure. Interviews sought to explore the degree of existing agreement on DfR criteria for these categories.

[550] The JRC has already carried out a review of many of these with a view to identifying best practice as part of ongoing Support to the Circular Plastics Alliance in establishing a work plan to develop guidelines and standards on design-for-recycling of plastic products here: https://publications.jrc.ec.europa.eu/repository/handle/JRC122453

Table A-4: Ease of Implementation for Case Study Packaging Types

Case Study Packaging Type	Ease of Implementation
Beverage Cartons	Beverage cartons have sat as an anomaly within the broader category of 'paper and board' and there is a need for this product group to have its own DfR guidelines. As the use of laminated paper is growing such as for snack food wrappers it may be that the guidelines for beverage cartons become more widely applicable. There is strong industry agreement among the main stakeholders on the design changes that can support the increased recyclability of beverage cartons and the limits of this approach for this packaging type. Removal of the aluminium layer simplifies the process of separating the recyclable components but is seen as only possible in some product lines. Removing the plastic liner entirely is not possible or the product loses all functionality. Some resistance to guidelines may be encountered as the beverage carton industry representatives are concerned that a narrow focus on 'recyclability' alone will push design away from an optimised solution that is 'sustainable' across a range of variables.
PET thermoform food trays	A lot of industry time has already been spent on defining the DfR guidelines for PET trays, and there is a high degree of alignment across different guidelines. Clear PET trays that are mono-material, with no additional polymers used will deliver the most efficient recycling process and high quality product. There are four plants in Europe that are running test lines for PET trays, and one of these claims to have overcome earlier problems in low yield. Challenges remain in the agreed approach to coloured PET trays which make up close to half the trays on the market. Some industry players see no reason why most coloured PET trays could not shift to clear versions.[551] However, a large recycler that we interviewed said that their preference is to do additional sorting of coloured from PET at the recycling plant, which gives them greater control over the process, so they see less of a need to insist on a design change in this regard.[552] Industry expressed concern that guidelines could stifle innovation and restrict the potential for the differentiation of products which brings market value.[553]

[551] Interview with Petcore on 3rd May 2021

[552] Interview with Faerch on 25th May 2021

[553] Interview with KP films on 24th May 2021

Case Study Packaging Type	Ease of Implementation
Plastic film	There is a need to align different industry DfR guidelines for film. Given the wide ranging applications included in this category industry may make the case for a range of different guidelines to be produced according to application.
Multi-layered flexible packaging	This sector relies strongly on innovation in the layering of multiple polymers in different formulations to improve the functionality and give increased value to end products. Existing design guidelines for flexible plastics focus largely on switching to mono-material formulations. It may be more difficult to get widespread industry support for guidelines that are seen as too restrictive.[554]

If EPR reporting requirements across Member States were harmonised the implementation of the DfR criteria, once agreed, could be straightforward. The use of an alert system to enable Member States to share knowledge on packaging approvals and potential instances of non-compliance would improve efficiency, not only for Member States but also for producers (see Impact Assessment appendix for intervention area Data & Reporting).

In the absence of this implementation could be more challenging, particularly if packaging producers have to make separate assessments/ declarations in each Member State, requiring the establishment of registries and enforcing bodies. However, as discussed in section 3.4.2, the use of existing PRO databases in EPR schemes can be leveraged by Member States in this regard, as can the role of an EU wide rapid alert system and market surveillance authorities in ensuring compliance of packaging on the market of each Member State. In this regard, the DfR self-evaluation could form a part of a packaging manufacturer's declaration of conformity with the PPWD and Essential Requirements. This would likely be the least costly option to implement from the perspective of the Commission. However, market surveillance procedures in the form of spot checks and audits would then need to be carried out at the Member State level to monitor against this.

Finally, it is recommended within this measure that the criteria should be checked for the need for revision at least every 3-5 years after 2030 to ensure that they adapt to innovation. If a negative list of materials or design elements that hinder recyclability is formed, then it will be necessary to keep this up to date. This may mean adding new items to the negative list or removing some as sorting and recycling infrastructure develops. While the implementation of this aspect will not be as challenging as the establishment of the criteria in the first place, it will require further effort and the dynamism of the measure is somewhat compromised in this regard (i.e., it will be difficult to keep up with rapid changes in packaging design and recycling technologies). Linking the measure to the modulation of EPR fees (measure 23) would be beneficial in this regard.

[554] Interview with Gualapack on 12th May 2021

3.7.3 Administrative burden

The administrative burden will fall most heavily on the Commission in the implementation phase (i.e., developing the implementing regulation, setting up technical committees/ CEN standardisation requests, and potentially developing the negative list of packaging features) as described in the process of implementation, after this period the compliance and enforcement burden lies with producers and Member States.

- **EU Commission:** Robust design for recycling criteria have already been developed and are widely in use for several packaging categories, so there are some efficiency gains to be made by ensuring that such existing work is not duplicated. In any case, the administrative burden to the Commission to set up this mechanism is likely to be significant, with the need for an implementing act to outline the evaluation and assessment procedure, as well as any accompanying testing protocols, and lists of packaging categories, etc. In addition, the set-up and management of the technical committee(s) to develop the relevant DfR criteria must be considered.
- **Member States:** Enforcement of this measure will fall on Member States, which is likely to bring a significant administrative burden. As discussed above, this can be mitigated to some extent by using existing PRO data, existing Member State surveillance authorities and harmonising EPR reporting requirements.
- **Packaging producers**: They will be required to meet the criteria in order to place packaging on the EU market, with some administrative burden associated with undertaking the assessment and gathering the necessary data. This is likely to be a one-off cost, though potentially significant if assessment data are not shared across Member States via an EU rapid alert system or harmonised reporting thereby requiring producers to undergo assessment as many as 27 times for a given type of packaging. Producers will also face administrative costs of 'managing change' associated with changes to their product lines in response to this measure. This is additional to the R&D and investment costs and can be significant depending on the scale of adaptation required.[555]

3.7.4 Economic impacts

The scope of economic impacts associated with this measure are similar to those discussed previously in measure 22a. In terms of scale however, the impacts are expected to be more significant, equivalent to around **~868m€ in the net packaging production costs relative to the baseline in 2030**. It should be noted though, that these costs are likely to be relatively low compared to an unregulated scenario in which Member States potentially set divergent and possibly conflicting recyclability requirements and criteria for producers to meet, thus fragmenting the internal market. Harmonisation of the criteria and reporting of recyclability thus mitigates against these inefficiencies. In addition, given that design changes are an ongoing cost for producers, and the timescale of implementation of this measure, these costs may be lower in reality. This is also due to the fact that producers will have a clear steer as to where their investment can be best targeted to improve recyclability and compliance with the regulations at the same time. The more detailed economic impacts on the case study packaging types are summarised in Table A-5 below.

[555] Interview with Danone 6th May

An additional economic cost associated with the diversion of packaging waste from incineration/ residual stream to recycling is estimated in the first few years of implementation. In the longer term, these costs would be offset to some extent by increased efficiency gains (due to lower levels of non-recyclable contamination), recycled material revenues and a reduction in costs required for managing waste in the residual stream. One report calculates that design improvements could as much as halve the costs of recycling plastic packaging waste.[556] The model shows that, by 2030, the resulting reduction in unit costs of recycling will not be offset by the increase in absolute tonnages recycled; overall, an **additional cost in recycling is therefore anticipated by 2030, equivalent to ~172m€,** which will be passed on to producers in the form of heightened EPR fees.

One indication of additional economic impact of this measure can be found in a CPA analysis of the sorting and recycling infrastructure investment needed to reach the target of 10Mt of plastic recyclates by 2025. They compare two scenarios, one with the development of existing technology and the other with 'design for recycling'. They estimate that to process the additional quantity of recyclables in the 'design for recycling' scenario would cost an additional 1,600m€, which is made up of an extra 20% on all investment costs plus a 'change' cost of 100m€ to upgrade and modify equipment.[557]

[556] Ellen MacArthur Foundation, The New Plastics Economy: Catalysing action, January 2017 cited in p2 of EU Commission, Inception Impact Assessment, June 2020, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12263-Reducing-packaging-waste-review-of-rules_en

[557] CPA May 2021 Final Draft copy of 'Roadmap to 10Mt Recycled Content by 2025'

Table A-5: Economic Impacts on Case Study Packaging Types

Case Study Packaging Type	Economic Impacts
Beverage Cartons	The additional impact of measure 22b over the changes that could occur under measure 22a are likely to be smaller than for other packaging types. This is because there is limited scope to make design changes for beverage cartons that will significantly increase their recyclability. It is not possible to remove the plastic layer without losing the functionality of the product, and whilst removing the aluminium layer is acceptable for some applications the carton will still need to follow the same recycling process with removal of the polyAlu from the fibreboard and recycling into a useable form. Given the limitations of design changes the beverage carton industry is active in investing in the infrastructure needed to process existing cartons. Given these limits the industry is looking at other ways to increase the scale of recycling of beverage cartons. Looking beyond the challenge of increasing collection there are two related economic hurdles that the beverage carton industry is facing. Firstly, stimulating the paper recycling industry to invest in specialist equipment that separates the 25% polyAlu material from the paper board. Secondly, there is a need to expand the infrastructure that can process the rejected polyAlu component once it has been aggregated. The beverage carton industry is already funding infrastructure investment and Tetra Pak, Elopak and SIG Combibloc GmBH have invested 8m€ in a new recycling plant in Cologne called 'Palurec' that has been operational since spring 2021. Scaling this up to meet the industry ambition of 90% collection rate and 70% recycling by 2030, then there will need to be additional infrastructure sufficient to process an estimated additional 120kt of polyAlu across Europe. Currently industry report that in around 37kt of polyAlu is processed in Europe so this will involve a threefold increase in capacity. The recently constructed Palurec plant cost €8M and processes 18kt so this increase in infrastructure could require up to 48m€. The packaging producers are unlikely to meet these costs themselves, as they have already invested in demonstrating the potential of the technology. Hence, they are reliant on the recycling industry finding sufficient value in the material produced to fund this infrastructure development. This measure alone does not create an economic incentive for recyclers but together with any future requirements for mandatory recycled content in beverage cartons, this could stimulate demand for the outputs of this process to be used in a closed loop. Industry is also calling for separate recycling targets for beverage cartons as distinct from paper and board.[558] It is difficult to discern the extent to which this measure would create an additional incentive to invest in the beverage carton recycling chain beyond the existing forecast for development.

Case Study Packaging Type	Economic Impacts
PET thermoform food trays	Implementing this measure and mandating the use of DfR guidelines for trays is expected to create a shift from coloured and multi-polymer trays to clear, mono-material PET trays with around 40% of the coloured trays likely to switch to clear. By 2030 this could mean that 70% of the PET trays in Europe being classified as recyclable.[559] A corresponding investment would be needed in sorting and recycling infrastructure to process this material of around 0.7MT. Using the CPA figures for average investment needed per tonne of material this could require an investment of between 1.1 to 1.5m€. Of the 30% of PET trays currently in use for applications where a recyclable option is not seen as viable, a shift to alternative packaging materials/ formats will be required in order to meet the 2030 requirement for all packaging to be recyclable. Depending on the collection approach taken by a Member State there may be an additional investment need for sorting equipment that can differentiate between PET bottles and trays.
Plastic film	DfR requirements have a large potential to improve the recyclability of post-consumer films. Whilst some mechanical recycling is operational for PE films, the complexity in additional materials used, and the high contamination levels of household films is problematic and restricting growth in this sector. Industry views expressed in the interviews for this IA estimate that by 2030 at best 70% of household films could be in formulations that are acceptable to recyclers.

[558] Interview with ACE on 28th April 2021

[559] Interview with Petcore 3rd May 2021

Case Study Packaging Type	Economic Impacts
Multi-layered flexible packaging	Packaging producers have successfully brought to market mono-material versions of the multi polymer layered pouches and state that for some applications there is no loss of functionality. The mono- material versions are more typically made from PP for the added strength this offers and are still multi-layered using different formulations of PP for different properties in the layers. Currently, the novel materials for a mono-material pouch will cost at least 10% more than the raw materials for a multi-polymer pouch presenting a cost barrier to switching.[560] Another interviewee pointed out that the costs incurred with switching to a more recyclable format for flexible packaging can vary greatly depending on the current formulation of the material. One brand tell us that their crisp packets are already mostly PP with a PE layer so that the switch to mono-material is quite straightforward. For other producers reliant on multi-material constructions, including the use of aluminium, the costs of switching to mono-material constructions are likely to be a significant hurdle. It is thought that some industry sectors would choose to hold back from switching their product design on the expectation that chemical recycling techniques will be sufficiently cost effective in ten years to provide an alternative route for recycling.

3.7.5 Social impacts

The changes in packaging production processes and the increased volumes of packaging waste diverted to recycling are likely to result in significant additional employment opportunities relative to the baseline. These will be offset to some extent by job losses at waste incinerators. Overall, it is estimated that **~19 thousand additional FTEs** will be generated because of the measure, relative to the 2030 baseline.

In terms of consumer preferences, consumers may be required to shift in their expectations of packaging items, particularly aesthetically. For example, to reduce the percentage of inks to packaging material, items such as frozen peas should ideally be packaged in clear mono-material film with less than 50% printed surface area.[561] Brands are resistant to such a shift as it reduces their marketing space and potential to stand out in comparison to competitors, yet consumer preference is malleable.

[560] Interview with Gualapack 12th May 2021

[561] Interview with Trioworld 5th May 2021

3.7.6 Environmental impacts

The environmental impacts associated with the changes in production processes and end of life management of packaging described above are summarised in the table below. These are estimated relative to the baseline in 2030.

Table A-6 Summary of Environmental impacts for Measure 22b

Summary of Environmental Impacts	
Change in GHGs, thousand tonnes CO_2e	-4,220
Change in water use, thousand m^3	-150
Change in GHG +AQ externalities, m€	-930

3.7.7 Stakeholder views

Stakeholders contacted during the course of the study largely support this approach, appreciating that this route supports high quality recycling and aligns actors across the value chain.[562] The measure should support the design of cost-effective infrastructure and encourage innovation in this area, but stakeholders noted the potential risks to product innovation if the assessment process is too prescriptive.[563] One stakeholder interviewed argued that novel packaging solutions should not be disadvantaged on the basis of small quantities as they could prove to be an optimised solution to a packaging need.[564]

Respondents to the online public questionnaire identified the need for harmonised guidance on design for recycling (DfR) practices. One stakeholder, for example, proposed a "dynamic and regularly updated positive/negative list" that could be developed alongside industry to give clarity. Many participants supported this. [565]

It is worth noting that in the online public consultation a key point was raised by participants that the recyclability of a container should not rely only on the ability of the consumer to separate the materials, but also efficient separation of waste in a sorting station.[566] This is a consideration that could be accommodated within DfR guidelines. Additionally, it was noted that a risk of "downcycling" exists if technical recyclability alone is assessed (as opposed to recycling performance/ recyclability in existing processes). DfR is not equivalent to 'eco-design' so the approach does not consider environmental performance or sustainability more broadly. This is a key concern to certain packaging products such as beverage cartons whose brand value is based on a wide view of sustainability, for which there is no consensus approach to calculating.

[562] P30 Appendix D European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[563] Ibid.

[564] Interview with Plarabel 20th May 2021

[565] Appendix F - Online Public Consultation Report

[566] Ibid.

A similar concern was raised regarding potential trade-offs required between product functionality and DfR guidelines. For example, switching to mono-material flexible packaging could reduce the shelf life of products which could negatively affect the amount of product going to waste and profit margins.[567]

3.8 Assessment of Measure 22c: Allowance for recyclable packaging to be defined as any packaging that exceeds a minimum recycling rate threshold

3.8.1 Effectiveness

The effectiveness of this approach ultimately relies on the capability to calculate recycling rates for specific packaging product types, and this is currently limited by a lack of accurate data. The level of detail of data needed is not just a matter of additional administrative burden but a lack of technology to trace waste. Looking forwards, however, there are new technologies being developed that could make the production of this data much more cost effective and achievable. The approach would utilise digital watermarking technology and sensor equipment to register the number of individual functional units of packaging sorted through sorting plants.

As the technology is not yet fully developed, **this approach is unlikely to be effective within the time period out to 2030** and is therefore not likely to be effective from the perspective of operationalising measure 21 by 2030.

However, it is likely to be extremely valuable to help define recyclable packaging using format specific recycling rates in the future. Being target-based, it is clearly measurable and more easily operationalised and enforced at a given point in time than other approaches. It also provides a reasonable amount of flexibility for the packaging industry as it is not a prescriptive 'how' but more a target to work within. In addition, because the definition is based upon actual performance it gives a clear incentive for investment in recycling systems to ensure the threshold levels are met. It could therefore potentially be implemented in staged manner, allowing packaging that can demonstrate compliance with the recycling threshold beyond 2040 to be exempt from having to undergo the DfR assessment procedure outlined in measure 22b, and moving to a mandatory recycling rate threshold based mechanism in later years.

Accordingly, the measure is likely to have significant impacts relative to the baseline, albeit these will not be realised within the 2030 timeframe. By 2040, on the other hand, recycling rates for packaging types that are currently problematic to recycle and unlikely to be impacted in the baseline could **increase by anywhere between 15-31pp (the most significant increases are expected in plastic packaging) relative to the baseline**. This corresponds to **increase in overall packaging waste recycling rates of ~2-3pp relative to the baseline in the year 2040**.

3.8.2 Ease of implementation

The effectiveness of this measure relies heavily on its implementation, including the level at which the threshold is set and the granularity in the packaging categories subject to relevant

[567] Interview with Gualapack 12th May 2021

thresholds. It is therefore anticipated to be challenging to implement, with some examples of potential issues to solve highlighted below:

- The level of the threshold proposed in the Essential Requirements scoping study was 20%.[568] However, more ambitious suggestions include aligning the threshold with the packaging recycling targets for each packaging material set out in Article 6 of the PPWD in the years following the latest date by which the targets are intended to be set. This is likely to require extensive analysis in order to set thresholds at a level that is ambitious, but not prohibitive to the market.
- This measure is unlikely to ensure that all packaging is recyclable (as per measure 21) if applied to broader packaging categories within which a small proportion may be unrecyclable. For example, within the category of PET thermoform trays a threshold level of recycling could be attained quite easily through the scaling up of the trial lines that process mono-material clear trays. Once the threshold for recycling has been attained there is no incentive for the complex constructions of trays that are difficult to recycle to adapt. Therefore, more granular data is needed.
- The section above highlights the issues at present regarding a lack of data and the need for technology that is still under development. The alternative to improved traceability of specific packaging types involves widespread sampling of waste in order to facilitate monitoring and enforcement against the measure (as discussed in section 3.4.3) – this would be prohibitively costly.

At present, there are considerable challenges associated with implementing this measure, though these are already in the process of being addressed by industry and by 2030 progress in some of these areas is expected.

3.8.3 Administrative burden

Based on the above discussion, significant administrative costs can be anticipated. If, however this measure was to be aligned with future EPR fee modulation by recycling rate (as in Measure 23) this would be less burdensome.

Regardless, there would be some additional cost to the Commission from developing the framework in a legal text, though the main cost associated with the method would be that of producing the necessary data relative to the baseline. Firstly, the PoM (Placed on the Market) data would need to be submitted by producers in total weight placed on the market, which is reasonable in the case of large producers from whom this data would also be required under a harmonised EPR reporting approach (see measure 42, intervention area on data and reporting). Information on average unit weights may need to be gathered if not already available. The more significant costs would relate to obtaining data the weight of packaging recycled by category.

Unless discreet recycling systems are used (e.g., a deposit refund system for beverage containers), or new innovative digital watermarking technology is mandated for all packaging, it is likely that detailed analysis of the composition of the recycling stream would be required. The burden may be higher for the recycling industry as this is the point at which the sampling

[568] European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

surveys would need to be carried out. However, these could be funded by those responsible for proving compliance i.e., the producers. The overall impact level would be expected to be high.

3.8.4 Economic impacts

The alignment of the definition of packaging that is recyclable with actual levels of recycling attained by a specific packaging type would allow for a high degree of efficiency in both packaging production processes and the development of recycling capacity to meet these thresholds. It would give a clear signal to stakeholders and confidence to investors regarding the need for additional investment in specific products and technologies.

Given the high degree of effectiveness associated with this measure, additional costs associated with the packaging design changes and increased recycling levels discussed above would be anticipated relative to the baseline (though in a longer timeframe than the 2030 period of interest). **Relative to the baseline in the year 2040, for example, additional costs of packaging production are estimated to be of the order ~1,600m€**.

While the overall increase in the tonnage of packaging waste diverted to recycling is expected to increase the costs of recycling in early years, the significant improvements in packaging design that are expected to accompany this measure will reduce the per unit costs of recycling. This is expected to be due to a significant reduction in contamination, sorting losses, and increased revenue associated with higher quality material outputs. Overall, the increase in the absolute tonnages recycled is estimated to result **in overall additional costs of ~49m€ for sorting and recycling relative to the baseline in 2040**, which will be passed on to producers in the form of higher EPR fees to cover the costs of end-of-life management of their packaging.

3.8.5 Social impacts

Given the impact that this measure is expected to have on improving production processes for packaging (i.e. incentivising producers to make packaging recyclable) and its direct link to increased recycling levels, additional employment benefits are anticipated relative to the baseline, albeit these impacts are unlikely to be felt within the 2030 timeline associated with measure 21.

In the longer term (i.e. considering the baseline in the year 2040), an **increase in employment benefits equivalent to as many as ~36 thousand FTEs is anticipated** in the CBA model, with the majority of these (circa 23 thousand) arising due to the diversion of waste from incineration and landfill to recycling (which is more employment intensive). The remaining impacts relative to the baseline (circa 13 thousand FTEs) are estimated to arise due to improvements in packaging production processes, switches to different packaging formats and materials, and increased R&D in the production phase to ensure the thresholds can be met. It is noted that it is assumed that as the thresholds increase over time, so do these impacts.

3.8.6 Environmental impacts

As noted above, impacts are unlikely to be felt within the 2030 timeframe. However, should the measure become feasible, by 2040, significant environmental impacts are estimated, as shown in the table below. These are associated largely with the diversion of waste from incineration and landfill to the recycling stream.

Table A-7 Summary of Environmental Impacts for Measure 22c

Summary of Environmental Impacts in 2040 relative to baseline	
Change in GHGs, thousand tonnes CO_2e	-8,300
Change in water use, thousand m^3	-287
Change in GHG + AQ externalities, m€	-2,500

3.8.7 Stakeholder views

Stakeholders were supportive of this approach in theory, recognising the clarity it offers and the potential for enforceability should the data and monitoring systems be in place. However, it was noted that if the definition was based upon current recycling rates only, this could hamper innovation without a mechanism to allow for new infrastructure to develop over a period of time such that the threshold rate could be proved. Hence, there would be merit in introducing this approach from 2030 onwards, following the implementation of the DfR approach in 22b such that the criteria for recyclability have already been harmonised to an extent.

Stakeholders also expressed some concern over the challenge of agreeing and setting the threshold level itself. In addition, it was pointed out that a quantitative metric does not take quality into account.

3.9 Summary and conclusion

When set alongside each other, each measure presents its own advantages and drawbacks:

- The qualitative definition would set the basic principles of recyclability and is flexible enough so as not to hamper innovation. However, as a measure used in isolation it is difficult to implement. There is much room for different interpretation across Member States and overall, a qualitative definition lacks the enforceability of other approaches (and as the existing situation exemplifies, enforceability of criteria is key);
- The DfR approach potentially provides a clearer system for defining 'recyclable', and supports high-quality recycling and should be implemented on the basis of the key principles set out in the quantitative definition (although the quantitative definition itself would no longer appear in Article 3 etc). There is an associated administrative burden that arises from implementing this measure, but this can be seen as a reflection of the high degree of complexity that currently exists in the design of packaging.
- Using recycling rates to define a threshold for packaging that can be considered recyclable or not would – subject to data being available - be clearly enforceable and would be flexible enough to respond to market and technological changes, as long as definitions of 'recycling' were updated accordingly. There is, however, a lack of data at the level of granularity needed to implement this method at present. Although technologies such as digital watermarking/ tracers etc. have significant potential in addressing these knowledge gaps, they are currently in their infancy, and cannot be relied upon as a basis for regulation at this current moment in time. The measure should be considered for implementation beyond 2040, in a staged approach alongside the DfR requirements which should have been implemented from 2030 onwards.

- A combined approach is therefore most appropriate, using a qualitative definition to provide underpinning principles for what constitutes recyclable packaging, operationalised by 2030 using a DfR approach, that in turn allows for the gathering of data to enable the recycling rate threshold approach to be implemented beyond 2030 (potentially from 2040 onwards).This will include consistent, harmonised data on the key design features of packaging at a greater level of granularity, and how these relate to both theoretical and actual recycling, in turn enabling identification of an appropriate level of granularity at which recycling rate threshold should be identified and an understanding of the factors that will affect these thresholds.

Table A-8 Summary of impacts for Measure 22

Impact category	Measure 22a (relative to 2030)	Measure 22b (relative to 2030)	Measure 22c (relative to 2040)
Effectiveness	Hampered by room for varied interpretation	More likely to be effective at creating cost-effective innovation across the recycling chain	Limited by lack of data at sufficient granularity at present, could be highly effective beyond 2030, if technological developments materialise
Ease of implementation	No mechanism in definition to support implementation	Builds on existing industry work to define criteria, requires implementing act to set out evaluation/ verification process	Difficult at present as requires widespread technological investment and adoption to get sufficient data
Administrative burden	Light for Commission, but enforcement by MS problematic given openness in definition	Significant on the Commission during process of implementation, Enforcement burden lies with Member States, which should be straightforward with harmonised requirements.	Significant with new data systems and reporting processes
Economic impacts	~260m€ additional net production costs ~91m€ additional costs in waste management	~868m€ additional net production costs ~172m€ additional costs in waste management	~1,600m€ additional net production costs ~49m€ additional costs in waste management

Impact category	Measure 22a (relative to 2030)	Measure 22b (relative to 2030)	Measure 22c (relative to 2040)
Social impacts	~5,700 additional FTEs	~19,000 additional FTEs.	~36,000 additional FTEs
Environmental impacts	Savings of 1,230 thousand tonnes CO2e, 44 thousand m3 water use and 270m€ in GHG + AQ externalities	Savings of 4,220 thousand tonnes CO2e, 150 thousand m3 water use and 930m€ in GHG + AQ externalities	Savings of 8,300 thousand tonnes CO2e, 287 thousand m3 water use and 2,500m€ in GHG + AQ externalities
Stakeholder Views	Concerns over lack of clarity in this definition	High degree of support with a few concerns over potential trade offs	Concerns over how this is implemented

4.0 Measure 23: Harmonisation of EPR Fee Modulation Criteria

4.1 Problem definition

The incentive for producers to shift to recyclable packaging design achieved by a certain level of fee modulation can be maximised if the criteria for such modulation are effectively targeting the core issues and applied consistently across all Member States. At present, reflecting the variation in packaging waste collection, sorting and recycling systems across Member States, fee modulation (where it exists) is based on a range of recycling criteria, and on design characteristics other than recyclability in some cases (e.g., whether recycled content is incorporated).

This dilutes the price signals to producers and brands regarding preferred design characteristics for recycling, potentially distorting the single market if a criterion is deemed desirable in one Member State but not others. The resulting scope and scale of investments in recycling capacity and the attainment of the recycling targets can therefore be made more efficient through legally binding harmonisation of the fee modulation criteria alongside harmonised recyclability criteria (as discussed in measure 22)

In addition, reflecting the increased costs of recycling associated with attaining a higher level of recycling target, the granularity of the underlying fee structure should also be increased and harmonised (see measure 42 on EPR reporting harmonisation). This will ensure that fees better reflect the different net costs of recycling each format to avoid cross-subsidy (vis a vis measure 42), while simultaneously incentivising consistent and targeted improvements in the recyclability of each format (through harmonised fee modulation criteria).

4.2 Baseline

As laid out in the Waste Framework Directive point (b) of Article 8a (4) requires EPR fee modulation, and Article 8(5) commits the Commission to publish guidelines on this, which are currently under development taking into account also the recommendations in the Study to support preparation of the Commission's guidance for extended producer responsibility scheme. [569]Article 8(5) also provides that the Commission may go further to "adopt implementing acts in order to lay down criteria with a view to the uniform application" of modulated fees based on harmonised criteria as suggested in this measure.

All 26 EU Member States that have EPR schemes for packaging waste have some basic differentiation in fee structure already in place. However, in many cases this only reflects heightened granularity in the structure of the fees based on the actual costs associated with different packaging types. This is therefore not the same as fee modulation on the basis of recyclability (where the fees go beyond actual costs in some cases, and below actual costs in others to incentivise certain design changes). In six of these Member States, there is both a

[569] EU Commission DG Env, Jan 2020, Study to support preparation of the Commission's guidance for extended producer responsibility scheme, https://op.europa.eu/en/publication-detail/-/publication/08a892b7-9330-11ea-aac4-01aa75ed71a1/language-en

high level of granularity in fee structure with fee levels modulated to differing extents for different material types, 'sortability' and 'recyclability'. [570]

4.3 Objectives

1. **Outcome:** Harmonisation of the criteria for packaging EPR fee modulation based on design for recycling approaches
2. **Objective:** The smooth functioning of the internal market in packaging production and recycling with increased consistency of incentives across Member States
3. **Impact:** To minimise the negative environmental impact of packaging waste management, by providing a clear, dynamic incentive to producers to shift to recyclable packaging types that will respond to market changes.

4.4 Description of the measure

Fee modulation criteria across Member States should be harmonised via an implementing act[571] to ensure not only the smooth functioning of the internal market, but also to maximise the potential for positive environmental change. The incentive for producers to shift to recyclable packaging design achieved by a certain level of fee modulation can be maximised if consistently applied across all Member States, using harmonised criteria for fee modulation.

It is noted that this does not mean that the *magnitude* of the modulation would be the same, as the focus is on the harmonisation of the criteria. Accordingly, while the magnitude of the modulation (relative to to the base fee structure that is reliant on the net costs of reyccling each format) might differ between Member States, the *direction* of the modulation would be consistent across the EU.

In addition, such an implementing act should enable harmonisation of packaging reporting formats and frequencies, and of fee categories, with the anticipated effect of:

- Improving data;
- Reducing administrative burden; and
- Increasing the potential for reducing confusion among importers, identifying and thus tackling both intentional and inadvertent free-riding.

In terms of 'operationalising' the criteria, harmonised design for recyclability (DfR) requirements as described in measure 22b above provide an appropriate basis for modulation, since it lends itself well to determining which types of design would incur a penalty (malus), which would be on the standard fee, and which would be eligible for a bonus. Alternatively, given also the responsibility for meeting the packaging recycling targets, there is merit in using fee modulation to reflect the relative extent to which different packaging formats contribute towards meeting the targets (as suggested in measure 22c above). Further detail on the design of this measure

[570] Ibid

[571] This would ideally need to link to measure 42 (see Impact Assessment on Data & Reporting measures)

and the rationale for its inclusion has been extensively researched in a previous study on EPR guidance.[572]

Finally, it is noted that the harmonisation of EPR fee modulation criteria is likely to be a key enabling factor in meeting the objective for all packaging to be recyclable by 2030 in a cost-effective manner. Once the measure has been implemented, EPR fees can be more easily changed by the PRO (e.g. fee value changed every year) to respond to the rapid developments in the packaging design and recycling sectors. In this context, following the initial implementation of harmonised EPR fee modulation criteria for recyclable packaging in an implementing act, the EPR fee mechanism acts as an ongoing dynamic incentive for improved packaging design which is flexible and more responsive than regular and ongoing updates to legal instruments.

4.5 Links to other measures

This measure links closely with the implementation of measures 21 Updates to the Essential Requirements and 22 Defining recyclable packaging, providing an economic incentive in addition to the regulatory ones proposed. Additionally, Measure 42: Harmonisation of EPR reporting and consideration of packaging registries is linked to the consideration of how data collection across Member States could be standardised more widely and the benefits associated with this in the context of the packaging sector.

4.6 Assessment of Measure 23

4.6.1 Effectiveness

This measure is likely to make the attainment of the recycling targets in the baseline more efficient and cost effective (i.e., the same target can be met at a lower cost/ in a reduced timeframe), since harmonisation of the criteria sends a clear signal with regards to the design of packaging that is needed to enable the targets to be met.

It could also encourage harmonisation of waste collection and sorting systems over time, to ensure that these processes are suited to the harmonised criteria. It is noted however that these should be seen as unintended consequences of the measure and not the rationale for the measure as the efficacy of the policy instrument is improved by retaining a single focus, rather than multiple objectives.

This measure is effective in providing an economic incentive to producers to invest in switching design choices and material choices to favour recyclable packaging. The effectiveness would be strengthened if implemented alongside measure 22b, which would determine:

- which types of design would incur a penalty (malus), for example, the 'Green' category under 3.4.2);
- which would be on the standard fee, for example, the 'Amber' category under 3.4.2)

[572] European Commission (2020), *Study to Support Preparation of the Commission's Guidance for Extended Producer Responsibility Schemes* at https://op.europa.eu/en/publication-detail/-/publication/08a892b7-9330-11ea-aac4-01aa75ed71a1/language-en

- and which would be eligible for a bonus, for example, the 'Red category under 3.4.2).

In addition, linking the two measures would ensure that those packaging types that are not sufficiently incentivised by EPR fee modulation to improve recyclability would still be subject to mandatory DfR criteria and would therefore be ruled off the market in the absence of improvements. Finally, EPR fee modulation linked to DfR criteria provides a useful dynamic incentive for producers to continue to make such design for recyclability improvements on an ongoing basis, mitigating against the impacts of any delays to the administrative process in revising and updating the DfR criteria over time.

An alternative basis for modulation is on the relative contribution of different packaging types to the recycling targets (for example aligning with the approach in measure 22c) but this may reduce the overall impact of the measure by preferencing those packaging types for which recycling infrastructure is already the most advanced. This would, at worst, hamper packaging and recycling innovations, despite producing efficient results based on existing technologies and infrastructure. To avoid this, a transition from modulation based on the DfR approach (see measure 22b) to one based on a recycling rate threshold (see measure 22c) should be explored, should the latter become feasible (based on technological developments) beyond 2030.

4.6.2 Ease of Implementation

The measure is proposed to be included in an implementing act that includes the harmonisation of packaging data reporting formats and frequencies (see measure 42), as well as fee categories and the criteria themselves. From the perspective of Member States, this is likely to be straightforward to implement, as PROs already collect much of the data required to operationalise the measure and would play a key role in monitoring. The harmonisation of the criteria and approach also removes the need for each MS to develop its own system, potentially creating barriers to internal market functioning from the perspective of packaging producers.

In addition, design for recycling criteria for several packaging types have already been developed and are in use by industry, with broad agreement on the majority of these across stakeholders. Harmonisation of the fee modulation in EPR schemes on this basis should therefore be relatively straightforward. However, in the absence of measure 22b to harmonise and make mandatory the packaging categories, criteria, and evaluation procedures, this is likely to be challenging to implement, requiring many of the key aspects of measure 22b to be developed here instead. In addition, there are likely to remain a small number of packaging categories for which industry do not agree on recyclability criteria, or evaluation procedures, for which further work will be necessary to ensure that differing interpretations of the fee modulation criteria do not arise.

4.6.3 Administrative burden

As fee modulation is already foreseen across all Member States in the baseline, and guidance is already in development, the additional administrative burden associated with this measure is limited to the development of a legal instrument (in the form of an implementing act) in the place of guidance, and on agreeing the criteria for modulation at the Member State/ industry level. Some additional burden on PROs (and therefore packaging producers) in lieu of budgetary planning, increased data management and reporting to Member States is also likely. However, given that fee modulation is already foreseen, the overall burden on Member States are PROs may actually be reduced relative to the baseline in which each would have to develop its own

system and approach. The harmonisation of EPR fee modulation criteria is therefore likely to be more cost efficient overall.

If linked to measure 42, by improving the consistency of EPR reporting requirements across Member States it is possible that for some producers this measure could lead to an efficiency saving in terms of data management and reporting.

4.6.4 Economic impacts

The economic impacts of this measure are anticipated to largely affect producers of packaging, though some additional impact is anticipated for other stakeholders as described below.

- **The European Commission/ Member States**– administrative costs as described in the preceding section.
- **Packaging Producers -** the harmonisation of EPR fee modulation criteria would set a clear, consistent economic incentive for producers to improve the design of their packaging in order to avoid higher EPR fees.
  - This is most likely to impact producers of packaged products for whom the relative cost of packaging to product is higher (as the modulation of packaging EPR fees will have a greater impact on the cost of the product overall in these cases). Additionally, impacts will be felt by producers of packaging types with several substitutes (i.e., for which the functionality of the packaging can be easily replicated and therefore the value of the product is not compromised.
  - Since fees will be modulated consistently across the EU, producers of the least recyclable forms of packaging will effectively subsidise the end-of-life costs of those with the most recyclable forms of packaging (such that the overall costs of the system are covered). While these impacts are expected to be felt to some degree in the baseline, guidance alone is not likely to bring about sufficient consistency in the approach applied across Member States, and these impacts are therefore expected to be more concentrated in the scenario.
  - It is not clear whether the measure will drive recycling rates above baseline levels (albeit if implemented alongside measure 22b it would facilitate the achievement of the impacts discussed in section A.3.7 above). However, the consistent application of criteria for fee modulation across the EU is anticipated to make the attainment of targets more cost-effective (i.e. the same target can be achieved at a lower unit cost) since design features that hamper recycling / reduce the quality of recyclate would be consistently disincentivised, allowing unit costs of recycling to reduce at a more rapid rate than in the baseline scenario. This would result in lower net EPR fees to producers over the longer term.
- **Recycling Industry -** The harmonisation of the criteria for fee modulation may also indirectly allow for greater consistency in the scope of investments in collection, sorting and recycling infrastructure across the EU in the longer term, particularly if implemented alongside measure 22b to bring about a harmonised understanding of what is considered recyclable and increased efforts to manufacture such packaging types. The market consistency across the EU that this measure will bring is also expected to increase investor confidence in recycling infrastructure and some packaging production processes. However, the scale of such investment relative to the baseline is not clear at present and will rely on the extent to which the economic incentive that consistent EPR fee modulation provides affects specific formats.

4.6.5 Social impacts

The employment impacts associated with this measure depend on the extent to which packaging production processes and materials change as a result of producers avoiding higher EPR fees. Increased volumes of waste recycling may similarly result in some additional jobs in the recycling industry, which may be offset to a lesser degree by losses in incineration and landfill facilities. The CBA model estimates a net job creation of around 5,700 FTEs relative to the baseline in 2030.

4.6.6 Environmental impacts

The environmental impacts of this measure are not anticipated to be significant (although positive) relative to the baseline, depending on the extent to which recycling rates are impacted (see section 4.6.4 for discussion on impact on recycling rates).

4.6.7 Stakeholder views

Stakeholders welcomed a coordinated approach to EPR fee modulation that is linked to the Essential Requirements. [573] Workshop participants raised the point that the Essential Requirements related to packaging recyclability and the modulation of fees under EPR schemes are two sides of the same coin so there needs to be a co-ordinated approach and harmonised definitions.[574]

In the interviews for this IA stakeholders were strongly supportive of the need to harmonise EPR fee modulation criteria in accordance with the other measures proposed (notably measure 22b). They expressed that EPR is seen as the economic tool that can drive industry to develop in a direction that is aligned to the Essential Requirements and that without harmonisation the market would remain fragmented and localised.[575] It was also pointed out where existing schemes use EPR modulation to incentivise recycled content (France and Germany) this can lead to market distortions with regard to optimal recycling processes.

4.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 23

[573] p25 of Appendix D, European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[574] P27 of Appendix D, European Commission, 2020, Effectiveness of the Essential Requirements for packaging and packaging waste and proposals for reinforcement available at: https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

[575] Interviews with Faerch 25th May 2021, Danone 6th May 2021, PepsiCo 24th May 2021

Impact category	Measure 23
Effectiveness	Expected to be effective in improving the functioning of the internal market in packaging production and recycling with increased consistency of incentives across Member States. Provides a dynamic, responsive economic tool
Ease of implementation	Straightforward if implemented alongside measure 22b. An implementing act will be needed.
Administrative burden	**EU Commission:** Securing agreement on criteria of the implementing act and drafting the implementing act. **Member States:** Enforcing and monitoring, data reporting. **PROs:** increased data management and reporting to Member States is likely. **Packaging producers**: reporting requirements, but the increased consistency across Member States could lower the administrative burden for some companies.
Economic impacts	Strong stimulation of investment into packaging that is designed for recyclability and the industry to process these.
Social impacts	Not anticipated to be significant, though positive (around 5,700 FTEs)
Environmental impacts	Not anticipated to be significant, but positive nonetheless
Stakeholder Views	Strong support for the alignment of EPR modulation with the Essential Requirements for packaging recyclability.

5.0 Measure 27c: Harmonised Labelling of packaging to include material component information

5.1 Problem definition

Harmonising the labelling requirements for recyclable packaging is considered a supporting measure to measures 21, 22 and 23 above. This measure is needed to bring consistency and transparency on whether packaging is recyclable and how it should be recycled to consumers and producers.

Additionally, it has been shown that consumer participation is a key component of the success of collection schemes without which the recycling chain cannot function to its potential. Research has shown that consumer confusion regarding the recycling of packaging (particularly plastic packaging) is currently widespread, and results in increased contamination in the recycling stream and a poorer resulting quality of outputs. [576]

Harmonising the labelling of packaging based on whether a given unit is recyclable or not is not viable (see discarded measure 27a in Section A.6). The harmonisation of information on recycling/ disposal routes at the EU level is currently not feasible (see discarded measure 27b in Section A.6), though the Commission's ongoing work to harmonise separate collection systems across the EU may change this in the future. In the longer term, material tracing technologies such as digital watermarking may reduce the need for physical labelling altogether, with information potentially conveyed via a barcode, or QR code. But such technologies are not yet widespread or viable at commercial scale (see discarded measure 27d in A.6). However, providing harmonised information to consumers on the material components of packaging, linked to Member State specific information on collection and disposal routes is feasible at present and has been assessed below.

5.2 Baseline

Article 8 of the PPWD states that "packaging shall indicate for the purposes of its identification and classification by the industry concerned the nature of the packaging material(s) used on the basis of Commission Decision 97/129/EC". The relevant Commission Implementing Decision 129/97 on marking sets out a proposed system for uniform numbering and abbreviations to be used on packaging made of different materials, though their application is voluntary and not currently widespread.

Article 13 in the PPWD requires Member States to provide packaging users with various information relating to the return, collection and recovery systems available to them, though the specific type and format for information to be provided in this regard is not harmonised. This reflects the current lack of harmonisation of separate waste collection systems across Member States as well.

[576] UN Environment Programme 2020, https://consumersinternational.org/media/352255/canirecyclethis-finalreport.pdf

Overall, though there are no existing mandatory requirements on the labelling of packaging as recyclable, some Member States, such as most recently Italy, Portugal and France, are introducing their own mandatory requirements for the marking of packaging materials in line with the Commission Implementing Decision 129/97.

Note that this measure has not been subject to a full quantitative impact assessment. While clear and consistent labelling of sorting and recycling instructions is associated with a high potential for improved packaging waste collection quality and quantities, it is not possible to estimate the extent to which consumers will actually follow the improved instructions provided, and do so accurately to enable a quantification of these impacts. Further, there is no way to estimate the extent to which inconsistent labelling of such information has directly impacted recycling rates in the baseline, and what the change resulting from this measure would therefore be. While a quantitative assessment has therefore not been feasible, the impacts on packaging waste collection rates and quality is expected to be positive, with indirect impacts on the efficiency of recycling and possibly, recycling rates. To assess this impact, more extensive stakeholder engagement was undertaken to inform the qualitative assessment below.

5.3 Objectives

1. **Outcome:** To harmonise the labelling of recyclable packaging across the EU and reduce confusion in consumer labelling
2. **Objective:** To increase consumer awareness of whether packaging is recyclable or not and engagement with this as a factor that can affect consumption and disposal choices
3. **Impact:** To increase collection rates of recyclable packaging waste, reduce contamination in recyclable packaging waste collected

5.4 Description of the measure

This measure is focussed on informing consumers about the material components of the packaging (e.g., for a typical plastic beverage bottle: PET plastic bottle, PP plastic cap, LDPE plastic label). This could be formalised through the development of a standard or implementing act, which can then be cross referenced against disposal guidance in each municipality/ country, etc. to enable consumers to correctly separate their waste for recycling or disposal.

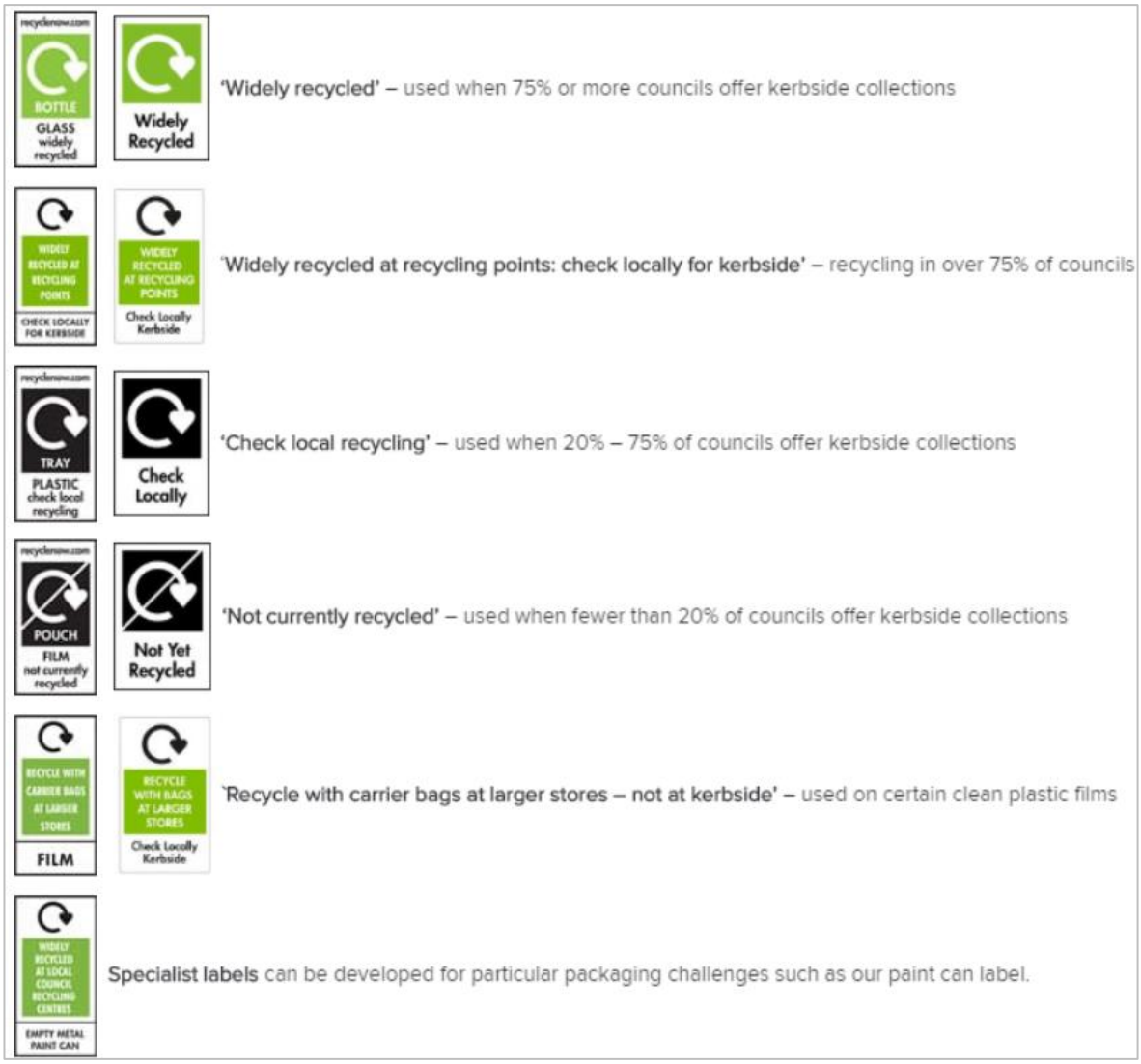
This is similar to the on-pack recycling label (OPRL) used in the UK, wherein consumers are provided with information on material components of a packaging unit (e.g. card sleeve, plastic tray, etc.), and colour-coded symbols to indicate whether each component is either widely recyclable at a national level, not yet recycled, should be recycled at the supermarket, or recycling centre, or where details should be checked at the local authority level (see Figure A-3).[577]

A similar system of pictograms linking packaging types to specific collection containers through the use of simple symbols and colour-coding alongside clear, bold text has been developed since 2017 in Denmark and is being adopted for joint Nordic recycling labelling. It is noted that the system is still voluntary and in the process of being implemented across several Nordic countries. Further, the approach to the Nordic pictogram labelling has been harmonised (i.e., using the three core elements of a symbol, a colour and a short text descriptor of the waste

[577] https://www.oprl.org.uk/

type), though the actual labels themselves (i.e. the key categories) differ from country to country.[578] So, for example, the system in Iceland has been adapted to include 78 pictograms in total (of which 16 are used for municipally collected waste and 12 are related to packaging)[579], while in Denmark 91 pictograms are being used (of which 18 are used for municipally collected waste fractions and 8 are related to packaging)[580]. Some of the common pictograms used for packaging waste are shown in Figure A-4 below, and could form a useful basis for developing a similar EU-wide system, albeit these are not at a suitable level of granularity for use in the EU across all packaging types at present (see Figure A-4) [581].

Figure A-3: OPRL packaging labelling categories



[578] https://norden.diva-portal.org/smash/get/diva2:1603260/FULLTEXT01.pdf

[579] https://fenur.is/wp-content/uploads/2020/11/Fenur-endurvinnslumerki.A4.pdf

[580] https://danskaffaldsforening.dk/sites/danskaffaldsforening.dk/files/media/document/UserManual-DanishWastePictograms-May2021-english.pdf

[581] https://www.grontpunkt.no/packaging-labels/

Figure A-4 –Example of Nordic pictogram packaging waste label types used in Iceland

Source: https://fenur.is/wp-content/uploads/2020/11/Fenur-endurvinnslumerki.A4.pdf

It is noted that in the proposed measure, providing information on the material components and recycling/ disposal routes for each packaging unit would be made mandatory, with the level of granularity of the information on material components, as well as the template for symbols to be used additionally harmonised across the EU. The information regarding recycling/ disposal routes would necessarily remain unharmonized at EU level at present (discarded measure 27b in section A.6), though this is not ideal. Given the Commission's ongoing work to assess the potential for harmonised separate collections of waste across the EU, this measure should be revised based on the outcomes of that work to assess whether packaging labelling regarding sorting/ disposal could also be harmonised in order to maximise effectiveness.

Finally, the information on material components would be made more detailed than both the Nordic and OPRL systems (particularly in the case of plastics), to reduce consumer confusion. For example, plastic trays may currently be widely recycled or not depending on the specific polymer they are made of as well as other properties (such as colour/ opacity) and the existing sorting infrastructure. Information to consumers based simply on the "plastic tray" would therefore vary, with some plastic trays being marked as recyclable, while others are marked as residual, or requiring consumers to check locally. Instead, consumers should be informed about the specific materials used as far as possible, to enable a clearer, consistent understanding of exactly which types of packaging are and are not recyclable in a given collection system (e.g. black PET tray, clear PP tray, etc.).

This measure therefore harmonises the existing requirements in Articles 8(2) and (3) of the PPWD. Updates to articles 8 and 13 in the PPWD are envisaged, potentially supported by either review, or repeal of implementing decision 97/129/EC in favour of a new standard or implementing act. An example of the wording that could be included within the PPWD to enable this is below:

> *"A harmonised design for a symbol and information used on any packaging placed on the EU market to depict the materials used and its relevant components shall be used, and developed through an implementing act."*

5.5 Links to other measures

This measure will support the implementation of all measures under the theme of recyclability, by increasing consumer awareness of packaging recyclability and directing packaging to the appropriate recycling stream with greater efficiency. To maximise this impact, the potential to link this measure to discarded measure 27b should be explored following the Commission's assessment of the potential for harmonised separate collection systems in the EU, with a view to harmonising information on both packaging material components as well as sorting instructions for consumers, to the extent feasible. Finally, it is noted that recyclability is only one element of packaging labelling, with additional labelling measures proposed in other intervention areas of this study – these should therefore be viewed in conjunction, and the potential to include new requirements in a single implementing act/ standard could be explored.

5.6 Assessment of Measure 27c

5.6.1 Effectiveness

This measure is expected to be effective in harmonising labelling across the internal market, though this will depend on the extent to which the wording in the implementing act is open to interpretation. In addition, the implementation of information systems by Member States and municipalities (in order to inform consumers how to correctly dispose of packaging waste of a particular material) will also have a direct bearing on how much consumers are engaged by the labelling and therefore the magnitude and direction of impacts.

The extent to which the measure will increase the quantity of packaging waste recycled, or the quality of waste collected, over and above the improvements anticipated in the baseline (largely driven by recycling targets and the harmonisation of separate collections) is unclear, albeit positive. However, a more significant change can be anticipated in the form of an improvement in the quality of waste collected due to reduced contamination, and therefore some indirect increase in the efficiency of recycling processes.

In terms of reducing consumer confusion, the continued use of other symbols (such as the green dot) which are commonly mistaken for recycling information may dampen the impacts of this measure to some degree (further discussed in 6.5.3), although it is more likely that such symbols will simply be disregarded if clear information pertaining to material components/ disposal instructions are provided. In addition, as discussed in A.6.7.4, given the legal and administrative burdens of banning confusing labels it is likely to be comparatively less

burdensome to mandate the use of a single consistent label indicating material components rather than placing restrictions on numerous current, and potential additional future labels.

Overall, a positive impact associated with the provision of consistent, transparent information regarding packaging materials and components is anticipated over the baseline. Previous surveys on the effectiveness of similar labelling systems to the one proposed have shown positive results in the form of reduced consumer confusion regarding packaging recycling labels relative to other commonly used labels (see Figure A-5).

Figure A-5: Results of 2018 consumer acceptance survey - ORPL labels vs others

The On-Pack Recycling Label. Making recycling simple.

How certain are you about what these labels mean?[1] (Number of people out of 10 responding)

I'm very certain	7	6	6	5	4	3	2
I think I know	2	3	3	3	4	4	3
I'm not sure	1	1	1	2	2	3	5

[1] Online survey with 2,580 respondents. Nationally representative spread of region, age, gender and social group across GB, November/December 2018. Conducted by Tangible on behalf of OPRL Ltd. Original sample 2,750 respondents but 2 percent of total responding "I don't really recycle at all and don't think it's that important" were excluded from the main survey. Supplemented by 50 in-depth interviews in Manchester and Windsor.

[2] Developed by PREP Design Pty for the Australian and New Zealand markets. Used by the Australian Packaging Covenant Organisation, a co-regulatory body, to reduce packaging's environmental impact.

Jane Bevis
Chair, OPRL Ltd

5.6.2 Ease of implementation

This measure harmonises the existing requirements in Articles 8 of the PPWD, and updates to articles 8 and 13 in the PPWD are envisaged. This is proposed to be supported by either review, or repeal of implementing decision 97/129/EC in favour of a new standard or implementing act. It is noted that a standard in this case is not likely to be needed, and unnecessarily time consuming (the development of harmonised standards can often take up to 3 years).

Provision for a revision of 97/129/EC is already made in the implementing decision which states that "the identification system will be periodically reviewed and, if necessary, revised in accordance with the procedure laid down in Article 21 of Directive 94/62/EC". A key change in this case will be a repeal of the provision that "the identification system is to be voluntary at least in a first stage but subject to revision to establish whether to introduce it on a binding basis at a further stage", making the system mandatory across all Member States and packaging types. These changes are all likely to be relatively straightforward to implement.

However, one area that may require more effort is the determination of whether the proposed measure should either replace the current system of numbering and abbreviations in Annexes I-VII or should supplement these. It is assumed that the proposed mandatory system would replace the existing system entirely, and the impacts below have been assessed accordingly.

Finally, in terms of the timeline for implementation, the findings of the ongoing Commission study to assess the potential for harmonising separate collection systems must be considered

before this measure is implemented. If the abovementioned study finds harmonisation is not feasible in a realistic timeframe, this measure in its current form may be implemented in a relatively short timeframe, with harmonisation limited to information regarding the material components of packaging as described above.

However, in the event that the harmonisation of separate collection systems is feasible, it would make more sense to introduce a single system of packaging labelling that incorporates both harmonised information on material components as well as sorting and disposal instructions across the EU, in line with the new proposals for harmonised collection systems. This is likely to push the implementation of packaging labelling revisions and any associated impacts back by several years. Nevertheless, this may be less burdensome in the long run (on both industry and public bodies) than requiring two rounds of changes to packaging labelling, to material information at present, and to sorting instructions further down the line.

Thus, it is proposed that provision be made in the current revision to the PPWD to introduce mandatory labelling requirements based on material specific information, with a caveat that such provision be subject to revision by 2028 based on the findings of the ongoing Commission study to harmonise separate collection systems and the implementation of harmonised sorting systems on the ground resulting therefrom.

5.6.3 Administrative burden

Administrative costs to the Commission associated with developing the harmonised requirements will be incurred, particularly in the development of the implementing act (or revision of the existing decision). It is anticipated that best practice from existing systems (such as OPRL and Nordic pictograms described above) will be incorporated here, rather than 'reinventing the wheel' to minimise such burden.

At the Member State level, in addition to implementing and enforcement costs, consumer awareness campaigns will also be necessary (including updates to household instructions/ information portals, etc.). This will involve some cost which may be passed on to municipalities or waste collection companies, and via EPR, to producers.

Producers of packaging will be responsible for changing the labelling on packaging, to comply with the new mandatory requirements, with Member State authorities responsible for monitoring and enforcement. This change in packaging will incur costs for producers, which should not be underestimated, however these costs are expected to be one off costs in order to change labelling templates etc., and therefore unlikely to be significant in the longer term. In terms of enforcement, some additional burden may be involved due to the requirements of being mandatory rather than voluntary, though this will likely displace the burden of developing and enforcing Member State level labelling requirements and standards to some degree.

5.6.4 Economic impacts

As mentioned above, packaging producers will face some costs to change the current labelling, but design changes are an ongoing cost for producers, which many already incur. Hence, this is likely to be minimal additional cost relative to the baseline and, in broader terms, the overall costs of packaging production. In addition, some cost savings to producers may be anticipated, as a single label design and template can be applied to all packaging placed on the EU market, relative the baseline in which different labelling requirements must be followed in different

Member States. However, depending on the nature of the requirements in the implementing act, the costs of making these changes may be higher for some actors, for whom such labelling requirements are not currently mandatory. For example, the required size of the label and number of characters in the text in order to be easily noticeable and understandable by consumers may cause particular issues for small packages (due to limited space in general) and for producers who want to place packaging on the market in MSs with different languages (due to limited space for required translations of text in different languages).

Waste operators are likely to experience some positive impact in the form of additional quantities of packaging waste recycled. The magnitude of these impacts relative to the baseline will depend on the implementation of the existing requirements for separate collection in Article 11 of the WFD, and may be quite low in comparison if the latter is implemented well. The more significant positive impact will arise in the form of improved qualities of separated packaging waste collected for recycling (with lower levels of contamination due to wrongly separated fractions). This has indirect benefits in reducing sorting costs and losses, improving the quantity and quality of recycling yields, and boosting secondary markets for packaging materials.

Stakeholders in the sorting/processing industry were also asked about the role that the existing Commission Decision 97/129/EC plays (establishing the identification system for packaging materials pursuant to European Parliament and Council Directive 94/62/EC on packaging and packaging waste), and the likely costs associated with repealing the existing requirements in favour of the proposed measure. Plastic Recyclers Europe and EPRO stated that the labelling is never or rarely used by sorters/processors and the current resin identifiers have no benefit and removing or changing them would be of no consequence for the sorting/processing process. The exception to this was some Hungarian sorters (views represented via EuRIC) where there is no automated sorting of mixed collected plastic waste and other stakeholders noted that these codes are still used in some Eastern European countries and are mandatory in Bulgaria. The costs associated with the proposed changes are therefore likely to be higher for stakeholders in these Member States, which will have to move to systems that do not require the use of resin identifier codes, although there were mixed views as to whether this would have happened anyway in the baseline scenario, and the likely timeline and costs of such changes.

5.6.5 Social impacts

Some improvement in consumer satisfaction can be expected from reduced confusion and heightened transparency regarding the composition of packaging and the associated disposal options for a given type of packaging. This is also likely to increase overall consumer confidence in recycling systems, and boost recycling behaviour accordingly. No significant employment impacts are anticipated over and above those in the baseline.

5.6.6 Environmental impacts

If the labelling supports an increase in collection rates for recycling (thereby diverting some recyclable waste from incineration or landfill), or an improvement in the quality of packaging waste collected (thereby reducing sorting losses and costs), then some positive environmental impacts will arise. The magnitude of these positive impacts relative to the baseline is unclear and depends on the extent to which materials are diverted to recycling from the residual stream, sorting losses are minimised, and secondary materials are brought back into circulation as a result of improved consumer sorting of waste for recycling.

5.6.7 Stakeholder views

Many respondents to the online public consultation highlighted the need for accurate and harmonised labelling cross the EU. One brand highlighted that improved recyclability of packaging only matters if consumers are aware of what can be recycled. This view was echoed by EUROCITIES and UNESDA, with the European Snack Association adding that mandatory labelling could help increase collection and sorting. [582]

In their feedback on the webinars, participants were widely supportive of harmonising labelling requirements across the EU to reduce consumers confusion and strengthen the single market functioning. Just one opposing view was received from paper and board convertors who believed this was not required. In terms of the nature of such harmonised labelling, several stakeholders suggested basing this on existing labelling systems. The "Nordic pictogram system" has already been rolled out in several EU Member States and could form a useful starting point, though it was noted that the symbols available for packaging categories are too limited in scope and granularity to be used in their current form. Other labelling systems mentioned by stakeholders included the UK On-Pack Recycling label (OPRL described above) and the Australian Recycling Label. It was suggested that symbols would be preferable to words due the translation requirements, though a combination of both could also be used.

Several respondents raised the point that the efficiency of national and local waste management often differs across Member States and that even if labelling was harmonised via this measure, the efficiency of collection and sorting may increase, but recycling may not. Hence the measure should be considered to support other, more targeted measures (such as 27b, which has currently been discarded in the absence of harmonised separate collection systems across the EU, but should be revisited if this changes).

Alternatively, the potential for a digital label (see further detail in A.6.7.5 on discarded measure 27e) was considered, for example by EUROCITIES, which suggested that digital labelling could be tailored using geolocation data to find country-specific information on local recycling services. EuRIC noted these labels would be particularly beneficial for PVC since even small amounts of PVC negatively influence quality of other recycled plastics.

5.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 27

[582] Appendix F - Online Public Consultation Report

Impact category	Measure 27c
Effectiveness	High effectiveness expected in achieving consistency in labelling and reducing consumer confusion. Positive impacts on quality and quantity of separate collection anticipated, though impacts are likely to be small relative to the baseline. Potential for some indirect improvement to packaging waste sorting and efficiency of recycling resulting from this, though this depends on current systems in place
Ease of implementation	Revisions to 97/129/EC or a new implementing act required, alongside updates to existing wording in PPWD. Further review of scope of 97/129/EC necessary, to identify whether new revisions should be implemented instead of or alongside existing ones. Revision clause necessary to ensure that potential for also harmonising sorting instructions is explored. If a standard is developed instead of an implementing act, this is likely to be more time consuming.
Administrative burden	**EU Commission** – development/ revision of implementing act and/or harmonised standard **Member States** – Provision of information portals/ guidance on disposal instructions at greater level of material granularity and monitoring, enforcement and consumer awareness campaigns **Producers** - changing production of labels, potential costs transferred through EPR.
Economic impacts	Potential for positive impacts on producers due to increased efficiency in labelling activities (across EU as opposed to individual MS level requirements). Potential for relatively higher costs to some producers for whom the requirements may be less straightforward, e.g., of smaller packaging types with limited space for large labels and text or for packaging sold in multiple Member States requiring labels to be translated and printed into several languages. Potential negative impacts on some sorters in some MS where repeal of existing labelling abbreviations and numerical codes (in line with implementing decision97/ 129/EC) will engender a change in sorting systems earlier than might otherwise have taken place. Potential for savings for recycling operators, mostly associated with reduced contamination and sorting losses for with marginal savings from increased packaging recycling waste volume and quality (potential to command higher prices for higher quality recyclate with increased demand).

Impact category	Measure 27c
Social impacts	No significant social impacts are anticipated over and above the baseline. Increased consumer satisfaction and confidence in recycling systems anticipated.
Environmental impacts	None directly from changes to labelling requirements. Positive impacts expected if the labelling harmonisation leads to an increase in material collected for recycling or the quality of the collected material for recycling.
Stakeholder Views	Strong support for harmonisation of labelling requirements, though differing opinions on the likely impacts.

6.0 List of discarded measures

6.1 Measure 22: Defining recyclable packaging

6.1.1 Measure 22d. Industry led voluntary DfR approach

Given the considerable progress that has been made by industry to develop DfR criteria and the ongoing work of the Circular Packaging Alliance in this respect, an industry led approach to implementing a design for recycling approach was explored as an alternative to Measure 22b. Wording along the lines of the following would be included:

> *"Industry stakeholders representing the whole value chain for at least each packaging material are requested to develop and implement standards that clearly indicate, either through a relevant list, or a series of criteria, the basis for determining what packaging is considered to be 'not recyclable'. They should do this by 2025. These standards will be the reference point for those placing packaging on the market, and packaging defined as not recyclable shall not be placed on the market – compliance with the standards is a presumption of compliance with the requirement set out in Article XXX of this Directive that all packaging placed on the market by 2030 shall be recyclable [or reusable]."*

Assuming that the changes to the PPWD will be implemented by 2023, this may provide adequate time for the standards to be created and, following that, for the packaging supply chain to start to adjust their practices to comply with them. For each packaging category, the features within the standard against which a packaging item must be assessed (material, size, colours, labelling, inks etc) will be stated. The above qualitative definition (Measure 22a) is intended to provide direction for the "spirit" of what should be in this standard.

In addition, to support the successful implementation of voluntary industry standards, it is important to include a clear regulatory backstop in the PPWD to ensure they are robust enough and fit for purpose. A requirement of this nature would therefore be included in the Directive:

> *"The Commission will evaluate the implementation of the voluntary industry standards that define what is not recyclable before 2027, and if found to not be suitable will request the European Standards organisations to develop a harmonised European Standard to define what packaging is not recyclable by 2030, and to review and update this standard at least every 5 years."*

The review of suitability of the voluntary standards will be conducted by the Commission taking the following elements into account:

- First, the extent to which the current industry recyclability guidelines have been taken into account (i.e. how much of the 'red' lists are included in the standards);
- Second, the degree to which cross-value chain agreement has been reached;
- Thirdly, the extent to which the standard drives high-quality recycling and an increase in recycling rates of the various packaging items covered; and
- Finally, through a market survey of packaging manufacturers and users to assess visibility and use of the standards in practice – and in particular, whether practices are changing at a sufficient rate that would bring the sector on track to achieving the requirement for all packaging to be recyclable [or reusable] by 2030.

However, given the requirement for packaging to be recyclable by 2030, there is a significant risk that this measure is inadequate. This is because the Commission's evaluation in 2027 would come too late for European standards to be implemented in time to meet the 2030 requirement if needed. In addition, the voluntary nature of the measure is flawed in terms of providing a binding definition for packaging that is recyclable and risks the smooth functioning of the single market if the voluntary criteria are not taken up. Hence, this measure was not developed further for inclusion in the Impact Assessment.

6.2 Measure 24: Defining high quality recycling

Given that there is considerable interest in ensuring that the recycling process delivers the best environmental outcomes, the quality of material recycled, and the use to which the material is put, is of particular interest. This is necessary to ensure that secondary raw materials produced are suitable for use in product applications with more demanding requirements, enabling a more circular economy.

There are a range of possibilities but to simplify matters and limit the contestability of such an approach, it would seem appropriate that high quality recycling be defined relative to the greenhouse gas savings of the application for recycled materials that delivers the greatest benefit and is accessible at commercial scale at present. For example, high quality recycling for material X could be defined as 'any recycling which delivered 75% or more of the greenhouse gas savings delivered by the most beneficial commercially applied recycling application'. More detail on a possible definition of 'quality of recycling' and an assessment framework to operationalise this definition is provided in the JRC report "Quality of recycling: Towards an operational definition",[583] Which states that:

"An operational definition for the quality of recycling should be one that supports the circular economy by helping to identify the features of 'quality' or 'value' that can and should be protected during sorting and recycling processes. This aims to maximise the material kept in the inner circular loops. It should be acknowledged that some degree of leakage to outer cycles via other forms of recovery, or to disposal, is always likely."

However, as noted in the report, the implementation of such a measure is not feasible at present in the absence of additional analyses of recycling value chains and data on material quality requirements. Further, given that such a definition would need to incorporate considerations of material applications beyond packaging, it would be more effective if implemented as a horizontal intervention beyond the PPWD (potentially within the WFD for example). JRC is currently working on a definition of high-quality recycling so that it can be included in the WFD revision. As such the measure has not been developed further for impact assessment.

[583] https://publications.jrc.ec.europa.eu/repository/handle/JRC122293

6.3 Measure 25: Reducing packaging material complexity

The new Circular Economy action Plan (CEAP)[584] requires the Commission to review PPWD with a focus on *"considering reducing the complexity of packaging materials, including the number of materials and polymers used"*. It is proposed that reducing the complexity of packaging design would enable increased recycling of packaging, particularly for multi-layer plastics and packaging with multiple components made of different materials. This could include restrictions on the use of certain materials in specific applications or, on the use of more than one material in certain applications. Alternatively, requirements for certain packaging applications to be manufactured using only certain approved materials could also be implemented.

It is noted that this measure overlaps significantly with Measure 22b, which would include material complexity as a criterion to be considered in determining whether packaging is recyclable or not as part of the design for recycling approach. In most cases, material complexity needs to be considered alongside other aspects of packaging design to determine whether packaging is recyclable or not, and so preference is given to Measure 22b. In addition, introducing such restrictions and requirements for only some packaging items is likely to be less cost effective with a higher risk of unintended market consequences. This is the resulting shifts to alternative packaging types and materials, including the development of new packaging materials and types, and impacts on the functionality of packaging and the flexibility of the market cannot be anticipated and controlled for. As such the measure has not been developed further for impact assessment in this study.

6.4 Measure 26: Updates to recycling targets

The legal requirement for packaging to be recyclable by 2030 proposed in this study should, in theory, be accompanied by an uplift in the recycling targets in Article 6(1), to ensure that there is sufficient incentive for packaging to not just be designed to be recycled, but to be actually collected and directed to recycling systems.

This is because the requirement for all packaging to be recyclable by 2030 implies an increase in both the volume and quality of recyclable waste packaging material available. At the same time, improvements in collection, sorting and recycling capacity are anticipated, with EPR cost coverage and possible additional funding via the unprecedented Recovery and Resilience Facility, for the Member States that choose to use RRF funding for waste collection, sorting and recycling infrastructure measures. An increase in the recycling targets is therefore likely to be justified for the year 2035, and to a lesser extent, updates to the existing 2030 recycling targets (in Article 6(1)(h) and 6(1)(i) may also be necessary. Several variants are explored below.

6.4.1 Measure 26a: Updates to existing recycling targets (2030)

It is noted that a revision of the recycling targets for packaging waste is already provided for in Article 6(1c) "with a view to maintaining or, if appropriate, increasing them". It may be appropriate to include this revision within the current proposals in order to:

- Provide an incentive for those materials that currently have relatively low recycling rates compared to others in the dominant material category (e.g., aluminium foils compared

[584] EUR-Lex - 52020DC0098 - EN - EUR-Lex (europa.eu)

to aluminium cans, or liquid packaging board compared to paper/cardboard as a whole) and consequently suppress higher recycling rates for the material category as a whole.
- Encourage further uptake of recycled content among those packaging materials for which supply, rather than demand, for secondary materials has been identified as a barrier (see Appendix A – Problem Definition).

This could be achieved either by increasing the recycling targets for the relevant material categories within the existing framework, or by splitting the existing targets for certain materials (as was the case in the 2018 revision whereby the recycling target for metals was subdivided into ferrous metals and aluminium). The following proposals are considered suitable within this timeframe:

- A separate recycling target for **liquid packaging board** (e.g., used in food and beverage cartons) should be introduced
  - The target should be set at a level that ensures a level playing field with other materials that are commonly used in similar applications (e.g., plastic bottles, glass bottles, aluminium cans).
  - It is noted that industry has already committed to ensuring that "90% of all beverage cartons are collected for recycling and at least 70% of all beverage cartons are recycled" by 2030.[585]
  - This bears further consideration from the perspective of Implementing Decision (EU) 2019/665 on the rules for the calculation, verification and reporting of recycling data which states that "composite packaging and other packaging composed of more than one material *[including beverage cartons]* shall be calculated and reported per material contained in the packaging" rather than reporting within its own category.
- The recycling target for **aluminium** should be increased (e.g., to 80%)
  - Industry reported that the average recycling rate for aluminium cans in the EU (76.1% in 2018)[586] is already significantly higher than the existing target (60% by 2030). A more ambitious target for recycling of aluminium cans (e.g., up to 80% to align with the ferrous metals target) would therefore be justified.
  - Despite the inclusion of aluminium recovered from incinerator bottom ash in the recycling target, the recycling performance of aluminium foils (including the aluminium fraction of multilayer/ composite packaging) is comparatively poor. The target may therefore need to be separated into aluminium rigids vs foils (with a relatively high target for the former) instead of increased to ensure that sufficient incentives are in place to improve collection, sorting and recycling of both fractions.
- The recycling target for **plastic** should be subdivided to better influence the wide variations in recycling performance of different types of plastic packaging

[585] ACE (2021), *The Beverage Carton Roadmap to 2030 and Beyond* at https://www.beveragecarton.eu/wp-content/uploads/2021/03/The-Beverage-Carton-Roadmap-to-2030-1.pdf

[586] European Aluminium/ Metal Packaging Europe, *Towards 100% Real Recycling by 2030: An Ambitious Recycling Roadmap for the Aluminium Beverage Can* https://www.canroadmap2030.eu/CanRoadmap2030.pdf

- Flexible packaging (including the plastic fraction of multilayer/ composite packaging) tends to be collected and recycled at comparatively lower levels than rigid counterparts
  - Eunomia report for PRE finds that only 23% of PE flexible films and 15% of flexible films overall were sent for recycling in the EU in 2018 compared to an average recycling rate of 40% for all plastic packaging in the same year[587]
  - Separate recycling targets for rigid vs flexible plastics (with a higher level of target for the former) could encourage the strengthening of collection services and reprocessing capacity to allow greater contributions of each stream to the overall packaging recycling targets

However, when considering any updates to the 2030 targets (whether an increase to existing material targets or a subdivision of the existing targets), it is important to note that the ambitious 2018 revisions to the recycling targets are still being implemented, and it is yet unclear what impact the new calculation methodology will have on the results reported by Member States. In addition, related measures, such as EPR requirements and the strengthened separate waste collection requirements that were implemented in the 2018 revision are still developing, and Member States have yet to implement these. The current performance of the sector is therefore projected to change significantly over the next decade. As such revisions to the 2030 targets as a measure to improve the recycling of packaging have not been developed further for impact assessment in this study.

6.4.2 Measure 26b: Proposal for increased recycling targets in 2035

The above proposed changes to the recycling targets could also be considered in the context of future recycling targets (i.e., in 2035). Given this increased timeframe, additional proposals that could be considered include:

The overall packaging recycling target should be increased (e.g., from 70% by 2030 to 80% by 2035). Within this,

- The proposed increase to the aluminium targets in Measure 26a above could be made more ambitious (e.g., from 60% by 2030 to 85% in 2035). The alternative (separate targets for aluminium rigids vs foils) could similarly be made more ambitious.
- The plastic recycling target could be increased (e.g., from 55% by 2030 to 65% by 2035). The alternative proposed in Measure 26a above (separate targets for plastic rigids vs films and flexibles) could similarly be made more ambitious.
- The introduction of a new category for liquid packaging board as described in Measure 26a above could be considered accompanied by a more ambitious target.
- The recycling target for glass should be increased
  - The Close the Glass Loop platform has committed to increasing the collection of glass packaging for recycling from 76% to 90% by 2030 – this suggests that a corresponding increase in the glass recycling targets from 2030 onwards would be justified (e.g., from 75% by 2030 to 85% by 2035)
- Subdivision of existing targets by colour (white, amber, green) to encourage separate collection, more targeted sorting and improved quality could also be considered

[587] Eunomia (2020), *Flexible Films Market in Europe: State of Play* at https://www.eunomia.co.uk/reports-tools/flexible-films-market-in-europe/

- A significant increase in the recycling target for wood should be considered in light of the requirement for all packaging to be recyclable by 2030 (including reusable packaging by 2035, such as wooden pallets, as per measures 21a and 21b)
- The recycling targets for ferrous metals and paper/ cardboard could also potentially be increased further, noting however that these are already relatively high, and that there is a limit to how much more recycling could (and potentially should, from an environmental perspective) be required.

It is noted that the extent to which these proposals are feasible relies heavily on the implementation of not only the 2018 revisions to the PPWD (which, as noted above, are still in development), but also the implementation of the current proposals in this study. A full impact assessment of this measure is therefore not feasible at present (and is therefore not included in the relevant assessment in this study).

However, given the ambitious commitments of the Commission, industry and Member States, a new package of targets for the year 2035 is justified. Therefore, in order to give a clear signal of the Commission's continued commitment to increasing the recycling of packaging waste, it is therefore proposed that indicative recycling targets for 2035 along the lines of the proposals above could be included in the text of Article 6, subject to a full impact assessment and potential revision of these proposals by the year 2028.

6.4.3 Measure 26c: Introduction of collection targets / requirements for deposit return systems for specific materials/ applications

A final variant that is considered is the potential introduction of collection targets for specific packaging waste streams, as is the case for single use plastic beverage containers in Article 9 of the Directive on Single Use Plastics (90% by 2030)[588]. With the same objective in mind, proposals for the introduction of mandatory introduction of deposit return systems (DRS) for some packaging streams were also considered.

In stakeholder consultations, such instruments were largely proposed for beverage cartons, with some consideration of beverage cans (for DRS specifically) and plastic films (for collection targets). The rationale is that increasing the volumes of waste collected might incentivise investment in recycling infrastructure and provide stability of supply to develop end markets for any resulting recyclate.

However, given that recycling targets are a well-established mechanism for incentivising improved collection and sorting as well as input to recycling, the added benefit of separate collection targets as opposed to recycling targets is unclear. Requiring the collection of packaging waste materials without simultaneously encouraging the recycling of such materials may be justified in the case of commonly littered items that are commonly recycled (such as single use beverage bottles) in order to prevent litter. For packaging types that are not commonly recycled (either due to a lack of sorting capacity, reprocessing capacity, or end markets, or a combination of these), increased volumes of waste collected are likely to be directed to incineration or landfill in the short term (which, if not commonly littered, is where

[588] https://eur-lex.europa.eu/eli/dir/2019/904/oj

they would have most likely ended up anyway as part of residual waste, without the added cost of meeting collection targets).

Given that the ambitious 2018 revisions to the recycling targets as well as related measures for EPR cost coverage and the separate collection model are still being implemented, their impact on the performance of the packaging waste market is unclear. In addition, a number of overlapping measures with similar objectives have already been proposed for impact assessment in the ongoing study (e.g., DfR requirements, recycled content targets, harmonised EPR fee modulation, etc.). As a result, introducing separate collection targets may be a costly measure with very little added value in terms of environmental improvements. Therefore, it is proposed that this measure be considered as part of the proposed package of targets in 2035 (as per Measure 26b above), but it has not been developed for impact assessment at present.

6.5 Measure 27: Labelling of recyclable packaging

6.5.1 Measure 27a. to include information on whether it is "recyclable" or not (in line with selected definition)

The requirement for all packaging to be recyclable by 2030 (see Measure 21 Updates to the Essential Requirements above) implies that the labelling of packaging as 'recyclable', including the use of the "chasing arrows" or other symbols to indicate recyclability of packaging, will become redundant by the year 2030.

In addition, given the proposal for 'recyclable' to potentially be defined as per Measure 22a, it is noted that what can be considered recyclable "at scale" would vary by Member State depending upon the nature of available waste collection and recycling systems. Therefore, if a harmonised label associated with whether packaging is 'recyclable' across the EU was implemented in the short term, the packaging would be recyclable in some Member States, but not others, thereby potentially causing further confusion for consumers. This measure is therefore not considered appropriate for impact assessment.

6.5.2 Measure 27b. to include information on disposal instructions

Equally, if the harmonised labelling requirement focussed on providing sorting/ disposal information to packaging consumers, this would incur significant administrative burden for producers to reflect the wide variations in collection systems both across EU Member States and within them (e.g., at the municipality level).

However, the introduction of this measure may become more viable if there is a harmonised collection system, as currently being investigated through the JRC study on separate collection harmonisation with results due in 2023.

With a harmonised collection system a single icon / pictogram/ colour coding to indicate exactly which container consumers should place their packaging waste for disposal/recycling can be used on packaging across the EU market, significantly reducing the administrative burden compared to introducing this requirement under the current divergent system. This measure could then be implemented in combination with measure 27c, such that labels would include harmonised information on packaging material components that must be separated, as well as the sorting/ disposal instructions for each such component.

This measure therefore has clear consumer benefits in terms of simplicity for consumers in conveying the key piece of information required to correctly dispose of packaging correctly, which should increase recycling rates and decrease contamination. This measure should be revisited following the conclusion of the on-going studies related to the separate waste collection harmonisation, and, if viable, included as part of the labelling requirements for recyclable packaging following the harmonisation of collection systems (i.e., implementation on the ground of harmonised sorting).

6.5.3 Measure 27d. to include restrictions on use of particular confusing labels

Finally, to strengthen the measure, consideration was also be given to including restrictions on the use of particular labels that are confusing and/or redundant within the harmonised requirements for labelling. For example, the use of the Green Dot symbol, which is often confused for the recycling symbol, relates to the existence of an EPR scheme for a particular packaging unit. However, as it is also expected that as all packaging will be under an EPR scheme the use of the Green Dot is arguably redundant, and should be restricted in light of the confusion it causes in the context of packaging recyclability.

However, it is recognised that to legally define the criteria for a label being "confusing / misleading" and specify what exactly is restricted would be complex and require ongoing work for the Commission assessing new 'confusing' labels as they emerged.

Additionally, it is expected that the progression of measure 27c would negate the need to remove confusing labels as consumers would receive clear signposting to know where to look to find out the material components of the packaging and with local disposal guidance how to dispose/recycle this material and be able to disregard any 'confusing' symbols also included on packaging. Therefore, this measure is not deemed necessary given the current proposals.

6.5.4 Measure 27e. to incentivise digital watermarking/ other tracer technologies

The use of digital labels has several benefits in the current situation where collection systems are not harmonised. This would enable access to a large amount of information about packaging materials, recycled content, reusability, recycling instructions, and so on, such that printing it on the label (on which a range of information already competes for space) may no longer be required. The measure already has some support from industry despite technology not being available at commercial scale at present (see A.5.6.7 above).

However, the use of digital labels (watermarks, barcodes, QR codes) requires an additional level of engagement and effort from consumers relative to the baseline, to take the time to scan the barcode and find the information as opposed to having it readily provided on the package itself. Therefore, whilst "dematerialised" digital information may be useful for sorters with automated systems that can easily scan and interpret this information it is unclear what consumer uptake would be like, and the impacts this could have on the quantity and quality of packaging waste separated for recycling.

This digital information for sorters could be captured using digital watermarking, which is currently being tested through commercial pilots (Holy Grail 2.0), which with the right equipment allows sorters to quickly read incoming material leading to better sorting and

processing. However, given that this technology has not been deployed at commercial scale, packaging measures are not proposed to be designed on this basis at present.

In addition, further assessment is required to determine whether digital watermarking technologies are the most appropriate solution in this area, since other approaches to achieve similar outcomes are currently also being explored (product passports, chemical tracers, etc.). In the absence of clear information regarding these options, it is not suitable to make recommendations requiring everyone to use this same technology.

Finally, some of the benefits of switching to such technologies could still be explored and recognised by the Commission, for example by including the use of such labels as one of the DfR criteria for traceability (see measure 22b) that would make producers eligible for a reduced EPR fee (see measure 23).

APPENDIX K – IMPACT ASSESSMENT OF COMPOSTABLE PACKAGING MEASURES

1.0 Introduction

This document is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 to 4.0 contain the impact assessments of the selected measures; and
- 5.0 contains further details on the measures.

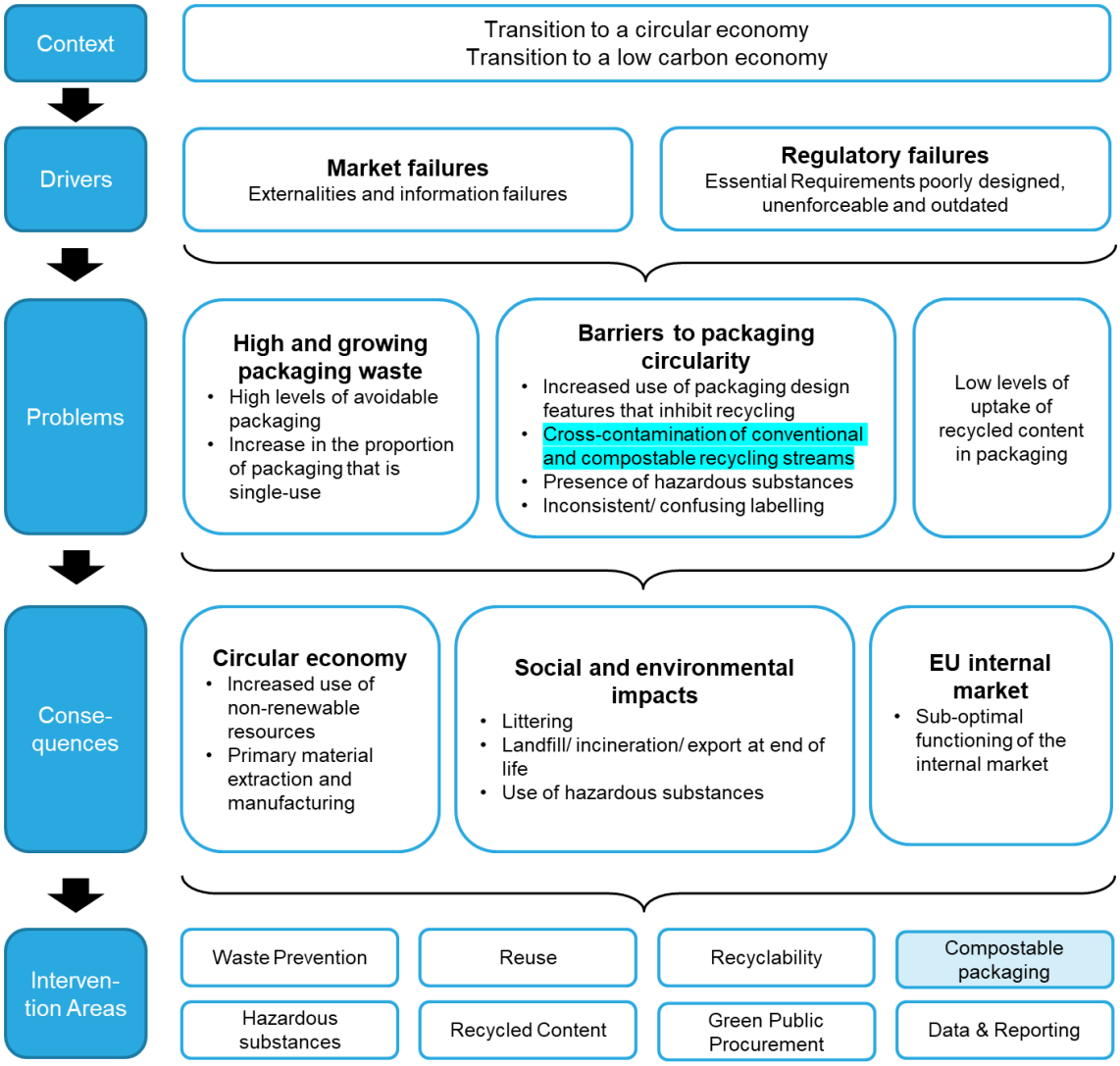
This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 2.2 describes the problem "Cross-contamination of conventional and compostable recycling streams" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. In this document the quantitative impacts are presented in relation to the baseline and, unless otherwise indicated, for the year 2030. Impacts are described qualitatively where quantitative analysis was not feasible.
  - Appendix D – Impact modelling methodology describes how the impacts for each measure were calculated and the underlying assumptions; section 5.0 discusses the measures of this document.

1.1 Intervention logic

As shown in Figure A-1 below, Compostable Packaging is one of the eight intervention areas identified in the intervention logic, and it is directly linked to one of the identified problems: **Cross-contamination of conventional and compostable recycling streams**. This problem has several negative consequences, especially on the quantity and quality of the resulting compost. More details can be found in Annex A – Problem Definition.

Figure A-1 Intervention logic diagram



1.2 Measures assessed

The following measures were assessed in the Impact Assessment:

- Measure 28: Updates to Standard EN 13432
- Measure 29: Criteria prioritising applications for compostable plastics
  - Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration
  - Measure 29b: Mandating compostable packaging for specific applications
  - Measure 29c: Ban on compostable plastic for the applications under consideration
  - Measure 29d: Mixed group of 29a and 29b
- Measure 30: Harmonised labelling for compostable plastics

1.3 Measures discarded

No measures were discarded for Compostable Packaging.

2.0 Measure 28: Updates to Standard EN 13432

2.1 Problem definition

A key underlying issue that drives the inconsistency in labelling of compostable plastic packaging, and, in turn, the contamination of the composting/ plastic recycling stream, is the shortcomings in the harmonised standard EN 13432. The standard is meant to satisfy the requirements set out in Annex II of the PPWD, that packaging intended for composting should be "*of such a biodegradable nature that it does not hinder the separate collection and the composting process*", while biodegradable packaging should be "*capable of undergoing physical, chemical, thermal or biological decomposition*", producing "*carbon dioxide, biomass and water*". The PPWD as revised in 2018 strengthened the language slightly by requiring that the compostable packaging "does not hinder" the separate collection and composting process rather than indicating that it "should not hinder" the process. More details can be found in Annex A – Problem Definition.

EN 13432 can be applied to any form of packaging that can be sent for organic recycling via a source segregated biowaste treatment system. As such, the scope of the standard includes paper and card as well as compostable plastics. The focus of the measures outlined here is on reducing issues arising from compostable plastics.

As the European Commission's Fitness Check of five Waste Stream Directives noted, Annex II of the PPWD (the Essential Requirements) could also create confusion – for Member States, suppliers and consumers – by not clearly differentiating between compostability and biodegradability.[589]

2.2 Baseline

The CEN technical committee has already been reconvened to commence the review of the Standard.

2.3 Objectives

- **Objective**: Reduce the likelihood that compostable packaging causes operational problems with composting processes in Member States, by ensuring that such packaging degrades in a timely fashion within such processes – taking into account the variety of such processes in operation across European Member States.
- **Impact**: Improved clarity of the definitions will make it less likely that compostable plastics will cause operational problems with organic treatment systems and issues in the environment in general otherwise resulting from poorer compost quality. This will also lead to an increase in organic recycling rates by reducing contamination rates at biowaste treatment facilities. The increase in organic recycling is anticipated, in turn, to lead to

[589] http://ec.europa.eu/environment/waste/packaging/index_en.htm; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0209&from=EN

greater compost production. It will also build confidence in the use of compostable polymers and support greater acceptance of compostable plastic products at organics recycling facilities.

2.4 Description of the measure

2.4.1 Update of the Essential Requirements

It is recommended that **reference to the concept of biodegradable packaging in Annex II of the Essential Requirements is removed**, except where this is incorporated within the context of the definition of compostable packaging. This could be achieved by changing the instances of the word "biodegradable" to compostable in paragraph 3(c) and removing paragraph 3(d). In this way, greater specificity is given to the term "biodegradable" – the conditions under which the packaging is biodegradable (i.e., within an industrial composting facility) having been more clearly defined.

2.4.2 Updates to Standard EN 13432

The main focus of this measure is on updates to Standard EN 13432 – which was developed several decades ago - to **reflect current actual conditions that are found in biowaste treatment facilities**. Potential issues include the following:

- Compostable plastics do not fully degrade in AD (Anaerobic Digestion) processes without a post-AD stabilisation stage (assumed in the Standard). In some countries – such as Sweden – this step is not routinely employed, and the resulting digestate is typically applied to land in liquid form.[590]
- Composting processes may take less time to complete than is considered in the standard. This is the case for Dutch composting facilities, for example, which may only allow several weeks for degradation. The resulting compost is more restricted in its applications than that arising from longer composting processes with a more extensive maturation phase, although it is less expensive to produce.[591]
- Some countries have tighter standards for levels of visual contamination than is currently incorporated into EN 13432 – this is the case in Germany.[592]

Updates to the standard should therefore consider the above issues at a minimum.

The review would need to consider the extent to which the above issues are problematic. Some recent research suggests that bags meeting the current standard degrade even in the short composting timescales of the Dutch facilities, although it is further noted that the biowaste

[590] One such example is the AD plant of VafabMiljö in Västeras, Sweden. See https://www.proweps-envirotec.com/effective-and-modern-anaerobic-digestion-plant-for-vafabmiljo-vasteras-sweden/

[591] BioGreenhouse (2016) Handbook for Composting and Compost Use in Organic Horticulture, Report for European Cooperation in Science and Technology, available from https://edepot.wur.nl/375218

[592] Visual contamination here refers to the existence of physical contaminants of a specified particle size. There may be other forms of contamination – such as contamination arising from specific chemicals – which is not visible.

treatment industry in the Netherlands is not in support of accepting compostable plastics and refuted the outputs from the study.[593]

It is noted that the above issues typically reflect specific conditions only found in a small number of countries. Many European countries were yet to start collecting food waste substantially in 2018.[594] A significant quantity of the biowaste that is currently collected in Europe is collected in one country alone - Italy - where collections are widespread and performing well. Italy also has the most developed compostable plastic industry and bans have been introduced here for conventional plastic bags. In this case the biowaste collection and treatment industry and the compostable plastic industry have worked together to ensure a mutually supportive system.

Considerable change is expected to take place in the European biowaste sector over the next few years in response to EU legislation mandating food waste separate collections. This will require a substantial increase in biowaste collection and treatment infrastructure – including in some countries which have already started to develop facilities, as the coverage may be incomplete. As this change occurs it is therefore recommended that efforts take place to increase and standardise biowaste collection and treatment across European countries. This could be achieved in part through existing work to harmonise collection systems taking place within under the Circular Economy Action Plan.

In countries, which have not yet substantially developed biowaste collection and treatment capacity, there is an opportunity to ensure this capacity develops in such a way that it is more supportive to the treatment of compostable plastics. For example, there are issues with regards to large quantities of digestate arising from wet AD facilities, which make such treatment systems less appropriate for tackling large quantities of biowaste in some countries.[595] Tackling this problem would mean that issues arising from the poor degradation of compostable plastics in wet AD facilities would become less of a problem.

An initial review of the evidence therefore suggests that there may not be a need for the standard to be updated, if other changes in the biowaste treatment industry occur such that greater harmonisation is seen in treatment standards across Europe. Of the three elements identified above, that relating to the consideration of the potential need to meet shorter composting times is considered to be aspect that most requires further consideration – as this is more pertinent for the treatment of a source segregated food waste stream.

The review could also consider **bringing the standard into alignment with other similar standards** that have been developed since EN 13432 was first published, and consider:[596]

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[593] Wageningen University & Research (2020) The fate of (compostable) plastic products in a full scale industrial organic waste treatment facility, report for the Dutch Ministry of Economic Affairs and Climate Policy (EZK); responses by the Dutch Composting industry include that published by Bioplastics News available from https://bioplasticsnews.com/2020/03/03/nl-composting-industry-does-not-want-compostable-plastics/

[596] Eunomia (2020) Relevance of Biodegradable and Compostable Consumer Plastic Products and Packaging in a Circular Economy, Report for DG Environment

- Including a requirement to separately test and meet the criteria for biodegradation of all organic constituents which are present in the material at a concentration between 1% and 15%
- the introduction of a nitrification inhibition test and an earthworm toxicity test.

2.4.3 Home composting

It is further noted that the standard is currently based on industrial composting and AD facilities. Products meeting 0 standard will not necessarily degrade in home composting piles. Some countries – such as France - are therefore introducing a requirement that compostable plastics degrade in home composting piles. There are standards such as the TUV Compost Home (developed in Austria) which aim to meet this requirement, and which might, therefore, be considered as a starting point for a European-wide home composting standard for compostable plastics. The application of such a standard to all European compostable plastic packaging was therefore considered in the course of developing this measure.

However, home composting is not an industrial process; there is considerable variation in the practices taking place within these piles, based on the knowledge and skill of those undertaking home composting. Furthermore, environmental conditions affecting biodegradation – such as ambient air temperature and humidity – vary considerably. As such, it is felt to be too challenging to come up with a pan-European standard to ensure compostable plastics degrade in home composting piles across the continent. It is therefore recommended that issues arising from the placement of compostable plastic packaging items in home composting piles are largely tackled through improvements in labelling, discussed further under Measure 30: Harmonised labelling for compostable plastics.

2.5 Links to other measures

There are links to other measures as follows:

- Waste prevention and re-use – some products that are more likely to be shifted into compostable plastic are also likely to be targeted by prevention / re-use activities. Problems will decrease if the number of products decreases.
- Measure 30 which considers improvements to the labelling of compostable packaging – if the compostable plastic is more clearly labelled this is anticipated to reduce problems associated with home composting and the contamination of conventional recycling.

2.6 Assessment of Measure 28

2.6.1 Effectiveness

The update to the definition of biodegradability in the Annex of the current Packaging and Packaging Waste Directive is not expected to result in a significant impact in and of itself.

The effectiveness of updates to EN 13432 is considered in respect of its potential to reduce issues arising from contamination at biowaste treatment facilities. There is some uncertainty surrounding the impacts of Measure 28, as it is not yet certain how the biowaste industry will develop in the baseline. As such, impacts associated with this measure have not been fully quantified.

At present, the issues identified in Section 2.4.2 relate to treatment systems in a very small number of countries. If the number of countries with problematic systems stays small, updates to the standard will have a relatively small impact. More countries will, however, need to develop food waste treatment systems in the coming years. If some of these countries also develop problematic systems from the perspective of compostable packaging, the size of the problem in the baseline will be expected to increase. In the latter case, impacts associated with updates to EN 13432 could be greater.

Assuming that the number of problematic systems stays relatively small, impacts associated with updates to EN 13432 are assumed to be somewhat less effective at reducing contamination than is the case for Measure 29a, where both conventional and compostable polymers are allowed on the market.

A number of outcomes are possible in the situation where updates to EN 13432 occur:

- Updates could assist in there being greater alignment in the biowaste treatment systems (e.g. the removal of wet AD systems), resulting in it being easier for greater take up to occur. But in practice it is considered unlikely that treatment systems would only change as a result of legislation to tackle compostable packaging.
- Updating the standard may make it more difficult for compostable packaging to be placed on the market in some cases. Some formulations would need to change to meet tighter standards. For other products (such as the rigid plastics) it may not be possible to develop a formulation to meet the new requirement. This may happen, for example, if the standard is changed to require products to degrade with a shorter composting process.

Even in the case where the number of problematic systems stays small, updates to EN 13432 are anticipated to result in an increase in compostable plastics being placed on the market overall, because packaging applications will be being developed in better alignment with treatment systems and this will build greater confidence in the product. But there no clear legislative focus on encouraging applications which are less likely to cause problems, as is the case with Measure 29a.

An increase in compostable packaging – alongside a commensurate decrease in conventional plastic packaging - is anticipated to lead to a reduction in conventional plastic contamination of compost. In addition, more compost (or digestate) is anticipated to be produced per unit of feedstock, as less contamination is removed. This will lead to environmental benefits as discussed in Section 2.6.6.

It is clear from the above that much depends on how the separate collection of food waste evolves in the short to medium term, and the co-ordination between updates in the Standard and work to harmonise the collection and treatment systems.

2.6.2 Ease of implementation

The measure requires, in the first instance, the reconvening of the CEN technical committee CEN/TC-261 to consider any updates to the Standard and how these could be implemented. As was noted in Section 2.2, this step has already happened. The committee previously included input from the compostable plastics industry, as well as those involved in the certification process, such as testing laboratories. Input should also be sought from the European Composting Network and NGOs. It is also noted that the Commission will produce a Communication on Biobased/biodegradable/compostable/ plastics in 2022, the content of which should also be considered within any updates. Given the links between the Standard and the

Essential Requirements, it is recommended that the Commission be consulted on updates to the Standard by the Committee.

There is a reasonable amount of agreement amongst the industry groups at the European level (compostable plastics / composting and AD) that the standard needs to be revised. Depending on the nature of the recommended changes to the standard, change may be required for specific countries where treatment practices are divergent from the rest. The implementation of updates to the standard is therefore likely to be easier if efforts are made to harmonise collection and treatment systems for biowaste across Member States.

2.6.3 Administrative burden

Updates to the Standard have already commenced. There is also likely to be work over the coming years to consider the types of treatment system that should be in place to treat food waste, and whether these systems are fit for purpose given the need to increase infrastructure requirements in many countries. However, this is work that would likely need to take place anyway in the absence of the Measure.

Existing burden associated with enforcing the Standard are not envisaged to change significantly arising from the updates; as such, administrative burden associated with the measure is considered negligible.

2.6.4 Economic impacts

Economic impacts are difficult to estimate given the uncertainties surrounding the future development of the biowaste treatment industry and the compostable polymers market. Waste management costs are reduced by €11 per tonne of contamination removed at biowaste treatment facilities;[597] this excludes the cost of subsequent residual treatment (incineration costs in the CBA (cost-benefit analysis) model are estimated on average at around €100 per tonne in European countries, based on data from the EU Reference model on waste). Although amounts of avoided contamination are difficult to quantify, levels are anticipated to be lower when compared to Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration.

Substantial changes in the Standard could result in additional costs being levied on compostable packaging producers if there is a need to recertify existing products – or to develop new products to meet a new standard. This would, however, be a one-off cost and could be offset by the potential for greater product sales from wider product acceptability. Alternatively, a tighter standard may result in less products being developed in compliance with the standard.

[597] REA (2018) REA response to HM Treasury's call for evidence on Tackling the plastic problem: using the tax system or charges to address single-use plastic waste, available from: http://organics-recycling.org.uk/uploads/article3429/Single_use_plastics_REA_evidence_30052018.pdf

2.6.5 Social impacts

If the updates to the Standard results in further development of the compostable packaging industry, this – combined with higher levels of organics recycling – would be expected to result in some job creation. The potential is estimated to be lower than that of Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration.

Health impacts associated with the manufacturing of compostable plastics are uncertain. Some products are associated with higher levels of pollution release than is the case with conventional plastics, but other – more novel polymers - show lower emissions to air than conventional polymers.[598] Much therefore depends on how the industry develops over the next decade.

2.6.6 Environmental impacts

Environmental benefits associated with lower contamination rates and better operations at facilities have been modelled under Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration. Benefits for this measure are estimated to be lower than for that measure and will therefore be relatively modest.

Environmental impacts arising from improvements in the quality of compost – which should be an outcome of the revisions to the Standard - are difficult to quantify, as there are currently few metrics available with which to assess this. There is thus some uncertainty with regards to the assessment of environmental outcomes resulting from this measure.

However, an increase in compostable packaging – alongside a commensurate decrease in conventional plastic packaging - is anticipated to lead to a reduction in conventional plastic contamination of compost. In addition, more compost (or digestate) is anticipated to be produced per unit of feedstock, as less contamination is removed.

Soil quality is improved by compost application in the following key ways:

- Inclusion of a source of nitrogen (and other nutrients) for plants that is more stable and less likely to be leached from the soil than is the case where conventional fertiliser is applied.
- Improvements in soil carbon. These will not be seen in the results where a 100 year Global Warming Potential is calculated but will be seen over shorter timescales. There is thus some short-term carbon sequestration benefit associated with the use of compost.
- Leading on from the soil carbon increase, there will be improvements in water retention and in the physical condition of the soil for sowing crops.

Such benefits will arise where a stable compost is produced, for example, as a result of a post-AD stabilisation phase. The above benefits are not seen where liquid digestate is applied to soil, such as is the case for wet AD processes; in the case of the latter, this will be a source of nitrogen for growing crops, but there will be restrictions on when this can be applied to land. The above benefits may also be less likely for a less mature, food-waste based compost, such as is produced from the shorter Dutch composting processes.

A further impact is that it is less likely that incompletely degraded compostable packaging will be included in compost. The implications on compost quality of this outcome are unclear, as it is

[598] Bassi et al (2021) An environmental and economic assessment of bioplastic from urban biowaste. The example of polyhydroxyalkanoate, Bioresource Technology, 327, 124813

not yet clear the extent to which such material might be expected to degrade in the short or medium term.

2.6.7 Stakeholder views

Many stakeholders highlighted the need for standards for compostability in the OPC (Open Public Consultation). Almost 90% of participants felt that updating the EN 13432 standard to further specify the criteria for compostable and biodegradable packaging, including composting conditions, would be an efficient and effective way to improve packaging design. BASF and FNADE further added that the focus of the standard should be on certifying products that are compostable in any kind of biowaste treatment process.

However, the divergent views of some countries are also noted, e.g. Germany has differing views on contamination to other Member States: divergent views from Member States are discussed further in Section 5.0.

In feedback sent to Eunomia after the webinars held in June 2021, The European Bioplastics Association confirmed that key areas of focus should be ensuring harmonisation in biowaste treatment practices, and the establishment and enforcement of best practice in biowaste treatment across Europe.[599] The organisation at this point did not express a view that the Standard was fit for purpose, although neither did it call for it to be updated.

After the presentation of the measure in the webinars there was a strong support for an updated and harmonised definition of compostable and biodegradable. Some stakeholders also expressed that the standard should be clear enough to clear compliance (and enforcement) without additional certifications. Most stakeholder agreed with a revision of the standard that takes into account the latest technological developments and best practices. Some stakeholders agree with the proposal of combining articles 3(c) and (d) to eliminate the term 'biodegradable' all together. An NGO objects to the norm itself, claiming that it does not lead to environmental benefits. Some comments were received from forest/paper associations requesting that the update of EN13432 includes paper-based products.

Several stakeholders across the board consider that there should be an EU standard on home composting and believe this could result in divergent standards by different Member States, which adds barriers within the single market. However other stakeholders believe that composting should be limited to industrial processes and/or that home composting could turn out to be environmentally harmful.

There was strong sentiment amongst the stakeholders that the quality of the compost should be prioritised and short composting times should not be allowed unless they result in effective outputs. There was also strong consensus to take into account the actual composting conditions of the facilities.

Stakeholders expressed concern around the lack of harmonisation of collections and even the wider issue of biowaste management – there was a request for EU-wide harmonisation.

[599] European Bioplastics (2021) Impact Assessment: Review of the Packaging and Packaging Waste Directive European Bioplastics – feedback to Eunomia, Workshops 15-24 June 2021

2.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 28: Updates to Standard EN 13432

Impact category	Measure 28: Updates to Standard EN 13432
Effectiveness	Not expected to result in a significant impact in and of itself, with updates to the definitions being less impactful than the other changes. Depends on how the separate collection of food waste evolves in the short to medium term. May need several revisions.
Ease of implementation	Reconvening of the technical committee to consider updates already happened. Reasonable amount of agreement amongst the industry groups at the European level that the standard needs to change. Implementation likely to be easier if collection and treatment systems for biowaste are harmonised across Member States
Administrative burden	Updates to the Standard have already commenced. Administrative burden not envisaged to change significantly arising from the updates; considered negligible if the updates to the Standard proceed in alignment with the needs of the Commission.
Economic impacts	Difficult to estimate; uncertainties surrounding future development of biowaste treatment industry and compostable polymers market. Waste management costs reduced by €11 per tonne of contamination removed at biowaste treatment facilities. One-off cost could be required to recertify existing products, could be offset by greater product sales from wider product acceptability.
Social impacts	Expected to result in some job creation. Health impacts uncertain. Some products associated with higher levels of pollution release; other polymers show lower emissions to air than conventional polymers.
Environmental impacts	Difficult to quantify. Environmental benefits modelled under Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration.
Stakeholder Views	Strong support in OPC and June webinar for updating the Standard. Divergent views of some countries/industries with regards to scope.

3.0 Measure 29: Criteria prioritising applications for compostable plastics

3.1 Problem definition

The European Commission has committed to supporting the sustainable and circular bio-based sector through the implementation of the Bioeconomy Action Plan, as is noted in the Circular Economy Action Plan.[600] This is anticipated to lead to investment in the use of biobased/ compostable plastics.

The use of compostable plastic material in the packaging sector - particularly in applications in which conventional plastics are already widely in use - is increasing. This, in turn, is leading to consumer confusion with respect to which collection system should be used for handling the product. It also may lead to confusion between compostable (in industrial facilities or at home) and biodegradadable in the open environment, thus leading to more littering. Given the scope for confusion – which leads to contamination of both types of collection system – there is a need to focus the use of compostable polymers in those applications where the use has most value. This, in turn, requires consideration of the added value of such material use in these applications, relative to reuse, recycling and other recovery operations of their conventional counterparts. This would include any agronomic benefits associated with the treatment of compostable plastics in compost/ digestate, as well as any particular applications in which the use of compostable plastic materials improve the quality/ quantity of organic waste collected as well as comparing its benefits to reuse / recycling: with the latter including both organic recycling as well as the recycling of conventional plastic.

Regarding agronomic benefits, a previous study by Eunomia for the Commission reviewed the case for compostable plastics from this perspective, finding that "the evidence is weak in favour of any particular agronomic benefit associated with compostable plastic materials in compost or digestate and therefore material choices for products and packaging should prioritise recyclability over compostability." [601]

However, there are areas where the use of compostable plastic is proven to have 'added benefits' such as increasing the collection of organic waste and its diversion from residual waste or reduction in plastic contamination of compost. Particularly given the likely significant increase in the separate collection of biowaste that is assumed to occur as a result of the introduction of mandatory food waste separate collections, there is a need, therefore, to focus any investment on compostable plastics into those applications which are most likely to deliver beneficial outcomes in terms of organic waste collection.

Where both conventional plastics and compostable plastics co-exist for the same type of product, the potential for consumer confusion is greater – leading to greater contamination of both types of recycling stream. Where only one type of plastic (i.e., either conventional

[600] European Commission (2020) A new Circular Economy Action Plan: For a cleaner and more competitive Europe

[601] https://op.europa.eu/en/publication-detail/-/publication/3fde3279-77af-11ea-a07e-01aa75ed71a1/language-en/format-PDF

polymers or compostable) is on the market for a specific application, the potential for consumer confusion is reduced.

3.2 Baseline

Both compostable and conventional plastics are allowed on the market across all packaging categories for most Member States except for various types of plastic carrier bags in some countries, e.g. Italy and France – where conventional plastic bags of certain types have been banned. Also some other Member States have policy exemptions for compostable and/or biodegradable lightweight plastic carrier bags to incentivise the use of compostable bags (Austria, Bulgaria, Hungary, Malta and Greece). In these countries, there is either an exemption from the ban on the carrier bag charge or a reduced charge.[602] In the majority of cases the bags must be compliant with EN 13432.

3.3 Objectives

- **Objective**: To develop a clear set of criteria which identify the applications where compostable plastics are likely to add value over the use of conventional plastics. It is intended that this be considered alongside the recyclability criteria for packaging in general.
- **Impact:** Negative impacts associated with the use of compostable plastics are reduced, as a consequence of such products not being used in applications where there is no added value; benefits associated with the use of compostable plastics are increased. There is decreased use of compostable polymers in applications that are not contaminated with food waste, improving conventional plastic recycling rates and reducing contamination of these streams. Alongside this, there is an increase in the use of compostable polymers in applications that interface with the biowaste collection system; increasing the quantity of compost produced and its quality. Both outcomes build confidence in the use of compostable polymers, and support greater acceptance of compostable plastic products at organics recycling facilities.

3.4 Description of the measure

The measure aims at prioritising the use of compostable plastic packaging in those applications where it can be demonstrated that compostable plastics are likely to add value over the use of conventional plastics. It is proposed that the list of packaging applications be developed through a set of criteria. An initial set of criteria is provided in Table A below. This set of criteria was previously developed in a research project undertaken by Eunomia on behalf of DG Environment in 2019-20, through discussions with stakeholders.[603] A weighting is applied to each of the sub-criteria in order to recognise the relative importance of the different sub-criteria against one another – these weightings are shown in the final column of the table.

[602] Data compiled by Eunomia in the context of work for DG Environment assessing the implementation of the Carrier Bags Directive.

[603] Eunomia (2020) Relevance of Biodegradable and Compostable Consumer Plastic Products and Packaging in a Circular Economy, for DG Environment

Table A-1: Criteria for Prioritising Applications where Compostable Plastic is likely to be Most Beneficial

	Criteria	**Wtg**
1	**The use of compostable plastic brings 'environmental benefits' over alternative materials**	
1a	This application could not have been designed for reuse	3
1b	The use of compostable plastic for this specific application can be expected to significantly increase the capture of biowaste compared to non-compostable alternatives	4
1c	Through the use of LCA – cradle to grave - or similar environmental assessment tool it can be demonstrated that compostable plastic is the preferred material for this particular application	3
2	**The use of compostable plastic does not directly or indirectly result in a reduction of the quality of the resulting compost**	
2a	The use of compostable plastic for this application does not lead to consumer confusion and subsequent increasing contamination with non-compostable plastics.[1]	4
2b	The use of compostable plastic for this application can be expected to significantly reduce the contamination of compost with non-compostable plastics (from this application) compared with current practice	5

Notes:

1. It is possible to require the whole product group to be designed for composting to avoid the coexistence of compostable with non-compostable materials within the same application.

The application of this list to packaging items will also, in practice, need to consider the readiness of biowaste treatment facilities to accept these items – which is also linked, in turn, to the potential need to update Standard EN 13432.

Where the criteria list is applied to packaging items, this leads to the products set out in Table A being prioritised for consideration, based on the product achieving a score above 45% in the assessment. Certain conditions prevail, as explained in the original study.

Table A-2: Priority Products for Compostable Plastic

Product type	Notes	% max. score against the criteria
Lightweight plastic carrier bags	Assuming a significant proportion has a second use to capture separate food waste, displacing the use of specific products such as caddy liners[1]	71%
Very lightweight plastic carrier bags, such as single use fruit and vegetable bags	Assuming a significant proportion has a second use to capture separate food waste, displacing the use of specific products such as caddy liners[1]	62%
Fast food trays that are unsuitable for re-use	Targets those used in closed collection / treatment systems, i.e., the waste generation situation takes place in an environment (envisaged to be an event or business) where those with a responsibility for the situation will collect most of the waste on-site (either directly or through a contract). Examples include the food waste produced in festivals, conferences, or on airlines.	72%
Tea bags	Not currently packaging items – assumes legislation is amended to allow this	84%
Fruit & vegetable labels		68%
Coffee capsules / pods	Not currently packaging items – assumes legislation is amended to allow this. The focus here is on the capsules that contain dense plastic (rather than those that resemble tea bags).	76%
Plastic film for perishables	Perishable foods are those likely to spoil, decay or become unsafe to consume if not kept refrigerated; examples of foods include meat, poultry, fish, dairy products – and pre-prepared meals containing these items. The measure targets the flexible plastic covering these items.	56%

Product type	Notes	% max. score against the criteria
Film used with food packaging	Film (flexible plastic) covering food trays used for pre-packaged food items. Pre-packaged food items include both trays used with fresh produce (such as fruit and vegetables), and pre-cooked meals designed for re-heating at home.	57%
Trays for fruit & vegetables	These items are the rigid plastics used with pre-packaged fruit and vegetables.	49%

Notes

1. Evidence from the Italian system – where both lightweight plastic carrier bags and very lightweight plastic carrier bags are mandated to be produced from compostable polymers – suggests that use of the single use carrier bags is prevalent in this respect. The use of caddy liners has been reducing over time.[604]

Further detail on the scoring system is provided in Table A-3. These data have been adapted from the analysis originally undertaken as part of the previously cited study undertaken for DG Environment.

The information on the scoring system confirms that such products are prioritised principally because all (to some degree) result in the additional capture of biowaste as a consequence of their use. The better performing products are also expected to result in a reduction in contamination of compost, associated with a reduction in the contamination currently arising from conventional plastics. This will be reflected to a certain extent in the outputs from LCA studies that consider impacts on soil and water arising from the use of compost. However, it is noted that many of the potential impacts cannot be readily considered through such an assessment. For example, there is no LCA metric available to consider the impact of microplastic pollution; similarly, LCA metrics do not consider the short-term benefits associated with carbon sequestration in soil (since the Global Warming Potential usually considers impacts over 100 years, and no data is available for the extent to which soil carbon may be preserved over that time scale).

[604] A translated source for the data from the CIC can be found here: https://www.polimerica.it/articolo.asp?id=24090

Table A-3: Detail of Scoring System applied to Compostable Plastic products

Example products	Could not have been designed for reuse	Increases the capture of bio-waste	LCA demonstrates preferred option is compostable plastic	Reduces the contamination of compost with non-compostable plastics	Does not lead to increasing contamination	Weighted Score	% of Max Score
Weighting>>	3	4	3	4	5		
Max	5	5	5	5	5	95	
Biowaste bags as liners for indoor caddy[2]	5	5	3	4	4	80	**84%**
Coffee capsules/pods (alternatives banned)	2	5	3	3	5	72	**76%**
Tea Bags (plastic heat sealed)	5	4	3	5	4	80	**84%**
Fast food Trays (closed system - reuse unavailable)[4]	4	5	3	3	3	68	**72%**
Lightweight carrier bags used in supermarkets[1]	2	4	3	4	4	67	**71%**
Fruit Labels	5	1	2	5	4	65	**68%**
Very lightweight carrier bags[6]	2	3	3	3	4	59	**62%**
Films for food trays	2	3	3	3	3	54	**57%**
Plastic wrapping for perishable meat / cheese	3	2	3	3	3	53	**56%**
Pre-packed fresh fruit bags	2	2	3	3	4	55	**58%**
Trays / punnets for fruit	2	1	3	2	4	47	**49%**
Flower pots	2	1	3	1	3	38	**40%**
Clothing packaging bags e.g. for shirts	2	1	2	1	2	30	**32%**

Example products	Could not have been designed for reuse	Increases the capture of bio-waste	LCA demonstrates preferred option is compostable plastic	Reduces the contamination of compost with non-compostable plastics	Does not lead to increasing contamination	Weighted Score	% of Max Score
Weighting>>	3	4	3	4	5		
Max	5	5	5	5	5	95	
Fast food Trays (closed system – reuse available)	1	1	1	2	2	28	**29%**
Trays used for fast food[3]	2	1	1	1	2	27	**28%**
Rigid Fast food Containers[3]	2	1	1	1	2	27	**28%**
Single use paper cups with plastic liner[5]	2	1	1	1	2	27	**28%**
Single Use Bottle	1	1	1	1	1	19	**20%**

It is noted that the above list is very similar to that set out by the European Bioplastics Association in its paper on criteria on switching products to certified compostable plastics.[605]

Some of the products included in the above table are also included in the priority list developed by the Nova Institut in its project BioSinn, which was launched this year.[606] The project considers those compostable plastic items for which biodegradation is deemed to make sense; it covers a wider scope than just packaging. Items that are in common with both projects are coffee capsules, tea bags and fruit / vegetable stickers. Lightweight and very lightweight carrier bags are not included in the Nova Institut list, although biowaste bags have been included.

Alongside the above documents, a further list of priority products to be made from compostable plastic polymers was also recently developed by the campaign organisation, A Plastic Planet.[607] It has developed Red and Green Lists, with the intention that these be aimed at providing product designers with guidance on when it is most appropriate to use compostable plastic polymers. Whilst the Red List identifies applications where compostable polymers should not be used, the Green List identifies priority applications where the use of compostable plastic polymers should be focussed. The Green List is developed by prioritising those applications that have the greatest potential to bring about a *"cleaner and higher capture of organic waste",* with the aim of improving soil quality and soil carbon stocks. This approach is therefore similar to that used in the assessment above, as set out in Table A-3. As such, the Green List has many similarities with the product list included in Table A. The short form of the Green List - what A Plastic Planet describes as *"in-disputed green products"* - covers the following items:

- Plastic carrier bags and lightweight plastic (carrier) bags;
- Tea bags;
- Coffee pods;
- Fruit and vegetable stickers;
- Food condiment sachets;
- Hot ready meal trays (these are assumed to have greater food contamination than the trays used with cold items).

There is some commonality with the list set out in Table A. Food condiment sachets are not specified in Table A but could be effectively included under the category "film used with food packaging". Hot ready meal trays are not specified in Table A; the film that covers some of these trays is, however, considered. It is not clear why this material was not also included in the list developed by Plastic Planet. The trays are less likely to be acceptable at biowaste treatment facilities than is the film that is covering them, but both products will have some food contamination. The report indicates there is consensus with respect to its list, although it does not set out in detail which organisations were consulted with as part of its project.

Nonetheless, the above analysis confirms that three products appear on all four of the lists – tea bags, coffee pods and fruit vegetable stickers. Lightweight and very lightweight plastic carrier bags are prioritised in three out of four lists.

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[605] EUBP_discussion_paper_criteria-for-compostable-plastics_products.pdf (european-bioplastics.org)

[606] The list of products is available at http://nova-institute.eu/biosinn/media/20-09-14BioSinnAnwendungslisteenglupload.pdf

[607] A Plastic Planet (2021) The Compostable Conundrum, available from https://drive.google.com/file/d/1phWIoskmh7PCrm2L-sZVUbI4nE811C9c/view

As is noted in the table, some items included within the list are currently not considered to be packaging. Annex I of the Packaging and Packaging Waste Directive would therefore need to be updated to allow for the inclusion of these items (which would need to move from the "non-packaging" to the "packaging" category).

Further considerations about the items on the list related to their acceptance in biowaste facilities can be found in section 5.1.

The impact assessment considers the following variants arising from this measure:

- **Measure 29a:** Both compostable and conventional plastics allowed on the market for the applications under consideration
- **Measure 29b:** Mandating compostable packaging for specific applications
- **Measure 29c:** Ban on all compostable plastic applications where these do not meet the Recyclability Criteria
- **Measure 29d:** Mixed group of 29a and 29b.

While measures 29a, 29b and 29c are easily understood in the context of this section, measure 29d requires some additional considerations. This measure results in the definition of two different groups of products:

- A smaller group of packaging applications mandated to be produced from compostable plastic polymers than considered under Measure 29b. These are items where the current evidence base for benefits of compostable polymers is the strongest:
  - Lighweight carrier bags;
  - very lightweight plastic carrier bags,
  - tea bags; and
  - fruit / vegetable labels.
- Other products previously discussed under measure 29 (as set out in Table A) would be potentially allowed to be made from compostable polymers, provided certain conditions are met to maximise the likelihood of beneficial outcomes.

For all the products included under the two mixed groups, benefits will be highest under the following circumstances:

- where the packaging product is most contaminated with food; this will depend in part on the amount of residue left on the product (and so will be application specific);
- where there is no or limited consumer confusion and thus limited cross-contamination; and
- where there is relatively little advanced plastics sorting infrastructure in place, resulting in higher levels of rejected conventional plastic packaging – this is likely to vary across Member States and is also subject to future change.

The benefits of utilising a compostable polymer will only be realised if the compostable plastic is accepted by the biowaste treatment infrastructure within a given locality. Acceptability is lower for the product group where both compostable and conventional products are allowed than is the case for those included within the group that would be mandated to be made from compostable polymers under this option; acceptability is lower still for rigid plastics than those products that are flexible plastic (i.e., the films).

Compostable packaging applications would only be allowed on the market for the mixed group under conditions aimed at maximising the benefits associated with the use of these products. Assessment of these conditions is anticipated to be largely related to adherence to the same criteria as set out above in Table A, but such an assessment would also potentially allow for the situation within specific Member States to be considered.

- As is indicated above, one condition would be the acceptance by biowaste treatment operators of the compostable polymers within that country.

- Further conditions could be a lack of separate collections targeting the packaging application in question and / or a lack of advanced plastics sorting facilities, which would lead to contaminated products being rejected.

Consideration of regional variations in infrastructure is less likely to be needed if a greater degree of the biowaste treatment harmonisation occurs across Member States, and so the consideration of the conditions of use might be different depending on how the introduction of mandatory biowaste treatment systems takes place. This, in turn, may be affected by decisions taken in respect of the review of EN 13432. As set out above, there are country specific considerations regarding the infrastructure in place for the re-processing of plastics (particularly flexible plastics): countries that have less well-advanced sorting infrastructure being more likely to reject the more heavily food contaminated materials. The situation is also expected to change over time as further investment in these facilities takes place.

By virtue of the definition of the group's members as set out above, there is a greater degree of uncertainty associated with the benefits associated with the mixed group, as this group of packaging products is less commonly produced from compostable materials. Data on the levels of contamination at a product level are not available at present for packaging products made from either compostable or conventional polymers. As such, it is difficult to reach a firm conclusion as to the extent to which such products might result in a reduction in contamination levels. It is understood, however, that contamination levels are likely to remain higher in the situation where both types of products remain on the market, such as would be the case under this measure for this group of packaging applications.

3.5 Links to other measures

This measure is related to Measure 28 Updates to Standard EN 13432 and 30 Improved labelling.

3.6 Assessment of Measure 29a: Both compostable and conventional plastics allowed on the market for the applications under consideration

3.6.1 Effectiveness

This measure is expected to be less successful at reducing contamination at biowaste facilities than is the case where a complete ban of conventional plastics is implemented for the products considered within the analysis. Both types of products still exist and with it, the potential for consumer confusion. Consumer confusion may be tackled to a certain extent through clearer labelling, covered by Measure 30: Harmonised labelling for compostable plastics. Since a certain amount of shift towards compostable carrier bags is assumed in any case to occur in the baseline, the measure is assumed to be only modestly effective at bringing about further positive effects associated with the use of compostable polymers.

The use of the criteria is considered to result in greater confidence in Member States associated with the use of compostable plastic for the prioritised products, and reduced reputational risk to compostable plastics producers arising from the use of such products in inappropriate

applications. This, in turn, is therefore assumed to result in an uplift in the switch of products across from conventional plastics to compostable polymers, compared to that which would have occurred in the baseline – although not all products are assumed to be switched for any of the product groups. The potential for these switches to occur is anticipated to be linked to the ease with which compostable polymers can replace the conventional polymers. For some applications – such as films covering perishable items – there are anticipated to be greater technical barriers associated with the switch, and this, in turn, is anticipated to limit the extent to which packaging moves across to compostable polymers from conventional plastics.

Effectiveness is considered in respect of the impact for each type of product on contamination levels for a given type of product: some products are anticipated to be more effective, on a per-tonne basis, at reducing contamination levels than others. Impacts also vary as a consequence of variation in the tonnage of different packaging applications. Where contamination levels are reduced in compost, more food waste can be recycled, and similarly, where contamination levels in conventional plastics recycling are reduced, more conventional plastics can be recycled – thereby improving outcomes from the perspective of the circular economy in both cases.

A further consideration in respect of contamination of conventional recycling systems for plastics is the degree to which advanced re-processing infrastructure has been developed within a specific member state. Such facilities are better able to tackle the contamination of conventional plastics (particularly films) by food waste, leading to less material being rejected. Further development of this infrastructure is anticipated to take place over the next decade as technology and investment evolve.

The effectiveness of the measure can be considered both in terms of the overall group of products as well as in terms of specific impacts associated with each product alone.

The impact by product is expected to vary partly because of the amount of each product. Products arising in only small amounts are expected to have a much smaller impact in terms of the potential for contamination at composting facilities than those arising in much larger amounts.

Our estimates of the amounts arising across Europe for each product are presented in Table A-4. The data indicates that the amount of available product is greatest for single use plastic carrier bags and film for perishables. On the other hand, amounts associated with tea bags, fruit labels and fast-food trays (not suitable for reuse) are small. It is noted that estimates for these products is highly uncertain as relatively limited data exists to identify the specific food applications set out in the list below – this is particularly the case for the film products and trays. For other products, however – such as the carrier bags – the data is relatively more robust as there are various sources that can be used to verify and benchmark the arising data.

The table also provides data on the total amount of contamination associated with each of the products – assumed to be comprised of both the plastic product and the amount of food that would potentially be removed with it as contamination. The amount is assumed to vary, depending on the likelihood of the product being used to contain food. For some products, it is assumed that the packaging may be discarded without there being much in the way of food in it, in some cases – this may be the case for the films where the food product is consumed. In other cases – such as coffee capsules – the drag factor is calculated based on the amount of

food (in this case coffee) that the product contains.[608] The factor relates to the amount of food waste that is assumed to be associated with the compostable plastic item. This factor is multiplied by the arisings figure for the compostable plastic to calculate the total amount of material that forms contamination - which will be removed from the composting facility if the product is not accepted for treatment. Thus for every 1 kg of lightweight carrier bags, 2.75 kg of food waste is also removed as contamination.

Food waste contamination impacts are therefore calculated from the amount of plastic product that ends up in biowaste treatment systems, as well as the additional food waste dragged across with the product should it be removed as contamination from the biowaste treatment facility.

Table A-4: Estimated Annual Product Arisings EU-27 and Food waste contamination assumption

Product type	Estimated annual arisings EU-27 Tonnes	Food waste "drag" factor[2]
Lightweight carrier bags	450,000	2.75
Very lightweight carrier bags, such as single use fruit and vegetable bags	50,000	2.00
Fast food trays that are unsuitable for re-use	4,500	1.20
Tea bags[1]	3,393	1.00
Fruit labels	4,500	1.00
Coffee capsules / pods	98,495	1.80
Plastic film for perishables	780,000	1.20
Film for food trays	50,000	1.30
Trays for fruit	50,000	1.05

[608] For lightweight plastic carrier bags, the factor is derived based on Italian data based on the drag effect seen at its facilities when plastic contamination is removed. Source: CIC (2020) *Ottimizzazione del riciclo dei rifiuti organici: Sintesi dei risultati del programma di monitoraggio*
CIC – COREPLA (2019-2020)

Product type	Estimated annual arisings EU-27 Tonnes	Food waste "drag" factor[2]
Notes 1. Includes weight of the tea as well as the bag 2. Factor for the amount of food waste that is assumed to be associated with the compostable plastic item. This factor is multiplied by the arisings figure for the compostable plastic to calculate the total amount of material that forms contamination - which will be removed from the composting facility if the product is not accepted for treatment. Thus for every 1 kg of lightweight carrier bags, 2.75 kg of food waste is also removed as contamination.		

Sources: Eunomia; CIC; Freshfel; Podback; Eurostat

The data suggests there is a potential for greater effectiveness for polymer switches associated with carrier bags and films, due to the amount of product available. Alongside the above data, however, there is the need to consider the technical limitations (identified in Section 5.1) which are expected to restrict the amount of compostable film covering perishable items under this measure.

3.6.2 Ease of implementation

The criteria have already been developed. There is a reasonable amount of evidence relating to the performance of some products against the criteria. However, for some of the criteria (and some products) the evidence base is still developing – and it will continue to evolve over the coming years, as more products are developed and as changes occur in organics processing and plastics re-processing. The criteria for inclusion in the legislation will need to consider any updates to Standard EN 13432 (should these be taken forward) and may also need further revision in the future to take into account changes in biowaste treatment facilities occurring as a result of the introduction of mandatory food waste separate collections across Europe.

There are various methods of implementing the criteria, which are summarised below:

1. **Assessment of products takes place prior to the updates of the Essential Requirements regulations**. This would involve reviewing the available evidence for all products at that point in time and adjudicating for specific types of products based on this information. The assessment could be used to inform amended text in the Annex of the Directive, specifying the circumstances under which specific products are to be placed on the market. Under such an approach, the ability to consider country specific variations in infrastructure would likely be more limited. Work would be needed up-front to assess the situation for Member States at that point. Assuming only one such assessment was undertaken, the evidence would be out-of-date relatively quickly, given the anticipated developments in infrastructure likely to take place over the next five years. Compostable products may be less likely to be developed, since producers would be less able to demonstrate their performance against the criteria under changed circumstances in the future.
2. An alternative to the situation described above is that the assessment of whole product groups described in approach 1 is **repeated at intervals over the next decade**, to take account of changes in infrastructure occurring over time. This would allow the legislation to be updated in response to circumstances such as the evolution of biowaste processing infrastructure (where considerable change is expected as a result of the introduction of mandatory food waste collection systems), and plastics re-processing. However, under such a situation there would be the need to update the legislation each time such an assessment took place. Development of compostable products is anticipated to be somewhat easier under this approach than in the implementation method above.

3. A further alternative is that the Essential Requirements are updated to include a requirement that **all compostable packaging will go through an assessment prior to being placed on the market for the first time**. The criteria for assessing compostable packaging would be included within the Implementing Act., which allows for the inclusion of technical information – and an evidence base for assessing the products. This would include default values for products to make it easier for a self-assessment by packaging product producers (and those using products in a specific application, where appropriate) to take place. The assessment process would be overseen by a technical committee; the latter would be able to assess products that are not using default values in their assessment. Under such a situation, the implementation of the Essential Requirements can be more responsive to changes in market conditions and infrastructure; some consideration could be made for infrastructure variations occurring across different Member States. Development of compostable packaging products will be more likely to take place. Effort will be required on an on-going basis to monitor the system but up-front burdens would likely be reduced.

Under the third approach, it is proposed that producers of packaging applications using compostable polymers undertake a self-assessment of their product when it is first put on the market, presenting evidence against each of the criterion – thereby demonstrating the extent to which the compostable packaging item adds value. The assessments can then be considered by **a technical committee** which will adjudicate the assessment. We propose that the technical committee includes representatives from the composting and the compostable plastics industries at a minimum, alongside representatives from the European Commission.

To make the assessment easier to undertake, it is assumed that producers will be provided with default values representative of key product types. Such values would include data on LCA evidence confirming the relative environmental performance of compostable polymers in comparison with packaging products made from conventional polymers (relevant for criterion 1c), and data showing reductions in contamination levels of organics processing systems as a consequence of the use of the introduction of compostable polymers (relevant for criterion 2b). The onus would then be on the packaging producer to present alternative values to these – and to justify them – as and when new data becomes available. The starting point for the default values could be the assessment undertaken as part of this impact assessment, subject to further verification by industry as appropriate. Such an approach would negate the need for packaging producers to undertake, for example, an LCA study each time they place a new product on the market. The work of the committee is primarily envisaged to be needed to assess those applications which deviate from the standard values. It would also be able to update the standard values where new evidence becomes available (e.g. as a result of work to standardise biowaste treatment systems).

This measure is assumed to be easier to implement by Member States than a complete ban across the range of products, in that it allows for the possibility that some regions (or certain types of facilities) do not allow compostable products to be used. This would allow for more flexibility in respect of the variation in biowaste treatment facilities should this continue in the future – but would mean that no single market would exist for these products. However, depending on the method of implementation, greater assessment of products may be required than in a situation where whole product groups are mandated to be made from either compostable or conventional polymers.

Ease of implementation is further assumed to vary across the products, and by country:

- As was indicated in Section 2.4, compostable carrier bags are already accepted in many European countries' composting systems, and as such, increases in the number of such products at biowaste facilities is expected to present fewer problems.

- For other products – such as those covered by film, and for rigid plastics applications – acceptability of the product is much lower in biowaste treatment facilities, and an increase in compostable products would therefore be expected to cause more issues.

Assuming the first approach is used for implementation, the timing of that assessment may be important when considering the circumstances under which compostable polymers may be allowed for specific products. A delay of several years to update the legislation would allow for some work to take place to harmonise biowaste treatment systems, potentially negating the need for further future updates in the evidence base to account for subsequent changes to treatment infrastructure.

3.6.3 Administrative burden

There will be administrative burdens associated with each of the different approaches outlined in Section 3.6.1 for implementing the criteria. All of the above approaches require some up-front assessment of the evidence for compliance with product groups against the criteria.

Overall burdens will likely be reduced under the first approach in comparison to methods 2 and 3 of implementation – although this depends to a certain extent on the thoroughness of the assessment of evidence that takes place prior to the initial update of the legislation. Under such an approach, it may be more challenging to fully consider future product developments or developments in infrastructure. To meet the latter requirement, there is a need either for further future one-off assessments, or an on-going process to consider the situation for products that deviate from the standard situation. The second method of implementation will result in higher administrative burdens than the first; the extent of additional burden will relate to how many times the assessment needs to be repeated.

If the third approach to implementation is followed, use of a default set of assessment outcomes is anticipated to reduce administrative burdens on the Commission associated with the on-going need for assessment for new products. Provided new products placed on the market are compliant with EN 13432 this should reduce any administrative burdens associated with enforcement.

3.6.4 Economic impacts

Economic impacts with regards to waste management (provided by the CBA model) are summarised in Table A. The impacts are provided for 2030 – by which time it is assumed that the policy changes will have been fully embedded. There is a slight increase in costs associated with recycling, whilst costs associated with incineration and landfill reduce relative to the baseline. Impacts are relatively modest as some switch to compostable items is already assumed to be occurring in the baseline, particularly in respect of plastic bags, as a consequence of policies that are already in place. The benefit from food waste contamination removal is negligible as a result of the relatively small amount of change in recycling seen – and the existence on the market of the conventional bags, which will still end up in biowaste treatment facilities, albeit in somewhat smaller amounts.

Table A-5 Estimated Economic Impacts from Measure 29a

Category		Estimated economic impact, 2030, €m
Waste management	Recycling	1.22

Category		Estimated economic impact, 2030, €m
	Incineration	-1.39
	Landfill	-0.12
	Food waste contamination removal	0.00
Overall impact		**-0.29**

Discussion with industry confirmed that the switch to compostable polymers for some flexible film products – those used to cover perishable items, for example – would require additional investment in research and development to account for the changes in equipment needed so that production lines could produce the new packaging items. One major packaging manufacturer estimated the effort required to adapt to the need to produce one of the more challenging products indicated that the following efforts would be required:

- >2-3 years of intense R&D efforts, including lab scale, pilot and industrial trials at the packaging producer.
- >1-2 years of involvement at the customer side, including testing on packaging lines as well as tests in the final application (e.g. shelf life).
- 10-30 Meur investment to adapt manufacturing capability to innovative products.
- Similar sizeable investments could be needed at the customer site to enable the new products to run efficiently on packaging lines.

The above estimates are considered to be those seen in a worst-case scenario. The investment is considered to be less likely to occur in the situation where both compostable and conventional polymers are permitted to be placed on the market, leading to relatively low levels of market penetration of compostable products in such a situation. Such investment would also be expected to lead to higher packaging costs in the short-medium term. However, it is noted that similar investment is likely to be needed in many cases to ensure that the product is able to meet the future design for recyclability requirement.[609] For other products – such as the bags – investment needs are anticipated to be relatively low as the compostable products already exist on the market.

3.6.5 Social impacts

The CBA model results confirm that the increase in recycling is expected to result in some positive impacts in employment, but very small: an estimated 150 FTE (full time equivalent) roles created by 2030. There may be some health impacts associated with the switch to more compostable materials – as was discussed under Measure 28: Updates to Standard EN 13432 - but these impacts are somewhat difficult to quantify and will depend in part on how the industry develops over the next decade.

[609] Investment needs for the packaging sector as a whole relating to product investment are discussed in the Recyclability intervention area

3.6.6 Environmental impacts

In line with previous sections, some environmental impacts can be expected but these are relatively modest as the switch from conventional to compostable polymers is relatively small, as was discussed in Section 3.6.4. However, some benefits occur from the switch away from residual treatment methods and towards composting / AD. Impacts are shown in Table A-3-6.

Table A-3-6 Estimated Environmental Impacts from Measure 29a

Summary of Environmental Impacts	Annual impacts in 2030
Change in GHGs, thousand tonnes CO_2e	-25.2
Change in water use, thousand m^3	0
Change in GHG & AQ externalities, € million	-4.3

Some benefit is expected to arise from improved compost quality, as was discussed under Measure 28. These benefits cannot readily be quantified in the impact assessment.

An increase in compostable packaging – alongside a commensurate decrease in conventional plastic packaging - is anticipated to lead to a reduction in conventional plastic contamination of compost. In addition, more compost (or digestate) is anticipated to be produced per unit of feedstock, as less contamination is removed.

Soil quality is improved by compost application in the following key ways:

- Inclusion of a source of nitrogen (and other nutrients) for plants that is more stable and less likely to be leached from the soil than is the case where conventional fertiliser is applied.
- Improvements in soil carbon. These will not be seen in the results where a 100 year Global Warming Potential is calculated but will be seen over shorter timescales. There is thus some short-term carbon sequestration benefit associated with the use of compost.
- Leading on from the soil carbon increase, there will be improvements in water retention and in the physical condition of the soil for sowing crops.

Such benefits will arise where a stable compost is produced, for example, as a result of a post-AD stabilisation phase. The above benefits are not seen where liquid digestate is applied to soil, such as is the case for wet AD processes; in the case of the latter, this will be a source of nitrogen for growing crops, but there will be restrictions on when this can be applied to land. The above benefits may also be less likely for a less mature, food-waste based compost, such as is produced from the shorter Dutch composting processes.

A further impact is that it is less likely that incompletely degraded compostable packaging will be included in compost. The implications on compost quality of this outcome are unclear, as it is not yet clear the extent to which such material might be expected to degrade in the short or medium term.

3.6.7 Stakeholder views

The open public consultation results indicated strong support from stakeholders in respect of mandating compostable packaging for specific applications as in Measure 29b. Applications for which the packaging was likely to end up in food waste (e.g., tea bags) were deemed to be the

most efficient and effective (identified by 80% of respondents), followed by applications that could facilitate the collection of organic waste (e.g., disposable coffee pods) (65%). Europen added that organic waste accounts for more than 50% of municipal solid waste and that compostable packaging for this waste would be preferable as it can be collected together and processed accordingly.

After the presentation of the measures in the June webinars, some stakeholders expressed preference for measure 29a and rejected any type of restrictions on the market. At the same time, some stakeholders objected to measure 29a on the basis that it would perpetuate the issue of cross-contamination and consumer confusion.

3.7 Assessment of Measure 29b: Mandating Compostable Packaging for Specific Applications

3.7.1 Effectiveness

The measure is assumed to be more effective at moving products from conventional plastic to compostable polymers – particularly for products where greater investment is likely to be needed to make this happen, such as for the films on putrescible products. Consumer confusion is further reduced for certain products (such as the carrier bags) as there is now only one end-of-life route to be considered. This, in turn, results in a more significant reduction in contamination issues arising at biowaste treatment plants.

For other products – such as the films covering putrescible materials – consumers are, however, considered to be somewhat less likely to consistently recognise that the packaging products should be treated via a composting collection scheme. This is because some other films (e.g. those not used in food production) will not be treated via this route. As such, the potential for some confusion remains.

3.7.2 Ease of implementation

The measure may be less easy to implement from the perspective of the packaging industry than Measure 29a, as greater investment in research and development will be needed to develop new products in line with the legislation. However, similar investment will be needed in many cases to develop products that meet the design for organic recycling requirement.

Other points raised under Measure 29a also apply here, with regards to the acceptability of compostable products at biowaste treatment facilities, and the necessary steps needed to put the criteria in place. There is, however, far less flexibility here to accommodate variability in biowaste treatment systems for specific regions. Under this measure, it is therefore more likely that some work to harmonise biowaste treatment systems across Europe will be required – to ensure that all biowaste treatment systems are able to accommodate the full range of compostable products.

3.7.3 Administrative burden

Where the decision is taken up-front to mandate whole product groups as being produced from compostable polymers – and the legislation updated accordingly – ongoing regulatory burdens for both the industry and the Commission are likely to be relatively minor, compared to the baseline. This assumes the product-based assessments set out under Measure 29a are deemed not to be necessary. Burdens for the Commission are reduced since there is no need for any on-going adjudication of products against the criteria – which would be required for the second or third approaches to implementation as set out for Measure 29a.

3.7.4 Economic impacts

With regards to waste management costs, this scenario is assumed to lead to greater levels of organic recycling along with a more significant decline in incineration and landfill. There is a financial benefit from recycling under this measure – more material is sent to AD / IVC (In-Vessel Composting) than conventional recycling and the total costs (collection + treatment) of the latter are higher than is the case for the former. The financial benefit from recycling is sufficient to offset the increased cost of purchasing primary compostable materials, in comparison to the conventional plastics. Results are summarised in Table A. This shows that a significant proportion of the financial benefit arises from the removal of contamination from food waste, levels of which are higher than under Measure 29a. Some financial benefit (seen in the baseline) associated with conventional recycling is lost as a result of the switch to compostable plastics, but levels of conventional plastic recycling in the baseline for some of the products under consideration here are relatively low.

Table A-7: Summary of Economic impacts of Measure 29b

Category		Estimated economic impact, in 2030, €m
Waste management	Recycling	-103
	Incineration	-53
	Landfill	-4
Food waste contamination removal		-211
Overall impact		**-370**

Costs for switching to the compostable polymers may result in higher material costs initially than was the case for the baseline scenario. However, much of the differential is expected to be eroded over time, as the market adjusts. Industry costs associated with adapting to the new production lines are discussed under Section 3.6.4 for Measure 29a. Total costs of this nature are expected to be higher under this measure as a larger number of products will need to switch from conventional plastic to compostable. However, similar costs would be expected in many cases for these products to meet the design for recyclability criteria that would otherwise apply. Investment costs for other products – such as the lightweight carrier bags, which make up a significant proportion of the products available to be switched to compostable polymers – are likely to be relatively small as the products already exist on the market.

3.7.5 Social impacts

The job creation potential for this measure is higher for Measure 29a, as a result of the greater switch from conventional polymers to compostable products. Under this measure, an estimated 28 thousand jobs are created mainly in the waste management industry by 2030. As with Measure 28 and Measure 29a, there may also be some health impacts associated with the changes in pollution, but these are somewhat hard to quantify. Health impacts relate to emissions of air pollutants such as NOx and particulates, which cause respiratory conditions and cardio-vascular disease. Emissions from the manufacture of compostable plastics are not yet understood however, as data is not yet readily available – and is likely to vary across the different polymers.

3.7.6 Environmental impacts

Impacts associated with this measure are set out in Table A. The measure delivers more substantial benefits than is seen under Measure 29a as a greater quantity of products are switched from conventional polymers to compostable.

This, in turn, leads to a greater reduction in incineration impacts than is seen under Measure 29a – offset to a minor extent by an increase in landfill impacts (as compostable polymers are associated with greater landfill impacts than conventional plastic). The incineration impacts account for 60% of the overall net benefit seen here.

There is an environmental benefit associated with a switch from the manufacturing of conventional polymers to compostable polymers. Impacts here are uncertain and carbon benefits may not, in practice, arise; this is dependent in part on the non-fossil carbon content of the polymer. There is some data to suggest water use in production is reduced over conventional plastics, although this is may also vary across the different polymers.

A relatively small change in recycling impacts is seen in the model. This is made up of two elements:

- Recycling of compostable packaging items via biowaste treatment systems; and
- A reduction in the conventional recycling of the same items via the conventional recycling system, relating to those items previously made of conventional plastic.

Per-tonne environmental benefits of conventional recycling are higher than compostable packaging items. But benefits associated with conventional recycling will also depend to a significant extent on the amount of conventional recycling assumed to take place in the baseline. For some of the products included here that make a significant contribution to the tonnage – coffee pods and film for perishables – conventional recycling rates in the baseline are relatively low, due to the low availability of specific recycling services for these items, and the low participation in these services. As such, overall, a net environmental benefit relating to recycling is seen under the measure, from the switch to compostable items from conventional. The net benefit would, however, be reduced if greater levels of conventional plastic recycling actually take place in practice than has been modelled in the baseline, potentially as a result of other measures considered under this impact assessment.

Table A- 8: Environmental Impacts of Measure 29b

Summary of Environmental Impacts	Annual impacts in 2030
Change in GHGs, thousand tonnes CO_2e	-2,148
Change in water use, thousand m^3	-143
Change in GHG & AQ externalities, € million	-518

It has not been possible to quantify some environmental impacts, including the following:

- Benefits associated with carbon sequestration in the compost.
- Impacts associated with microplastic pollution – both from the conventional and compostable polymers. The measure would be expected to reduce the former, which are likely to cause greater harm than the latter per unit of contamination (since compostable polymers would be subject to degradation particularly where the particle sizes are very small). This, in turn, would be expected to improve the quality of the compost that is produced, by reducing the quantity of contaminants.
- Impacts associated with the reduced requirement to manufacture caddy liners as a result of an increased use of carrier bags in food waste collection systems.

A discussion on the benefits associated with improved soil quality is provided under Measure 29a. These benefits will be more significant under Measure 29b as more compost will be produced.

3.7.7 Stakeholder views

The OPC results indicated strong support for mandating compostable packaging for specific applications, as was discussed under Measure 29a.

After the presentation of the measures in the June webinars, several stakeholders objected to the criteria for selecting the products and the proposed list of products under measure 29b.

In general, some stakeholders supported measure 29b (recycling industry, PRO, packaging manufacturers, trade associations) since they believe it will lead to less contamination from conventional plastics and higher quality stream of compostable material . On the other hand, some stakeholders objected to measure 29b for very different reasons: some industries consider it discriminatory and disproportionate, an NGO considers that exceptions would confuse customers that efforts should rather be allocated to reuse alternatives, other industries consider that bans hamper innovation and/or that producers should be allowed to choose the type of material for their packaging products.

3.8 Assessment of Measure 29c: Ban on all compostable plastic applications where these do not meet the Recyclability Critieria

In the absence of the above two measures, compostable plastics will only be able to be placed on the market if they meet the Recyclability Criteria. Depending on how the Recyclability Criteria are implemented, this may result in compostable plastics being largely ruled off the market. Measure 29c therefore considers the impact of this approach.

3.8.1 Effectiveness

The net result is expected to be an increase in contamination of recycling systems compared to the baseline, and a more modest increase in recycling. Contamination levels are higher in food waste collection systems under this measure, as a result of higher levels of conventional plastic (particularly in respect of the bags) - leading to a greater loss of material from these systems as food waste is removed along with the plastic. Although it is also expected that contamination levels would be reduced in conventional plastic collections, existing data indicates that compostable packaging currently results in relatively low levels of contamination of these systems even in countries where compostable plastics are prevalent. Data from 2017 relating to Italian facilities sorting conventional plastic waste indicates that less than 1% of the input composition was compostable plastic; at this level, no issues arise with processing the conventional plastic waste.[610]

3.8.2 Ease of implementation

Under this measure, products would need to meet the design for recyclability requirement rather than the compostable packaging criteria – as discussed under Measure 29a. These impacts would potentially fall on different industries – the industry that currently produces compostable plastics would no longer be able to produce packaging products. There would be no need to operate a separate system for compostable plastics.

The rise in contamination would likely place additional burdens on biowaste treatment operators who would likely need to remove more packaging and lose more food waste; authorities may need to increase communications campaigns to scheme participants with the aim of reducing this contamination.

3.8.3 Administrative burden

Administrative impacts will be similar to those set out under the Recyclability intervention area and may vary depending on which approach is used. There may be greater administrative burdens in some areas associated with tackling the increased contamination of biowaste collection systems, although impacts are dependent on how such treatment systems develop over the coming years. As such, impacts associated with the latter are uncertain.

3.8.4 Economic impacts

Table A sets out the economic impacts associated with waste management changes under this measure. Waste management costs are anticipated to increase under this scenario, as recycling costs are higher than those associated with biowaste management, and there are only modest benefits associated with the reduction in landfill and incineration. There is also a net increase in the cost of tackling contamination.

Table A-9: Economic Impacts: Measure 29c

[610] COREPLA (2017) Monitoring of plastic packaging at sorting facilities

Category		Estimated economic impact, in 2030, €m
Waste management	Recycling	152
	Incineration	-17
	Landfill	-1
Food waste contamination removal		79
Overall impact		**189**

As was discussed under Measure 29b, there will be investment costs associated with the need to meet the design for recyclability requirement for those manufacturing some products – but avoided costs associated with the reduced requirement to design products to meet the compostable polymer criteria. The costs are anticipated to be relatively similar but may fall on different industries.

3.8.5 Social impacts

The measure is estimated to create 9 thousand jobs in the waste management industry by 2030.

3.8.6 Environmental impacts

The measure is anticipated to result in lower environmental benefits in contrast to Measure 29b but higher benefits than Measure 29a, where the climate change impacts are considered. There are increased emissions from incineration relative to Measures 29a and 29b, arising from the products that do not get sent for recycling. This is offset by benefits arising from landfill and recycling – climate change impacts for the latter being higher due to the greater recycling benefit (per tonne) associated with mechanical recycling. The recycling benefits are the most significant contributor to the overall benefit seen here – associated with increased environmental benefits from conventional recycling.

A net contribution to the external costs is seen, as manufacturing impacts are higher for conventional polymers than for compostable. However, there is a lack of data for the latter, so these results should be treated with some caution as these benefits may not be seen in practice. Water consumption is also assumed be higher for conventional plastics than compostable polymers, although this may be dependent on the polymer.

Table A-10: Environmental Impacts of Measure 29c

Summary of Environmental Impacts	Annual impacts in 2030
Change in GHGs, thousand tonnes CO_2e	-93
Change in water use, thousand m^3	36
Change in GHG & AQ externalities, € million	46

3.8.7 Stakeholder views

The OPC results indicated strong support for mandating compostable packaging for specific applications, as was discussed under Measure 29a.

After the presentation of the measures in the June webinars, stakeholders had several comments on the criteria and the list of products (see 3.7.7). Some stakeholders expressed their preference for measure 29c (plastic industry, recycling industries, PROs, a Member State) on the basis that all packaging must be recyclable, while other stakeholders considered measure 29c discriminatory, disproportionate and potentially leading to a loss of competitive advantage (and even a barrier to international trade).

3.9 Assessment of Measure 29d: Mixed group of 29a and 29b

3.9.1 Effectiveness

For those products and applications under Measure 29d where only compostable packaging is permitted, the measure is assumed to be more effective at moving products from conventional plastic to compostable polymers – particularly for products where greater investment is likely to be needed to make this happen, such as for the films on putrescible products. Consumer confusion is further reduced for certain products (such as the carrier bags) as there is now only one end-of-life route to be considered. This, in turn, results in a more significant reduction in contamination issues arising at biowaste treatment plants.

For other products where both products are allowed on the market, the situation described under Measure 29a is applicable: the potential for consumer confusion remains as a result of both types of products being permitted on the market. However, it is noted that there would be some consumer confusion even under Measure 29b for some of these products – since certain types of film (i.e., those not contaminated with food residue) would not be made from compostable polymers.

3.9.2 Ease of implementation

For products that are in the group where only compostable polymers are permitted, the measure may be less easy to implement from the perspective of the packaging industry than Measure 29a, as greater investment in research and development will be needed to develop new products in line with the legislation. However, similar investment will be needed in many cases to develop products that meet the design for recycling requirement. There is less flexibility here to accommodate variability in biowaste treatment across Member States for this product group – since all these items need to be made from compostable polymers.

For the group where both types of polymer are potentially allowed, the situation set out under Measure 29a is applicable. Different methods of implementing the criteria are possible, and this, in turn, may have some impact on the extent to which products shift across to compostable formats from conventional polymers. For products in this group, acceptability issues are more likely to arise at biowaste facilities – this is particularly the case for the rigid plastics applications (trays and coffee capsules). It is noted, however, that biowaste treatment operators will have to accommodate the treatment of some compostable items by virtue of some products being mandated to be made of compostable materials. As such, there is less flexibility in respect of

Member State variations in biowaste treatment capacity under Measure 29d than is the case under Measure 29a.

3.9.3 Administrative burden

As was outlined under Measure 29b, where products have been mandated to be produced from compostable polymers, the burdens are reduced, since these products do not need to go through an assessment process.

For those products where co-existence of both types of polymer is permitted, the burden may vary to a certain extent depending on the method of implementing the assessment process for adjudicating on the criteria, as outlined under Measure 29a.

3.9.4 Economic impacts

With regards to waste management costs, this scenario is assumed to lead to greater levels of recycling than that shown for Measure 29a, along with a more significant decline in incineration and landfill. Benefits are however somewhat lower than under Measure 29b since both types of polymer will be permitted on the market for some product applications, reducing the potential for reduction in contamination.

There is a financial benefit from recycling under this measure – more material is sent to AD / IVC (In-Vessel Composting) than conventional recycling and the total costs (collection + treatment) of the latter are higher than is the case for the former. Results are summarised in Table A. This shows that a significant proportion of the financial benefit arises from the removal of contamination from food waste, levels of which are higher than under Measure 29a.

Table A-11: Summary of Economic impacts of Measure 29d

Category		Estimated economic impact, in 2030, €m
Waste management	Recycling	-33
	Incineration	-25
	Landfill	-2
Food waste contamination removal		-138
Overall impact		**-199**

Costs for switching to the compostable polymers may result in higher material costs initially than was the case for the baseline scenario. However, the differential is expected to be eroded over time, as the market adjusts. Industry costs associated with adapting to the new production lines are discussed under Section 3.6.4 for Measure 29a. Total costs of this nature are expected to be higher under this measure as a larger number of products will need to switch from conventional plastic to compostable. However, similar costs would be expected in many cases for these products to meet the design for recyclability criteria that would otherwise apply. Investment costs for other products – such as the carrier bags, which make up a significant proportion of the products available to be switched to compostable polymers – are likely to be relatively small as the products already exist on the market.

3.9.5 Social impacts

The job creation potential for this measure is higher than is seen for Measure 29a, as a result of the greater switch from conventional polymers to compostable products. Impacts, are, however, somewhat lower than Measure 29b as both types of polymer are permitted for some products.

Under this measure, an estimated **17 thousand jobs** are created mainly in the waste management industry by 2030. As with Measure 28 and Measure 29a, there may also be some health impacts associated with the changes in pollution, but these are somewhat hard to quantify.

3.9.6 Environmental impacts

Impacts associated with this measure are set out in Table A. The measure delivers more substantial benefits than is seen under Measure 29a as a greater quantity of products are switched from conventional polymers to compostable – although benefits are, however, lower than was the case under Measure 29b. The larger amount of material switched leads to a greater reduction in incineration impacts – offset to a minor extent by an increase in landfill impacts (as compostable polymers are associated with greater landfill impacts than conventional plastic). There is a relatively modest environmental benefit associated with a switch from the manufacturing of conventional polymers to compostable polymers. Impacts here are uncertain and carbon benefits may not, in practice, arise; this is dependent in part on the non-fossil carbon content of the polymer. There is some data to suggest water use in production is reduced over conventional plastics, although this is may also vary across the different polymers.

Table A-12: Environmental Impacts of Measure 29d

Summary of Environmental Impacts	Annual impacts in 2030
Change in GHGs, thousand tonnes CO_2e	-1,091
Change in water use, thousand m^3	-73
Change in GHG & AQ externalities, € million	-262

Some environmental impacts have not been quantified, as was set out in Measure 29b.

3.9.7 Stakeholder views

The OPC results indicated strong support for mandating compostable packaging for specific applications, as was discussed under Measure 29a.

This measure was not presented in the June webinars, but the comments under Measure 29a, 29b and 29c continue being applicable.

3.10 Summary and conclusion

Table A-13 Summary of Impacts for Measure 29: Criteria prioritising applications for compostable plastics

Impact category	Measure 29a	Measure 29b	Measure 29c	Measure 29d
Effectiveness	Modestly effective. Less successful at reducing contamination at biowaste facilities than a complete ban of certain conventional plastics.	More effective at moving products from conventional plastic to compostable polymers. Consumer confusion reduced.	Increase in contamination of recycling systems compared to baseline, modest increase in recycling. Contamination levels higher in food waste collection systems.	A combination of 29a and 29b
Ease of implementation	Easier to implement than a complete ban across the range of products.	Less easy to implement than 29a. More likely some work to harmonise biowaste treatment systems will be required.	Impacts would fall on different industries. Additional burdens on biowaste treatment operators.	A combination of 29a and 29b
Administrative burden	Relatively minor	Slightly higher than 29a	Similar to Recyclability intervention area	A combination of 29a and 29b
Economic impacts	Relatively minor in waste management. Industry investments R&D, testing, and adapting manufacturing	-396 m€ savings in waste management. Higher industry investments.	+201 m€ additional costs in waste management. Similar industry investments to 29b.	-199 m€ savings in waste management. Similar industry investments to 29b/c.

Impact category	Measure 29a	Measure 29b	Measure 29c	Measure 29d
Social impacts	Relatively minor	26 thousand jobs created, mainly in waste management	2 thousand jobs created, mainly in waste management	17 thousand jobs created, mainly in waste management
Environmental impacts	-25.2k tonnes CO_2e 0k m^3 water use -4.3 m€ in GHG & AQ externalities	-2,148k tonnes CO_2e -143k m^3 water use -518 m€ in GHG & AQ externalities	-93k tonnes CO_2e +36k m^3 water use +46 m€ in GHG & AQ externalities	-1,091k tonnes CO_2e -73k m^3 water use -262 m€ in GHG & AQ externalities
Stakeholder Views	Divergent views – some in favour while others against.	Divergent views – some in favour while others against.	Divergent views – some in favour while others against.	Presumed to be similar to 29a, 29b and 29c
	Strong support in OPC for mandating compostable packaging for specific applications. Different view on the selection criteria and the list of products under each category.			

4.0 Measure 30: Harmonised labelling for compostable plastics

4.1 Problem definition

Consumer confusion arising from conventional and compostable plastics both being used for similar products results in the contamination of both conventional recycling systems and food waste treatment systems. Other labelling bad practices may encourage litter. In the absence of further intervention, the problem is anticipated to increase as more compostable plastics are placed on the market.

4.2 Baseline

No harmonisation across Member States with respect to the labelling used on compostable plastics used for packaging.

4.3 Objectives

The objective of this measure is to reduce the likelihood of contamination (of both organic waste management systems and conventional recycling collections) and of littering, by providing consumers with clearer information on end-of-life management routes for packaging products produced from compostable plastics.

4.4 Description of the measure

Under this measure, labels are recommended to include the following messages:[611]

- This product is suitable for industrial composting – place it in your food or garden waste bin. Do not place this packaging in your recycling bin.
- The product is not suitable for home composting.[612]
- Do not litter – this package will still harm the environment.

The relevant messages could potentially be delivered via the use of logos or graphics, assuming appropriate graphics can be developed to convey the relevant information.

Labelling should also confirm which certification the product complies with.

4.5 Links to other measures

This measure has links to the other measures in this intervention area:

- Measure 28: Updates to Standard EN 13432
- Measure 29: Criteria prioritising applications for compostable plastics

[611] Developed from guidance published by the European Bioplastics Association and the UK Plastic PACT.

[612] Where appropriate

4.6 Assessment of Measure 30: Harmonised labelling for compostable plastics

4.6.1 Effectiveness

The effectiveness is expected to vary across different products due to variations in the ease of labelling. This is discussed further in Section 4.6.2.

Consumers do not necessarily pay attention to labelling. As such, product labelling is likely to be most effective where it takes place in conjunction with communications campaigns covering the operation of biowaste and recycling services. However, even in this case, the potential for confusion remains.

Discussions with industry stakeholders confirmed that the most effective means of reducing contamination is likely to be removal of the potential for confusion that arises from having multiple similar products with different end-of-life treatment routes.

4.6.2 Ease of implementation

Implementation will be easier for some products than others. Improved labelling is likely to be impossible for some – such as the fruit labels, although these products make up only a tiny proportion of packaging. For other small products – such as tea bags and coffee capsules – the product itself could not be labelled directly due to the size, so the box would be labelled.

For other products, the end-of-life labelling will occupy space that would otherwise be used for marketing. This may be less of an issue where there is additional packaging (such as a cardboard sleeve) with product information. Additional labelling requirements may be less of an issue for other products such as carrier bags and produce bags where space is at less of a premium and where (in some cases) no branding is applied. Such products make up a significant proportion of the compostable packaging stream.

4.6.3 Administrative burden

There is likely to be the need to ensure on-going compliance with the labelling standards. This could be one of the tasks of the market surveillance authorities.

4.6.4 Economic impacts

The measure may result in very modest benefits - i.e., smaller than those seen under Measure 29a - as a result of a very small reduction in contamination impacts associated with products being inappropriately recycled. Investment impacts discussed under Measure 29 are assumed not to occur as the measure is not expected to bring about much in the way of product switching (from conventional to compostable polymers).

Assuming the requirement is phased in, the changes in labelling that are required could be incorporated into other changes in branding and marketing and would not necessarily require additional investment by product producers.

Some up-front work in the Commission is needed to agree the standardised format of labelling across the Member States, and some work to ensure enforcement of the legislation. The work

could, however, be incorporated into other workstreams needed elsewhere in the Directive to harmonise the labelling of other packaging products.

4.6.5 Social impacts

The measure may result in very modest benefits - i.e., smaller than those seen under Measure 29a - as a result of a very small reduction in contamination effects associated with products being inappropriately recycled.

4.6.6 Environmental impacts

The measure may result in very modest benefits - i.e., smaller than those seen under Measure 29a - as a result of a very small reduction in contamination effects associated with products being inappropriately recycled.

Some environmental impacts – such as those associated with an anticipated reduction in littering – have not been quantified as the impacts are more uncertain and difficult to quantify. A minor reduction in littering is expected to occur as a result of this measure – due to clearer labelling including a confirmation of where such items should be disposed of. This, in turn, would be expected to lead to a minor reduction in plastic pollution of the natural environment.

4.6.7 Stakeholder views

Over 90% of respondents to the OPC indicated support for harmonised labelling in respect of compostable plastic packaging. And after the presentation of the measure in the June webinars, there was a strong support for harmonised labelling, noting the current confusion and diverging practices in the market. Also different considerations were raised:

- Some stakeholders noted that there are good certificates and labels for compostable, such as EN13423, Italian and Irish certification schemes, Seedling and OK compost.
- Some stakeholders expressed their recommendations for digital watermarking solutions and/or any kind of technological solutions that allow dedicated messages in different territories.
- Some stakeholders (industry and brands) expressed concerns on the availability of space in labels to include additional messages. This was also raised in previous interviews.
- Some stakeholders objected to the proposed text for the labels on different grounds: too lengthy, would need to specifically mention if the packaging is suitable for industrial or home composting. Additionally, it was requested to make clear that the packaging is not suitable for plastic recycling, to avoid contamination. Several stakeholders agreed with the message of "do not litter" to reduce consumer confusion.
- There was a strong request from stakeholders to consider labelling in a wider sense within PPWD so that there is a horizontal measure to describe the sorting instructions of the package. Many of the stakeholders also requested harmonised collection and sorting systems across the Member States.
- Some stakeholders believe that vague, confusing or misleading terms (especially "biodegradable") should be forbidden. On the other hand, some stakeholders believed that more labelling would only add to the existing confusion.
- Some stakeholders noted the need to accompany any new labelling requirement with communication to consumers.

4.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 30: Harmonised labelling for compostable plastics

Impact category	Measure 30: Harmonised labelling for compostable plastics
Effectiveness	Different degrees of effectiveness, as consumers do not always read the labels
Ease of implementation	Easier for some products than others due to space or material constraints
Administrative burden	Need to ensure on-going compliance with labelling standards, could be incorporated into existing work
Economic impacts	Very modest benefits + a phased approach would not require additional investment by product producers
Social impacts	Very modest benefits
Environmental impacts	Very modest benefits
Stakeholder Views	Very high support from stakeholders and several considerations: concerns on taking up space in the packaging, the proposed text, request for digital watermarketing (or innovative solutions), request for appropiate communication to customers,

5.0 Further details on Compostable Packaging measures

5.1 Measure 29: Criteria prioritising applications for compostable plastics

The European Composting Network summarised the acceptability of compostable plastics of different types at its members' biowaste treatment facilities in 2019.[613] The information is summarised in Table A below. This list covers most of the countries in which composting facilities are more widespread. Separate information on the acceptability of compostable plastics in Denmark is also available; from this it is noted that bags are acceptable in some treatment facilities such as that in Copenhagen.[614] Information is less readily available on the acceptability of the bags in Sweden, where food waste collection schemes are already in place; here there may be issues with acceptability due to the use of wet AD facilities without a subsequent composting step. The separate collection of food waste is at a relatively early stage in most other European countries not covered here.

Table A-1: Acceptability of compostable plastics by product type in Selected European Countries.

	Acceptance of the products in the biowaste treatment facilities		
	Bags and Liners	Catering Ware	Complex compostable packaging[1]
Austria	Thin-walled (<15 micron) EN 13432 certified, labelled as home compost (TÜV Austria) bags only	Yes, if biowaste recycling facilities do previously agree to receive such types of deliveries, if legally permitted	No, more valuable and meaningful is the material recycling of these precious polymers
Belgium	Only in combination with the distribution of the compostable bags, only these bags can be used	Sporadic	
Germany	Low, to be verified with local authorities and composting facilities	No	
Finland	General acceptance	Yes, if agreed with local waste treatment plant	

[613] ECN (2019) ECN Position Paper on the Acceptance of Compostable Plastics

[614] https://www2.mst.dk/Udgiv/publications/2020/02/978-87-7038-165-9.pdf

	Acceptance of the products in the biowaste treatment facilities		
	Bags and Liners	Catering Ware	Complex compostable packaging[1]
France	Widely accepted	Very rare on the market	Not available on the market
Ireland	Yes, once they meet the new Cre Compostable Certification Scheme.		
Italy	General acceptance	Significantly developed	Low, to be verified with local authorities
Netherlands	General acceptance	No	

1. includes packed foods covered in compostable trays and films, both commercial / domestic

The above information indicates that whilst compostable bags are widely accepted in biowaste treatment systems operating in Europe, other types of compostable packaging are less likely to be acceptable. In particular, film products and domestic food packaging items such as compostable plastic trays covered in compostable plastic film are currently only accepted in relatively few plant – this being even the case in Italy, where compostable plastic is relatively widely used.

Product specific considerations associated with making the switch from conventional plastics to compostable are summarised in Table A below.

Table A-2: Product specific considerations

Product type	Potential issues associated with the switch from conventional plastic to compostable
Single use carrier bags	Accepted in most European country's composting facilities, although there are issues for some countries with wet AD facilities. Bans are already in place for conventional plastics for this product in a number of countries.
Very lightweight carrier bags, such as single use fruit and vegetable bags	Accepted in most European country's composting facilities, although there are issues for some countries with wet AD facilities. Bans are already in place for conventional plastics for this product in a number of countries.
Fast food trays that are unsuitable for re-use	Rigid plastics are not accepted in many European composting facilities.
Tea bags	Likely to be accepted at all biowaste facilities; products will look indistinguishable from those made with conventional plastics.

Product type	Potential issues associated with the switch from conventional plastic to compostable
Fruit labels	Several countries have recently put in place a requirement that stickers should be made of home compostable plastic only e.g. Belgium and France. However, there are potential issues with obtaining glue for the stickers that meets any existing home composting standards, although glues are available that meet industrial composting standards.[615]
Coffee capsules / pods	Rigid plastics are not accepted in many European composting facilities. More coffee needed for any packaging materials other than aluminium.
Plastic film for perishables	There are currently technical difficulties associated with meeting food safety standards for these products; further investment is likely to be required to ensure products can meet these. Such products are less widely accepted at food waste treatment facilities.
Film for food trays	There are currently technical difficulties associated with meeting food safety standards for these products; further investment is likely to be required to ensure products can meet these. Such products are less widely accepted at food waste treatment facilities.
Trays for fruit	Rigid plastics are not accepted in many European composting facilities. Such products are less widely accepted at food waste treatment facilities.

[615] Confirmed in confidential communication received from stakeholders, 1 March 2021

APPENDIX L – IMPACT ASSESSMENT OF HAZARDOUSNESS MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Hazardous substances, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded; and
- 2.0 to 4.0 contain the impact assessments of the selected measures.

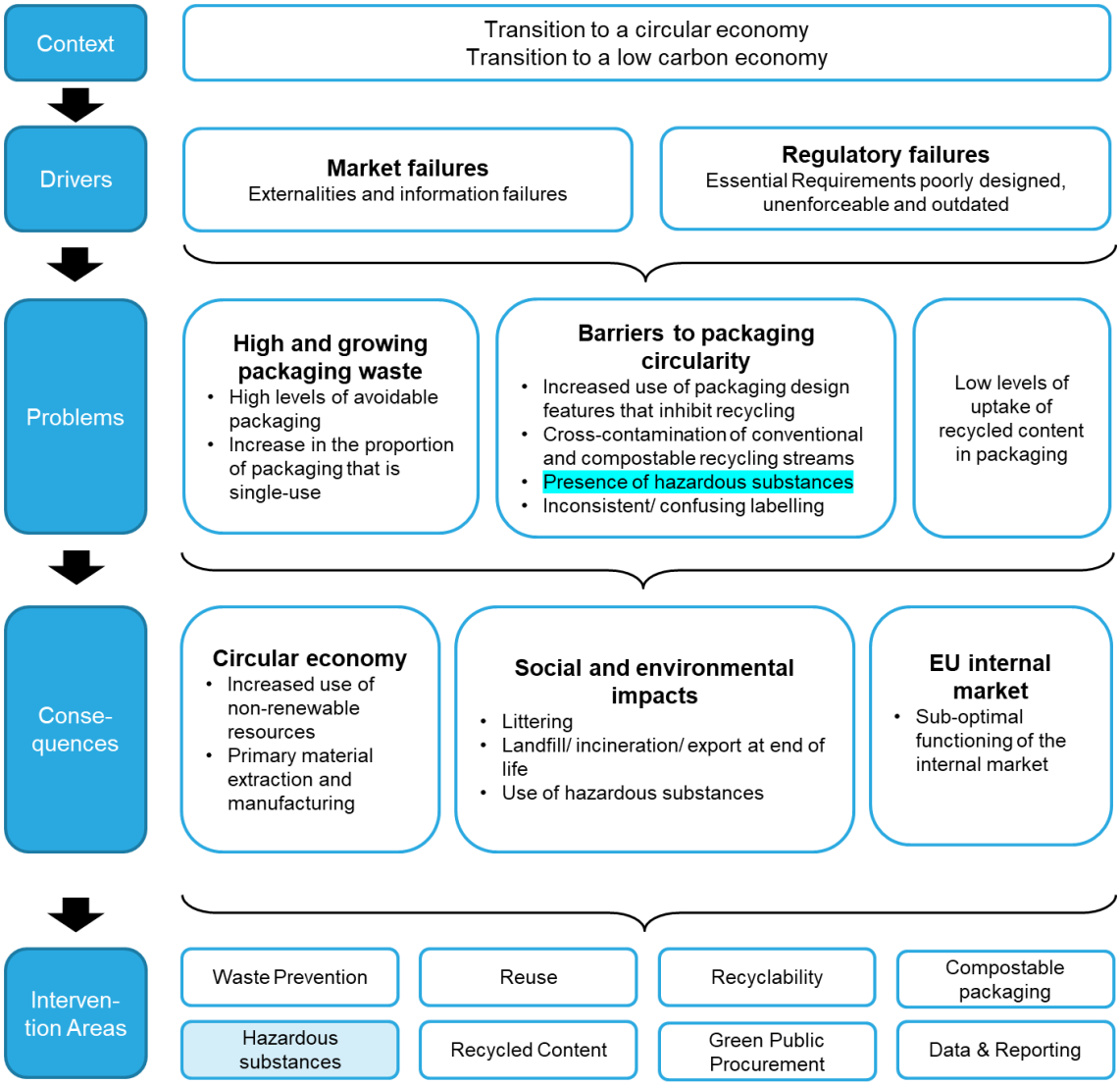
This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 2.3 describes the problem "Lack of mechanism in essential requirements for addressing changes in use of chemicals in packaging" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. However, none of the measure in this intervention area have been assessed via CBA.

1.1 Intervention logic

As shown in Figure A-1, Hazardous substances is one of the eight intervention areas identified in the intervention logic. This intervention area is directly linked to the problem "Presence of hazardous substances" which in turn also affects "Low levels of uptake of recycled content in packaging".

Figure A-1 Intervention Logic diagram



1.2 Measures assessed

The measures included within the Impact Assessment for hazardous substances are as follows:

- Measure 31: Update 'hazardousness' in PPWD
- Measure 32: Expanding the information base on substances
  - Measure 32a: assessment of the information provided through SCIP notification
  - Measure 32b: assessment of substances harmonised under CLP
  - Measure 32c: assessment of all substances used/present
- Measure 33: Restriction of hazardous substances under a new dedicated process under PPWD

1.3 Measures discarded

No shortlisted measure has been discarded from the impact assessment.

2.0 Measure 31: Update 'hazardousness' in PPWD

2.1 Problem definition

Article 11 of the PPWD restricts the use of four heavy metals in packaging, but it does not provide for any further specific restrictions on the use of chemicals.

In addition, Annex II laying down essential requirements on the composition of packaging requires the following:

> "*Packaging shall be so manufactured that the presence of noxious and other hazardous substances and materials as constituents of the packaging material or of any of the packaging components is minimized with regard to their presence in emissions, ash or leachate when packaging or residues from management operations or packaging waste are incinerated or landfilled*." (Annex II, Section 1, 3rd indent)

This raises two questions/issues:

- First, the term 'noxious and other hazardous substances and materials' is not defined and therefore open for interpretation.
- Second, the minimisation is not required per se but only "with regard to their presence in emissions, ash or leachate when packaging or residues from management operations or packaging waste are incinerated or landfilled".

This lack of legal certainty is problematic; addressees of EU legislation must be able to understand what is required from them to be compliant.

Additionally, as the PPWD was drafted long before the Circular Economy Action Plan, the Plastics Strategy and the Chemicals Strategy for Sustainability, it has yet to be updated. Currently it falls short of requiring packaging to be kept free from hazardous substances to ensure hazardous substances are not kept in the loop through recycling.

2.2 Baseline

See previous section 2.1.

2.3 Objectives

The primary objectives of this measure are:

- to clarify the legal uncertainties around the substances in scope; and
- to adopt a more inclusive approach with regards to the impacts of these substances.

2.4 Description of the measure

This measure recommends the following changes in the PPWD:

- to expand the objectives in Article 1 of the Directive

  - to include the **protection of human health**; and
  - to consider the **whole life-cycle of packaging** when establishing requirements on the content of hazardous substances in packaging
- to replace the term 'noxious and other hazardous substances and materials' by 'substances of concern', as defined in the Chemicals Strategy for Sustainability Towards a Toxic-Free Environment[616]

With regard to the second point, the 'substances of concern' would be substances listed as SVHC[617] (substances of very high concern) on the Candidate list under REACH, or as hazardous substances having a chronic effect for human health or the environment according to Annex VI[618] to the Classification, Labelling and Packaging (CLP) regulation, and substances which hamper recycling for safe and high quality secondary raw materials.

2.5 Links to other measures

This measure has links to Measure 33 'Restriction of hazardous substances': any potential restriction will be affected by the definition and scope of impacts.

2.6 Assessment of Measure 31

2.6.1 Effectiveness

With regards to the expansion of the objectives, it could lead to reduction in the use of hazardous substances in packaging because the assessment will not be limited to substances resulting from end of life options (landfilling and incineration) and it will include human health impacts. However, the extent of the reduction is unknown, due to the lack of available data.

With regards to 'substances of concern', arguably, the new wording is somewhat more restrictive and provides greater legal certainty than the current wording in Annex II to the PPWD ('noxious and other hazardous substances and materials'); the latter includes all substances in the "candidate list" as well as hazardous substances with a harmonised classification for chronic hazards to health and the environment. It also includes an undefined category of substances which hamper recycling for safe and high quality secondary raw

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[616] European Commission, *Chemicals Strategy for Sustainability Towards a Toxic-Free Environment*, COM(2020) 667 Final, p.6. According to footnote 16, 'substances of concern' include *"primarily those related to circular economy, substances having a chronic effect for human health or the environment (Candidate list in REACH and Annex VI to the CLP Regulation) but also those which hamper recycling for safe and high quality secondary raw materials."*

[617] SVHCs are substances which meet criteria listed in Article 57 of the REACH Regulation: substances which meet the criteria for classifications as carcinogens, mutagens or toxic for reproduction 1A and 1B (CMR) as per the CLP Regulation, substances meeting persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) criteria as per REACH Annex XIII, and substances that are considered on a case by case basis to present the same level of concern as CMR or PBT/vPvB (such as those having endocrine disrupting properties or those having PBT or vPvB properties but not meeting REACH Annex XIII criteria).

[618] Not all hazardous substances listed in Annex VI of CLP are substances of concern.

materials (and which do so for reasons other than their toxicity). This results in a list of several thousand hazardous substances classified with the relevant hazard statements and listed in Annex VI of the CLP Regulation.

Therefore, it is expected that this measure would have some favourable effect in minimising 'substances of concern', but the extent is unknown. In any case, the 'minimisation' is very difficult to control, and the implementation therefore heavily relies on the compliance of producers.

This measure should reduce the ambiguity, increasing legal certainty and thus reduce confusion around the substances in scope.

2.6.2 Ease of implementation

In terms of implementation this measure would require a revision of the PPWD and a revision of the guidance materials.

2.6.3 Administrative burden

Since this measures does not require further actions beyond implementation,

2.6.4 Economic impacts

Increased scope of substances and impacts may require additional minimisation efforts from packaging manufacturers; this could take the form of additional communication with suppliers with regards to the substances present in packaging materials or even adaptation costs by changing the formulation or switching packaging formats. The extent is unknown due to lack of data.

2.6.5 Social impacts

An expected social benefit is improved human health thanks to more limited use of substances of concern in packaging. This is difficult to quantity at the moment due to lack of available data.

2.6.6 Environmental impacts

Positive environmental impacts are expected thanks to reduced presence of substances of concern in packaging. This is difficult to quantity at the moment due to lack of available data.

2.6.7 Stakeholder views

As a general comment, many stakeholders from brands, industry associations and EPR schemes believe that the issues of hazardous substances in packaging should be addressed via REACH, the EU Chemicals Strategy for Sustainability and the Food Contact Material (FCM) regulations. They see a potential policy duplication if addressed via PPWD and claim that PPWD is not the appropriate legislative tool for this area.

Some stakeholders requested a clear reference to the Food Contact Material (FCM) legislation, some even suggesting that it should be clear that FCM prevails over PPWD. Feedback from

recycling industries is supportive of eliminating substances that render recycling difficult already at the design stage, to increase recyclability and uptake of recycled material.

Several stakeholders agreed with aligning PPWD's term 'noxious and other hazardous substances and materials' with the REACH term 'substances of concern' to facilitate compliance. One notable exception believes that PPWD should only refer to substances in packaging and not to general lists of substances that might not be fully applicable to packaging.

2.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 31

Impact category	Measure 31
Effectiveness	Some minimisation is expected, the extent is unknown. Increased legal certainty.
Ease of implementation	Revision of legislation, revision of guidance materials
Administrative burden	None expected.
Economic impacts	Potential minimisation efforts in the packaging industry would incur adaptation costs; currently difficult to quantify due to lack of data
Social impacts	Positive impact on human health through reduced presence of substances of concern in packaging
Environmental impacts	Enhanced protection of the environment through reduced presence of substances of concern in packaging
Stakeholder Views	Several stakeholders agreed with aligning PPWD's terminology with REACH to facilitate compliance. A majority of stakeholders preferred leaving all hazardousness topics in the hands of REACH and FCM.

3.0 Measure 32. Expanding the information base on substances

3.1 Problem definition

As described in the Synthesis Report (section 2. Problem Definition), there is little information on the use of hazardous substances in packaging and packaging components. An article by Groh et al. (2019)[619] identified the lack of publicly accessible comprehensive registries for chemicals used in plastic packaging. Additionally, it showed that the use of hazardous chemicals in plastic packaging is suspected to be extensive.

The lack of adequate information on the chemical content of products has also been highlighted by the Commission in relation to the implementation of the circular economy package[620].

3.2 Baseline

Currently, two pieces of EU legislation require manufacturers and importers of articles, including packaging[621], to provide information on SVHCs to the recipient and to ECHA, respectively: the REACH Regulation and the Waste Framework Directive.

Article 33(1) of the REACH Regulation requires suppliers of articles containing substances identified as SVHC in a concentration above 0.1 % weight by weight to pass on sufficient information on the substances contained in the article (as a minimum, the name of the substances) **down the supply chain** to allow safe use. Suppliers of articles are also required to provide such information to consumers upon request (Article 33(2)).

Furthermore, pursuant to **Article 7(2) REACH**, producers and importers must **notify to ECHA** SVHCs in articles when the substance is present above a concentration of 0.1% weight by weight and if the substance is present in articles in quantities totalling over one tonne per year. Both conditions have to be met and especially the second conditions sets a very high threshold. In addition, there are two cases when such a notification will not need to be required:

- The producer or importer of an article can exclude the exposure of humans and the environment to the substance during normal or reasonably foreseeable conditions of use of the article, including its disposal. In these cases, the producers and importers will give appropriate instructions to the recipient of the article.
- The substance has already been registered by a manufacturer or importer in the EU for that use.

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[619] Groh KJ, Backhaus T, Carney-Almroth B, Geueke B, Inostroza PA, Lennquist A, Maffini M, Leslie HA, Slunge D, Trasande L, Warhurst M, Muncke J. 2018. Chemicals associated with plastic packaging: Inventory and hazards. PeerJ Preprints

[620] COM(2018) 32 final, Section 3.1.

[621] ECHA, Guidance on requirements for substances in articles, Version 4.0, June 2017, p.23: "The packaging is not part of the substances, mixture or article being packaged. It is therefore to be considered as a separate article under REACH […]."

The **Waste Framework Directive**[622] mandated ECHA to establish a database with information on articles containing SVHC. The database is called SCIP (**S**ubstances of **C**oncern **I**n articles as such or in complex objects (**P**roducts)) and since 5 January 2021 suppliers of articles, including packaging, containing SVHCs in a concentration above 0.1% weight by weight must provide the information pursuant to Article 33(1) of REACH to the database. This process is referred to as '**SCIP notification**'. The rationale behind this obligation is that "*the presence of hazardous substances may render waste unsuitable for recycling or the production of secondary raw materials of high quality*" (WFD Recital 38). The SCIP notification allows that information about the presence of SVHCs in articles is available throughout the whole lifecycle of the article, including at the waste stage.

ECHA's 'Requirements for SCIP notifications'[623] provides for three types of information requirements:

- Mandatory (i.e., if not provided, the submission of the notification fails): name of the article or complex object; primary article identifier; article category (based on CN/TARIC codes and descriptions on function and use); complex object components (if applicable); identification of the SVHC present in the article; identification of the material that the article is made of where the SVHC is present; identification of mixtures containing the SVHC/s incorporated in the further processing step (e.g. coating) of an article or incorporated when joining or assembling two or more articles in a complex object (e.g. adhesive, solder).
- Required (i.e., information is required but there is an option "no data" available allowing to submit the notification without fulfilling the requirement): production in European Union (yes/no); safe use instructions; concentration of the SVHC in the article in terms of concentration ranges weight by weight.
- Optional (i.e., not required for submission of the notification but provision of information is encouraged): other article names (brand name, model or other); other article identifiers (product code or identifier used for its commercial and trade practices); article characteristics and picture(s); disassembling instructions; number of units (number of occurrences of the linked component in the complex object, if applicable); additional information on the material the article is made of; SVHC no longer present (as part of voluntary update).

ECHA has established a harmonised SCIP format and notifications can be submitted through the ECHA Submission Portal[624].

Finally, it is worth noting that some information about substances used in packaging should also be available via the scrutiny of information on identified uses in the REACH registration dossier. However, this may be not be useful given that use of a substance as an additive in plastic, for instance, may not distinguish if that plastic will be used for packaging.

[622] Article 9(2) Waste Framework Directive 2008/98/EC as revised by Directive (EU) 2018/851.

[623] ECHA (2020) Requirements for SCIP notifications.

[624] ECHA (2020) Requirements for SCIP notifications.

3.3 Objectives

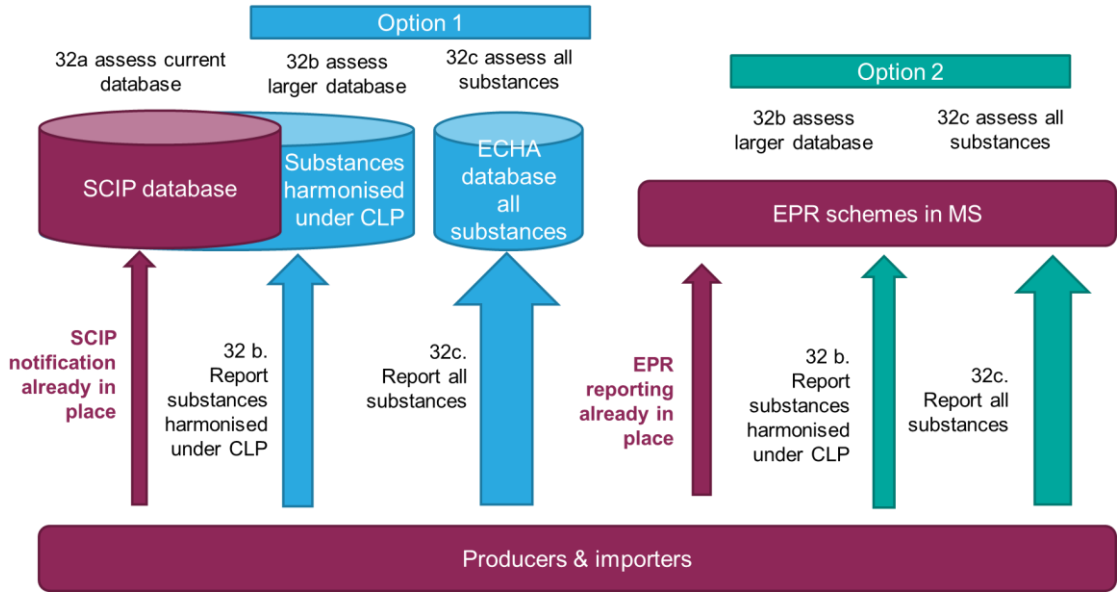
The primary objective of this measure is to increase the knowledge base on the presence of substances of concern in packaging by gathering information of the chemical composition of packaging.

3.4 Description of the measure

This measure seeks to determine if there is presence of substances of concern in packaging and three different methods have been identified to gather relevant data:

- Measure 32a: assessment of the information provided through SCIP notification
- Measure 32b: assessment of substances with harmonised classification under CLP
  - Option 1. Information to be provided to an expanded SCIP database
  - Option 2. Information provided to EPR scheme (link to measure 42)
- Measure 32c: assessment of all substances used/present
  - Option 1. Information provided to ECHA
  - Option 2. Information provided to EPR scheme (link to measure 42)

Figure A-1 Diagram of information flows for the three variants of Measure 32 [dark red is for existing arrangements and blue/green for new arrangements under the measures]



3.4.1 Measure 32a: assessment of the information provided through SCIP notification

To get an idea of the content of SVHC in packaging manufactured and imported in the EU the Commission or ECHA could analyse the information provided under REACH and through the SCIP notification. The obvious advantage of the first option would be that no further regulatory action would be required as only data that has already been gathered would be evaluated.

The information provided under Articles 7 and 33 of REACH and the WFD does not allow, however, for a comprehensive assessment of the use of hazardous substances in packaging. First, the

information requirement under Article 33(1) REACH concerns only information to be passed on in the supply chain. This information is not collected in a central public database and can therefore not be used to gain information on the scale of SVHCs present in packaging.

Second, the information provided under Article 7(2) REACH is provided to ECHA but the scope is small since it only covers articles containing SVHCs and applies only to substances present in those articles in quantities totaling over one tonne per producer or importer per year, and therefore most packaging articles will not be captured by it.

The SCIP notifications are collected in a publicly available data base, and as is the case under the REACH requirements, they only concern the presence of substances of very high concern (SVHC).

The list of hazardous substances likely associated with plastic packaging provided by Groh et al. (2019) covers quite a lot of substances, including colorants, flame retardants, plasticisers, monomers, solvents, stabilizers and surfactants, as shown in Table A-1 below.

Table A-1 Substances in the non-exhaustive list of most hazardous chemicals likely associated with plastic packaging of (Groh et al. (2019) which are also included in the REACH Candidate List as SVHCs

Function	Family	Name	EC number	CAS number
Colorant	Dye	4,4'- Diaminodiphenylmethane (MDA)	202-974-4	101-77-9
		4-methyl-m-phenylenediamine (toluene-2,4-diamine)	202-453-1	95-80-7
		Disodium 4-amino-3-[[4'-[(2,4-diaminophenyl)azo][1,1'-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)	217-710-3	1937-37-7
		Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)	209-358-4	573-58-0
	Pigment	Cobalt(II) diacetate	200-755-8	71-48-7
Fire retardants	Boron	Boric acid	233-139-2	10043-35-3
		Disodium tetraborate, anhydrous	215-540-4	12179-04-3, 1303-96-4, 1330-43-4
	Organo-phosphate	Tris(2-chloroethyl) phosphate	204-118-5	115-96-8
		Trixylyl phosphate	246-677-8	25155-23-1
Plasticiser	Chlorinated paraffins	Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	287-476-5	85535-84-8
	Phthalates	Bis (2-ethylhexyl)phthalate (DEHP)	204-211-0	117-81-7
		Benzyl butyl phthalate (BBP)	201-622-7	85-68-7
		Dibutyl phthalate (DBP)	201-557-4	84-74-2
		Dicyclohexyl phthalate	201-545-9	84-61-7
		Dihexyl phthalate	201-559-5	84-75-3
		Bis(2-methoxyethyl) phthalate	204-212-6	117-82-8
		Diisobutyl phthalate (DiBP)	201-553-2	84-69-5
Monomer or intermediates	Acrylic	Acrylamide	201-173-7	79-06-1
	bisphenol	4,4'-isopropylidenediphenol (BPA)	201-245-8	80-05-7
	Other	Methyloxirane (Propylene oxide)	200-879-2	75-56-9
		1,2,3-trichloropropane	202-486-1	96-18-4
Solvent	Hydrocarbons	Trichloroethylene	201-167-4	79-01-6
		2-methoxyethanol	203-713-7	109-86-4

Function	Family	Name	EC number	CAS number
		N,N-dimethylformamide	200-679-5	68-12-2
Stabilizer	Tin	Dibutyltin dichloride (DBTC)	211-670-0	683-18-1
		2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)	239-622-4	15571-58-1
	Organi-phosphite	tris(4-nonylphenyl, branched) phosphite, tris(nonylphenyl) phosphite	247-759-6	26523-78-4
	Benzotriazol	2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350)	253-037-1	36437-37-3
		2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV-327)	223-383-8	3864-99-1
		2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	247-384-8	25973-55-1
		2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	223-346-6	3846-71-7
	Other	1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazinane-2,4,6-trione (TGIC)	219-514-3	2451-62-9
Surfactant (or its degradation product)	Nonylphenol, Octylphenol and Nonylphenol-related	Phenol, 4-nonyl-, branched	284-325-5	84852-15-3
		Nonylphenol	246-672-0	25154-52-3
		4-(1,1,3,3-tetramethylbutyl)phenol	205-426-2	140-66-9
		p-nonylphenol	203-199-4	104-40-5
		4-Nonylphenol, branched, ethoxylated;Poly(oxy-1,2-ethanediyl), α-(4-nonylphenyl)-ω-hydroxy-, branched	500-315-8	127087-87-0
		4-Nonylphenol, ethoxylated	500-045-0	26027-38-3
		Isononylphenol, ethoxylated	609-346-2	37205-87-1
		2-[2-[2-[2-(4-nonylphenoxy) ethoxy]ethoxy]ethoxy]ethanol	230-770-5	7311-27-5
		Nonylphenol, branched, ethoxylated	500-209-1	68412-54-4
		Nonylphenol, ethoxylated	500-024-6	9016-45-9
	PFAS	Pentadecafluorooctanoic acid (PFOA)	206-397-9	335-67-1
		Ammonium pentadecafluorooctanoate (APFO)	223-320-4	3825-26-1

3.4.2 Measure 32b: assessment of substances with harmonised classification under CLP

In this measure producers and importers would be required under the PPWD to report on all substances contained in their packaging that have **harmonised classification under CLP,** in addition to Candidate list substances.

This approach would cover, in addition to the substances included in Table A-1 above, the groups of accelerators (Dithiocarbamate, Thiazole/Thiuram), and biocides (such as parabens), some fire retardants, phthalates, monomers (acrylic, amine, zinc-containing monomers and others), solvents (limonene or naptha-related) and surfactants (amine or nitrogen-containing).

There could be several ways how and to whom to report information and two main options have been identified:

- **Option 1: information provided to SCIP database.** Producers are already reporting on SVHC via SCIP notification and they would increase the range of substances. This would translate as an additional requirement of the SCIP notification and would necessitate an amendment of the provision in Article 9 of the Waste Framework Directive.
- **Option 2: information provided to EPR scheme (link to measure 42).** As producers are already reporting to EPR schemes in each Member State a requirement could be added to report information on substances classified as hazardous underwith a harmonised classification in CLP for chronic effects. Measure 42 (in Data & Reporting Impact Assessment) requires the information from the EPR schemes to be harmonised, and the Commission (or ECHA) could use it to carry out the hazardousness assessment. It is worth noting that some Design for Recycling (DfR) methodologies already consider hazardousness and thus these data would need to be provided where relevant in order to apply the fee modulation.

3.4.3 Measure 32c: assessment of all substances used/present

The study by Groh et al. also pointed at another important aspect about the status of hazardous substances: a lack of harmonised toxicological information, such as CLP hazard classifications for many of the substances associated with plastic packaging.

Therefore, this measure would require manufacturers and importers under the PPWD to **report on all substances used for or contained in packaging**, regardless of their (potential) hazard classification. It would be important that detailed information concerning the use of chemicals in plastics manufacturing and the chemicals' presence in final products would be given. This would in particular also include additives and not intentionally added substances (NIAS). Furthermore, it would capture substances that are not yet classified under any relevant hazard class because currently the relevant data are missing.

Similar to 32b, there are two main options in term of consolidation of the datasets for assessment:

- Option 1: information provided to ECHA. Producers would report directly to ECHA.
- Option 2: information provided to EPR scheme (link to EU-database in measure 42a). Same as 32b with increased range of substances (all).

3.5 Links to other measures

This measure is closely related to Measure 33 "Restriction of hazardous substances" since the information gathered by this measure would be used as the basis for assessing hazardous substances and potentially further regulatory action, such as restricting them from being placed on the market.

3.6 Assessment of Measure 32a: assessment of the information provided through SCIP notification

3.6.1 Effectiveness

This measure is unlikely to be sufficient to gain a comprehensive overview of the hazardous substances contained in packaging. Some of the substances included in the list of most hazardous substances likely associated with plastic packaging provided by Groh et al. (2019) are not in the so-called Candidate list listing the SVHC identified under REACH so far. In addition, the Candidate list currently contains 219 entries (as updated on 8 July 2021). Substances are periodically, but it is still reflecting just a small part of all substances that could potentially qualify as particularly hazardous to human health and the environment. In comparison, the (SIN) list maintained by the NGO International Chemical Secretariat (ChemSec), contains around 1,000 chemicals.

Therefore, the data collected in the SCIP data base would not be sufficient to assess the scale of the use of substances of concern, as defined in the Chemicals Strategy.

3.6.2 Ease of implementation

As described in section 3.4.1, this measure would only requirement the assessment of already-existing data. There would be some implementation effort in terms of putting in place the assessment process (by ECHA or the Commission) and it would require some ongoing activities to keep the process and outcomes up to date.

3.6.3 Administrative burden

This measure would not place additional administrative burden on producers/importers since there is no change to the current reporting conditions.

3.6.4 Economic impacts

No significant economic impact is expected for this measure since its nature is only analysing information.

3.6.5 Social impacts

No significant social impact is expected for this measure since its nature is only analysing information.

3.6.6 Environmental impacts

No significant environmental impact is expected for this measure since its nature is only analysing information.

3.6.7 Stakeholder views

Stakeholders provided feedback after presenting the measures in a webinar in June 2021, and the majority of stakeholders who responded were in favour of measure 32a. More details can be found in Appendix E Stakeholder Synopsis Report.

3.7 Assessment of Measure 32b: assessment of substances with harmonised classification under CLP

3.7.1 Effectiveness

This measure also has its limitations; Groh et al. (2019) found that less than a third of the chemicals likely associated with plastic packaging had harmonised classification under CLP or are identified as PBT, vPvB, EDC under REACH. However, other chemicals might be hazardous but are not yet classified as such in the EU. An example could be Bisphenol S, which is listed in Groh et al. (2019) as part of the most hazardous substances likely associated with plastic packaging because it is recognised as EDC in a 2018 United Nations Environment Programme (UNEP) report[625], but still under ED (endocrine disruptor) assessment at EU level. It should also be considered that the list provided by Groh et al. (2019) only refers to plastic packaging.

Therefore, requiring producers to report all substances contained in packaging having harmonised classification under CLP (due to chronic effects) might not be sufficient to gather a comprehensive overview. However, it would be a start.

3.7.2 Ease of implementation

The implementation of this measure would largely depend on the selected method for data gathering:

- Option 1. As an additional requirement of the SCIP notification, necessitating an amendment of the Waste Framework Directive and, potentially, the adaptation of the database itself;
- Option 2. A new information requirement could be inserted in the PPWD - see impact assessment for measure 42 (intervention area Data & Reporting).

3.7.3 Administrative burden

This measure is likely to place additional reporting burden on producers/importers as it will include substances that were previously not being reported. The producers/importers may need to gather information from their supply chain or to obtain it / check directly via targeted chemical analysis.

Additional enforcement efforts would be expected from Member States.

[625] UNEP, 2018. Overview Report I: Worldwide Initiatives to Identify Endocrine Disrupting Chemicals (EDCs) and Potential EDCs. International Panel on Chemical Pollution (IPCP).

3.7.4 Economic impacts

Potential need for testing might have an economic impact on operators. Member States will have greater enforcement efforts to make.

3.7.5 Social impacts

No significant social impact is expected for this measure since its nature is only analysing information.

3.7.6 Environmental impacts

No significant environmental impact is expected for this measure since its nature is only analysing information.

3.7.7 Stakeholder views

See section 3.8.7 – the majority of the stakeholders offered feedback on measures 32a and 32c. One stakeholder noted that measure 32b should further specify which classifications are to be included as not all are relevant in this context, and that there should also be a concentration threshold for reporting.

3.8 Assessment of Measure 32c: assessment of all substances used/present

3.8.1 Effectiveness

As described in section 3.1, the problem of hazardous substances in packaging is two-fold: 1) the presence of substances is unknown, and 2) there could also be substances that are hazardous (for human health, environment and/or hampering recycling) but these are currently not labelled as such. Therefore this measure would be very effective as it requires reporting on all substances used in packaging.

If this information is made available to ECHA, it could be used in the context of its integrated regulatory strategy, to screen and prioritise candidate substances to be restricted in packaging. This would enable ECHA to perform accurate risk assessment and possibly explore substitution options. This could then be the basis for further regulatory action of the Commission (see measure 33).

3.8.2 Ease of implementation

This measure would be more arduous to implement than measure 32b due to the increased scope of substances (all of them).

3.8.3 Administrative burden

This measure is likely to place a high reporting burden on producers as it will cover all substances present in packaging. The producers may need to gather information from their supply chain.

3.8.4 Economic impacts

Potential need for testing and data gathering might have an economic impact on operators. Member States will have greater enforcement efforts.

3.8.5 Social impacts

No significant social impact is expected for this measure since its nature is only analysing information.

3.8.6 Environmental impacts

No significant environmental impact is expected for this measure since its nature is only analysing information.

3.8.7 Stakeholder views

Some stakeholders from the packaging industry that have been interviewed for this study expressed some concern about providing information on the chemical composition of packaging to an EU database as they would consider it confidential business information (CBI) (see measure 42 in Data & Reporting intervention area).

However, in terms of protection of CBI, other requirements could be perceived as more damaging to the interests of industry, such as an obligation to label the packaging, or an obligation to provide the information to consumers on demand (as required for SVHC under Article 33(2) REACH).

With regards to the appropriate actor to deal with CBI, there are different views. On one hand, some PROs believe that they can be trusted with confidential data that then gets aggregated and shared with regulators, which avoids any inappropriate sharing of confidential information. On the other hand, for increased control and security of information, it may be recommended to submit the information directly to one authority – ECHA or a potential EU packaging database – rather than to national packaging schemes and then to ECHA. Having the exact data on composition might allow ECHA to draw more meaningful conclusions. For the purpose of gaining transparency on all substances used in packaging it would also not be necessary to be able to trace the substance back to a certain product or manufacturer/importer. Therefore, even if the data base were made accessible to the public there would be no risk that CBI would be disclosed. Only the authority would have access to information on which substances are used in which application and in what quantities, and at which level they are present in final products.

The majority of consulted stakeholders were in favour of measure 32a and expressed concerns on measure 32c regarding reporting burden, difficulty of implementation and confidentiality of commercial data.

3.9 Summary and conclusion

Table A-2 Summary of Impacts for Measure 32

Impact category	32a. assessment of SCIP notification info	32b. assessment of substances with harmonised classification under CLP	32c. assessment of all substances
Effectiveness	Generation of knowledge on the presence of SVHC in packaging. No overview of the presence of all substances of concern will be achieved.	Similar to 32a, with a higher effectiveness due to the broader scope of substances.	Most effective: generation of a comprehensive data base on the presence/use of substances in packaging
Ease of implementation	Assessment would require set up effort and some ongoing operational activities	Same as 32a + more implementation effort (depending on Option 1 or 2)	More implementation effort than 32b
Administrative burden	No additional effort for operators	Some additional reporting efforts	High reporting efforts
Economic impacts	None expected	Potential economic impact on producers/importers and enforcement authorities.	
Social impacts	No direct impact		
Environmental impacts	No direct impact		
Stakeholder Views	Majority in favour of measure 32a and expressed concerns on measure 32c regarding reporting burden, difficulty of implementation and confidentiality of commercial data.		

4.0 Measure 33. Restriction of hazardous substances

4.1 Problem definition

As described in previous section 3.1, there is little information about hazardous substances in packaging, but evidence seems to suggest that their use could be extensive at least in plastic packaging. Exposure to certain hazardous chemicals can pose a threat to human health. Considering that packaging is present in everyone's daily life, be it workers making or using packaging, or sorting packaging waste for recycling, or consumers having skin contact with packaging, the exposure to hazardous chemicals contained in packaging could be very widespread.

As briefly mentioned in section 1.1, the presence of substances of concern has been identified as a barrier for the uptake and confidence in secondary raw materials from packaging (see Appendix A – Problem Definition).

4.2 Baseline

In the **Chemicals Strategy for Sustainability** the Commission recently committed to 'minimise the presence of substances of concern in products by introducing requirements, also as part of the Sustainable Product Policy Initiative, giving priority to those product categories that affect vulnerable populations as well as those with the highest potential for circularity, such as textiles, packaging including food packaging, furniture, electronics and ICT, construction and buildings'[626].

As described in section 2.1, PPWD currently only restricts four chemicals in packaging. Pursuant to Article 11 of the PPWD, the sum of concentration levels of lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components must not exceed certain thresholds. Additional ad-hoc restrictions are possible via an amendment of the Directive, via the ordinary legislative procedure (i.e. co-decision).

There is an **existing restriction procedure under Title VIII of REACH** which could already be used to restrict hazardous substances in packaging.

- A Member State, or ECHA, at the request of the European Commission, can start the restriction procedure when they are concerned that a certain substance (or group of substances) may pose an unacceptable risk to human health or the environment.
- ECHA can also propose a restriction on articles containing substances that are on the Authorisation List (Annex XIV).

[626] European Commission, Chemicals Strategy for Sustainability Towards a Toxic-Free Environment, COM(2020) 667 Final, p.6. According to footnote 16, 'substances of concern' include "*primarily those related to circular economy, substances having a chronic effect for human health or the environment (Candidate list in REACH and Annex VI to the CLP Regulation) but also those which hamper recycling for safe and high quality secondary raw materials*. "

Under this option, the Commission would request ECHA to prepare one or several Annex XV restriction dossiers under REACH for prioritised substances that are used in (non-food contact[627]) packaging.

The process is obviously not aimed to tackle particularly hazardous substances in packaging and it would therefore not systematically address these substances. The full restriction process under REACH, from inclusion in the "registry of intentions" to the possible adoption of a Commission proposal under REACH can easily take 3 years, including the time for dossier preparation, per substance. It is likely that it will still take many years until all hazardous substances used or present in packaging could be addressed through these processes.

4.3 Objectives

The primary objective of this measure is to find/create a legal instrument to allow restricting hazardous substances in packaging.

4.4 Description of the measure

To address hazardous substances in packaging in a dedicated manner, the Commission could request ECHA or otherwise engage in an assessment of substances which are used in packaging and propose a priority shortlist of substances for which, due to their potential risk in the whole life-cycle of non-food contact packaging, a restriction could be warranted. This restriction could be enacted in two ways: either by using the existing REACH restriction process as described above, or under a new dedicated process under PPWD (measure 33). Under this measure, the Commission could require ECHA to prepare a restriction dossier, in a process akin to that followed in REACH, but governed under the PPWD.

This option would be in line with the approach taken in the Proposal for a Batteries Regulation[628]. Article 6 of the proposed Batteries Regulation provides that Annex I to the Regulation contains restrictions in addition to the restrictions set out in Annex XVII to REACH. Pursuant to par.2 of Article 6,

> "[w]*hen there is an unacceptable risk to human health or the environment, arising from the use of a substance in the manufacture of batteries, or from a substance present in the batteries when they are placed on the market, or during their subsequent life cycle stages, including the waste phase, that needs to be addressed on a Union-wide basis, the Commission shall adopt a delegated act to include the substance in Annex I as restricted substance*[629]*."*

[627] Food-contact material is already addressed under the FCM legislation.

[628] Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020, COM/2020/798 final.

[629] Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020, COM(2020) 798/3, available at: https://ec.europa.eu/environment/pdf/waste/batteries/Proposal_for_a_Regulation_on_batteries_and_waste_batteries.pdf.

These substances can subsequently only be used, and products containing them only be placed on the market if they comply with the conditions of the restriction. This includes imported products.

This process transferred to packaging would, like the restriction process under REACH, include opinions to be provided by the Committee for Risk Assessment and the Committee for Socio-economic Analysis of ECHA, and a stakeholder consultation. In addition, ECHA could consider in its assessment whether the substance 'hamper[s] recycling for safe and high quality secondary materials', as set out in the Sustainable Chemicals Strategy defining 'substances of concern'[630].

If, at the end of this process, the Commission comes to the conclusion that there is indeed an unacceptable risk to human health or the environment it would add this substance to a new annex to the PPWD that would include substance restrictions. The current substance restrictions laid down in Article 11 of the Directive could also be listed in the new annex.

The interplay of the different entities would be as follows:

- The process would be defined by the PPWD;
- The restriction dossier preparation and opinion making would be done by ECHA, at the request of the Commission;
- The actual restriction would be enacted, not under REACH, but via the committees / expert groups responsible of the PPWD; and
- The decision-making procedure would be envisaged under the revised PPWD.

Such an approach would ensure a dedicated process to address the restriction of 'substances of concern' in packaging, rather than addressing these substances, together with all other restrictions under REACH.

4.5 Links to other measures

Measure 31 provides the basis for any restriction, by accurately defining the substances in scope and the impacts to be considered. Measure 32 will help assessing whether there is a problem in relation to the use and content of hazardous substances in packaging and what the scale of the problem is. In this measure it is assumed that Measure 32 will prove that indeed extensive use of hazardous substances is made in packaging.

4.6 Assessment of Measure 33: restriction under a new dedicated process under PPWD

4.6.1 Effectiveness

This measure would ensure that there is a dedicated process for substances of concern in packaging and would effectively limit their use and presence in packaging. This could potentially increase the uptake and confidence in secondary raw materials in packaging.

[630] European Commission, Chemicals Strategy for Sustainability Towards a Toxic-Free Environment, COM(2020) 667 Final, p.2, footnote 16.

4.6.2 Ease of implementation

This approach would require a revision of the legislation and the guidance materials (see section 4.4 for a description of the process and roles of the entities involved).

4.6.3 Administrative burden

Some administrative burden could be expected arising from the restriction for ECHA, Commission and potentially Member States.

4.6.4 Economic impacts

Similarly to measure 31, restrictions of substances of concern in packaging may require additional efforts from packaging manufacturers. This could take the form of additional communication with suppliers with regards to the substances present in packaging materials or even adaptation costs by changing the formulation or switching packaging formats. The extent is unknown due to lack of data.

4.6.5 Social impacts

The main expected social benefit is improved human health thanks to more limited use of substances of concern in packaging. This is difficult to quantity at the moment due to lack of available data.

4.6.6 Environmental impacts

Positive environmental impacts are expected thanks to reduced presence of substances of concern in packaging. This is difficult to quantity at the moment due to lack of available data.

4.6.7 Stakeholder views

See general comment under 2.6.7 – several stakeholders believe that that PPWD is not the appropriate instrument for restriction and those should be left at the hands of REACH and the Food Contact Material (FCM) regulation.

4.7 Summary and conclusion

Table A-1 Summary of Impacts for Measure 33

Impact category	Measure 33
Effectiveness	Effective in limiting the use of substances of concern
Ease of implementation	Would require a revision of legislation and a revision of guidance materials
Administrative burden	Some administrative burden expected

Impact category	Measure 33
Economic impacts	Potential impact on the packaging industry if restrictions applied
Social impacts	Improved protection of human health
Environmental impacts	Improved protection of the environment
Stakeholder Views	Strong views from stakeholders that PPWD is not the appropriate instrument for restrictions and those should be left at the hands of REACH and the Food Contact Material regulation

APPENDIX M – IMPACT ASSESSMENT OF RECYCLED CONTENT MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Recycled Content, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 to 4.0 contain the impact assessments of the selected measures; and
- 5.0 contains the description of the discarded measures.

All impacts shown, unless otherwise stated, are referring to the effects of the measure in 2030 compared to the baseline in 2030.

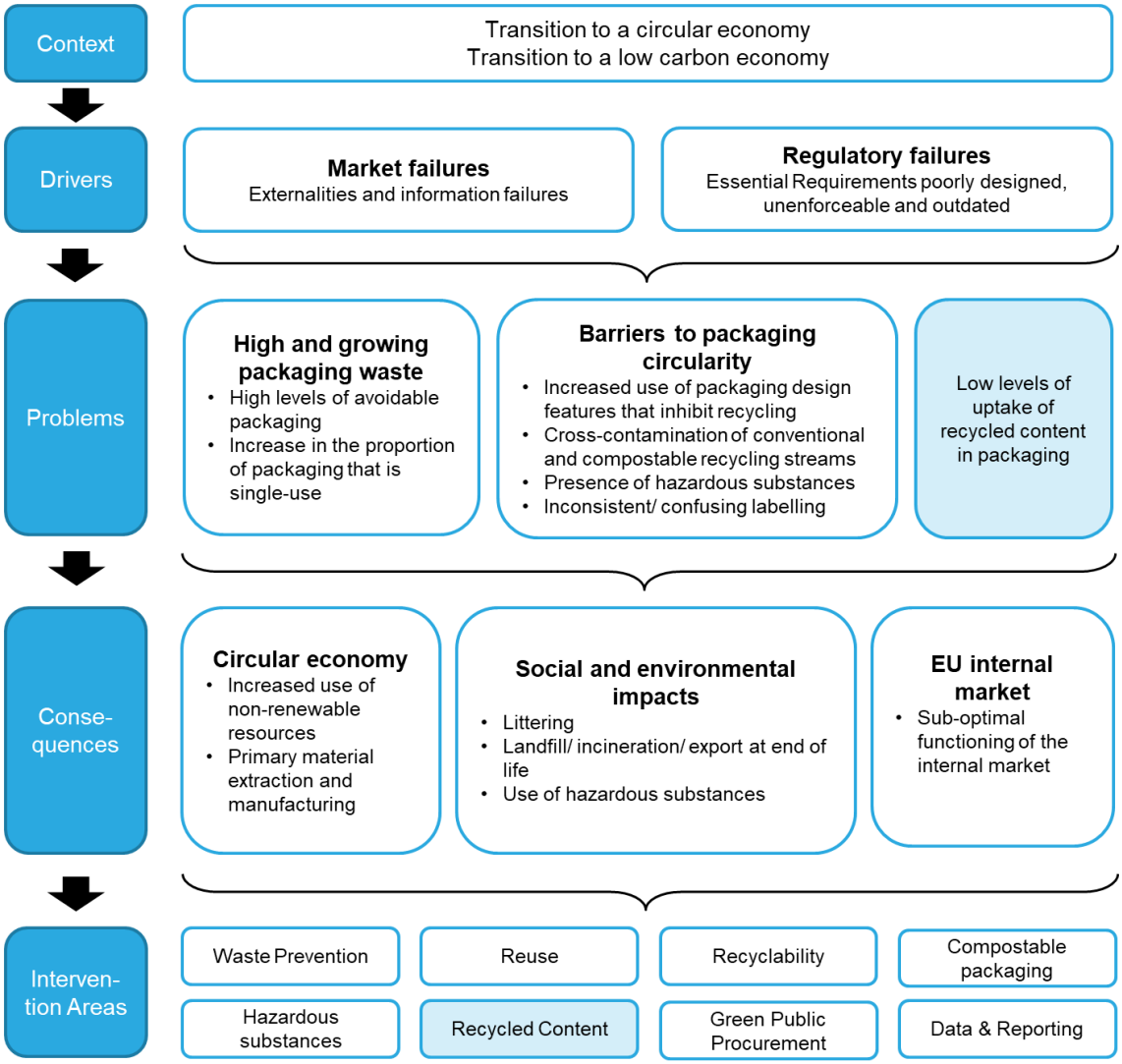
This annex is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Section 3.0 describes the problem "Low levels of uptake of recycled content in packaging" which is most related to this intervention area.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario, and section 4.5 specifically discusses recycled content projections.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. In this document the quantitative impacts are presented in relation to the baseline and, unless otherwise indicated, for the year 2030. Impacts are described qualitatively where quantitative analysis was not feasible.
  - Appendix D – Impact modelling methodology describes how the impacts for each measure were calculated and the underlying assumptions. Section 2.4 specifically discusses the recycled content measures.

1.1 Intervention logic

As shown in Figure A 1 below, Recycled Content (RC) is one of the eight intervention areas identified in the intervention logic, and it is directly linked to one of the identified problems: **Low levels of uptake of recycled content in packaging**.

Figure A 1 Intervention Logic diagram



1.2 Measures assessed

- Measure 34: Requirements for recycled content in all packaging
  - Measure 34b: Introducing a mandatory reporting requirement for recycled content in all packaging
- Measure 35: Mandatory recycled content targets
  - Measure 35a: Material-specific target for plastic packaging (average across *all* plastic packaging)
  - Measure 35b: Product-specific targets for plastic packaging (5 plastic packaging product groups)
  - Measure 35c: Targets based on contact-sensitivity/ broad application of plastic packaging
- Measure 37: Harmonised definition and measurement method

1.3 Measures discarded

- Measure 34: Requirements for recycled content in all packaging
  - Measure 34a: Updates to Essential Requirements operationalised through harmonised standards
- Measure 35d: Mandatory recycled content targets for *all* packaging
- Measure 36: Polymer substitution quotas
- Measure 38: Harmonised standards for labelling of recycled content in packaging
- Measure 39: Harmonisation of EPR Fee Modulation Criteria based on recycled content

2.0 Measure 34: Requirements for recycled content in all packaging

2.1 Problem definition

In neglecting recycled content, setting a very low bar to be classed as recyclable and allowing all plastics to be incinerated, it is accepted that the Essential Requirements – and accompanying Standards – stimulate neither the demand for nor the supply of recycled materials in packaging. However, given that measures to address these specific issues with the Essential Requirements have already been proposed as part of the intervention area related to packaging recyclability, and that targets for recycled content in all packaging (aside from plastics) have been assessed as unnecessary at present (see discarded measure 35d), it is questionable whether updates to the Essential Requirements related to recycled content are necessary.

Indeed, since the Essential Requirements are designed to apply to all packaging placed on the EU market, rather than just plastic packaging, they are not a suitable mechanism whereby the above problem identified and highlighted in both the Plastics Strategy and the CEAP 2.0 (a lack of uptake of recycled plastics) can be addressed in the packaging sector (see discarded measure 34a In Section A.5 for further detail).

However, while the current emphasis for interventions in this area is on plastic packaging, it is important to note that recycled content uptake is also currently limited in other types of packaging (e.g., liquid carton board, aluminium foils, etc.; see Appendix A Problem Definition for detail). Therefore, to facilitate an even playing field in regulation across all packaging materials, it will be important to expand the scope of recycled content targets in the future (see measure 35d) to include other materials. However, at present, there is a significant lack of consistent, officially reported data on current levels of recycled content in packaging at the level of granularity needed to inform a holistic assessment of the need for further targets, and the setting of such targets across the sector at present. This data gap must be addressed so that the root causes of poor recycled content uptake in other types of packaging can be identified and understood, enabling sound policy making in the future as the market for secondary materials develops.

In the absence of specific mandatory targets for recycled content in all packaging materials, it will also be particularly important to send a clear signal to the non-plastic packaging industry regarding the direction of EU policy in this regard, to encourage innovation and market developments in line with EU circularity principles. Finally, for the producers of those packaging types that will be subject to mandatory recycled content targets (i.e., plastics), minimising disruption by adopting a transitionary approach to the implementation of these targets would be preferable, given that this is a relatively novel area of regulation and data gathering for which changes will need to be adopted along the entire packaging value chain.

2.2 Baseline

As discussed above, there is currently no requirement for producers to incorporate recycled content in packaging placed on the EU market. The emphasis of the packaging regulations so far has been on directing waste to recycling rather than incentivising high quality end markets for

the resulting recycled outputs within the packaging sector. This is particularly true for plastic packaging, which contributes to a high proportion of recycled plastic materials available on the market, but is able to absorb very little of this recycled material itself. The current regulations around the use of recycled plastics in food contact applications (Regulation EC 282/2008, which is currently under revision) are seen as a particular barrier. For packaging in which recycled materials are used to some extent, limited supply of (and resulting competition with other sectors for) recycled material in the quantities and qualities necessary have prevented further increases in recycled content uptake in the packaging sector.

While there is already a CEN Report (CR 13504) on Packaging – Material Recovery – Criteria for a Minimum Content of Recycled Material, this report does not appear to be widely known or used. The report sets out the factors to consider in determining the potential recycled content, but concluded that "the basis for a mandatory stated minimum recycled content in packaging is considered unsound".

Some Member States incentivise the use of recycled materials in packaging through the modulation of EPR fees (France and Germany being notable examples here), though the extent to which this has been successful is not clear, since the scale of the incentive relative to the cost of producing packaging, and the final value of packaged products, is low.

2.3 Objectives

This measure seeks to solve three key problems –

- To establish a clear market signal in favour of incorporating recycled materials in all packaging placed on the EU market without undue administrative burden or risk of unintended consequences;
- To enable transparency and a common understanding of current practice to inform future policy on recycled content by gathering data at the required level of granularity using against a harmonised methodology; and
- To allow economic operators to adapt supply and manufacturing processes associated with the calculation and verification of recycled content in packaging ahead of the implementation of mandatory targets

2.4 Description of the measure 34b: Introducing mandatory reporting requirement for recycled content in all packaging

From 2025, economic operators will be required to mandatorily report data to Member States on the levels of recycled content in their packaging at the level of the specific packaging type placed on the EU market. This data will then be reported by Member States to the Commission and made public. It is noted that there are likely to be some commercially sensitive elements associated with any publication of this data, which would have to be provided for, for example, by aggregating the data by the key packaging materials, potentially with further breakdown for main groups of applications (e.g. plastic rigid, plastic flexible, etc.).

Where recycled content cannot be incorporated due to consumer health and safety concerns, or legal restrictions, this should form a part of the declaration. Additional information that could be required relates to the source of any recycled materials utilised (sometimes distinguished by

industry as pre-consumer and post-consumer waste), the production process utilised and any efficiency or material losses resulting from the use of recycled materials, etc. This information may be useful in setting future policy, but this benefit must be carefully weighed against the implementing and administrative burden that gathering such data involved. For example, while a requirement related to post-consumer material specifically is likely to have more impact on the quality and quantity of waste recycled, pre-consumer waste often constitutes a comparatively affordable, high quality stream of recycled materials for producers who may otherwise not be able to make a business case for using recycled materials. However, these types of waste are not currently distinguished or defined in EU law and as such supply chains are not necessarily set up to gather such data in a consistent and verifiable way at present.

It is anticipated that data gathering will be supported by PROs, with market surveillance authorities supporting in enforcement and auditing activities. To maximise impact, the data may feed into electronic databases of packaging with a high level of granularity on specific packaging products (Annex Impact Assessment for Intervention Area Data & Reporting).

The implementation of this measure relies heavily on the development of a harmonised definition for recycled content and the application of a consistent measurement method for determination of recycled content levels (see measure 37 Harmonised definition and measurement method). In addition, this measure acts as a forerunner to the implementation of mandatory recycled content targets for plastic packaging in 2030 (see measure 35), providing economic operators with a predictable legal framework to guide their investments and innovation ahead of the mandatory requirements. For packaging that is not subject to targets in 2030, the measure sends a clear signal to the market of the direction of EU policy in this regard and encourages consideration of the uptake of recycled materials in the packaging design stage (albeit not a mandatory requirement).

The gathering of this data will additionally enable the development of evidence-based policy on recycled content targets in the packaging sector in the future. This is currently hindered by a lack of data at the level of individual packaging applications across the key packaging materials. This would also enable the identification of best-in-class packaging formats and materials from the perspective of recycled content uptake, and provide some incentive for producers to maximise recycled content in their packaging with the threat of further regulation and targets for those items that perform poorly or with inadequate justification for low levels of recycled content (i.e., for reasons other than consumer health and safety/ legal restrictions as above).

This requirement could therefore play a significant role in the setting of more ambitious and targeted measures for increasing recycled content in the packaging sector in the future in addition to ensuring that producers are improving the design of packaging to include higher levels of recycled content in the present.

2.5 Links to other measures

- The measure is linked to the establishment of a harmonised definition of the term "recycled content", as well as a consistent methodology for calculating, reporting and verifying recycled content in packaging (Measure 37)
- There is an overlap with Measure 35, which requires plastic packaging producers to comply with minimum recycled plastic content targets by 2030.

- The measure is also linked to harmonised EPR reporting requirements (measure 42) that are discussed in the data and reporting intervention area

2.6 Assessment of Measure 34b

2.6.1 Effectiveness

This measure will ensure that some consideration is made of recycled content when placing packaging on the EU market, albeit without any binding requirements regarding a specific level of recycled content to be used. This is important to prevent market disruption given the lack of data on the technical, legal and economic feasibility of incorporating recycled content in different packaging applications/ materials at present, while simultaneously allowing such data to be gathered to inform future policy making. However, it does mean that if implemented alone, this measure does not effectively contribute to fulfilling the commitment made in the new circular economy action plan (CEAP 2.0) on a mandatory recycled content target for packaging to increase the uptake of recycled plastics.

In addition, although the measure does not provide a direct incentive for industry to increase their use of recycled content in packaging, it sends a clear market signal that further regulatory requirements regarding recycled content in the packaging sector can be anticipated. The knowledge that the data must be reported against a harmonised methodology and will underpin future policy in this intervention area may encourage some packaging producers and brands to improve their performance and invest in R&D.

To increase its effectiveness, this measure should ideally be implemented alongside measure 35 and measure 37, allowing a transitionary approach whereby economic operators have a chance to adapt to the new harmonised calculation and verification methodology (measure 37) and invest in the necessary supply chain changes before mandatory targets are implemented in 2030 (measure 35). In this way, the three measures together create a predictable regulatory framework for recycled plastics, and set a clear policy direction for recycled materials in non-plastic packaging that are not subject to targets, thereby meeting the objectives of the Green Deal and CEAP 2.0:

> *To increase **uptake of recycled plastics** and contribute to the more **sustainable use of plastics**, the Commission will propose mandatory requirements for recycled content and waste reduction measures for key products such as packaging...*

2.6.2 Ease of implementation

The requirement for mandatory declaration of recycled content levels in packaging by economic operators to Member States should be included within the body of the PPWD, in a new Article, and updating the reporting formats in Annex III, using wording along the lines of the below:

"As of 1 January 2025, Member States shall require economic operators to declare and provide reliable information regarding the concentration of recycled materials that are present in each unit of packaging placed on the EU market, expressed as a percentage by mass of each broad category of packaging material…

Member States shall report the data concerning the implementation of [the above] for each calendar year to the Commission. They shall report the data electronically within 18 months of the end of the reporting year for which the data are collected in the format established by the Commission in Annex III..."

In this case, further work will be required to determine the types of information that should form a part of the mandatory declaration, and therefore the format to be included within Annex III, as well as in terms of the gathering, verification, collation and reporting of such data by Member States and subsequently by the Commission. As mentioned before, data are likely to have to be reported in an aggregated manner to protect the commercial interests and sensitivities of economic operators.

The use of existing PRO databases, electronic registries and declarations that form a part of other regulatory requirements (e.g. REACH regulations, Regulation (EC) No 282/2008 for food contact applications, Regulation EC No. 1223/2009 for cosmetics applications, etc.) should be considered to identify any potential overlaps and minimise additional effort on the part of Member States. Additionally, a rapid alert system could also allow Member States to share information and evaluation findings about particular types of packaging and to reduce the need for producers to report the same data for the same type of packaging in several different ways and platforms across the 27 Member States.

From the industry perspective, improvements in supply chain cooperation and innovation are anticipated, as brands will require data to be gathered and verified at different points in the supply chain to support reporting. The initial set up and establishment of systems to gather the necessary data at the level of packaging units will likely be challenging, though not unfeasible. Similarly, within the Commission, working across Directorates to ensure that exemptions are coherent with health and safety requirements in other parts of the law will be required.

The more challenging aspect to implement in this case will be the development and application of the harmonised rules for calculation and verification of this declaration (see measure 37) which must underpin the requirement.

2.6.3 Administrative burden

As indicated above, the administrative burden associated with initially implementing the measure is not expected to be significant, and the integration of the reporting requirements for Member States overlaps to some extent with existing reporting requirements and others proposed in this intervention area (measure 35 in particular).

However, the administrative burden associated with ongoing monitoring and reporting by Member States is anticipated to be more significant relative to the baseline. In addition, the administrative burden to industry should not be underestimated, particularly for SMEs, since the declaration of recycled content is a novel requirement. Although the data necessary to make such a declaration is currently available at different points in the supply chain, the gathering of such data and integration of information across the supply chain is likely to involve some effort, in addition to the final calculation and reporting necessary at the level of the unit of packaging, which would be resource intensive. For plastic packaging producers, it is noted that this effort would be required in any case from 2030 onwards depending on the implementation of the targets proposed in measure 35.

2.6.4 Economic impacts

Given that this measure does not directly incentivise increased uptake of recycled content in packaging, economic impacts relative to the baseline are not anticipated to be significant. Some R&D investment into new materials and processes that allow greater uptake of recycled content

in certain packaging applications could be expected as an indirect result of the measure, though the proportion of the market that will be impacted and the scale of associated costs in this case are uncertain.

From the perspective of policymakers, improved quality and access to data regarding the current performance of the packaging sector in the recycled content intervention area will enable the identification of best practice and improve the efficiency of policy making in this regard. However, the quantification of such impacts is not feasible.

2.6.5 Social impacts

The direct social impacts of this measure are negligible, with no change in employment anticipated. Increased transparency and consistency in brand claims regarding their use of recycled materials may be a result of this measure, allowing heightened consumer awareness of the sustainability of packaging. This depends on the level of public accessibility to the data reported by Member States, and the level of granularity at which any data is published. Therefore, the scale and magnitude of such impacts are uncertain.

2.6.6 Environmental impacts

As noted above, this measure does not directly incentivise increased uptake of recycled content in packaging, and therefore environmental impacts relative to the baseline are not anticipated to be significant.

2.6.7 Stakeholder views

Stakeholders were largely supportive of this measure, with some expressing concern about the administrative burden involved in reporting recycled content levels in the absence of clear targets for the same. However, others expressed a clear preference for such a system to be adopted across all packaging types prior to the setting of specific recycled content targets, to allow time for industry and policy makers alike to enhance their understanding of the baseline situation and of what is feasible, and to adapt to a new framework for recycled content (this is linked closely to the establishment of harmonized definitions and a measurement methodology in Measure 37: Harmonised definition and measurement method, below).

2.7 Summary and conclusion

Table A-2 Summary of Impacts for Measure 34b

Impact category	Measure 34b
Effectiveness	Coherent with wider policy direction. Recycled content considered in EU market. Clear market signal but does not effectively contribute to fulfilling the commitment made in the new circular economy action plan on a mandatory recycled content target for packaging if implemented without measure 35 and 37.
Ease of implementation	Development and application of reporting requirement challenging but with several potential overlaps with existing systems and requirements. Improvements in supply chain cooperation and innovation anticipated.
Administrative burden	Initial implementation not expected to be significant. Ongoing compliance and enforcement more significant. Data necessary will already be gathered in some cases, though this will have to brought together with heightened supply chain cooperation.
Economic impacts	Not anticipated to be significant. Economic operators that choose to increase levels of RC, although not required by this ER, may experience increased costs. R&D investment into new materials and processes.
Social impacts	Employment not anticipated to be significant, scale and magnitude of other impacts uncertain
Environmental impacts	Not anticipated to be significant. Measure does not directly incentivise increased uptake of recycled content.
Stakeholder Views	Largely supportive. Some concern about administrative burden involved in reporting RC levels. Strong preference for system to be adopted prior to the setting of specific RC targets.

3.0 Measure 35: Mandatory recycled content targets

3.1 Problem definition

The uptake of recycled content in plastic packaging is currently low relative to other materials (see Annex A – Problem Definition). Although plastic packaging accounts for a high proportion of all plastics recycled, the proportion of plastic recyclate that is subsequently used in the packaging sector is low. This results in continued dependence on virgin materials in the sector, associated with high GHG emissions and other negative environmental externalities.

In addition, the increased recycling targets for plastic packaging waste suggest a need for high quality end markets (in which demand is currently lacking) in order to ensure that material is being kept in circulation for as long as possible. Member States are currently considering a range of interventions to tackle these issues, which suggest a risk to the smooth functioning of the internal market in coming years if producers have to meet several different requirements in different Member States.

3.2 Baseline

There are currently no recycled content targets in the packaging legislation. However, recycled content levels in some forms of packaging are reported to be relatively high – research suggests that there is justification for increasing recycled content levels in plastic packaging in particular (see Annex A – Problem definition). The Plastics Strategy refers to the need to establish a "market for recycled and innovative plastics (…) with clear growth perspectives as more products incorporate some recycled content" and envisages a four-fold demand for recycled plastics.

Recycled plastic content targets for single use plastic beverage bottles are set at the Member State level in the Single Use Plastics Directive (25% for PET bottles in 2025 and 30% for all SUP bottles in 2030) though these are already being achieved and exceeded in several Member States (suggesting ambition could be higher). For example, a report from BKV GmbH using data from the reference year 2017, estimates that PET bottles in Germany (95% of which are beverage bottles) already contained, on average, 25% recycled materials.[631] A separate report mapping plastic flows in Sweden in 2019 estimated that on the Swedish market, the proportion of recycled material in new PET bottles is around 50%.[632]

There are currently legal restrictions on the use of recycled plastics in materials intended to come into contact with food, which must be adhered to and have been identified as a barrier.

At the Member State level, targets that go beyond those in the SUP Directive are being considered. Belgium's Flemish Government has set more ambitious targets for recycled content

[631] GVM Gesellschaft für Verpackungsmarktforschung mbH for BKV GmbH (2020), *Study: Potential for the Use of Recycled Plastics in the Production of Plastics Packaging*, available at https://www.bkv-gmbh.de/studies/potential-for-the-use-of-recycled-plastics-in-the-production-of-plastics-packaging-in-germany-gvm.html

[632] Naturvårdsverket (2019), Plastic in Sweden - Facts and Practical Advice, A summary of Kartläggning av plastflöden i Sverige (Mapping Plastic Flows in Sweden), available at https://www.naturvardsverket.se/Documents/publ-filer/978-91-620-8854-5.pdf?pid=26005

in plastic bottles than the SUP Directive, mandating a minimum level of 25% recycled content in PET bottles by 2022, and 50% by 2050[633]. In Spain (since 1st January 2020) plastic bags exceeding 50 microns in thickness must contain at least 50% recycled content[634]. Ongoing policy proposals include a measure to impose fees of €0.10 - €0.50 on takeaway food packaging in Portugal, unless at least 25% recycled content can be verified by certification from an independent body[635], whilst in Spain consideration is being given to requiring minimum levels of recycled content in other packaging articles, in addition to those covered by the SUP Directive. Taxes on virgin plastics are currently under consideration in several countries as well (e.g., in Italy, Spain and, beyond the EU, in the UK[636]).

Industry standards related to the definition and measurement of plastic recycled content are currently in use, though few of these relate to the packaging sector specifically. As noted in Section 2.2 above, some EPR schemes incentivise the use of recycled materials in plastic packaging (e.g. a bonus for PP or PE packaging containing at least 50% recycled material in France). The Circular Plastics Alliance is currently working to increase the supply/ uptake of recycled plastics to 10 million tonnes per annum by 2025, though this relates to all plastics, not just packaging. A number of voluntary commitments have been made by industry on the subject. See Annex A – Problem Definition for more details.

3.3 Objectives

The measure aims to establish a clear regulatory requirement for increased uptake of recycled plastic in plastic packaging, stimulating the collection and recycling of post-consumer plastic packaging waste to generate high quality secondary materials. This is to improve the environmental performance of plastic packaging (by reducing the use of virgin materials and encouraging recycling), stimulating the transition to a circular economy.

3.4 Description of the measure

The Commission will establish recycled content targets and associated reporting requirements for plastic packaging to be met by economic operators placing packaging on the EU market (potentially at the level of brands, though further clarity is needed in defining this term) from the year 2030 onwards. The levels of the targets have been set below what is considered achievable for some packaging types to reduce the need for exemptions. In terms of the implementation and enforcement of the measure, two key approaches have been considered –

- targets on packaging placed on the EU market, which may be met as averages across groups of packaging items (measures 35 a and b), which represent the measures taken forward to the impact assessment here.

[633] Member State Questionnaire response from Belgium, September 2020

[634] Member State Questionnaire response from Spain, September 2020

[635] Member State Questionnaire response from Portugal, September 2020

[636] ICIS News (2021), Italy Plastics Tax: Latest Developments, accessible at https://www.icis.com/explore/resources/news/2021/05/13/10639154/italy-plastics-tax-latest-developments

- targets on packaging placed on the EU market, monitored and enforced at the member state level, which must be met by each and every packaging item (measure 35c). This was proposed as an alternative to measures 35a and b to be considered following the impact assessment. Further work is therefore necessary to fully assess the likely impacts of measure 35c, and to obtain stakeholder feedback on its key elements before a final proposal can be put forward.

The three variants assessed here are:

- **Measure 35a**: Material-specific target for plastic packaging (average across all plastic packaging, applied at brand level)
- **Measure 35b**: Product-specific targets for plastic packaging (average across each of 5 plastic packaging product groups, applied at brand level)
- **Measure 35c**: Targets based on contact-sensitivity/ broad application of plastic packaging, applying to every item of packaging

3.4.1 Measure 35a: Material-specific target for plastic packaging (average across all plastic packaging, applied at brand level)

The target would be specified as a minimum average percentage (by weight) of recycled plastics to be used across all plastic packaging placed on the EU market. An implementing act to establish harmonised rules for the calculation, reporting and verification of recycled plastics against the target should be provided for alongside this requirement (as suggested in measure 37). The target would be set at the level of:

- 25% (low ambition);
- 30% (medium ambition);
- 40% (high ambition).

A target level of 30% is proposed for 2030, based on initial consultations with stakeholders and considering the technical, economic and legal barriers to incorporating recycled plastics in packaging at present. A lower target (25%) is also considered, to reflect a less optimistic scenario with regards to the supply of adequate quantities and qualities of recycled plastics. Similarly, a higher target level of 40% can be assessed assuming that recycling capacity increases more significantly than projected due to the commercialisation of chemical recycling technologies and increased mechanical recycling capacity due to high recycling targets and increased volumes of recyclable packaging by 2030 (see Annex Impact Assessment for Intervention Area Recyclability).

It is important to note that unlike the targets introduced in the SUP Directive, the target would not apply at the Member State level, but rather, at the level of individual brands placing packaged products on the EU market. In addition, these targets are not intended to apply to every single unit of packaging placed on the EU market, such that each one must contain an equal minimum amount of recycled content by 2030 in accordance with the level of the target set. Instead, this is applied as an *average* target across the packaging portfolio of a particular brand, such that some types of packaging may exceed the recycled content target in order to make up for those in which such high levels of recycled material incorporation are not yet technically or economically feasible. Setting the target in this way allows flexibility to the brands in the choice of which polymers, packaging applications and products are most suited to meeting the target. This is important given the wide variations in legal, technical, and economic feasibility associated with including recycled plastic in plastic packaging at present.

Setting the target at brand level also protects the smooth functioning of the single market. If an average target would be introduced on Member State level, it may be interpreted and transposed at Member State level in numerous different ways. This would require producers to meet as many as 27 different sets of requirements for plastic packaging across the EU. Similarly, a material-specific target at the level of individual packaging manufacturers (i.e., converters) would be difficult to enforce, as it would create a very large number of obligated parties, many of which are SMEs and/or highly specialised and may therefore be unable to meet such a target due to market barriers or other legal restrictions (e.g., manufacturers of plastic packaging for medical applications). A complex system of exemptions and enforcement, or tradeable credits, would therefore become necessary, which in practice, is not likely to be feasible to implement.

At the brand level, exemptions are still likely to be required in the form of a de minimis threshold based on sales volumes, so that smaller brands are not disproportionately impacted relative to the amount of packaging they are responsible for. Further exemptions may need to be considered for brands that specialise in a single type of product which cannot meet packaging recycled content targets due to other legal restrictions based on consumer health and safety concerns (pharmaceuticals, for example).

In addition, it is noted that although brands are obligated by these targets, they have very little control over the supply of recycled plastics which directly influences their ability to meet the targets in a cost-effective way. In order to ensure that the supply of recycled plastics is increased in proportion to the increased demand created by the targets, therefore, a requirement for all Member States to separately collect all plastic packaging for recycling should also be considered. This supports a shift to harmonised packaging waste collection systems across all Member States, which could be considered as a horizontal intervention area in the future, but has not been assessed here.

Finally, in terms of implementation, monitoring and enforcement, it is anticipated that this requirement will need to be implemented in a separate regulation as opposed to the Directive, both in order to regulate the economic operators directly and also avoid any unintended fragmentation of the market due to differing interpretations of the requirements during member state transposition. Data reported to PROs will form the basis for monitoring and verification activities, which will need to be collated, verified, and published by the Commission at the EU level, while Member State market surveillance authorities will be tasked with enforcing compliance and audits. The role of third-party certification bodies is likely to be crucial to the implementation of the measure (particularly in verification, see measure 37) in order to minimise burden on the Commission (envisaged to be similar to that used in the Renewable Energy Directive).

3.4.2 Measure 35b: Product-specific targets for plastic packaging (5 plastic packaging product groups)

As an alternative to a single average target applied across all plastic packaging, plastic packaging product-specific targets can be specified. This requires some prior knowledge of what is technically and economically feasible depending on the granularity of categorisation used, but is an approach that is more suited to directing secondary material to higher value applications than a material-specific target (measure 35a). However, at present, consistent and reliable data on current and future feasible levels of recycled content by plastic packaging type are lacking,

particularly at the level of granularity required to specify targets by not only application but also contact sensitivity and polymer.

Therefore, average targets are proposed for 5 priority packaging types below, using broader groupings. Once again, it is noted that the targets are applied as an average across the group, with some individual packaging types within the group likely to exceed, and others falling behind, the overall group target. This allows targets to be specified for the majority of plastic packaging on the EU market at present, but with some degree of flexibility regarding the specific applications and polymers that will achieve higher levels of recycled content in order to potentially make up for others such that on average, the group target is met. These packaging groups, and the levels proposed for each, are shown in the table below:

Table A-3 Proposed 2030 targets per packaging group

Packaging group	Proposed 2030 target
Plastic bottles, flasks, carboys and similar articles (<5L in capacity) including their caps and lids (including contact sensitive applications in this category)	55%
Plastic pots, jars, tubs, trays, punnets and similar articles (including contact sensitive applications in this category)	15%
Plastic films used in primary packaging applications including pouches, bags, liners, peel-off lids, wraps, etc. (including contact sensitive applications in this category)	25%
Plastic films used in secondary packaging applications including stretch and shrink wrap, liners, sacks, bubble packing, envelopes, etc. (including any contact sensitive applications in this category)	70%
Plastic crates, pallets, boxes and bulk storage containers and similar articles (including any contact sensitive applications in this category)	70%

It is noted that in proposing the target levels above, further distinction is not made either based on the contact sensitivity of the given applications (e.g., food contact, cosmetics, pharmaceuticals, toys, etc.) or for specific polymers. This is because it is assumed that the targets are achievable as a minimum average across all polymers and applications within a given group. For example, the target for pots, tubs and trays has been set relatively low to account for the fact that most packaging in this category is used in food contact applications, in which the use of recycled materials is currently restricted (particularly for polymers other than PET). Since the targets already take these factors into account, no exemptions are proposed to be included in the PPWD.

In all other aspects (point of application, exemptions, implementation and enforcement), the proposal for the design of these targets is the same as that in the material-specific targets (measure 35a). In addition to the calculation methodology, either the implementing act accompanying these targets or separate guidance should provide further clarity on the exact packaging types within each group.

3.4.3 Measure 35c: Targets based on contact-sensitivity/ broad application of plastic packaging

This measure would set mandatory targets for recycled content in plastic packaging from the year 2030 onwards, with the following key differences in design from those in 35 a and b:

- The targets would be applied as a requirement on each item of obligated packaging as opposed to an average to be met across a group of packaging items;
- The basis for the targets would be packaging placed on the EU market, such that they would be implemented, monitored and enforced at the level of Member States, as opposed to EU-wide by the Commission; and
- The targets would be differentiated based on types of application and contact sensitivity as opposed to broader product groups or material.

Accordingly, the targets would be implemented within a new article in the Directive, requiring Member States to ensure that from 2030, economic operators incorporate a minimum amount of recycled plastics in each item of plastic packaging belonging to a specified category placed on the EU market. The targets would be calculated as the mass of recycled plastics expressed as a percentage of the total mass of the packaging item placed on the EU market.

The initially proposed categories for such targets and the associated target levels are provided in the table below. These figures are provisional only and are therefore subject to change pending further stakeholder engagement, research and analysis. Further detail on the rationale that underpins this initial proposal is provided in the sections that follow.

Packaging Category	2030 proposed target	2035 proposed target
Contact-sensitive rigid packaging		
Primary packaging	30%	50%
Secondary/ tertiary packaging	10%	25%
Contact-sensitive flexible packaging		
All (primary, secondary, tertiary)	10%	25%
Non-contact-sensitive packaging		
All (primary, secondary, tertiary)	50%	70%

It can be seen that a distinction is made firstly between contact-sensitive and non-contact sensitive packaging. This reflects the current legal restrictions placed on the use of recycled plastics in several packaging applications that present potential risks to human health and safety, including (for example) primary packaging intended for healthcare/pharmaceutical

products[637] or food contact[638], and for certain cosmetics[639] deriving from those same requirements. Therefore, to reflect these restrictions, the targets for non-contact sensitive plastic packaging are initially proposed to be higher than those for contact-sensitive counterparts. It should be noted that the terms contact sensitive and non-contact sensitive are not currently defined in EU law. Therefore, further work is needed to clarify this, either in an Annex to the PPWD specifying the types of packaging that this refers to, or in the form of a definition in Article 3 referring potentially to the relevant legal restrictions the term is meant to cover (e.g., Regulation (EC) No 282/2008).

A further distinction is made between rigid and flexible packaging, though only in the context of targets for contact-sensitive packaging applications. This reflects the fact that recycled PET is the only recycled plastic polymer that can currently be used widely in food contact and other similar applications based on the relevant regulation[640]. Given that contact-sensitive packaging made of rPET is therefore not restricted in the same way as contact-sensitive packaging made of other polymers, and that rPET is technically more suited to rigid packaging applications than flexible ones, it follows that the targets for contact-sensitive rigid packaging should be higher than that for contact-sensitive flexible packaging.

Similarly, a final distinction is made between primary and secondary/ tertiary applications, in the context of contact-sensitive rigid packaging only. This is because within the contact sensitive rigid packaging category, rPET is mostly used in primary packaging applications (bottles in particular), rather than in secondary/tertiary applications.[641] Hence, the targets for contact-sensitive rigid primary packaging are higher than that for the relevant secondary/tertiary sub-category, in which the only ways to increase recycled content at present would be a switch to PET materials or multi-layer production (with a recycled mid-layer encapsulated in virgin inner and outer layers. This would risk creating too much competing demand for limited supplies of rPET and the potential for material shifts and packaging designs that changes that could have negative environmental or regulatory consequences.

As was the case in the use of the term "non/contact sensitive", the terms rigid packaging and flexible packaging are commonly used across industry, though no legal definition currently exists in EU law. Therefore, this term requires further definition to ensure that plastic packaging with both rigid and flexible properties are clearly classified. An example of a definition of flexible packaging that could be used is one based on the ISO Packaging vocabulary,[642] i.e, flexible packaging is "packaging whose shape is likely to change after the contents are added or removed". This appears to be aligned with definitions used by the US packaging industry, and could include wording along the following broad lines in Article 3 of the PPWD: "flexible packaging is packaging made of flexible or easily yielding materials, which when filled or closed, can be readily changed in shape. The construction may be of paper, plastic, metal foil, or any

[637] See https://www.bpf.co.uk/design/recycled-content-used-in-plastic-packaging-applications.aspx, Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices

[638] Commission Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food

[639] See Section 3.4 of Commission Implementing Decision on Guidelines on Annex I to Regulation (EC) No 1223/2009 on cosmetic products

[640] Regulation (EC) No 596/2009

[641] Eunomia for PRE (2019), PET market in Europe State of Play, https://www.plasticsrecyclers.eu/_files/ugd/dda42a_c4c772a57d6b4fcaa3ab7b7850cb536c.pdf

[642] https://www.iso.org/obp/ui/#iso:std:iso:21067:-1:ed-1:v1:en

combination of these and typically takes the shape of a bag, film, lidding, liner, overwrap, pouch, rollstock, sleeve, or wrap."[643]

Rigid packaging could similarly be defined with reference to the ISO vocabulary as "packaging whose shape remains essentially unchanged after the contents are added or removed". However, to ensure that the entire packaging market is covered, the corresponding definition of rigid packaging could also be specified to simply include everything that is not covered by the flexible packaging definition, i.e., "rigid packaging is any packaging that is not flexible, as defined in Article XX". Given that grey areas are likely to persist, these broader definitions should be subject to further revision through stakeholder engagement, and ultimately clarified, alongside detailed examples, in an implementing act to determine the way in which they should be interpreted alongside the definitions of the terms "plastics" and "non/contact-sensitive" for the purposes of calculating attainment against the targets above.

With regards to the use of the terms "primary", "secondary", and "tertiary" packaging, Article 3(1) in the PPWD already provides a useful basis for distinction between these types:

> *Packaging' consists only of:*
>
> *(a) sales packaging or primary packaging, i. e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase;*
>
> *(b) grouped packaging or secondary packaging, i. e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics;*
>
> *I transport packaging or tertiary packaging, i. e. packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packagings in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, ship and air containers.*

However, this is unlikely to be sufficient to support the implementation of the targets above, as in many cases, these definitions can be interpreted to imply that some forms of secondary packaging may also be considered to be primary packaging, e.g., a multipack of potato chips in which the smaller individual packets within the larger are not meant to be sold to the consumer individually. This has resulted in some forms of secondary packaging being produced to the same specification as primary packaging since the final intended use of the secondary packaging is not clear. For example, crates and pallets used for food-contact applications are often manufactured to align with food contact requirements to reflect the fact that the food items contained within them are not always protected by primary packaging (e.g., loose fruit and vegetables). Therefore, the determination of which target should apply in such cases would be challenging, potentially creating incentives for producers to change the design of their packaging for no functional or environmental benefit in order to avoid higher recycled content targets. Therefore, these definitions should be updated and made fit for purpose for the implementation of the targets.

[643] https://www.flexpack.org/industry-overview

3.5 Links to other measures

- The measure is linked to the establishment of a harmonised definition of the term "recycled content", as well as a consistent methodology for calculating, reporting and verifying recycled content in packaging (Measure 37: Harmonised definition and measurement method)
- There is an overlap with Measure 34b: Introducing a mandatory reporting requirement for recycled content in all packaging, which requires packaging producers to report on recycled content in packaging.

3.6 Assessment of Measure 35a: Material-specific target for plastic packaging (average across all plastic packaging)

3.6.1 Effectiveness

The use of recycled plastic in packaging in the baseline is expected to increase from ~12% on average at present to reach a level of ~15% average recycled plastic content across all plastic packaging by 2030 (mostly due to the impact of the SUP Directive targets for beverage bottles).

The table below summarises the estimated increase in recycled plastic material use (expressed in both tonnes and percentages) as a result of the measure, modelled at different target levels relative to the 2030 baseline. These figures do not take into account any exemptions for small producers that may be necessary, and should therefore be considered as an optimistic estimate.

Table A-4 Estimated additional recycled plastic uptake for Measure 35a

2030 proposed target level	Estimated additional recycled plastic uptake in packaging relative to 2030 baseline	
	(thousand tonnes)	(pp relative to baseline of 15%)
25%	~+2,100	~+10pp
30%	~+3,100	~+15pp
40%	~+5,200	~+25pp

The extent to which these figures represent an overall increase in recycled plastics uptake is unclear, as material may simply be diverted from other sectors such as rigid household items, automotive parts and textiles to packaging. However, insofar as this may encourage the development of more circular material and waste policies in other sectors, this may have an indirect benefit. In either case, the regulation of plastic sectors beyond packaging is out of the scope of the PPWD.

Given that the target is set as an average to be achieved by brands across all plastic packaging, it is not expected that all packaging types will achieve the target level, with some going beyond this to make up for those that (due to legal or technical constraints) cannot. While this feature of the target's design is crucial to allow brands flexibility in meeting the targets without significant risk of market disruptions, it makes the modelling of impacts at the level of specific packaging types challenging, since brands may choose to meet the target across their product

portfolios in numerous different ways. However, differing impacts between food contact and non-food contact plastic packaging were considered in the analysis. These are very uncertain, as the composition of packaging placed on the market is likely to change significantly by 2030. Nonetheless, they provide a useful illustration of the effectiveness of the target at a more granular level.

Stakeholders anticipated that in reality, this target will be met largely by around 45-50% of all plastic packaging, with the remainder continuing to achieve relatively low, or zero, levels of recycled content due to other legal restrictions (the regulation of food contact applications being key among these). The share of impacted plastic packaging includes plastic beverage bottles, which are already subject to a 30% recycled content target in 2030 under the SUPD and may have to go further than this to support the attainment of this new PPWD target. This is because they are likely to be a relatively straightforward application within which to incorporate additional recycled material, in existing production processes and for which recycled plastics of a suitable quality to meet the food contact regulations is already available. This outcome is likely to be driven by both the 90% collection rate target for single use plastic bottles under the SUPD and commitments already made by the major beverage brands with respect to recycled content that significantly exceed 30%. Other items that are likely to be impacted include mostly non-contact sensitive plastic packaging applications, including non-beverage bottles, rinse-off cosmetics packaging, non-food packaging and secondary plastic packaging (including a large proportion of films).

For brands that do not have sufficiently diverse or large portfolios of packaging to compensate for low recycled content levels (e.g. pharmaceuticals, cosmetics, SMEs, etc.), exemptions may be considered as mentioned in the description of the measure, although it is noted that the targets are intentionally set at a low level to account for these cases. To some extent however, in the absence of exemptions, the targets could engender a shift from some polymers to rPET in contact sensitive applications, since other recycled plastics may not meet the associated legal requirements. In other cases, there may be a shift away from plastic packaging altogether to avoid the targets. In addition, industry anticipates that the development of chemical recycling technologies will enable the use of recycled plastic in such applications by 2030, although the extent of this is currently uncertain and has therefore not been accounted for in the level of the targets proposed at present.

Assuming in the worst case that non-PET food contact plastic packaging, plastic packaging for medical applications, and plastic packaging for regulated cosmetics do not include any recycled content by 2030, the remaining plastic packaging applications will, on average, need to contain anywhere between 35%-60% recycled plastic by 2030 (depending on the level of the target – 25%, 30% or 40% - that is set). It is noted that these applications do not always represent the highest quality applications for recycled materials, and that they themselves need to be recyclable in order to ensure that material value is maintained for as long as possible in line with circular economy objectives. A more pragmatic scenario is therefore also considered below.

In this case, given the ongoing advances in chemical recycling technologies (that may allow the incorporation of more recycled plastics in food contact applications in the future) as well as advances in mechanical sorting and recycling techniques and plastic manufacturing processes, it is likely that some level of recycled content will be achievable in non-PET food contact plastic applications by 2030. Indeed, several food contact applications besides beverage bottles already do incorporate some recycled plastic content, albeit at relatively low levels. Based on this assumption, for a given target level, the average recycled plastic content levels in 2030 are

expected to be achieved between food contact and non-food contact applications with the following distribution:

Table A-5 Estimated recycled plastic content food vs non-food per target levels in Measure 35a

2030 proposed Target level	Estimated recycled plastic content in 2030	
	food	non-food
25%	~20%	~33%
30%	~23%	~40%
40%	~32%	~52%

Based on these figures, the targets are likely to be effective in improving the environmental performance of packaging by reducing reliance on virgin materials. This is discussed further in Section 2.3.

However, it is unclear whether this will correspond to an increase in plastic packaging waste collection and recycling levels relative to the baseline. This is because despite the increase in demand for recycled plastics that is the direct result of the measure, recycling levels are already expected to increase significantly in the baseline given the effects of the revised recycling targets (55% by 2030) and other revisions to the PPWD in 2018 that are still being implemented. Recycling rates will be impacted further by the measures proposed in the Recyclability intervention area of this study. In addition, as mentioned above, there may be some positive impact on the quality of recycling due to heightened demand for recycled plastics that meet a particular standard for packaging applications, but in terms of quantity of material, this may simply be diverted from other sectors/ export markets rather than representing an increase in overall recycling levels.

Finally, as described in section 3.6.2 below, the measure may need to be accompanied by a requirement for Member States to separately collect all plastic packaging for recycling, to guarantee the supply of recycled materials (to the extent possible) to obligated brands that otherwise have no control over this aspect of the market. This would suggest some scope for additional collection, sorting and recycling of plastic packaging waste streams, though the likely magnitude of this impact is uncertain. It was therefore not possible to determine any additional impacts on levels of plastic packaging recycling associated with the recycled content targets in the model in this context.

3.6.2 Ease of implementation

The measure is likely to be challenging to implement, given the lack of experience with recycled content targets in the sector to date. It is likely that a regulation will be necessary in place of the Directive, in order to enable the Commission to directly obligate economic operators and prevent any divergence in the interpretation of the Directive's requirements during member state transposition (given that the targets are proposed to be applied at EU level rather than member state level, this would severely undermine the measure).

This is linked closely to measurement methodology and definitions underpinning the target (see Measure 37: Harmonised definition and measurement method), with the need for post-

consumer recycled plastics to potentially be calculated separately from pre-consumer fractions requiring particular attention.

The fact that the target is set at the brand level and is applied as an average across all plastic packaging allows a degree of flexibility in compliance, and prevents unintended risks of market disruption due to perverse incentives in favour of one type of packaging over others, or price volatility and competition for materials due to imbalances in material supply and demand. However, from the perspective of implementation, this may be challenging to monitor and verify, as may any provision for a de minimis threshold for exemptions to SMEs and producers of products that are legally restricted from using recycled plastics (such as pharmaceuticals/ food contact applications). For example, the nature of enforcement activity must be considered. If applied stringently, a brand that does not meet the target in a given year would be ruled off the EU market entirely – this appears disproportionate and likely to have negative impacts on consumers and supply chains. Instead, a system of fines could be implemented, though the establishment of an appeals system to settle disputes in interpretation will likely be burdensome the Commission, Member States and industry.

To some extent, the use of existing PRO datasets, and Member State surveillance systems could be leveraged to minimise duplication of effort. In addition, the development of an EU wide packaging register will be necessary to support data gathering and enforcement which will undoubtedly be challenging to implement, but would result in numerous benefits in the enforcement of the targets, particularly allowing them to be monitored at the level of brands placing packaging across the EU market as opposed to at the individual Member State level. However, the development and maintenance of such an EU-wide register is not considered feasible for the Commission at present, and this therefore compromises the overall feasibility of implementing this measure.

An accompanying requirement for Member States to collect all forms of plastic packaging waste, if found to be necessary, would likely also be challenging to implement, though given existing requirements for separate collections against the backdrop of increasing recycling targets, this will already be occurring in the baseline to some degree. Therefore, no such assumption has been used in the impact assessment.

3.6.3 Administrative burden

Additional administrative burden is anticipated for the Commission and Member States, including market surveillance authorities and PROs, given the challenges set out above.

A one-time cost to brands to register their obligated packaging at a more detailed level of granularity, and to subsequently report recycled content levels annually to demonstrate compliance will also arise. However, the ongoing administrative burden to brands associated with determining the best allocation of recycled materials across their packaging portfolios to meet the average target, compiling the necessary data across their packaging supply chains and undertaking the necessary calculation and verification procedures will likely be high.

Further down the supply chain, packaging converters and plastic producers will need to comply with any verification processes, which may require them to collect and report additional data. Food contact packaging producers that currently do not use any recycled plastic content and are therefore not subject to Commission Regulation (EC) No 282/2008 may also have to bear costs associated with complying with this regulation in the future.

3.6.4 Economic impacts

It is noted that due to fluctuating prices and the significant uncertainty around recycling capacities and related technological developments, it has not been possible to model the economic costs of this measure. As noted in Section 3.6.1, the expected increase in collection and recycling capacity in the baseline has not yet been realised, making the attribution of any additional impacts to the measure unfeasible.

However, in qualitative terms, the economic impacts of this measure are likely to be negative in the short term, as increased demand for recycled plastics drives prices up with a corresponding increase in plastic packaging production costs (which may be transferred to brands, and onwards to the consumer). There may be additional costs associated with changes to production processes that will be necessary to allow greater quantities of recycled plastics to be incorporated in packaging. It is noted that in the high target level scenario (40%) in particular, it is more likely that brands will switch to other packaging materials for some of their products to avoid excessive costs.

However, in the longer term, as volumes of recycled plastics on the market increase, and confidence in the availability of end markets increases, prices should stabilise. In addition, higher values for recycled material could have the effect of reducing net costs paid by producers to cover the costs of meeting recycling targets (as per the revised EPR requirements).

It is noted that the short term impacts of price increases for recycled plastics are likely to disproportionately impact smaller brands, who are less able to absorb these cost fluctuations and compete with larger brands. One concern, for instance, is that larger producers would buy a significant proportion of the available supply – either simply because of the minimum quantity they need to meet their targets or to demonstrate to their customers that they are going above and beyond their legal obligations. This in turn could increase the price of secondary materials and/ or reduce the availability of recycled material, which would make it more difficult and more expensive for smaller producers to meet their legal obligations. Given that a small number of large brands are responsible for a disproportionate majority of packaging placed on the EU market[644], **an exemption for SMEs** could therefore be considered to prevent negative impacts on competition and innovation in the EU market. The requirements should apply to all brands, including importers and e-commerce fulfilment operators, to ensure that the competitiveness of the EU plastic packaging value chain is not disproportionately impacted.

Some additional impact on consumer welfare may be anticipated in terms of market preferences for certain kinds of packaging. In particular, increased recycled plastic content in packaging is likely to change the appearance of plastic packaging (potentially to include some visible discolouration). This is unlikely to have any significant impact on consumer welfare – indeed, studies have shown that consumers are increasingly willing to pay more for packaging that is perceived to be more sustainable, particularly that made of plastic. Finally, the willingness to pay for packaging that includes recycled content varies in different Member States, and there may therefore be uneven distribution of packaging and costs by brands (with packaging incorporating more recycled content placed in those Member States where willingness to pay for such packaging is higher).

Additional investment in waste collection, sorting and recycling infrastructure may be an indirect result of the measure, particularly if Member States are required to collect all plastic packaging

[644] ReThink Plastic Alliance (2018) at https://rethinkplasticalliance.eu/news/coca-cola-pepsico-and-nestle-found-to-be-worst-plastic-polluters-worldwide-in-global-cleanups-and-brand-audits/

in order to secure supply of recycled plastics, and if demand for specific types or qualities of recycled plastics increase significantly. However, the extent to which these economic impacts will be experienced relative to baseline is unclear, as significant investment in recycling infrastructure is already underway.

Finally, a positive economic impact is anticipated in the form of R&D investment to develop new packaging production processes, sorting and recycling technologies, and plastic packaging formats to enable the targets to be met in increasingly cost-efficient ways over time.

3.6.5 Social impacts

The social impacts associated with this measure include impacts on employment in the packaging and packaging waste sectors, as well as potential consumer impacts.

The net impact on employment is unclear, since the target will not be applied to all plastic packaging, but rather as an average – hence any job losses arising from changes in packaging materials or processes are likely to be balanced out by an increase in employment in other areas. Some additional positive impacts on employment relative to the baseline may similarly be anticipated if an increase in plastic packaging waste collection and recycling is realised, though this is uncertain.

In the context of consumer impacts, stakeholders raised the issue of potential health and safety impacts to consumers associated with the use of recycled plastic in packaging. As noted in Section 3.6.1, the design of the targets allows flexibility to brands in terms of the specific packaging types that will meet the target and they should therefore be attainable within those applications that pose less risk (or that are not contact sensitive). Additionally, packaging applications in these categories are already closely monitored under different regulations, and will continue to be so in the scenario.

3.6.6 Environmental impacts

Given the uncertainty associated with the impacts of the measure on recycling level and plastic packaging production processes, the environmental impacts modelled focussed on a change in materials used, simplistically assuming that virgin plastic materials are directly substituted by recycled counterparts. The table below summarises the impacts in terms of the change in GHG emissions relative to the baseline, as well as the change in the cost of environmental externalities relative to the 2030 baseline (including not only GHGs but also air quality externalities). The impacts are compared across the three levels of the target proposed – as expected, greater positive environmental impacts are associated with higher levels of targets.

Table A-6 Summary of Environmental Impacts for Measure 35a per levels of targets

Summary of Environmental Impacts	25%	30%	40%
Change in GHGs, thousand tonnes CO_2e	-4,330	-6,640	-11,270
Change in GHG + AQ externalities, € million	-1,180	-1,810	-3,070

3.6.7 Stakeholder views

Stakeholders broadly supported the introduction of a material-specific target for plastic packaging (average across all plastic packaging), noting the need for flexibility in the attainment of targets. Additionally, there was broad support for a 30% target without the need for any exemptions, assuming that pre-consumer plastic waste would also count towards the attainment of targets.

A target focussed on post-consumer recycled plastic specifically was not rejected, with agreement on the intention of such a target, though emphasis was placed on ensuring that the target level is suited to the scope of materials that will count, and therefore potentially lowered to 25%. It was agreed that pre-consumer materials should still be allowed to be used in recycled plastic packaging, even if they do not count towards the targets. At a 40% level target, there was uncertainty about the feasibility of meeting these levels given current levels of recycling capacity and concerns around quality standards for plastics.

In terms of implementation, concerns were raised regarding the administrative burden involved with the calculation of an average target, the likely nature of enforcement activity and the potential for this measure to penalise small, specialised brands in favour of large multinationals who were viewed as having greater resource and wider packaging portfolios across which to spread the target requirement.

3.7 Assessment of Measure 35b: Product-specific targets for plastic packaging (5 plastic packaging product groups)

3.7.1 Effectiveness

As discussed in Measure 35a above, the targets within each group of applications are expected to be met as averages across the group – this means they will be exceeded in those specific packaging types that are most suited to recycled content increases, while for others, the target may not be met. Overall, therefore, although the targets will cover all packaging, the measure is estimated to impact roughly 55% of all plastic packaging (based on data from Germany for the year 2017-18)[645], with an average recycled plastic content of 45% across impacted plastic packaging types. This represents an increase in levels of recycled plastics of ~25% relative to the baseline, corresponding to an additional ~5,250 thousand tonnes of recycled plastic material used in the packaging sector.

Noting that the data underpinning the analysis is subject to significant uncertainty, further estimates of the likely changes in recycled content levels across individual plastic packaging types (expressed as both tonnages and percentages) were modelled. However, these are useful to consider the relative impacts within categories alongside those mentioned earlier across plastic packaging as a whole.

[645] GVM Gesellschaft für Verpackungsmarktforschung mbH for BKV GmbH (2020), Study: Potential for the Use of Recycled Plastics in the Production of Plastics Packaging, available at https://www.bkv-gmbh.de/studies/potential-for-the-use-of-recycled-plastics-in-the-production-of-plastics-packaging-in-germany-gvm.html

Table A-7 Estimated additional recycled plastic uptake for Measure 35b

Target category	2030 proposed target level	Estimated additional recycled plastic uptake in packaging relative to 2030 baseline	
		(thousand tonnes)	(%)
Plastic bottles	55%	~+1,850	~+35%
Plastic pots, tubs and trays (PTTs)	15%	~+410	~+10%
Plastic films (primary)	25%	~+720	~+20%
Plastic films (secondary)	70%	~+1,870	~+40%
Plastic crates, pallets, boxes (secondary)	70%	~+440	~+50%
TOTAL	/	**~+5,290**	**~+25%**

3.7.2 Ease of implementation

The implementation of this measure will be largely similar to that described in Measure 35a above since their design is largely similar (targets as averages across the EU market implemented at the level of brands). However, additional effort would be necessary to define the product categories in a specific way, with potential need for an implementing act or guidelines. This is likely to include a significant amount of effort on the part of the Commission, to define them in such a way to ensure clarity and consistency in the interpretation of the packaging categories.

3.7.3 Administrative burden

The administrative burden associated with this measure will be largely similar to that described in Measure 35a above. However, given that each individual target must be implemented, monitored and enforced, there may be a small additional burden associated with the need for additional data reporting, interrogation and publication. Conversely, given that measure 35a covers more types of packaging than this one, it is likely that for obligated economic operators the administrative burden will be higher in 35a to generate the additional data and report.

3.7.4 Economic impacts

The overall economic impacts of this measure will be largely similar to those discussed in Measure 35a. However, the distribution of these impacts will be different, focussed on the producers of the packaging types that are subject to the product specific targets, while producers of other types of plastic packaging will face no additional costs.

They will also vary between the packaging groups that are included within the scope of the targets, depending on the baseline levels of recycled plastics in each category, and the technical and legal requirements associated with each. For example, the target of 70% on secondary

plastic films could be considered to have a greater economic impact on the associated supply chain than the 25% target on primary packaging films, since the former represents a recycled plastic content increase of 40 percentage points relative to a twenty-percentage point increase for primary films.

However, primary films require a higher quality of material, which is likely to be more costly, and must meet additional criteria, for example, related to the food contact regulations. In addition, given that the baseline recycled plastic content of primary films is estimated to only be around 5%, while that in secondary films is around 30%, the 25% target for the former represents a fivefold increase in recycled plastic content, while the latter is required to increase by a little over two times. Therefore, it is not necessary that the packaging groups with higher targets will necessarily bear higher economic costs than those associated with the lower targets.

3.7.5 Social impacts

The social impacts of this measure are anticipated to be very similar to those discussed in Measure 35a above. However, the distribution of these impacts will be different, focussed on the supply chains of the packaging types that are subject to the product specific targets, while there will be no change in employment impacts associated with other, non-obligated packaging types.

3.7.6 Environmental impacts

The scope of impacts here is the same as those discussed for Measure 35a above. However, the table below highlights the scale of these impacts specific to the product-specific targets proposed in this measure. The impacts of each of the five categories would be proportional to the tonnage of recycled content uptake per packaging type (see section 3.7.1 above).

Table A-8 Summary of Environmental Impacts for Measure 35b

Summary of Environmental Impacts relative to baseline in 2030	
Change in GHGs, thousand tonnes CO_2e	-11,300
Change in GHG + AQ externalities, € million	-3,070

3.7.7 Stakeholder views

Stakeholders noted the benefits of this measure in potentially enabling recycled plastic materials to be directed towards the most beneficial applications, as well as in making implementation and enforcement more straightforward from industry's perspective. Some preference was indicated for making targets even more focussed (i.e. broken down by polymer/ more granular applications/ contact sensitivity). However, given the lack of data at present regarding current and future potential recycled content levels at this level of granularity, stakeholders agreed that there was significant risk of unintended consequences if such targets were set without underpinning analysis.

Additionally, while stakeholders agreed that each individual target proposed within a packaging application group is feasible to attain, and that the level of flexibility within each group is desirable, there was still concern about whether competing demand for recycled plastics across the packaging application groups would render them unfeasible. Measures to increase and further disaggregate the recycling targets were therefore considered, but discarded from the impact assessment as part of the Recyclability intervention area. Finally, questions were raised

regarding the framework of incentives created by application specific targets, whereby packaging applications in which recycled content is most easily integrated are currently being burdened with higher targets (and any associated costs) compared to those with lower potential to include recycled content (which should somehow be viewed as poorer performers and therefore penalised to a greater level).

Concerns regarding the implementation and enforcement of the measure mirrored those expressed for measure 35a.

3.8 Assessment of Measure 35c: Targets based on contact-sensitivity/ broad application of plastic packaging

3.8.1 Effectiveness

In the absence of a quantitative impact assessment, the measure's effectiveness cannot be accurately estimated. This being said, the measure will be effective in stimulating an increase in the uptake of recycled plastics in packaging, with each and every item of packaging impacted (albeit to differing degrees). The inclusion of contact sensitive packaging types in the targets is also likely to result in higher quality recycling and materials being targeted at higher value applications than would be the case in either measures 35a or b. However, these impacts are associated with certain risks of unintended consequences, which may result from switches between packaging types and heightened competition for secondary materials for which demand may outstrip supply.

It is further noted that there is an overlap between the 2030 targets proposed here and the target already set in article 6(5) of the SUPD for SUP beverage bottles in 2030 (which would fall under the category of rigid contact sensitive primary packaging). The target level here has therefore been set at 30% in 2030, to ensure that there is no conflict with the level set in the SUPD. However, a key difference lies in the fact that the SUPD targets may be implemented as an average across a group – meaning that depending on MS transposition of the requirements, the target is not necessarily applicable to each and every SUP beverage bottle, with the outcome that some SUP beverage bottles (notably those made of rPET) are likely to exceed the target to make up for others (rPP, rHDPE) which cannot. Conversely, the targets proposed here require that each packaging item in the relevant category attains a minimum level of 30% recycled content – including the rPP and rHDPE SUP beverage bottles that for the same reason did not necessarily have to meet this target as per the SUPD requirements. This potential conflict with the SUPD therefore bears further legal consideration.

One solution may be to exempt SUP beverage bottles from the targets proposed in this measure for the year 2030 in view of the requirements already set in the SUPD, including them instead in the scope of the 2035 PPWD target. The remainder of packaging in the rigid, contact sensitive, primary packaging category can then feasibly be subject to a higher target than 30% in the PPWD in 2030. This would also involve updating the SUPD in the 2027 revision to make clear that the targets in Article 6(5) no longer apply from 2035 onwards. From a technical perspective, this represents a missed opportunity, since PET beverage bottles are widely accepted to be a packaging application in which high levels of recycled content uptake and circularity are already feasible (far exceeding the targets set in the SUPD) and would therefore ideally be subject to higher targets than even the 30% proposed in this revision of the PPWD.

3.8.2 Ease of implementation

Member States will be required to report to the Commission against minimum targets for the proportion by mass of "recycled plastic content" that must be contained in each item of packaging belonging to a specific category that is placed on the EU market. Member States are required to pass on the burden of compliance against these targets to "economic operators", which is a term that must be further defined in the Directive to prevent confusion and diverging interpretations by Member States.

At the same time, a framework for calculation and verification against these targets must be established. This should include, as a minimum, definitions for the term "placed on the market" in this context, and for what should count as "recycled plastic content", in Article 3 of the PPWD. In addition, clarity on the packaging categories established in the targets should be provided, as definitions in Article 3 or in an Annex accompanying the Directive.

This is therefore closely linked to measure 37, creating a requirement for the Commission to establish an implementing act to set out the calculation and verification methodology by a certain date in advance of the enforcement of the targets, as well as the timeline for Member States to report against these targets (e.g. per calendar years, with reporting a maximum of 18 months after the date of implementation- July 2032 for the targets first enforced in January 2030). As part of this, further direction should be laid out in the Directive itself to establish the methodological basis for any verification (i.e., the acceptable chain of custody approach to be adopted), as well as the mechanism for such verification (as discussed earlier, authorised third party certification processes could have a role to play here).

In terms of monitoring and enforcement, Member States should be encouraged to make use of existing electronic registries and PRO reporting databases as a mechanism to gather the necessary data, which would ideally be harmonised in content (see measure 42). Additionally, market surveillance authorities should be empowered to support monitoring and enforcement activities at the level of obligated economic operators, which is enabled by the application of the targets at the packaging item level, along with a certification process.

Finally, given the above considerations around the structure and level of these targets, as well as the current limitations of this proposal in terms of a lack of robust data and analysis, this measure in its current form is associated with a high degree of uncertainty and risk of unintended market consequences. This is exacerbated by considerable uncertainty around the development of the EU packaging market over the nine years leading up to 2030, when the targets are first proposed to apply. Therefore, the following supporting framework of implementation is proposed to reduce the potential negative impacts of these risks –

- A provision should be made within the Directive to allow the Commission to revise these targets in a delegated act, allowing time to monitor the data arising from the reporting requirement above and market developments in terms of the supply and demand of requisite recycled plastics to meet these targets.
- The measure should be implemented alongside measure 34, such that reporting by economic operators to Member States and, subsequently, the Commission, on recycled content levels is made mandatory for all packaging placed on the EU market by 2025, followed by the implementation of targets for recycled plastic content levels in plastic packaging in 2030. This allows valuable data to be gathered to inform any necessary amendments to the targets set above, and allows economic operators to adjust their supply chains and practices in line with new verification procedures before the mandatory targets are imposed.

- The measure should be implemented after further development of measure 37 and in view of the results from the Commission's ongoing work to develop rules on the calculation, verification and reporting of recycled content against the targets in article 6(5) of the SUPD and more broadly applicable thinking emerging from this work. This is because:
  - Decisions regarding the specific materials that may count as 'recycled' for the purposes of the target and the acceptable methodologies for chain of custody verification and for allocation rules under 'mass balance' (particularly relevant to chemical recycling) have a direct bearing on the approach and ability of the market to meet the targets and therefore the levels at which the targets should be set;
  - The combination of these factors will effectively establish a framework of incentives for increased investment in the use of specific plastic packaging materials and types, as well as in recycling infrastructure to support increased quantities of specific recycled plastic outputs of a certain quality; and
  - The absence of a regulatory framework of verification that encourages transparency and proportionality, and that is considered reliable by civil society and consumers, may result in greenwashing and a lack of credibility among consumers at best, and a shift to sub-optimal systems of recycling with negative environmental consequences at worst.

Given that this measure was introduced at a late stage in this study, in response to the findings of the impact assessment of measures 35a and b, further effort will be required on the part of the Commission to more fully develop measure 35c. This should include the necessary data gathering and stakeholder consultation needed to develop the necessary definitions and finalise the levels of the targets, in combination with the with work on acceptable methodologies for allocation and chain of custody verification, as part of a comprehensive framework. This latter element is particularly important for this measure, because as noted above, there is a direct interaction between the level of the targets and the allocation rules under mass balance where chemical recycling is utilised. As such, the same target level might have quite a different impact on the market under one set of mass balance allocation rules versus another, requiring significantly more (or less) chemical recycling capacity to be developed to meet the same target. This issue is likely to be of particular relevance to the targets for contact sensitive packaging (perhaps especially flexible contact sensitive packaging), where mechanical recycling cannot currently meet the regulatory requirements in respect of food contact applications.

35c applies to each item of packaging placed on the market. This difference relative to 35a and b results in reduced flexibility within the market and requires packaging formats and materials that are not currently able to incorporate recycled content as a result of regulatory barriers (e.g. PP and PE in contact sensitive applications) to 'solve' these technical challenge, either through chemical recycling or significant technical advances in mechanical recycling. As such, although well-reasoned targets have been proposed here, they should be considered illustrative at this stage, as they cannot be finalised in the absence of work on allocation rules and chain of custody verification, which in turn would require significant stakeholder engagement.

Ideally, a full quantitative impact assessment should be carried out to test the initial findings discussed here. The development of a delegated act to adjust the target levels on the basis of this analysis may therefore be necessary.

3.8.3 Administrative burden

As was the case for measures 35a and b, additional administrative burden is anticipated for the Commission and Member States, including market surveillance authorities, PROs and third-party certification bodies that will be involved and monitoring and verification.

Following these implementing steps, as with measures 35 a and b, a one-time cost to economic operators to register their obligated packaging at a more detailed level of granularity (rigid vs flexible, contact vs non-contact sensitive, primary vs secondary vs tertiary), and to subsequently report recycled content levels annually to demonstrate compliance will also arise. The additional ongoing administrative burden to these operators associated with meeting the targets and coordinating across packaging supply chains to compile and report the necessary data will likely be high. However, this should be lower than the burden associated with also determining the best allocation of recycled materials across a packaging portfolio and calculating the average, as was the case in measures 35a and b, since here, each and every item of packaging must meet a clearly predetermined target. This should therefore be more straightforward to implement.

Further down the supply chain, packaging converters and plastic producers will need to comply with any verification processes, which may require them to collect and report additional data. Food contact packaging producers that currently do not use any plastic recycled content and are therefore not subject to Commission Regulation (EC) No 282/2008 may also have to bear costs associated with complying with this regulation in the future.

3.8.4 Economic impacts

Due to several uncertainties regarding the development of the market for recycled plastic materials in upcoming years as well as the target levels as discussed above, a quantitative assessment of the economic impacts of measure 35c has not been feasible. However, in qualitative terms, the economic impacts are anticipated to be broadly similar to those discussed in the assessment of measures 35a and b, but with a potentially important difference of more directly driving investment in innovation and infrastructure for non-mechanical recycling and more advanced forms of mechanical recycling.

It is noted that given the application of the target on each packaging item rather than as an average across a group, a further likely outcome of this measure within the contact sensitive rigid primary packaging category is a shift from the use of other polymers to rPET in the manufacture of most of such packaging. This effect will be more pronounced at higher levels of the target, due to the stringent requirements on the use of recycled plastics in contact sensitive applications that to date only rPET can be used to achieve. This may result in significant market disruption, particularly if the desired quantities of rPET cannot be supplied to meet the targets, or the targets are set too high in this regard. To some extent, the SUPD requirement for a 90% collection rate for SUP bottles will mitigate this risk, by increasing the supply of waste PET bottles that can be reincorporated in the packaging sector. However, competition for this high quality, homogenous material is already intense, both within the packaging sector and across others (e.g. a large amount of rPET is currently used in the textiles sector). There will be significant demand from the beverage sector driven by brand commitments as well as mandatory targets, and the low yield of material from non-bottle PET packaging waste recycling processes may exacerbate a structural deficit in rPET supply to some parts of the market (e.g. pots, tubs and trays). This limited supply coupled with competition and high levels of demand would push rPET prices up, stimulating the recycling industry but effectively driving out smaller

packaging producers and supply chain operators who are not able to compete. It is therefore suggested that provision should be made to revise the proposed targets prior to 2030 based on the development of the market till that date. Exemptions for SMEs may also be considered to mitigate these impacts, although this would result in some reduction of the effectiveness and environmental benefits associated with the measure.

Similar consideration must also be given to the setting of the targets for contact-sensitive flexible packaging, in which the potential for the use of rPET to achieve the targets is limited. Instead, in this case, it is anticipated that non-mechanical recycling technologies will play a significant role in ensuring that recycled materials of the necessary quality (to satisfy the legal requirements for contact sensitive applications) and quantities (to meet the targets) are available on the market. This is clearly subject to significant uncertainty, however, given that such technologies are nascent and are yet to be fully assessed and evaluated for their environmental impacts (note ongoing work at the JRC to clarify the role of such "chemical recycling" and "physical recycling" technologies as recovery or recycling operations).

An alternative (or complementary) channel may be through advances in mechanical recycling that, with further investment in research and development, may have the ability to achieve the quality necessary to satisfy the legal requirements for contact sensitive applications. However, the potential for competition rather than coordination between established and more advanced mechanical recycling systems and non-mechanical recycling technologies for certain kinds of packaging waste in this regard must also be considered. As discussed above, the determination of verification approaches and the setting of the target levels are also closely linked to these considerations.

3.8.5 Social Impacts

The social impacts of this measure are anticipated to be very similar to those discussed in Measures 35a and b above, having a long-term positive impact on employment in the recycling sector. Impact in this regard could be expected to be higher than for 35a and b, as investment in high quality recycling of packaging waste materials beyond PET would be more strongly incentivised. However, as the measure has not been subject to a quantitative impact assessment, the magnitude of such impacts is not clear.

3.8.6 Environmental impacts

This measure has not been subject to a quantitative impact assessment, in the absence of which the environmental impacts cannot be estimated. However, the environmental impacts of the measure are anticipated to be positive, in line with and potentially greater than the discussion in measures 35 a and b above, resulting from the substitution of virgin plastic materials and increased recycling of plastics. In addition, given that the measure requires a fixed minimum target for all packaging items placed on the EU market, it is anticipated that the impacts will likely be of a higher magnitude to those described in measure 35b, with targets applying to each and every item of packaging and with a more targeted impact on encouraging recycled plastics to be utilised in higher value packaging applications beyond PET to a greater extent than in 35 a and b.

3.8.7 Stakeholder views

The stakeholder views on measures 35a and b have been used to inform the description of this measure. This includes consideration of the differences in contact-sensitive and non-contact sensitive packaging applications from the perspective of technical and legal feasibility to incorporate recycled content, as well as concerns about the potential enforceability and administrative burden associated with measures 35a and b. However, this measure was added to the study following the completion of all stakeholder engagement activities and workshops, and therefore has not been presented to stakeholders for further feedback and refinement. It is therefore recommended that the Commission undertake further stakeholder assessment of both the measure and its expected impacts to inform and refine the targets.

3.9 Summary and conclusion

In the absence of comprehensive and consistent EU data on recycled plastic material flows by packaging application at present, the targets proposed in measures 35 a and b allow a degree of flexibility in compliance and reduce risks of unintended market disruption (e.g., due to perverse incentives in favour of one type of plastic packaging over others, or price volatility and competition due to imbalanced material supply and demand).

The application of the targets at the level of the EU market, obligating economic operators rather than Member States, also reduces the challenges faced in the implementation of the recycled content targets in the SUPD, for example. Both measures 35a and b would be effective in meeting the objectives of the Green Deal and CEAP 2.0 by increasing the uptake of recycled plastics in the packaging sector, and in generating the associated environmental benefits of doing so. Overall, measure 35b is preferred to measure 35a as it will be more effective in targeting the use of recycled materials to specific packaging applications, and therefore has a greater degree of feasibility in implementation and enforcement, as well as a better distribution of impacts among specific packaging types rather than across the whole packaging market.

However, these benefits must be weighed against the costs of implementation and compliance that the measures entail. The same elements of flexibility that reduce the risks associated with the measure (EU wide application, targets applied as averages rather than item specific) also make the implementation and enforcement of the above proposed targets challenging, with the administrative burden on the Commission and economic operators likely to be prohibitive. The absence of an EU wide register for packaging at present, and the potential difficulties that would be faced by smaller, specialised brands and supply chains in meeting these targets relative to larger multinationals are also of concern.

Therefore, the impact assessment concludes that neither measure 35a nor measure 35b are appropriate for inclusion in the Commission's proposal for revisions to the PPWD. An alternative measure 35c is therefore defined. Further work will be needed to refine the measure and engage with stakeholders and determine its role within the wider body of options for revisions proposed in this study. However, it is anticipated that measure 35c is more feasible from the perspective of implementation and enforcement, and likely to be more effective (with greater environmental benefits), so long as the risks of negative economic consequences due to market distortions can be adequately managed.

4.0 Measure 37: Harmonised definition and measurement method for recycled content in packaging, including reporting and verification

4.1 Problem definition

There is currently no definition of the term "recycled content" in packaging legislation and there is no accepted or harmonised methodology for the measurement of recycled content in packaging placed on the EU market. A lack of harmonisation of these elements risks the smooth functioning of the internal market when targets (mandatory or voluntary) are proposed or figures are calculated and reported on EU level.

Also, industry and Member States are currently proposing a range of voluntary targets and regulatory measures to increase recycled content uptake in the sector. Some brands currently claim recycled content in packaging (sometimes associated with a price premium), and the lack of harmonised definitions and calculation methods poses a problem also for the verification of such claims, their comparability and transparency.

4.2 Baseline

As mentioned above, there is currently no definition of the term "recycled content" in packaging legislation. A range of definitions and measurement principles are suggested in industry standards at present, though these rarely relate to the packaging sector specifically and are not harmonised.

Work is ongoing to provide clarity on these aspects in the context of the SUP Directive targets for recycled plastic in single use plastic beverage bottles, in the Commission's "Study to develop options for the calculation, verification, and reporting of recycled content with a focus on setting out rules for the implementing act related to certain types of single-use plastic bottles under the Directive (EU) 2019/904 on reducing the impact of certain plastic products on the environment". However, the applicability of these recommendations to the PPWD is unclear, depending on the formulation of requirements and targets (see Measure 34 and Measure 35, above) and how these differ from those in the SUP Directive.

4.3 Objectives

This measure supports the implementation of Measure 34: Updates to the Essential requirements and Measure 35: Mandatory recycled content targets, above, and forms a fundamental basis of the regulatory framework to introduce recycled content related requirements. A key objective is to protect the smooth functioning of the internal market and to ensure consistency, comparability and transparency in the use of terms and calculations related to recycled content in packaging.

4.4 Description of the measure

The PPWD will include a provision for an implementing act to establish a harmonised methodology for the calculation, reporting and verification of recycled content levels in packaging, as well as clarifying the definition of the terms recycled content (and indeed, the scope of any associated terms like "recycled plastics") and placed on the market in the context of the packaging sector.

The exact scope of the measure and the elements of the implementing act will depend on whether either or both Measure 34 and Measure 35 are taken forward in the legislative proposal based on the impact assessment.

The development of a harmonised methodology for calculating recycled content is a key supporting measure to implement mandatory recycled content targets. To maximise efficiency, the development of the implementing act should draw on the findings of the ongoing study to develop recommendations for calculation of the SUPD targets. This will be included in an accompanying implementing act.

Should measure 34b be taken forward, there will be a need to define recycled content in packaging to guide the development of the implementing act. This could follow the definition that is currently commonly used by industry based on ISO 14021, 2016, which states that recycled content is the "proportion, by mass, of recycled material in a product or packaging". However, it is noted that this definition is very broad, and implies that any kind of recycled "material" that is incorporated in the final packaging item may be reported as recycled content. To encourage a greater degree of circularity in the sector, it may be appropriate to also refer specifically to waste of a specific material that has been recycled into new packaging of that same material, referring specifically to the definitions of waste and recycling that are already in Article 3 of the PPWD (and linked to the WFD, i.e., Directive 2008/98/EC). In this case, the above definition for recycled content would be accompanied by definitions for recycled materials relevant to each of the key packaging materials (glass, paper/ card, steel, aluminium, wood and plastic).

For example, and also oo provide further clarity on the scope of the targets in measure 35, a definition for the term **"recycled plastic**" could include the following detail in Article 3 of the PPWD:

> *For the purposes of attainment against the target in Article XX, "recycled plastic" shall mean the outputs of plastic waste recycling that are used in the manufacture of plastic packaging listed in XX and pursuant to the definition of "plastic" in Article 3(1), and "recycling" in Article 3(17) of Directive 2008/98/EC on waste.*

Measure 35 also considers that targets could be specified to focus on increasing the uptake of post-consumer recycled plastics in particular. If this is the case, the definition above should be modified to reflect this change in scope from "plastic waste recycling" to "post-consumer waste recycling". Since the term "**post-consumer waste**" is not defined in legislation, it is likely that further guidance will be required to ensure consistent interpretation of this term. This would ideally be included in the legislation itself, as an implementing act is not an appropriate instrument to introduce such a definition.

Additional elements of the calculation methodology that should be considered as a part of this implementing act are **the measurement points**, particularly the point at which packaging is considered to be placed on the EU market as outlined in measure 35. This should include consideration of the format of the packaging product when it can be considered placed on the market (e.g. empty or filled, when sold to the end consumer or at the end of the manufacturing

process, etc), as well as the point in the supply chain that this corresponds to and the implications for the data gathering and calculation, including those associated with intra-EU movements and third party trade. Finally, consideration should be given to the need for any adjustments in the calculation related to contaminants, moisture, additives etc that may be present in recycled plastics but do not necessarily make their way into the final packaging item.

However, the most important aspect of this measure is the determination of a verification procedure to ensure that the calculation is robust and reliable. This is particularly challenging because there is no way to determine the quantity of recycled plastic in a finished product – necessitating tracing of materials through the supply chain to ensure that what is reported actually corresponds to the recycled content input into a given item. Establishing this physical traceability should be considered a crucial aspect of the implementing act, with any deviations (for example, to allow a batch-based calculation as opposed to an item specific one) needing to be carefully justified. Therefore, a range of chain of custody approaches could be applied, each having its own merits and demerits and resulting in different types and quantities of material being able to be counted as recycled material.

This suggests the need for development of the verification process to be undertaken alongside the finalisation of the level of the recycled content targets, since there is a risk of adopting a too-flexible verification process that would render a recycled target meaningless or not ambitious enough, and vice versa. The determination of the level of any recycled content target should therefore be considered at the same time as the determination of the underpinning verification process, even if the legal implementation of the former is in the Directive with the latter in an implementing act. Finally, the Directive should also make clear any provisions regarding the actual implementation of the verification procedures that are designed. It is proposed that **authorised third party certification processes**, similar to those used in the Renewable Energy Directive could be considered here as well.

4.5 Links to other measures

As mentioned above, the measure underpins the implementation of Measure 34: Updates to the Essential requirements and Measure 35: Mandatory recycled content targets, above.

4.6 Assessment of Measure 37: Harmonised definition and measurement method for recycled content in packaging, including reporting and verification

4.6.1 Effectiveness

This measure is a prerequisite for the implementation of Measure 34: Updates to the Essential requirements and Measure 35: Mandatory recycled content targets. The effectiveness of Measure 34 and Measure 35 discussed above therefore rely heavily on the implementation of this measure. In the absence of an implementing act harmonising definitions and a measurement method for recycled content in the context of packaging specifically, it is likely that stakeholders will interpret these requirements in a number of different ways, posing significant risks to the smooth functioning of the internal market.

4.6.2 Ease of implementation

This measure is likely to be moderately challenging to implement, depending on the level of clarity and direction provided in the legislation itself. Attention to detail will be required to ensure that the measurement method and associated system of verification is not overly burdensome to implement, while ensuring robust, consistent results and coherence with the intention of the legislation.

Ongoing work to develop recommendations for an implementing act in line with the recycled content targets in the SUP Directive can be drawn on to prevent duplication of effort here, though it will be crucial to tailor these findings to the formulation of the requirements in the PPWD. In particular, a definition of the term "recycled plastic" is explored, though other, potentially significant terms to support the implementation of Measure 34 and Measure 35 are not (e.g. recycled content, recycled paper, etc.).

4.6.3 Administrative burden

The administrative burden discussed in Measure 34 and Measure 35 above will be significantly mitigated for Member States and brands if a harmonised measurement methodology and definition are included in an implementing act. This will prevent differing interpretations of terms and potentially conflicting methods of measurement and verification that different brands may choose to adopt (which would result in enforcement by Member States becoming impossible due to vagueness in the legislation). Any added administrative burden on the Commission is therefore likely to be justified in view of these benefits and the significant impacts on the effectiveness of Measure 34 and Measure 35. The magnitude of this burden will differ significantly based on the chosen approach for verification and certification in the implementing act, and therefore cannot be assessed further in this study.

4.6.4 Economic impacts

This measure is a prerequisite for the implementation of Measure 34 and Measure 35. The economic impacts of Measure 34 and Measure 35 discussed above therefore rely heavily on the implementation of this measure.

4.6.5 Social impacts

This measure is a prerequisite for the implementation of Measure 34 and Measure 35. The social impacts of Measure 34 and Measure 35 discussed above therefore rely heavily on the implementation of this measure.

4.6.6 Environmental impacts

This measure is a prerequisite for the implementation of Measure 34 and Measure 35. The environmental impacts of Measure 34 and Measure 35 discussed above therefore rely heavily on the implementation of this measure.

4.6.7 Stakeholder views

Stakeholders are unlikely to support the introduction of either Measure 34 and Measure 35 above in the absence of harmonised definitions and a measurement method for recycled content. Many noted that this will form a fundamental feature of any framework for increasing

recycled content in the sector. Some expressed preference for the measure to be implemented via an implementing act as opposed to the use of harmonised standards. Some noted there may be a need for an associated standard for labelling of products that contain recycled content in line with the definitions and methodology established in this measure.

4.7 Summary and conclusion

Table A-9 Summary of Impacts for Measure 37

Impact category	Measure 37
Effectiveness	Effectiveness of Measure 34 and Measure 35 rely heavily on the implementation of this measure.
Ease of implementation	Moderately challenging. Attention to detail required for robust, consistent results that are not burdensome.
Administrative burden	Administrative burden for Measure 34 and Measure 35 mitigated through this measure. Added administrative burden on the Commission is likely to be justified.
Economic impacts	Economic impacts of Measure 34 and Measure 35 rely heavily on the implementation of this measure.
Social impacts	Social impacts of Measure 34 and Measure 35 rely heavily on the implementation of this measure.
Environmental impacts	Environmental impacts of Measure 34 and Measure 35 rely heavily on the implementation of this measure.
Stakeholder Views	Unlikely to support the introduction of either Measure 34 or Measure 35 without this measure. Some preference for measure to be implemented via an implementing act as opposed to the use of harmonised standards. May be needed for associated standard for labelling of products that contain recycled content.

5.0 List of discarded measures

5.1 Measure 34: Requirements for recycled content in all packaging

The Essential Requirements were introduced in 1994, and do not include any reference to recycled content, even though the increased uptake of recycled content has been identified as a key feature of the transition to a circular economy in the packaging sector. Recycled content is also not mentioned in the harmonised standards underpinning compliance with the requirements. It has therefore been argued that there is a need to update the requirements to be consistent with the direction of policy in more recent years and to ensure that the use of recycled content is considered in the production of packaging placed on the EU market.

In assessing the scope of this problem, and therefore of the need for intervention, The Plastic Strategy states that "Weak demand for recycled plastics is another major obstacle to transforming the plastics value chain. In the EU, uptake of recycled plastics in new products is low and often remains limited to low-value or niche applications." Noting this emphasis on recycled plastics specifically, paragraph 3.4 of the Commission's communication on the CEAP 2.0[646] also states that:

To increase uptake of recycled plastics and contribute to the more sustainable use of plastics, the Commission will propose mandatory requirements for recycled content and waste reduction measures for key products such as packaging, construction materials and vehicles, also taking into account the activities of the Circular Plastics Alliance.

Therefore, a clear problem to be addressed in the context of the current revision of the PPWD is the lack of uptake of recycled plastics in packaging, as opposed to a wider lack of recycled content uptake across all packaging materials.

Further, a wider analysis of this problem conducted as part of the problem definition in Appendix A highlighted that for several non-plastic packaging types, a similar lack of circularity can be observed, for example, in aluminium foils and beverage cartons. Introducing an Essential Requirement that covers all packaging (both plastic and non-plastic) would therefore be in the interest of maintaining a level playing field across all packaging types, as well as from the perspective of a circular economy, by requiring recycled content to be considered in all packaging placed on the EU market. However, in the absence of reliable and robust data on the current uptake of recycled materials in packaging applications at a suitable level of granularity, the need for intervention to increase recycled content of other non-plastic packaging materials is currently unclear. Indeed, the evidence that *is* available points to the fact that recycled material demand and uptake across non-plastic packaging is already relatively high given the current levels of supply (for rigid aluminium, container glass and corrugated paper packaging, for example).

Therefore, two variants of measure 34 are explored. In the first, it is proposed that reflecting the ambitions of the Green Deal and the new Circular Economy Action Plan, the use of recycled content in packaging could be linked to the Essential Requirements for packaging to be placed

[646] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe, COM/2020/98 final

on the EU market. To operationalise this requirement and enable Member States to enforce compliance with it, the development of a harmonised standard (with a presumption of compliance for producers who use these) is also explored as a part of this measure 34a (Section A.5.1.1) below.

In addition, noting the current lack of data and a clear intervention logic to potentially justify such an Essential Requirement across all packaging at present (and the fact that the Essential Requirements are not suitable to introduce requirements on plastic packaging only), an alternative measure 34b is also considered. This would include a mandatory reporting requirement for all packaging that would be included in the main body of the PPWD as opposed to forming an Essential Requirement, thereby achieving many of the benefits of an Essential Requirement to this effect, but without the same level of stringency which is difficult to justify in the absence of data to support such a requirement.

5.1.1 Measure 34a: Updates to Essential Requirements operationalised through harmonised standards

Wording to the effect suggested below could be considered for inclusion within Annex II as part of the requirements specific to the manufacturing and composition of packaging:

> *"Packaging shall be designed, produced and commercialised in such a way as to substitute the use of virgin materials with recycled materials in so far as this is technically feasible to maintain the necessary level of safety and hygiene for the consumer."*

To operationalise this definition, the development of a harmonised standard to assess the maximum feasible recycled content in packaging was considered, adherence with which would result in a presumption of compliance with the requirement.

It should be noted that there is already a CEN Report (CR 13504) on Packaging – Material Recovery – Criteria for a Minimum Content of Recycled Material, but that this report does not appear to be widely known or used. The report sets out the factors to consider in determining the potential recycled content, but concluded that "the basis for a mandatory stated minimum recycled content in packaging is considered unsound". The report was, however, published in 2000 and does not include an actual process to assess whether the potential recycled content has been maximised – as is recommended here. In addition, EN 15343:2007, Plastics - Recycled Plastics – Plastics recycling traceability and assessment of conformity and recycled content, alongside EN 15342, 15344, 15345, 15346, 15348 are used to improve the traceability of the source of plastic recycled materials and the verification of the quality of plastic recyclates. However, these are not packaging application specific and relate to the recycled material in question, rather than an assessment of the product into which it is potentially being incorporated (which is the subject of the standard proposed here).

Based on feedback received during the previous Essential Requirements scoping study[647], this proposed process in the harmonised standard would therefore take into account at least the following key factors:

[647] Eunomia, COWI, Adelphi, Ecofys (Navigant), Milieu (2020), *Effectiveness of the Essential Requirements for Packaging and Packaging Waste and Proposals for Reinforcement* at https://op.europa.eu/en/publication-detail/-/publication/05a3dace-8378-11ea-bf12-01aa75ed71a1

- The maximum possible recycled content that could be used;
- The maximum recycled content that could be used in the packaging without leading to significant negative impact on the essential functions of the packaging like mechanical strength and flexibility (but excluding impacts such as on marketing or visual appearance);
- Legal restrictions that limit the use of recycled content (such as in food-contact applications).

However, this measure may not be effective at stimulating any significant change in uptake of recycled content, because it does not place any direct requirements / incentives on producers to encourage this. Additional consideration therefore needs to be given to how this measure would interact with mandatory targets for recycled content in packaging (see measure 35), if both were to be introduced. For example, the results of such standardised assessments (if accompanied by reporting requirements) may be useful to guide the level at which recycled content targets should be set. However, care should be given to avoid the results being used as justification for why higher recycled content targets cannot be achieved for a particular packaging material or format, as they would represent only the current state of play as opposed to any future potential for improvements.

Alternatively, undertaking this standardised process could be made mandatory only for those packaging types/ materials in which the feasibility of incorporating recycled content is currently unclear, and for which therefore mandatory recycled content targets cannot be justified. This would force producers of such types of packaging to reconsider whether this is really the case, for example, once impacts on marketing/ visual appearance are no longer considered key barriers. However, there does not appear to be a significant barrier to understanding how to incorporate recycled content in materials other than plastics, making the administrative and implementing burden of this measure unjustifiable. In the case of plastic packaging, the proposed introduction of mandatory targets for recycled plastic content (see measure 35) precludes the need for an assessment of the maximum feasible levels of recycled content, with exemptions and flexibility already inbuilt in the measure to cover packaging types for which achieving the targets is genuinely not feasible. Given these considerations it is recommended that this measure **is not taken forward** and assessed in the impact appraisal.

5.2 Measure 35d: Mandatory Recycled Content Targets for *All* Packaging

To drive improvements in the quantity and quality of secondary material uptake in the packaging sector, it is proposed that mandatory product-specific recycled content targets should be included within the PPWD.

However, recycled content use is already reported to be relatively high for packaging of some materials. For example, the average proportion of recycled content used in packaging across the

EU in 2017 was estimated at 58% for steel packaging[648], ~55% for container glass (average of all colours)[649] and ~89% for corrugated paper packaging.[650]

Additionally, for some materials, such as wood and glass, the introduction of targets for recycled content must consider not only the recycling targets for these packaging materials (which is a determinant of the supply of relevant recyclate), but also in view of the potential for systems for reuse to be expanded for such packaging. For example, although the scope for including recycled content in wooden pallets is reported to be limited, the scope for refurbishment and reuse of such pallets is significant, and, from the perspective of the waste hierarchy, preferable. In such cases, therefore, mandatory recycled content targets may not be suitable to drive additional environmental benefits.

The environmental justification for further increasing recycled content use for packaging of such materials at present is therefore limited. For others (plastics in particular), uptake of recycled content in the packaging sector is limited (aside from single use plastic beverage bottles, for which a 30% recycled content target is in place for 2030). Therefore, mandatory recycled content targets for the year 2030 are proposed to focus on plastic packaging (as per measures 35a, b and c).

5.3 Measure 36: Polymer Substitution Quotas

As an alternative to product based recycled content targets, polymer substitution quotas could be considered. This involves setting minimum quotas on plastic resin manufacturers (both virgin and recycled) requiring them to produce a proportion of recycled plastic resins relative to the overall volumes produced. This would be combined with a credit trading system to allow producers to buy and sell credits based on their respective production volumes. The reduced supply of virgin plastics on the market should result in higher prices, thus providing a financial incentive to use recyclates, which in turn could become cheaper through economies of scale.

To comply with the quotas, resin manufacturers would either have to produce their own recycled resins to meet the quota, or buy credits from recyclers/ other manufacturers who have production volumes in excess of the quota, in order to comply. A producer of virgin plastics must therefore invest in the recycling industry in order to remain active on the market. Over time, the quota for the minimum proportion of recycled resins could be increased, and a minimum floor price could be included to allow the price to be determined by the market but without significant risk.

As an alternative to setting up a new credit trading scheme, the existing infrastructure of the EU-ETS (Emissions Trading System) could also be leveraged to implement this measure, by integrating the plastics and recycling industry in the CO2 emissions trading scheme, thereby

[648] APEAL (2019), web article *Recycled Content for Steel Packaging?*, accessed on 19th December 2019 at https://www.apeal.org/news2/recycled-content-of-steel-for-packaging/

[649] FEVE (2019), Position paper: "RECYCLED CONTENT AND GLASS PACKAGING", accessed on 19th December 2019 at https://feve.org/wp-content/uploads/2019/07/Recycled-Content-FEVE-Position-June-2019.pdf

[650] CEPI/ FEFCO (2018), *European Database for Corrugated Board Life Cycle Studies* (p16), accessed on 19th December 2019 at http://www.fefco.org/lca

giving recycled plastics an advantage in price competition with virgin plastics and generating stronger demand.

It is noted, however, that resin manufacturers are not responsible for the applications to which their resins are directed in the market – therefore in order to maximise its impact, this model would include all plastic applications, not just plastic packaging (which only accounts for ~40% of plastic raw material demand) or individual product categories. It would also include all standard polymer types, but potentially with different recycled content quotas. In addition, although it overcomes many of the issues associated with the setting of product specific recycled content targets, the measure does have several potential drawbacks. Ensuring that the recycled plastics produced to meet the quota are of a high enough quality to be included within packaging applications, and that imports of plastics are treated equally such that local producers are not disadvantaged are key among these. This is of particular concern here, since imports of resins may be subject to the same requirements as those produced in the EU, but the monitoring of all converted plastic products that incorporate such resins will be unfeasible. In contrast, measures that are proposed at the level of plastic packaging are easier to implement and monitor since the scope of the products to be monitored is clearer.

Therefore, although the measure is recommended for further development by the Commission in a horizontal intervention area, the PPWD is not the appropriate instrument in which to do this. The measure is not taken forward for impact assessment.

5.4 Measure 38 Harmonised standards for labelling of recycled content

A further supporting measure considers any associated requirements related to the labelling of packaging with recycled content. This reflects the current consumer interest in and demand for more circular packaging (particularly plastics), and would ensure that the claims made by producers with regards to the recycled content in their packaging are regulated and harmonised against a consistent approach. Given that producers are likely to want to make such claims regarding recycled content, there is therefore a risk that in the absence of such a measure, multiple different approaches to calculating and claiming recycle content will be adopted, causing a lack of comparability and consumer confusion.

Labels that outline whether packaging is recyclable or not have a clear purpose in influencing consumers to play their role in correctly separating their waste for recycling, therefore aiding in the functioning of the collection and recycling system more widely. Recycled content labels targeted at consumers, on the other hand, serve no purpose other than to increase consumer awareness regarding the packaging that they consume. In this respect, labels showing a simple percentage of recycled content in particular packaging types are likely to be misleading to consumers, in the absence of further information regarding the maximum potential recycled content for that packaging type. This may lead to unintended consequences in the choices that consumers make to, potentially, switch away from packaging that is perceived to have low levels of recycled content, even if the pack is achieving the maximum possible for their packaging category.

Such labelling could also be designed to influence consumers to switch away from packaging with no recycled content, to packaging that does utilise secondary materials. In this case, labelling with a simple red-amber-green system of marking to depict packaging with "no recycled content", "some recycled content", and "the maximum possible recycled content" could

be utilised. Should such switching behaviour be deemed unnecessary (given that targets are only proposed for some forms of packaging and not others), then a simpler form of marking on the packaging, such as a QR code or link to further information, could alternatively be used to provide consumers with access to information regarding the recycled content in their packaging while avoiding the pitfalls of more specific labelling.

A final consideration is whether labelling requirements would only apply to those packaging categories that become subject to recycled content targets (and who will therefore be obliged to use agreed harmonised methods for estimating and reporting recycled content), or whether this would be applied across all packaging to ensure consistency. It could be argued that allowing recycled content labelling on only some forms of packaging would put other forms of packaging at a competitive disadvantage given current consumer demand.

However, there would be no rational for seeking to constrain Member States or producers in their ability to implement such logos on packaging at the national level or for individual product lines sold in multiple countries if they so wish. Without any actions taken at the European level, a diverse approach across Member States might develop leading to issues with consumer confusion. Therefore, there would be some benefit to developing a harmonised design for a symbol /approach that seeks to indicate the level of recycling content in a given type of packaging at the European level. This could be achieved through an implementing act. So, the revision of the Directive could include the following statement:

> *"A harmonised design for a symbol etc used on any packaging placed on the EU market to depict the level of recycled content within it shall be used, and developed through an implementing act."*

Additional requirements could be outlined, for example, aligned with the approach taken in the food contact materials regulations (EC 282/2008):

> *Voluntary self-declaration of the recycled content in recycled plastic materials shall follow the calculation, verification and certification rules laid down in Art. XX and the related implementing act according to Art AA*

However, it is noted that packaging currently already includes numerous labels for product and packaging information that is deemed necessary for consumers. The addition of a recycled content label could prove confusing, for example, if consumers cannot discern between products that contain recycled content as opposed to products that are recyclable, and vice versa. It is therefore suggested that a measure relating to labelling should not be developed further for impact assessment in this study.

5.5 Measure 39: Harmonisation of EPR Fee Modulation Criteria

A number of stakeholders have expressed their support for recycled content to be included as a criteria for fee modulation in EPR schemes. In theory, this would provide an incentive for packaging to be designed not only to be recyclable, but to keep recycled material in the economic cycle by reintegrating it into packaging applications. At present, there is some precedent for this in the requirements of EPR schemes in France and Germany.

In the absence of a harmonised definition, measurement methodology and targets for recycled content, however, the intended outcomes and framework for such fee modulation are unclear,

with significant risk of different PROs and Member States developing a wide range of criteria. This poses a risk to the smooth functioning of the single market. Accordingly, this measure would require the development of harmonised recycled content criteria for achieving the recycled targets (such as those proposed in measure 35), to determine the basis for any meaningful modulation, as well as an implementing act to harmonise definitions, a calculation methodology and a verification procedure, in line with measure 37.

However, it must be noted that even in those Member States in which EPR fee modulation on the basis of recycled content has been introduced, there has been no significant impact on recycled content levels in packaging. This has been attributed by stakeholders to the fact that in some cases, the magnitude of EPR fees relative to the overall value of packaged products is too low to provide any incentive for design changes which are the objective of modulation. In addition, the costs of incorporating recycled content in packaging often outweigh the additional EPR fees that must be paid for failing to do so. Therefore, given that this measure does not seek to harmonise the level of EPR fees charged in different Member States, or the magnitude of any fee modulation (but rather only the criteria for and direction of such modulation), it is not likely to be effective in stimulating recycled plastic uptake. The implementing and administrative burden associated with introducing this requirement is therefore likely to outweigh any resulting environmental benefit associated with increased recycled plastic uptake.

In addition, it has been noted in previous Commission studies[651] that:

> *"a key principle in applying fee modulation…is that it is better to focus a policy instrument on doing one thing well, than on seeking to achieve multiple objectives. A tension can be created within an EPR scheme if it is seeking to do too many things. A focus on seeking to meet the recycling targets in a way that is cost-effective and fair to different packaging formats gives a clear steer to the way in which an EPR scheme should use fee modulation. However, to also introduce an incentive for recycled content can disrupt the efficient operation of the price signals."*

This has been the case for plastic trays in recent years, which have been associated with relatively high levels of recycled content (which would suggest low EPR fees as per this measure), but with very low recycling levels in reality (which would suggest higher fees).

Further, it is important to note that different materials and packaging formats would be more or less amenable to incorporation of recycled content. Accordingly, it would be easier for some types of packaging to respond than for others, given, for example, legal restrictions related to food contact packaging. For metals, for example, it can be argued that incentives for recycled content in packaging are not required, as sufficient demand already exists – not just in packaging, but in all metal applications. In addition, given the significant price differential between secondary materials and virgin counterparts in some cases (e.g., recycled plastics and virgin plastics), the level of fee modulation that would be required to encourage a switch to recycled materials would have to be relatively significant – stakeholders report that this has not been the case where EPR fees are currently being modulated on the basis of recycled content uptake.

It would thus be better for recycled content to be incentivised through other means, leaving EPR schemes for packaging with a clear focus on achieving the recycling targets in the most appropriate way. This is also more aligned with the principles of extended producer

[651] Eunomia for DG Environment (2020), *Study to support preparation of the Commission's guidance for extended producer responsibility scheme*, https://op.europa.eu/en/publication-detail/-/publication/08a892b7-9330-11ea-aac4-01aa75ed71a1/language-en

responsibility, designed to cover the costs of end of life management of packaging rather than regulating the production of packaging.

This measure is therefore not developed further for impact assessment in this study.

APPENDIX N – IMPACT ASSESSMENT OF GREEN PUBLIC PROCUREMENT MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Data & Reporting, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded; and
- 2.0 and 3.0 contain the impact assessments of the selected measures.

This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. However, none of the measure in this intervention area have been assessed via CBA.

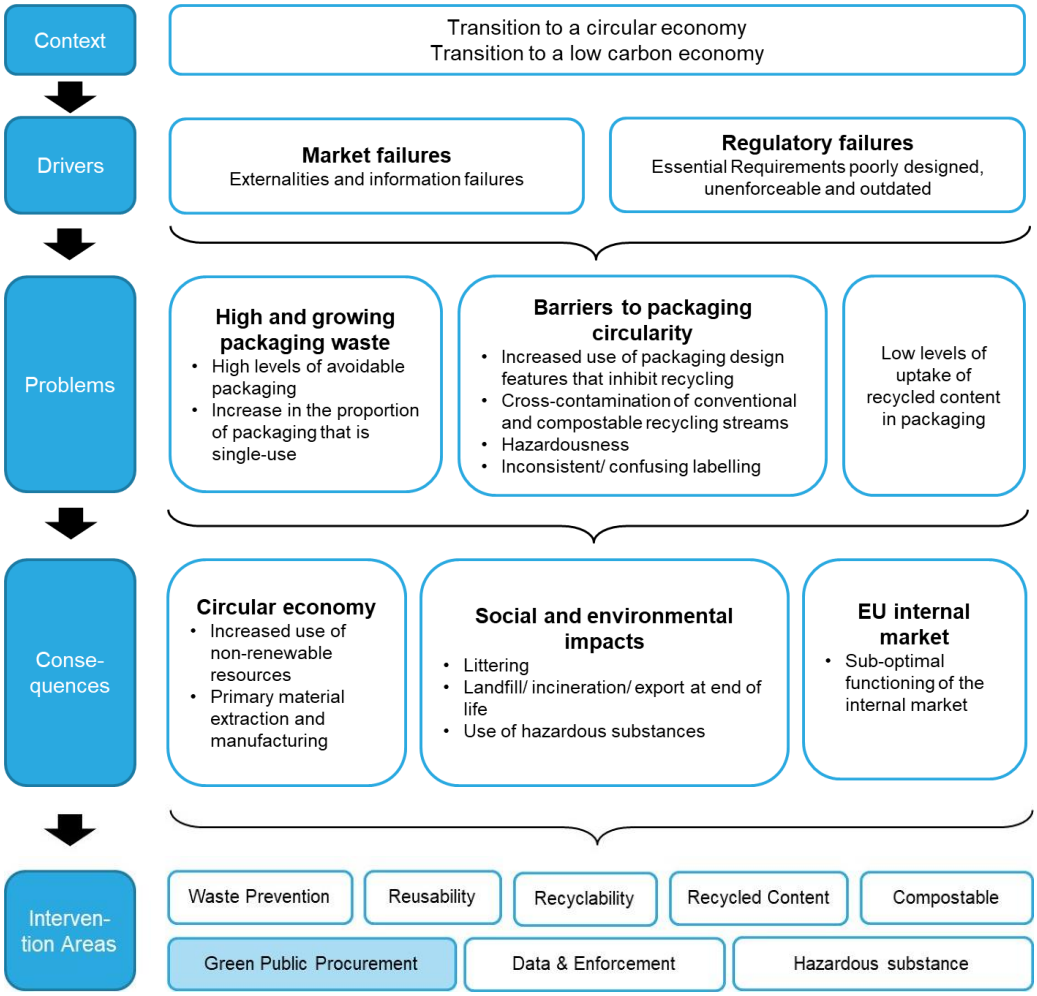
1.1 Intervention logic

Government expenditure on works, goods and services represents around 14% of EU GDP, accounting for EUR 1.8 trillion annually.[652] GPP constitutes an important tool to promote the use of greener products and services by the public authorities and, therefore, to achieve environmental policy goals relating to climate change, biodiversity loss, resource efficiency and sustainable production and consumption. Appendix G contains more details about EU GPP and the product categories.

As shown in Figure A-1 below, GPP is one of the eight intervention areas identified in the intervention logic. Because of the nature and influence of GPP, it can contribute to addressing all of the identified problems and their consequences.

[652] EU. Buying Green, a Handbook of Green Public Procurement, (2016). Available online: https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf (accessed on 16 October 2020).

Figure A-1: Intervention Logic diagram



1.1.1 Measures assessed

The measures included within the Impact Assessment for GPP are as follows:

- Measure 40: Packaging criteria in GPP
  - Measure 40a: Additional criteria on packaging added to the current (voluntary) GPP measures
  - Measure 40b: Mandatory minimum packaging criteria for priority product and service areas
  - Measure 40c: Mandatory minimum packaging criteria for all products and service areas
- Measure 41: Required use of environmental award criteria

1.1.2 Measures discarded

No measures were excluded from the Impact Assessment.

1.2 Background

Common EU GPP criteria have been developed for priority products and services that have been identified as most suitable for "greening" through public procurement. EU GPP criteria are not mandatory, rather voluntary in approach, as endorsed in the communication 'Public Procurement for a Better Environment' (COM (2008) 400)[653].

Whilst EU GPP criteria (understandably) tends to focus on mitigating the negative environmental impacts arising from a particular product or service, criteria to tackle the impact of packaging within the existing EU GPP criteria is largely absent. However, whilst packaging impacts are not dominant against product specific impacts, they are not negligible either.

A review of the 20+ EU GPP product criteria has identified that packaging criteria is included for only a limited number of product categories (e.g., GPP for Food and Catering Services). Whilst in the past, packaging criteria have featured within GPP criteria for particular product groups (for example, criteria for ensuring recyclability and separability of packaging materials, use of packaging materials based on renewable raw materials), more recent versions do not reflect any criteria to address packaging impacts specifically.

For example:

- **EU GPP for Furniture** - earlier (2014) versions of the EU GPP criteria for furniture included specific criteria to address environmental impacts arising from packaging (ensuring recyclability and separability of packaging materials, use of packaging materials based on renewable raw materials), however there is a noted absence of minimum criteria for packaging in the latest version of the document (published in 2017).
- **GPP Criteria for Cleaning Products and Services** - whereas earlier versions of the GPP Criteria for Cleaning Products and Services included core and comprehensive criteria for product packaging (with products carrying a relevant Type I Ecolabel fulfilling the listed criteria deemed to compliant), the latest version of the GPP Criteria, published in 2018, does not include the criteria for packaging as set out in the correspondent Ecolabel for Detergents and Cleaning Products.
- **EU GPP Criteria for ICT products** - similarly, the 2012 version of the EU GPP criteria EU GPP Criteria for Office IT Equipment advocated approaches to avoid the generation of packaging waste, introducing criteria to ensure the recyclability packaging, and increased use of recycled content in packaging. However, updated versions of the EU GPP EU GPP Criteria for Computers and Monitors does not identify packaging as a key environmental impact specifically, and hence, criteria to mitigate the impacts associated with product packaging is not reflected.

It is further considered that the scope for address packaging impacts in areas of public procurement, beyond product and services covered by GPP should be considered. For example, EU GPP Criteria relating to construction products and equipment is confined to a limited number

[653] European Commission (2008) Public Procurement for a Better Environment https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0400:FIN:EN:PDF

of product groups.[654] As noted above, there is a noted absence of any criteria that relates to packaging for these product groups.

[654] Sanitary ware (including tap ware, toilets and urinals), water-based heaters, and street lighting.

2.0 Measure 40: Packaging criteria in GPP

2.1 Problem definition

Common EU GPP criteria have been developed for priority products and services identified to be most suitable for "greening" through public procurement. However, these criteria tend to focus on mitigating the negative impacts arising from the products or services themselves, and do not in general, include criteria aimed at tackling the impact of any associated packaging. Although in most cases the impact of the product or service outweighs that of the packaging, the impacts associated with the packaging are not negligible and should not be ignored.

Whilst packaging requirements have historically featured within GPP criteria for some product groups (for example, criteria for ensuring recyclability and separability of packaging materials, use of packaging materials based on renewable raw materials), more recent updated versions of EU GPP guidance have not included criteria addressing packaging impacts specifically[655].

Furthermore, at present, implementing GPP criteria is voluntary. Therefore, it is up to individual Member States and the relevant contracting authorities to encourage it. As a result, the EU GPP criteria can currently be regarded as a supporting framework rather than a legally binding requirement. With this in mind, uptake of GPP across the EU remains limited and fragmented. Despite a previous European Commission target for 50% of EU-wide public procurement to be green by 2010, a 2012 report on the uptake showed that the goal was not reached at the local, regional, or national level[656]. These factors contribute to the fact that GPP is currently underutilised.

2.2 Baseline

As explained in section 2.1 above, GPP criteria is a voluntary instrument, and therefore uptake across the EU remains limited and fragmented. Additionally, GPP criteria adopts a life cycle approach to addressing key impacts associated with particular products and services, and hence does not specifically address associated packaging impacts.

[655] For example, the 2014 version of the EU GPP Criteria for Furniture included specific criteria to address environmental impacts arising from packaging (ensuring recyclability and separability of packaging materials, use of packaging materials based on renewable raw materials), however there is a noted absence of minimum criteria for packaging in the latest version of the document.

[656] Institute for European Environmental Policy. The Impact of Better Regulation on EU Environmental Policy under the Sixth Environment Action Programme. 2010 https://ieep.eu/publications/the-impact-of-better-regulation-on-eu-environmental-policy-under-the-sixth-environment-action accessed 19th May 2021

2.3 Objectives

The purpose of this measure is to enable sustainable, circular, and resource efficient procurement of packaging for products and services within the EU. This is supported by two key objectives:

1. To ensure that the existing list of GPP criteria is updated to include criteria which specifically addresses packaging impacts; and
2. To maximise the potential of the EU public sector procurement to drive circularity in the packaging value chain.

2.4 Description of the measure

This measure will develop packaging criteria for product and service categories which represent high potential for impact. It will build on the existing GPP criteria for priority goods and services by introducing additional criteria on packaging. This will enable the public sector to leverage its influence to drive packaging waste prevention and circularity through supply chains.

This measure will require identification of a body responsible for developing and regularly updating the GPP criteria. The body will create new packaging criteria for product and service categories, for use and adoption by Member States, on either a voluntary or mandatory basis, depending on level of ambition.

Measure 40 has three levels of ambition, increasing in both effort and expected impact. The levels are:

- **Measure 40a** – Additional criteria on packaging added to the current voluntary GPP measures. Existing GPP criteria for products and services would be reviewed and updated, to include criteria aimed specifically at addressing packaging impacts. The packaging criteria would then be adopted by Member States on a voluntary basis. This option could also be viewed as a short-term measure to measure 40b.
- **Measure 40b –** Mandatory minimum packaging criteria for priority product and service areas representing high potential for impact. In this measure, mandatory minimum packaging criteria would be developed for high impact products and services procured by the public sector.
- **Measure 40c** – Mandatory minimum packaging criteria for all product and service areas, across all public sector contracts where packaging arises. In this measure, a general set of packaging criteria would be applied across all public sector contracts where packaging is used and when packaging waste arises.

2.4.1 Measure 40b. Mandatory minimum packaging criteria for priority product and service areas

There is already a precedent whereby specific mandatory GPP rules have been inserted within legislation. For example:

- The Energy Star Regulation (2008), requiring the procurement of energy efficient IT office equipment;
- The Clean Vehicles Directive (2009), mandating the purchase of environmentally friendly vehicles;

- The Energy Performance Building Directive (2010), introducing the obligation for new building owned and occupied by public authorities to be "nearly zero-energy" by the end of 2018; and
- The Energy Efficiency Directive (2012), requiring the purchase of energy efficient buildings and equipment of the highest energy labelling class[657].

Under this proposed measure, mandatory minimum packaging criteria would be developed for public sector product and service expenditure representing high potential for impact (see Appendix G). Specific mandatory GPP rules would be inserted into legislation, requiring Member States and contracting authorities to apply minimum packaging criteria to relevant contracts above and below OJEU (Office of the Journal of the European Union) financial threshold.

Research has identified examples of mandatory minimum packaging criterion being adopted by Member States. Examples[658] include:

- **The Netherlands** - the Dutch Government introduced mandatory green procurement for their central government departments, with implementation of the minimum requirements being mandatory for all government procurements. This includes mandatory minimum criteria for packaging, which covers 16 product groups[659]. Research shows that approximately 70% of Dutch government bodies including minimum GPP requirements in the early phases of tender specifications development.[660]
- **Italy** - enacted mandatory GPP requirements for all public entities via Procurement Code (Legislative Decree 50/2016), for contracts above and below OJEU financial threshold[661]. Minimum Environmental Criteria for specific product groups and services are included within the Italian GPP National Action Plan, covering 16 product and service areas. Examples have also been identified where the Italian national GPP criteria goes beyond EU GPP criteria on packaging requirements, for example requirements are specified on the recyclability and recycled content of packaging.

Due to the wide range of products and packaging formats consumed by the EU public sector, it is important to focus on those that have the most environmental impact as a priority. Prioritisation can be based on a wide range of factors including amount consumed, relative impacts of different packaging types, and the potential for influence and change.

Limited primary data comparing packaging intensity and impacts of the major product categories consumed by the EU member states public sector has been identified in the literature review, therefore a simplified assessment approach was needed. A method was therefore

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[657] Pouikli (2020) Towards Mandatory Green Public Procurement - requirements under the EU Green Deal: reconsidering the role of public procurement as an environmental policy tool. ERA Forum.

[658] See Appendix G for more details.

[659] Including ICT hardware and devices, vending machines, workwear, external meetings, facilities, office supplies, furniture, catering, cleaning products and services.

[660] ClimateWorks Foundation (2019) Curbing Carbon from Consumption – the Role of Green Public Procurement https://www.climateworks.org/wp-content/uploads/2019/09/Green-Public-Procurement-Final-28Aug2019.pdf

[661] Italian Government - Ministry of the Environment & the Protection of Territory and Sea (2020) GPP Green Purchases https://www.minambiente.it/pagina/gpp-acquisti-verdi

developed to rapidly assess and prioritise product categories without additional primary research and LCA.

Common Procurement Vocabulary (CPV) codes are used across the European public sector for the purpose of public sector contract notice classification (including associated products and services). The CPV coding system was used as a starting point, since the dataset comprises individual project codes (e.g. 15321100-5 Orange juice), which are grouped together with other similar products under 45 Divisions (e.g. 15 - Food, beverages, tobacco and related products). A simple prioritisation scorecard was developed to assess the significance of different CPV Divisions. This identified the following priority categories:

- 3 - Agricultural, farming, fishing, forestry and related products
- 15 - Food, beverages, tobacco and related products
- 18 - Clothing, footwear, luggage articles and accessories
- 22 - Printed matter and related products
- 30 - Office and computing machinery, equipment and supplies except furniture and software packages
- 31- Electrical machinery, apparatus, equipment and consumables; Lighting
- 33 - Medical equipment, pharmaceuticals and personal care products
- 38 - Laboratory, optical and precision equipment (excl. glasses)
- 39 - Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products
- 44 - Construction structures and materials; auxiliary products to construction (excepts electric apparatus)
- 45 - Construction work
- 50 - Repair and maintenance services (across a wide range of product groups)
- 60 - Transport services (excl. Waste transport).

2.4.2 Measure 40c. Mandatory minimum packaging criteria for all products and service areas

Whilst measure 40b above describes a product-specific approach, this alternative option would instead deploy a horizonal approach to mandating the application of a general set of packaging criteria across all public sector contracts where packaging arises.

Mandatory criteria would potentially require some variation (i.e. specific or strengthened criteria) in accordance with particular product or service categories (e.g. food and catering), and is subject to further assessment. However, this may include the following:

- The amount of single use packaging has to be limited as much as possible. When packaging is necessary, the contracting authority gives preference to the use of reusable packaging.
- When single use packaging has to be used:
    - The packaging consists of one single material or materials that are not connected to each other (i.e. not glued, not stapled)
    - At least 70% of fibres of paper and cardboard packaging is from sustainable sources (recycled / sustainably managed forests).
    - Any plastic packaging should include polymers which are readily recyclable – e.g. PET, HDPE, or LDPE.

Relevant examples include the approach adopted by the Government of Flanders, which has developed a guiding 'General GPP Criterium on Packaging[662]', for use across all contracts that include the delivery of goods and services. The criterium developed by the Government of Flanders is considered relevant to a broad spectrum of government contracts where packaging arises, and which should be adapted on a case-by-case basis, giving preference to the minimisation of packaging as much as possible, and to the use of reusable packaging when packaging is unavoidable. If single-use packaging has to be used, the criterium stipulates:

- Mono-material packaging or non-attached materials that can be easily separated by hand;
- Plastic packaging should be from plastic types with high recycling rates in the region (PET, PP, HDPE, LDPE or PS – both bio-based and fossil based);
- Paper/cardboard should be made from at least 70% sustainably managed forests and/or recycled.

The criterium also advocates the use of extra contract performance clauses based on market information available for the products being purchased (for example a minimum use of recycled content in plastic packaging). See Appendix G for more details.

It is noted that any use of mandatory criteria for packaging would need to fully consider the use of sanctions to incentivise the application across public sector contracts. We anticipate exploring the use of any such sanctions (including success) with Member States which have already taken steps towards mandatory application of GPP more broadly (e.g. Italy).

2.5 Links to other measures

This measure is linked to the other GPP measure, 41: use of environmental award criteria, which would incentivise performance beyond the minimum.

In addition, measure 40 is linked to measures in other intervention areas that set out packaging criteria, such as:

- Links with reuse measures 8: Member State-level 'bottom up' reuse targets, 9: mandatory Member State 'top down' percentage reduction targets, and 14: updating the Essential Requirements for packaging to encourage reuse.
- Links with Recyclability measures 23: harmonisation of EPR fee modulation criteria for recycling, 21: updates to Essential requirements, and 27: harmonised standards for labelling of recyclable packaging.

GPP criteria would need to consistent with the rest of the (selected) measures and it could even a) set stricter requirements for public procurement, or b) anticipate the date of entry into force of the packaging criteria.

[662] Government of Flanders – Generic Criterion Packaging https://overheid.vlaanderen.be/generiek-criterium-verpakkingen

2.6 Assessment of measure 40a: Additional criteria on packaging added to the current voluntary GPP measures

If implemented, measure 40a would see the existing GPP criteria reviewed and updated to include additional criteria to address the impacts arising from packaging. It would require identification of a body to review and develop minimum (core) packaging criteria for product groups covered under GPP.

As is the case currently, packaging criteria would be adopted by Member States on a voluntary basis, alongside the relevant environmental criteria for products and services. This option could also be viewed as a short-term solution, ahead of implementation of measures 40b or 40c.

2.6.1 Effectiveness

If implemented, this measure would see the existing GPP criteria widened to include additional criteria which address packaging impacts. The measure would facilitate the application and use of packaging criteria within public contracts by contracting authorities across Member States. However, since uptake of GPP across Member States is variable, the impact may be limited to those contracting authorities within Member States that proactively use GPP as standard.

As mentioned, previous targets set by the Commission to deliver a target of 50% of EU-wide green public procurement by 2010 were not achieved at the local, regional, or national level. A Member State survey and analysis of 1,760 contracts identified that uptake of GPP not only varies across Member States but also by product groups, with four product groups covered by GPP having an uptake of less than 20%[663]. Whilst more recent figures are not available, this information provides an indication of the likely effectiveness of this proposed measure (no higher than 50% uptake, potentially less than 20% for certain GPP criteria).

2.6.2 Ease of implementation

To implement measure 40a, this would most likely require the appointment of JRC to add additional criteria on packaging within existing GPP measures. As the JRC updates the GPP criteria routinely, it is expected that this should not require significant additional effort. Furthermore, such revisions may only require the 'shortened development procedure,' which is applicable when:

1. Updating existing criteria when a non-substantial revision is needed; or
2. Developing new criteria where the scientific base is already well-established (for example, through existing ecolabels, eco-design requirements, best-available techniques, or national GPP criteria)[664].

It is also recognised that many Member States have gone beyond EU GPP criteria within National GPP Action Plans, with examples of packaging criteria reflected across contracting

[663] Centre for European Policy Studies *The Uptake of GPP in the EU27,* accessed 19 May 2021 https://ec.europa.eu/environment/gpp/pdf/CEPS-CoE-GPP%20MAIN%20REPORT.pdf

[664] EUROPA *Procedure for the development and revision of EU GPP criteria*, accessed 17 May 2021, https://ec.europa.eu/environment/gpp/gpp_criteria_procedure.htm

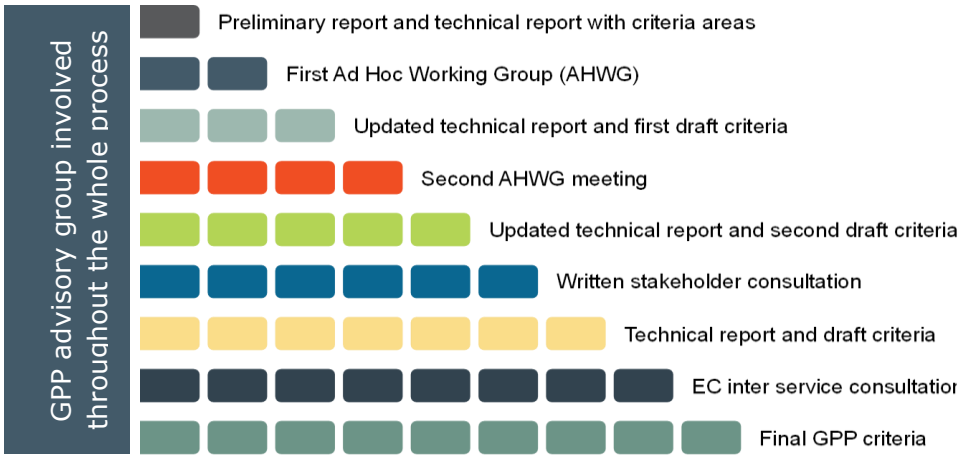
authority category guidance (e.g. Federal Government of Belgium) or including packaging criteria developed by centres of expertise (e.g. the Dutch Public Procurement Centre for Expertise). Hence, efforts by Member States to develop additional packaging criteria is likely to provide a basis for the development of additional packaging criteria for relevant products and services covered by EU GPP criteria.

As the criteria would remain voluntary in measure 40a, there would be no requirement for EU-level enforcement.

2.6.3 Administrative burden

Administration burdens would include additional time and resource commitments by JRC to support the development and delivery of additional criteria on packaging within existing GPP measures. The standard procedure for updating the criteria can be seen in Figure A-1.

Figure A-1: GPP criteria development process



Source: Eunomia

Whilst Figure A-1 depicts the standard procedure, there are instances where a shortened procedure can be used instead, as is outlined in 2.6.2. Since national GPP criteria for packaging exists in multiple Member States (representing a starting point for the development of additional packaging criteria for priority products and services covered by EU GPP criteria), it is possible that the shortened procedure may be applicable in this scenario.

For the shortened procedure, a technical background report and the proposal for draft EU GPP criteria must be made available for public consultation on the Commission website for a period of two months to allow for comments[665]. Once responses have been given to all comments, the Commission is able to seek out the EU GPP Advisory Group directly, submitting the proposal and the technical report for opinion and, ultimately, approval. Hence, the shortened procedure is likely to place considerably less burden on the JRC when compared to the standard development process.

[665] ibid.

Regardless of which procedure is required (standard, or shortened development procedure), it is worth noting that the JRC updates the GPP criteria routinely to take into account the latest scientific data, new technologies, market developments, and changes in legislation. Therefore, it is assumed that addressing packaging impacts through additional criteria would form part of the planned administrative process associated with updating GPP criteria.

The Commission encourages individual Member States to incorporate the GPP criteria within National Action Plans (NAPs). A NAP is a document created by a Member State detailing how public procurement will be "greened" over the next three-year period. It should contain an assessment of the existing situation, ambitious targets, and the measures needed to achieve them[666]. They are recommended by the European Commission as they can help to raise awareness of more sustainable procurement practices and stimulate further implementation. As of March 2021, 22 Member States had adopted National Action Plans or similar documents. We conclude therefore that the process of simply updating their NAP to reflect additional criteria on packaging will most likely result in light administrative activities for a Member State.

Further administrative activities considered of relevance include additional dissemination of relevant information by contracting authorities to suppliers, and in some instances, provision of training to procurement staff on the use of criteria.

2.6.4 Economic impacts

The economic impacts of measure 40a are largely proportional to the administrative burdens incurred. The costs incurred by relevant and identified stakeholders have been outlined below:

- **The European Commission** – Would be required to instruct the JRC to review and amend the existing GPP measures to include additional packaging criteria. Limited information regarding the cost of this process has been identified and without further investigation it is not necessarily clear what work effort is required to update GPP criteria. However, we can provide a rough approximation of the work effort needed to add packaging criteria in relation to creating GPP criteria from new. We have estimated that, if the process of creating a new GPP criterion equated to 10 FTE from beginning to end, including packaging criteria was account for 5% of this, equalling 0.5 FTE. This is considering the fact that adding packaging criteria would form a subset of the overall work required. In addition to funding criteria development, the Commission may also be required to maintain up to date guidance on how to implement additional GPP criteria for public sector procurement employees[667].
- **DG JRC –** Would undertake the development of additional packaging criteria. This activity should remain within DG JRC in order to avoid double counting. This activity would be financed via the Commission.
- **Member States** – Would be encouraged to update National Action Plans, an activity assumed to be funded through Member State governments. Limited additional costs may also be associated with the communication and dissemination of new packaging criteria.

[666] EUROPA (2021) *GPP National Action Plans*, https://ec.europa.eu/environment/gpp/action_plan_en.htm

[667] European Commission (2020) Regulation of the European Parliament and of the Council Concerning Batteries and Waste Batteries

- **Public Bodies** – Public bodies across Member States may also require guidance on the use and application of additional packaging criteria. This could include training on how to integrate packaging criteria within a tendering procedure, how to assess and verify environmental claims made by tenderers, and how to evaluate life cycle costs in tendering.
- **Suppliers** – May be required to change packaging linked to the supply of products and services to Member States. This activity will likely incur additional economic cost.

2.6.5 Social impacts

The social impacts arising from the development of additional criteria on packaging are dependent on the changes that the criteria promote. In the absence of defined criteria, it is not possible to quantify the expected social impacts. However, it is anticipated that positive social impacts may include:

- Improvements in residents' mental and physical health as a result of lower levels of littering in local environments due to less packaging use overall[668]; and
- Possible job creation as result of an increased uptake of reuse business models, promoted through GPP criteria.

2.6.6 Environmental impacts

As above, environmental impacts arising from the development of additional criteria on packaging will be dependent on the changes that the criteria promote. In the absence of defined and agreed criteria, it is not possible to quantify the expected environmental impacts. However, it is expected that benefits will:

- Prevent and reduce packaging waste, leading to lower levels of leakage, and pollution in waterways and on green spaces, thereby reducing biodiversity losses;
- Reduce single use packaging waste to landfill and incineration;
- Stimulate demand for recycled content packaging; and
- Decrease demand for virgin resources.

2.6.7 Stakeholder views

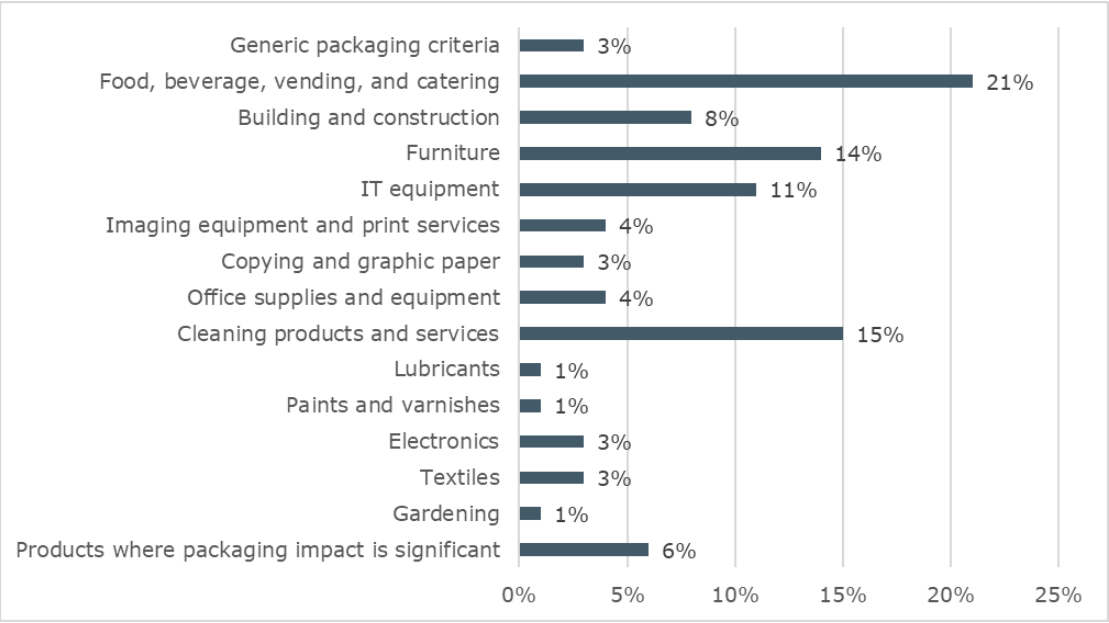
As part of the stakeholder consultation process, 19 Member State representatives and national experts were surveyed for their views on packaging criteria for GPP. When asked to identify the product categories they felt represented the highest priority for inclusion of additional packaging criteria, the most popular responses were:

- Food, beverage, vending, and catering (21%);
- Cleaning products and services (15%); and
- Furniture (14%).

[668] Eunomia Research & Consulting (2013) *Exploring the Indirect Costs of Litter in Scotland*, http://www.zerowastescotland.org.uk/sites/files/zws/Indirect%20Costs%20of%20Litter%20-%20Final%20Report.pdf

These responses provide insight into the product categories considered by stakeholders to represent the priority for additional packaging criteria. Figure A-2 displays the full responses[669].

Figure A-2: Member State responses identifying priority product categories for inclusion of additional packaging criteria



Source: Eunomia. Number of responses: 17

Following the June Impact Assessment webinars, stakeholders were afforded the opportunity to provide further qualitative feedback on the proposed measures. A small group of stakeholders used this opportunity to note that whilst other GPP criteria are voluntary, any additional packaging-specific criteria should be too. One stakeholder also highlighted that voluntary approaches backed by industry are often able to achieve policy goals faster and with better results. Whilst the stakeholder provided an example of success they had experienced with voluntary targets, it was not sufficiently comparable to GPP.

A stakeholder representing the Swedish Environment Agency (EPA) expressed that, even though Sweden had a long history of applying voluntary environmental and sustainability criteria, they recognised that non-binding recommendations may not have sufficient impact to achieve socio-political goals.

Finally, a representative from the food and drink industry noted that the packaging criteria within the wider catering GPP criteria were already sufficiently complete to meet the overall aims. They highlighted that these existing criteria should be aligned with the PPWD revision suggestions.

[669] *Questionnaire for Member States Regarding Packaging and Green Public Procurement,* issued December 2020

2.7 Assessment of measure 40b: Mandatory minimum packaging criteria for priority product and service areas

If implemented, measure 40b would enforce mandatory adoption of additional packaging criteria for identified products and services representing high priority, across the EU. This would require legislative change, to ensure Member States and contracting authorities are required to apply minimum packaging criteria to relevant contracts above and below OJEU financial threshold.

2.7.1 Effectiveness

This measure would promote wider uptake of packaging criteria across Member States, increase demand for lower environmental impact packaging, and encourage the development of circular packaging solutions across supply chains. Under this measure, priority product and service categories would need to be defined, and associated packaging criteria developed.

Since implementation for packaging criteria across these product and service categories would be mandatory, this would significantly increase the uptake of criteria across all Member States. As such, measure 40b would effectively meet both objectives as set out in Section 1.0.

2.7.2 Ease of implementation

As referenced in Section 2.6.2, a body would need to be identified to support the development of additional packaging criteria for priority products and services. However (unlike measure 40a), measure 40b is proposed as a mandatory measure, and hence implementation will depend largely on enforcement activity at both EU and Member State level. This would require the creation of supporting legislation, reporting frameworks, and enforcement systems. Defining exactly how easy this will look is difficult. Possible legislative vehicles could include:

1. Sector-specific legislation for each product or service area;
2. An annex to the Packaging and Packaging Waste Directive; or
3. An annex to the Public Procurement Directive.

Whilst sector-specific legislation has been established to mandate GPP for some products, the large majority of the existing GPP criteria are voluntary and without explicit directives. Therefore, introducing sector-specific legislation for each product or service area would likely result increase the work needed to effectively implement this measure. Although a plausible solution, it is expected that this approach would not be an efficient route forwards.

Alternatively, GPP could be mandated as an annex to either the Packaging and Packaging Waste Directive or the Public Procurement Directive. The Public Procurement Directive could be an appropriate legislative vehicle for enforcing mandatory adoption of GPP criteria because:

- Public procurement professionals are more likely to refer to the Public Procurement Directive and associated national legislation in the course of their work. Therefore, this is presumably a more straightforward route to transposing requirements to national procurement legislation; and
- Should future developments of GPP include further expansion of mandatory criteria beyond packaging, the annex to the Public Procurement Directive could be updated. If

the legislation were included as an annex to the Packaging and Packaging Waste Directive, it would be illogical to amend the annex to include criteria outside of packaging.

However, amending the Public Procurement Directive is would not be the best option for ease of implementation. Additionally, the Circular Economy Action Plan[670] requires that: "*the Commission will propose minimum mandatory green public procurement (GPP) criteria and targets* in sectoral legislation".

Regardless of the policy vehicle selected, instigating this supporting legislation may result in this measure being significantly less more difficult to implement than voluntary measure 40a (Additional criteria on packaging added to the current voluntary GPP measures).

It is worth noting that mandatory implementation of criteria for all public procurement will be clearer to suppliers, which may arguably make it easier to implement.

2.7.3 Administrative burden

As referenced in Section 2.6.3, much of the administrative burden associated with the development of additional packaging criteria would most likely be the result of additional activity undertaken by the JRC. Implementing the adoption of mandatory criteria for packaging would also likely result in administrative activities for other stakeholders in the value chain, namely:

- **Member States -** Would be required to ensure the new criteria are implemented, monitored, and reported on;
- **Public Bodies -** May have to change their tendering processes to include the relevant GPP criteria. In addition, they may also need to provide training to procurement staff regarding how to integrate environmental considerations into tender procedures, where to find assistance in developing environmental criteria, how to assess and verify environmental claims made by tenderers, and how to evaluate life cycle costs[671]; and
- **Suppliers -** May need to provide additional information outside that which is currently required when submitting an application for a public sector contract. This may include answering further questions or providing evidence to show the way in which environmental criteria are met. In some instances, suppliers may need to amend or source new packaging options to meet GPP requirements. As the measure is mandatory, requirements will be consistent across Member States, therefore resulting in clearer legislation to suppliers and potentially lower administrative burdens.

2.7.4 Economic impacts

Measure 40b would mandate the implementation of GPP criteria for packaging arising from the priority products and services in all Member States. Hence, the monitoring and enforcement requirements will be significant. However, the mandatory nature of the measure will ensure

[670] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

[671] European Commission (2016) *Buying green: A handbook on green public procurement, 3rd Edition*, 2016, http://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

consistency in requirements across Member States. This will increase the ease of reporting for suppliers and enforcement for governing bodies.

Whilst a quantitative assessment of the economic impacts of this measure was not possible given that they are dependent on the selected criteria, the incurred costs outlined in Section 2.6.4 remain valid for this measure. However, an additional economic impact has been identified:

- **Suppliers** – May be required to provide verification against additional packaging criteria. This may involve, for example, certification of recycled content. Achieving this certification or gathering this proof of performance would be at a cost to the supplier.

2.7.5 Social impacts

As referenced in Section 2.6.5, social impacts arising from the development of additional criteria on packaging are dependent on the changes that the criteria promote. Some examples of social impacts may include:

- A reduction in littering leading to improvements in local environments and additional co-benefits, such as improved mental wellbeing and decreased likelihood of crime[672]; and
- Possible job creation as result of an increased uptake of reuse business models, promoted through GPP criteria.

Since measure 40b is proposed as a mandatory measure, any social benefits arising from the development of additional packaging criteria will most likely be greater than measure 40a. However, in the absence of defined packaging criteria, determining the nature and extent of the social impacts is not possible.

2.7.6 Environmental impacts

Whilst environmental impacts arising from the introduction of measure 40b have not been quantified, literature sources identified during the course of the research highlight positive impacts arising from the setting of mandatory GPP criteria, with mandatory provisions for strategic public procurement linked to stronger uptake results[673]. Therefore, environmental impacts and benefits arising from a mandatory approach to the adoption of additional packaging criteria is considered to result in higher environmental benefits over a voluntary measure.

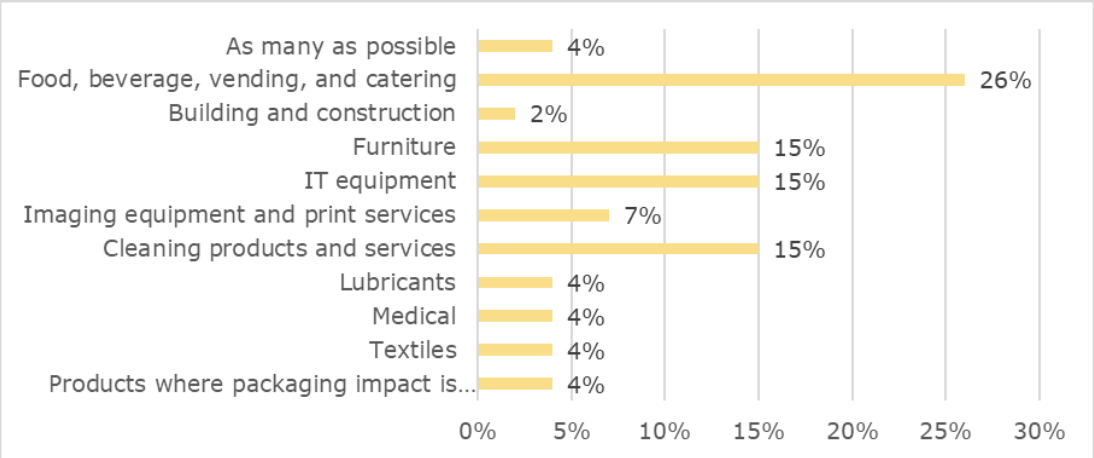
[672] Eunomia Research & Consulting (2013) *Exploring the Indirect Costs of Litter in Scotland*, http://www.zerowastescotland.org.uk/sites/files/zws/Indirect%20Costs%20of%20Litter%20-%20Final%20Report.pdf

[673] DG GROW *Strategic use of Public Procurement in Promoting Green, Social and Innovation Policies*, accessed 19 May 2021 https://op.europa.eu/en/publication-detail/-/publication/6a5a4873-b542-11e7-837e-01aa75ed71a1/language-en

2.7.7 Stakeholder views

Member States and national experts were asked to identify product and service categories where mandatory GPP requirements for packaging would be particularly impactful. Figure A-3 displays the full responses[674].

Figure A-3: Member State responses: suggested product categories for mandatory packaging criteria



Source: Eunomia. Number of responses: 17

The most common product and service categories identified by respondents (where mandatory packaging requirements would be particularly impactful) included:

- Food, beverage, vending, and catering (26%);
- Furniture (15%);
- IT equipment (15%); and
- Cleaning products and services (15%).

Many of the stakeholders who provided feedback following the June Impact Assessment webinars were in favour of mandatory minimum packaging criteria for GPP. Often, there was no definition made between this measure (40b) and measure 40c (mandatory minimum packging criteria for all product and service areas). However, several stakeholders highlighted that there was a need for some exceptions or additional considerations:

- Minimum requirements should not restrict the ability of contracting authorities to set more ambitious sustainability requirements where desired;
- Any mandatory requirements introduced by the PPWD should be aligned with established packaging criteria where they exist (e.g., in catering); and
- There should be pre-defined procedures to enable exemptions in exceptional circumstances (e.g., disaster releif).

[674] *Questionnaire for Member States Regarding Packaging and Green Public Procurement,* issued December 2020

2.8 Assessment of measure 40c: Mandatory minimum packaging criteria for all product and service areas

2.8.1 Effectiveness

If implemented, this measure would mandate the procurement of products and services with sustainable packaging in all areas of public procurement. Cross-cutting guidance would identify mandatory minimum criteria for all packaging in any public sector contract. This measure would meet both objectives, exceeding the effectiveness of measure 40b through application to a wider range of products and services.

2.8.2 Ease of implementation

The GPP criteria development requirements outlined in Section 2.6.2 remain relevant for measure 40c. However, as this measure is mandatory for all areas of public procurement, the rules will be clearer to suppliers, arguably making measure 40c easier to implement when compared with measures 40a and 40c.

As with previous measure, the JRC would be responsible for the development of the additional packaging criteria. It is expected that relevant exemplars (such as "The General GPP Criterium on Packaging" implemented by the Government of Flanders[675]) would provide a starting position for reviewing the development of such criteria. Given the mandatory nature of the proposed measure, successful implementation will largely depend on the ability of both Member States and the EU to enforce the legislation. Therefore (and similarly to measure 40b), there will be a requirement for supporting legislation, reporting frameworks, and enforcing systems.

2.8.3 Administrative burden

Given the similarities between measures 40b and 40c, much of the administrative requirements will be the same, particularly administrative activities of the JRC. Further details can be seen in Section 2.7.3. However, as measure 40c requires a single, cross-sectoral solution rather than a sector-specific approach, we expect that its implementation will be less burdensome than measure 40b.

The discussion around the legislative vehicles in section 2.7.3 also applies to measure 40c.

As with measure 40b, measure 40c would also likely result in administrative activities for other stakeholders in the value chain, already described in section 2.7.3.

[675] Government of Flanders – Generic Criterion Packaging https://overheid.vlaanderen.be/generiek-criterium-verpakkingen

2.8.4 Economic impacts

Whilst the economic impacts of measure 40c can be assumed to be broadly in line with those identified for measure 40b (Section 2.7.4) additional factors to consider include the following:

- **The European Commission** – The cost to the Commission may be less significant as the creation of a single cross-cutting criteria for packaging may well be less burdensome than the creation of individual criteria for priority products and services.
- **Public Bodies** – Would be required to implement the packaging criteria across all public procurement contracts as opposed to a select number. This will likely result in the need to update a greater number of tendering documents and train a wider range of procurement staff. Therefore, the associated costs are likely to be higher than those of measure 40b.
- **Suppliers** – A greater number of suppliers would likely be required to meet mandatory minimum packaging criteria, and therefore could face greater overall reporting and certification costs.

2.8.5 Social impacts

Since measure 40c is the most ambitious of the three measures and relates to wider areas of public sector expenditure where packaging arises, positive social impact of this measure would most likely be greater than measures 40a and 40b. However, quantifying the extent and/or nature of the social impacts is not possible with the information currently available.

2.8.6 Environmental impacts

Similarly, the environmental impacts of measure 40c are likely to be greater than measures 40a and 40b, however quantification of the resulting impacts has not been undertaken within the scope of the analysis. See Sections 2.6.6 and 2.7.6 for further details.

2.8.7 Stakeholder views

The stakeholder feedback provided following the June Impact Assessment webinars that is listed under measure 40b is also applicable to measure 40c.

2.9 Summary and conclusion

Table A-1 Summary of Impacts for Measure 40

Impact	Measure 40a	Measure 40b	Measure 40c
Effectiveness	Dependent on uptake. Expected to be between 20% and 50%	More effective than measure 40a	More effective than 40a and 40b

Impact	Measure 40a	Measure 40b	Measure 40c
Ease of implementation	Voluntary, therefore no need for enforcement activities. JRC (or other) to update existing GPP criteria to include packaging.	Mandatory, therefore need for supporting legislation and enforcement systems. Mandatory criteria clearer to suppliers, therefore easier to implement. Commission required to develop appropriate legislative vehicle.	Mandatory, therefore clearer to suppliers and easier to implement. Existing national GPP criteria to provide the basis. Commission required to develop appropriate legislative vehicle.
Administrative burden	JRC (or other) to update criteria as part of ordinary administrative duties. MSs encouraged to update NAPs. Contracting authorities to lead training and dissemination activities.		
Economic impacts	Estimated to be approximately 5% of the work effort needed to create new a GPP criterion	Similar to 40a but with additional monitoring and enforcement requirements	Similar to 40b, but cross-cutting criteria so likely lower economic impact
Social impacts	Dependent on changes the criteria promotes - not currently possible to quantify.	Greater impact than 40a	Greater impact than 40b
Environmental impacts	Dependent on changes the criteria promotes - not currently possible to quantify.	Greater impact than 40a	Greater impact than 40b
Stakeholder views	If other GPP criteria are voluntary, packaging criteria should be too Non-binding recommendations may not achieve aims Some criteria (e.g., catering) already include packaging	Considerable support overall for mandatory GPP packaging criteria Minimum requirements should not limit authorities' ability to set more ambitious targets There should be pre-defined procedures to enable exemptions in exception circumstances	

3.0 Measure 41: Environmental award criteria

3.1 Problem definition

Whilst additional packaging criteria offer the potential for setting minimum requirements for packaging performance across public sector contracts, this approach does not necessarily incentivise further innovation.

3.2 Baseline

Environmental award criteria for packaging does not currently feature for products and services covered by EU GPP criteria.

3.3 Objectives

The aim of this measure is to continue to stimulate supplier innovation in the delivery of high performing packaging solutions, without compromising the ability of certain areas of the market to compete in public tendering processes.

3.4 Description of the measure

Packaging criteria which are formulated as environmental award criteria is also considered to be an important mechanism, to stimulate additional environmental performance, without being mandatory. Such criteria would help to stimulate innovation and technical progress without foreclosing the market in areas that cannot reach the proposed level of performance. This would further incentivise and reward the market for going beyond minimum criteria in certain areas; (e.g., increased packaging prevention options, achieving higher recycled content in packaging). This is one possible method for ensuring a fair market without stunting growth.

Under this option, and beyond minimum mandatory GPP criteria for packaging as described in measure 40, environmental award criteria would be developed and would see higher scores in certain areas awarded to suppliers exceeding the minimum requirements during assessment of a tender submission.

3.5 Links to other measures

- Directly links with mandatory GPP measures 40b and 40c.
- Links with reuse measure 16: incentives for reuse models.
- Links with recycled content measures 35a and 35c: targets for the use of recycled content in specific materials and applications.

3.6 Assessment of measure 41: Environmental Award Criteria

Packaging criteria formulated as environmental award criteria are considered to be an important mechanism for stimulating additional environmental performance. As the criteria would be voluntary, it could be introduced without risk of foreclosing the market in areas that cannot reach the proposed level of performance. Under this option, and beyond minimum mandatory GPP criteria for packaging, environmental award criteria for packaging would be developed to further incentivise and reward the market for going beyond minimum criteria in certain areas. Criteria could include, for example, increased packaging prevention options or achieving higher recycled content in packaging.

3.6.1 Effectiveness

Measure 41 would be voluntary and therefore it is difficult to determine the level of uptake of such award criteria by contracting authorities, and similarly, resulting impacts across the supplier base.

3.6.2 Ease of implementation

It is assumed that any overarching additional award criteria would be developed by the JRC (in parallel with the development of minimum packaging criteria). There is also a precedent for the use of environmental award criteria for packaging at a Member State level. For example, the Dutch central government uses packaging award criteria to incentivise high collection, reuse, and recycling rates.

3.6.3 Administrative burden

Assuming environmental award criteria for packaging are developed as a complementary measure to mandatory GPP, the additional administrative burden associated with its implementation is likely to be negligible. There will be an assumed additional burden on those bodies responsible for development of the supporting award criteria (understood to be the JRC and/or individual Member States).

3.6.4 Economic impacts

Economic impacts of measure 41 will be dependent on the uptake of this voluntary measure by contracting authorities, as well as the resulting supplier responses. Where this voluntary measure is implemented by contracting authorities, this may result in additional negligible administration costs to evaluate supplier responses to the award criteria.

3.6.5 Social impacts

Determining the social impacts of this proposed measure is challenging in the absence of defining the particular award criteria. Section 2.6.5 highlights some potential social impacts.

3.6.6 Environmental impacts

Determining the environmental impacts of this proposed measure is challenging in the absence of defining the particular award criteria. Section 2.6.6 highlights some potential environmental impacts.

3.6.7 Stakeholder views

Stakeholder feedback following the June Impact Assessment webinars concerning measure 41 can be broken down into two key points:

1. Any environmental award criteria should relate to the entire life cycle of the product, not just the waste. Any ranking or favourability should be based on overall environmental benefits, quantified/justified by life cycle assessment or other equally quantitative means; and
2. Award criteria should be aligned with existing standards/labels that show environmental performance (e.g., eco-labelling schemes).

3.7 Summary and conclusion

Table A-1 Summary of Impacts for measure 41

Impact category	Measure 41
Effectiveness	Voluntary therefore difficult to assess
Ease of implementation	Voluntary therefore not reliant on enforcement
Administrative burden	Negligible if developed as a complementary measure to GPP
Economic impacts	Dependent on uptake
Social impacts	Not possible to assess without defining specific award criteria
Environmental impacts	Not possible to assess without defining specific award criteria
Stakeholder views	Criteria should relate to the entire life cycle of the product. Criteria should be aligned with existing standards/labels.

APPENDIX O – IMPACT ASSESSMENT OF DATA & REPORTING MEASURES

1.0 Introduction

This appendix sets out the policy measures for the intervention area of Data & Reporting, and it is structured as follows:

- 1.0 Introduction, intervention logic, measures assessed and discarded;
- 2.0 contains the impact assessments of the selected measure; and
- 3.0 contains the description of all the discarded measures.

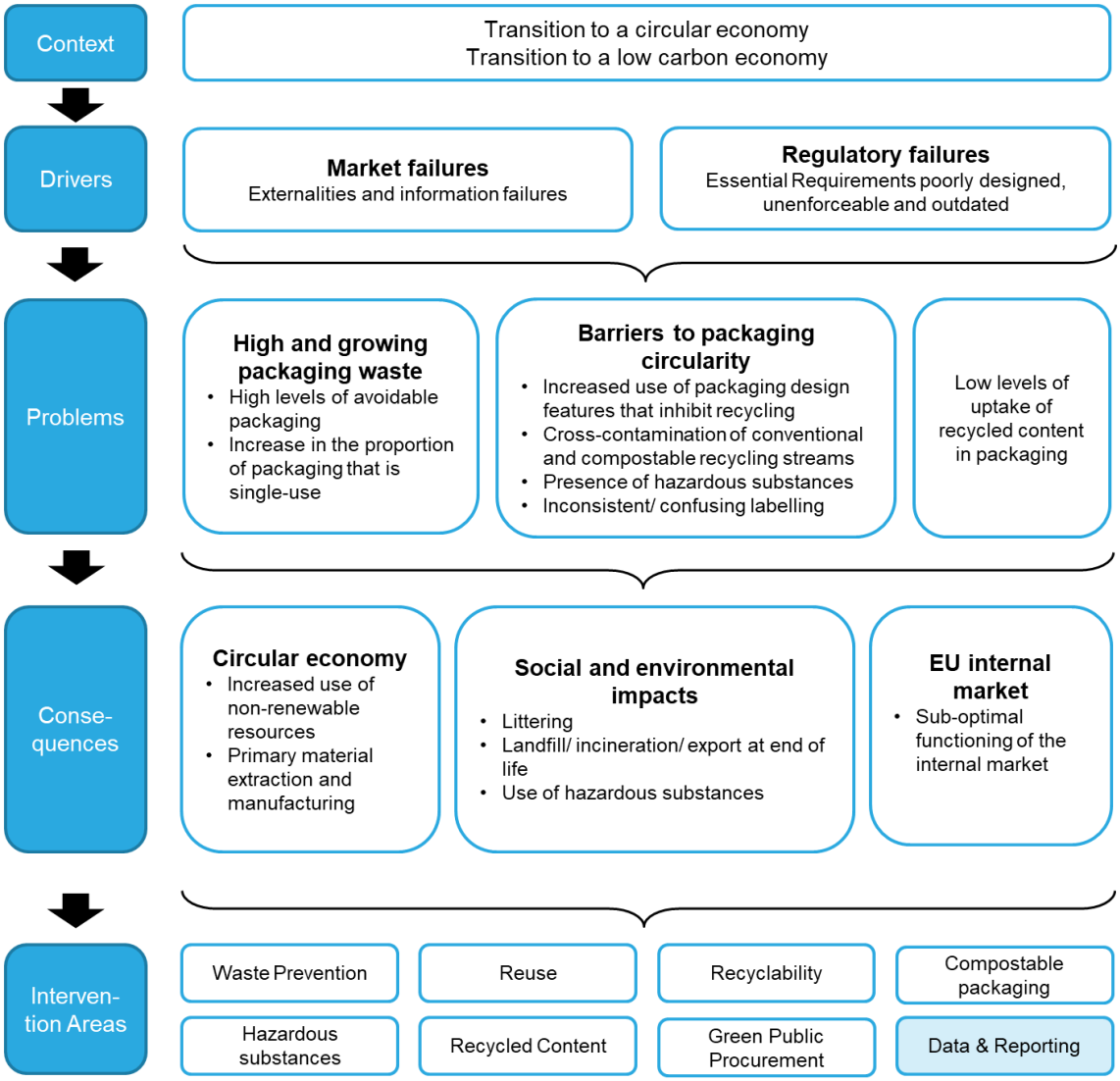
This appendix is linked with the rest of the report as follows:

- The Synthesis Report (sections 2, 3 and 4) describes overall the intervention logic (also referenced in section 1.1): problem definition, problem evolution, consequences, need for EU intervention and objectives.
  - Appendix A provides further details of the problem definition, and it has been referenced throughout this document where applicable. Issues related to lack of data are found across all sections.
- The Synthesis Report (chapter 5) describes the baseline scenario (in the absence of further policy interventions).
  - Appendix B provides a detailed description of the methodology used to determine the baseline scenario.
- The Synthesis Report (chapter 6) describes the process for determining an initial longlist of measures, and screening into a shortlist of measures.
  - Appendix C contains the longlist of measures.
- A Cost-Benefit Analysis (CBA) model has been built to quantitatively estimate the social, environmental and economic impacts of the measures, as far as possible. However, none of the measure in this intervention area have been assessed via CBA.

1.1 Intervention logic

As shown in Figure A below, Data & Reporting is one of the eight intervention areas identified in the intervention logic. Because of the nature and influence of this area, it can contribute to addressing all of the identified problems and their consequences. It is of particular relevance to ensure a well-functioning EU internal market.

Figure A-1 Intervention Logic diagram



1.2 Measures assessed

The measure and variants included in the impact assessment is:

- Measure 42: EPR reporting harmonisation and consolidation
  - Measure 42a: EPR reporting harmonisation with de minimis threshold
  - Measure 42b: EPR reporting harmonisation with de minimis threshold alongside Member State reporting of EPR data to the Commission

1.3 Measures discarded

The measures and variants not included within the Impact Assessment are as follows:

- Measure 42: EPR reporting harmonisation and consolidation
  - Measure 42c: EPR reporting harmonisation with de minimis threshold alongside PRO reporting of EPR data into the Commission
- Measure 43: EU packaging compliance portal
- Measure 44: Member State enforcement reporting
- Measure 45: Reinforcement of the market surveillance authorities

2.0 Measure 42: EPR reporting harmonisation and consolidation

2.1 Problem definition

At present, Member States are legally required to set up collection or return systems for their packaging waste[676]. Almost all Member States currently meet this obligation through extended producer responsibility (EPR)[677]. Whilst Article 8a of the revised Waste Framework Directive (WFD) identifies the general minimum requirements for EPR, as a directive it does not dictate a common approach that must be explicitly followed. Therefore, whilst point c of Article 8a(1) of the WFD states that Member States are required to:

> *ensure that a reporting system is in place to gather data on the products placed on the market of the Member State by the producers of products subject to extended producer responsibility*

It is up to the individual Member States to decide how to transpose this measure into national law. Consequently, the reporting systems and associated reporting requirements across Member States are varied. The resulting inconsistencies in reporting frequency and data granularity can cause issues to key stakeholders within the packaging value chain. For example:

- **Packaging producers** may be required to report different data into schemes in different Member States for similar packaging. This causes administrative burden, and can cause confusion, particularly where producers operate internationally, which may lead to increased instances of inadvertent free-riding and non-compliance with national EPR obligations. The additional administrative burden can also act as a barrier to entry for producers considering breaking into new markets, limiting innovation and economic growth.
- **EPR schemes** are required to determine the optimum level of granularity for data reporting themselves. This can leave multiple PROs seeking the same guidance from external parties or conducting the same studies themselves in order to determine the most appropriate practices.
- **The European Commission** cannot usefully combine and compare data from multiple Member States to obtain an EU-wide view on the types and volumes of packaging and packaging waste at the level of granularity that would significantly facilitate decision-making.[678] This leaves the Commission less able to identify and critically assess potential supporting legislative tools both within the field of EPR (e.g., modulation criteria) and outside of it (e.g., best-in-class product packaging examples).

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[676] Council of the European Union (2018) *Proposal for a Directive of the European Parliament and of the Council amending Directive 94/62/EC on packaging and packaging waste*

[677] Watkins, E., Gionfra, S., Schweitzer, J.-P., Pantzar, M., and Janssens, C. (2017) *EPR in the EU Plastics Strategy and the Circular Economy: A focus on plastic packaging*

[678] A lack of consistent and more granular data has been a challenge throughout the course of this work

This issue is further exacerbated by the lack of a centralised and unified data repository containing the types and volumes of packaging placed on the European market.

As explained in the Study to Support Preparation of the Commission's Guidance for Extended Producer Responsibility Schemes, greater granularity in fee structure is something that is sought by brands that are making efforts to increase the recyclability of their packaging.[679] The reason for this is as follows.

In seeking to achieve a recycling target, it is most cost-effective to target formats and circumstances where the costs are lowest. At lower recycling rates it might be supposed that average costs – which in the case where an EPR scheme already covers all costs, are represented by the flat fees paid by weight of material - are reasonably approximate to the costs of recycling each packaging format that is recycled (of course the extent to which this holds true depends upon the shape of the cost curve).

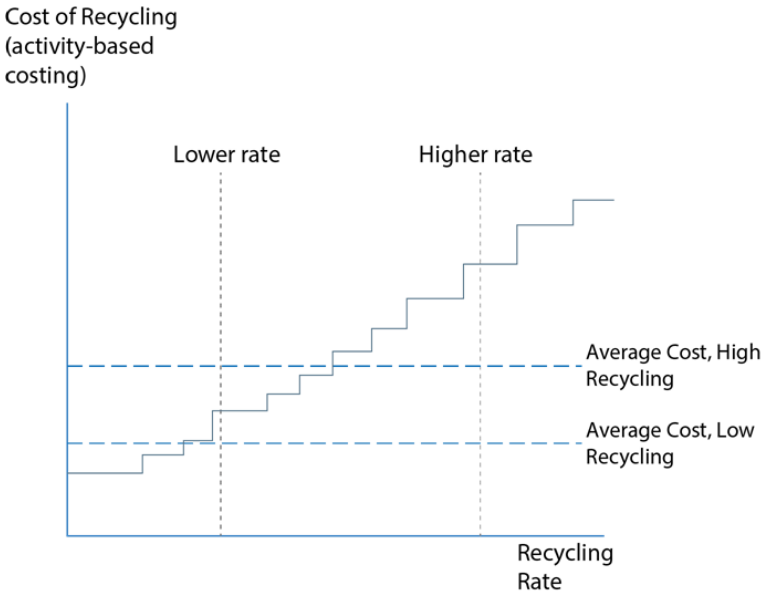
However, as recycling targets are raised, it is necessary for additional packaging formats to be recycled and thus contribute to meeting the target. Unless the cost curve is relatively flat (and empirical evidence suggests that it isn't), the actual cost of recycling the marginal formats might be significantly above the costs of recycling the lowest cost formats. At higher recycling rates, the divergence from average costs (represented by flat fees based on material alone) can reasonably be expected to be greater than at low recycling rates.

This is illustrated in a basic manner in the figure below, which shows a stylised graphic representing the marginal cost of recycling packaging of a given material. Each horizontal section of the stepped line is representative of one or more packaging formats for which the cost of recycling is roughly equivalent.

This immediately raises the question of fairness, and the challenge of avoiding cross-subsidisation of different packaging formats. A move away from a flat fee structure, to one that is more granular in nature, with different categories for different formats, that better reflects the different net costs of recycling each format is required to avoid cross-subsidy. Quite understandably, brands requesting a more granular fee structure want their efforts to be reflected in the fees that they pay, rather than see their formats cross-subsidize the management of packaging from competitors who have not made the effort to change their packaging design.

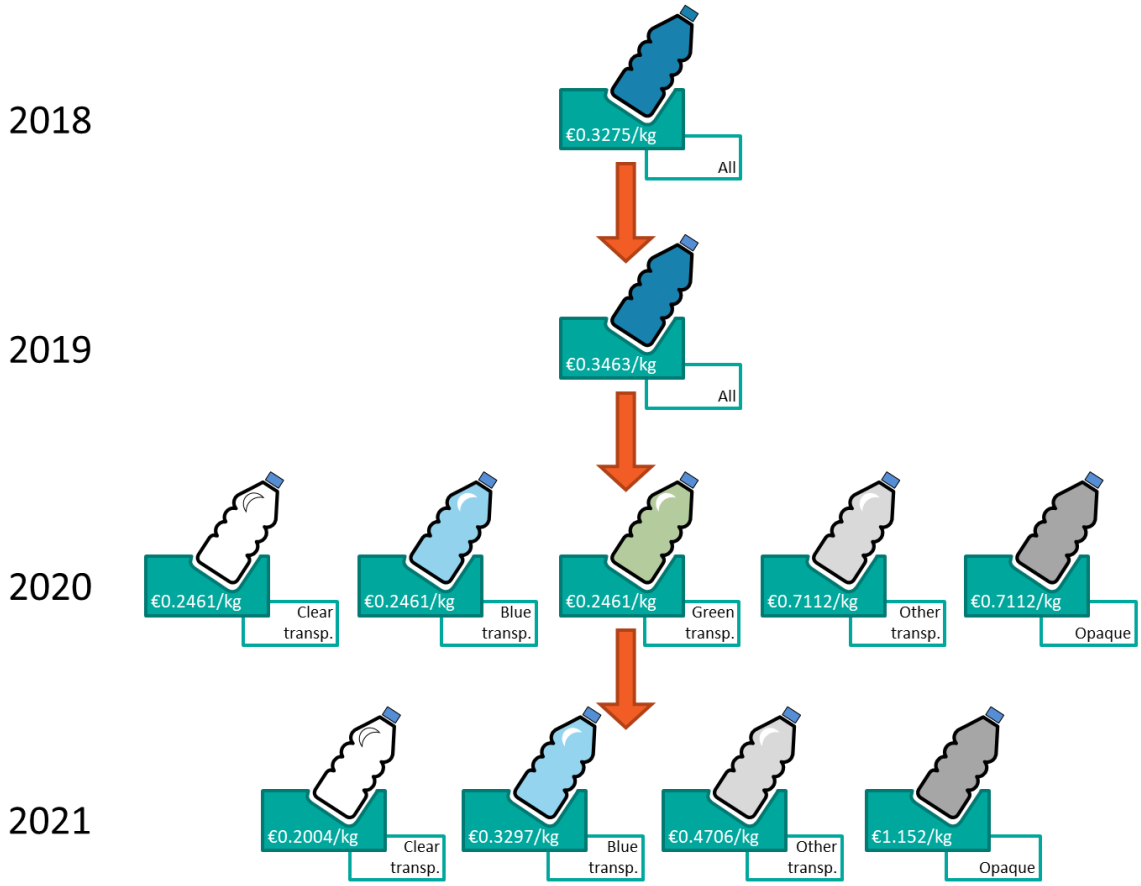
[679] Eunomia Research & Consulting Ltd (2020) Study to Support Preparation of the Commission's Guidance for Extended Producer Responsibility Schemes, Report to DG Environment, March 2020, available at https://op.europa.eu/en/publication-detail/-/publication/ecb86ea2-932e-11ea-aac4-01aa75ed71a1/language-en

Figure 2: Cost Curve for Recycling Different Packaging Formats



A specific example of this can be seen with the changes in the Belgian Green Dot fees for PET bottles over the past three years, shown in Figure 3. While in 2018 and 2019 all PET bottles paid the same fee, by 2021 disaggregation into a more granular fee structure allowed for a more accurate representation of end-of-life costs based on the colour and whether the PET bottle is transparent or opaque. This means that 'other' transparent bottles now pay a per kg fee more than twice as high as clear transparent bottles.

Figure 3: Evolution of Green Dot rates for PET bottles and flasks (2018-21)



Source: Eunomia diagram based on data from Fost Plus

Recently published rates for 2022 indicate that the per kg fee for clear transparent PET bottles will reduce to €0.1039, while that for blue transparent PET bottles will increase to €0.4172, and 'other' transparent bottles will increase to €0.5957, respectively four times and nearly six times more expensive than clear transparent PET bottles.[680] It is worth reflecting on the fact that this scale of variation in the level of fees is just within PET bottles, and other plastic formats pay higher fees.

The pressure for EPR schemes in all Member States to move to a more granular fee structure will continue to grow, especially given:

- The significant increases in costs to be covered by EPR schemes as a result of the minimum requirements under Article 8a of the WFD as well as litter clean-up costs for some types of packaging as a result of the SUP Directive;
- The challenging nature of the 2025 packaging recycling targets; and
- The point at which recycling is now measured, which makes the targets even more challenging to achieve

[680] See https://www.fostplus.be/en/members/green-dot-rates

Accordingly, greater granularity of fee structure is inevitable across Member States, with the risk that unless co-ordinated and harmonised, divergent approaches will be taken. Not only will this mean that Member States and/or EPR schemes duplicate effort in determining the fee structures to choose, but producers will be at risk of an increasing divergence in reporting requirements. The requirement under Article 8a of the waste framework for fees to be modulated, where possible, risks adding a further layer of complexity if the underlying fee structure is not harmonised.

2.2 Baseline

As explained in Section 2.1, greater granularity of fee structure is inevitable across Member States, with the risk in future years that unless co-ordinated and harmonised, increasingly divergent approaches will be taken.

Whilst Annex 3 of the Packaging and Packaging Waste Directive requires Member States to send some data pertaining to their packaging generation and consumption to Eurostat, the data requirements are limited. For placed on the market data, Member States are required to include quantities of packaging consumed within their country for broad material categories (e.g., glass, plastic, etc.). However, no greater level of granularity is required. Therefore, the reporting requirements of the different EPR schemes vary considerably. Packaging producers must register all products in every country in which they are placed on the market individually. Some Member States maintain national packaging registries, but these are not currently enforced.

At present, 26 of 27 Member States have established EPR schemes for packaging. Some have multiple competing schemes, others have a single PRO servicing the entire market. Table A-1 displays the number of packaging type categories used by each of the PROs featured in the 2021 participation costs overview published by Packaging Recovery Organisation Europe[681] alongside the same data found elsewhere for Finland (RINKI)[682] and Italy (CONAI)[683]. As has been previously noted, some Member States (e.g., Poland) have multiple competing EPR schemes. The table below names just one PRO per Member State, focussing on household packaging. This list is not intended to be exhaustive – there are more than fifty PROs for packaging across the EU – it is an illustration of the variety in granulation of data.

Table A-1: The number of material categories currently used by Member States

Member State	PRO	No. of categories
Austria	ARA	13

[681] PRO Europe (2021) *Participation Costs Overview 2021*

[682] RINKI (2021) *Producer Responsibility Fees for Packaging in 2021*, https://rinkiin.fi/en/rinkinews/news-and-news-releases/producer-responsibility-fees-for-packaging-in-2021/

[683] CONAI (2021) *Environmental Contribution*, https://www.conai.org/en/businesses/environmental-contribution/

Member State	PRO	No. of categories
Belgium	Fost Plus	25
Bulgaria	EcoPack	8
Croatia	Eko-Ozra	12
Cyprus	Green Dot	12
Czechia	EKO-KOM	39
Estonia	ETO	5
France	Citeo	15
Germany	DSD	8
Greece	HERRCo	8
Hungary	Okopannon	10
Ireland	Repak	13
Latvia	JSC	5
Lithuania	VsL	9
Luxembourg	Valorlux	9
The Netherlands	AFV	13
Poland	Rekopol	7
Portugal	Ponto Verde	8
Romania	ECO-ROM	11
Slovakia	ENVI-PAK	9
Slovenia	Slopak	16
Spain	Ecoembes	10
Sweden	FTI	8
Finland	RINKI	16
Italy	CONAI	10

It is worth noting that Denmark is not included in the table as it does not yet have an established EPR scheme for packaging, and Malta has been removed as the number of material categories used by the PRO GreenPak was not available.

The range in the number of material categories used by different Member States clearly indicates variation in the categories used. This can be further interrogated by examining the categories themselves. For example, Estonia (ETO) and Latvia (JSC) both have just five material categories. These are:

- Glass;
- Paper;
- Plastic;
- Metal; and
- Wood

With some variation regarding addition products that are specified as included (for example, Estonia includes ceramics within the glass category). In contrast, Belgium (Fost Plus) has 25 categories which further differentiation between some specific material types. Whilst this is not the way they are grouped by Fost Plus, here, the 25 categories have been sorted into the five material types used in the previous example to show how further differentiation can be made:

- Glass
    1. Glass
    2. Composite packaging in which glass accounts for the greatest weight
    3. Pottery, ceramics, porcelain
- Paper
    4. Paper-cardboard (≥85%)
    5. Beverage cartons
    6. Composite materials in which paper-cardboard accounts for the greatest weight
- Plastic
    7. PET – bottles and flasks – transparent colourless
    8. PET – bottles and flasks – transparent blue
    9. PET – bottles and flasks – transparent – other than colourless and blue
    10. PET – rigid packaging other than bottles and flasks – transparent
    11. HDPE – bottles, flasks, and other rigid packaging
    12. PP – bottles, flasks, and other rigid packaging
    13. PS – hard packaging except for EPS
    14. PE – films
    15. Other plastics – films, except for compostable
    16. PET – bottles and flasks – opaque
    17. Other plastics – hard packaging, except for compostable plastics and EPS
    18. Other plastic packaging – whether or not composite – where plastic accounts for the greatest weight, including compostable plastics and EPR
- Metal
    19. Steel (≥50%)
    20. Aluminium (≥50% and ≥50µ)
    21. Aluminium smaller than 50µ, non-composite

22. Composite packaging in which steel accounts for the greatest weight

- Wood
    23. Word, cork, textile
- Additional categories
    24. Household packaging that must be sorted as hazardous household waste after use
    25. Household packaging that obstruct collection, sorting, or recycling

2.3 Objectives

The primary objective of this measure is to harmonise the reporting requirements of EPR schemes within the EU. A secondary objective is to facilitate collation of this data at EU-level.

2.4 Description of the measure

Measure 42 has two levels of ambition carried forward to Impact Assessment. These levels are:

- **Measure 42a: EPR reporting harmonisation with de minimis threshold** – Producers above a de minimis threshold will report harmonised and more granular data to all PROs in each Member State they are active in. The nature of the harmonised reporting requirements will be detailed in an implementing act.

- **Measure 42b: EPR reporting harmonisation with de minimis threshold alongside Member State reporting of EPR data to the Commission –** As above, producers above a de minimis threshold will report harmonised and more granular data to all PROs in each Member State they are active in. In addition, Member States will be required to consolidate national data and pass it on to the Commission. This will be sufficiently anonymised to protect confidential data.

This measure will develop harmonised reporting requirements for EPR schemes across the EU. The subject of the harmonisation is likely to include, but may not be limited to, the level of data granularity that producers are required to report at, the frequency and timing of reporting by producers to EPR schemes, and the frequency at which Member States are required to gather it.

This measure will also seek to increase the granularity of the data that is available across the EU. Access to more granular data will provide policy makers with an improved overview of the packaging market, particularly if the measure includes activities to collate the data at EU-level. Understanding not just the tonnages of the different materials (i.e., plastics, metals, etc.) that are placed on the market, but also the specific material types (e.g., HDPE, aluminium, paper, etc.) will allow for better-informed decision making regarding future developments to the waste management system for packaging.

Additionally, Measure 42 would streamline the reporting process for producers operating in multiple Member States. Producers would be required to contribute data to all relevant Member States at the same time in the year and to the same level of data granularity, which would ease their compliance with EPR requirements and reduce the problem of free-riding.

Finally, this measure would seek to prevent further diversification of reporting categories between PROs in the future. By providing intervention and harmonisation at EU-level, a potentially significant and disruptive issue would be avoided. As cost coverage and recycling targets increase, pressures from producers to ensure fair cost distribution will require schemes to increase the granularity of their reporting (and fee) structures to prevent cross-subsidisation. This effect is already being seen in some Member States. Without intervention, issues with inconsistency and conflicting requirements between Member States will continue to expand. This measure is intended to be such intervention.

2.5 Links to other measures

This measure has links to the following other measures:

- Measure 23: Harmonisation of EPR fee modulation criteria [Recyclability Intervention Area]. It is expected that the harmonisation of EPR reporting requirements and harmonisation of EPR fee modulation criteria may be included within the same implementing act.
- Measure 45: Reinforcement of the market surveillance authorities. While measure 42 mandates the reporting requirements, measure 45 ensures that the standard is upheld.

2.6 Assessment of Measure 42a: EPR reporting harmonisation with de minimis threshold

2.6.1 Effectiveness

If implemented, this measure would see the introduction of standardised EPR reporting requirements across the EU. All PROs in every Member State would be obligated to collect data at a certain level of detail and at certain time in the year. Therefore, all producers meeting the set (de minimis) threshold would conform to the same reporting schedule. This would help to create a more accurate overview of the EU packaging market, supporting national efforts to identify instances of non-compliance/free-riding. Furthermore, the common approach to data reporting would effectively simplify the obligations faced by producers operating in multiple markets by ensuring that one dataset sufficiently fulfils all of their EPR reporting requirements.

However, the effectiveness of this measure is dependent on the ability to enforce harmonised data requirements. Therefore, it would only be effective if Member States and/or economic operators are subjected to an implementing act that defines how reporting must occur. This would replace the current scenario where Member States have the ability to transpose the obligations as set out in the WFD into national law however they see fit. This measure will only function if the Commission is able to create and implement an appropriate legislative act enforcing a common reporting framework across the EU.

2.6.2 Ease of implementation

Implementation of measure 42a would first require an agreement regarding the most appropriate frequency and level of data granularity for EPR reporting. Once these factors have been agreed, a suitable implementing act must then be drafted and executed.

Currently, the Commission does not influence how EPR data is reported by producers at Member State level. However, both the WFD and the PPWD include reporting requirements for Member States:

- Point c of Article 8a(1) of the WFD notes that Member States must ensure that a reporting system is in place between Member States and Eurostat. This system must gather placed on the market and waste data for products identified to be within the scope of EPR.
- Article 12 of the PPWD includes points on information systems and reporting. It requires Member States to ensure databases on packaging and packaging waste are established. It references that this must include the data set out in Annex III of the PPWD.
- Annex III of the PPWD specifies the data to be included by Member States in their databases on packaging and packaging waste. The level of granularity currently included within this annex is limited to broad material categories (e.g., plastic, wood, glass).

Whilst existing articles/annexes contain certain requirements for EPR data reporting, obligating an increased level of granularity will require an amendment to the reporting format. This should be referenced within the PPWD (as an amendment to an existing article/annex or as an additional article) and detailed within an implementing act. It is possible that this could be combined with measures seeking to introduce common fee modulation.

Following establishment of a suitable implementing act, execution of measure 42a would then require EPR schemes to update their reporting requirements and producers to meet their reporting obligations.

Much of the effort needed to implement this measure would come during setup, with little ongoing resource needed to maintain it. How much effort, and whom it is needed from, is discussed in Section 2.6.3.

2.6.3 Administrative burden

Much of the administrative burden associated with the setup of measure 42a is likely to fall on the Commission and Member State national governments. The Commission will be required to:

- Revise the chosen PPWD article or annex to amend the reporting format; and
- Create an implementing act to specify the data reporting requirements.

Member State national governments will be obligated to:

- Transpose the legislation into national law; and
- Enforce EPR schemes to report at the required level of granularity.

For EPR schemes and producers, the scale of the administrative burden is largely dictated by the difference between their current reporting performance and that which would be required under the implementing act defined in measure 42a. As the level of reporting has not been

determined, and as there is considerable variation in reporting amongst PROs and producers, it is not yet possible to comment further on the expected administrative burden.

As this measure includes increasing the granularity of reporting, it is likely that the additional administrative burden resulting from its implementation will be greater for EPR schemes currently requiring producers to report against lower numbers of material categories. This is partly because it is expected that they will need to provide further support and guidance to their members and partly because they will be required to become adept at handling greater volumes of data.

Similarly, producers placing products on markets with less detailed EPR reporting requirements will likely face greater additional administrative burden than those producers placing products on the market in Member States where a greater level of granularity is already required (e.g., Belgium, Finland, Slovenia). Producers will be required to classify their products in greater detail and report more data to the relevant EPR schemes. However, the harmonisation of the reporting requirements will facilitate easier entry into markets in multiple Member States. If implemented, this measure is expected to reduce the inconsistencies and confusion associated with conflicting or contradictory EPR scheme design.

In addition, consideration should be given to producers under the identified de minimis threshold. At present, there is no EU-level standard procedure for reducing the burden experienced by smaller producers. This should be addressed and included within the implementing act to ensure that it remains feasible for these organisations to contribute towards EPR schemes.

2.6.4 Economic impacts

The economic impacts of measure 42a are likely to be largely attributed to the increased data handling needs associated with harmonised and more detailed EPR data. The costs incurred by the relevant stakeholders have been approximated below in an estimation of full time equivalent (FTE) resource. However, it's important to note that these costs are estimated against the current level of granularity, representing the changes needed to report at more detailed level, rather than against the anticipated counterfactual of more granularity but with divergence in approaches across Member States:

- The majority of **packaging producers** would be required to supply relevant EPR schemes with more detailed product data. Depending on the size of the producer, the number and range of products they place on the market, the current status of their reporting, and the additional resource needed to bring them up to the required level as dictated by the measure, it is expected that the initial economic impact on a producer might equate to between 0 and 1 FTE. It is recommended that a de minimis threshold be introduced for producers below a certain size. This threshold will limit the reporting requirements faced by small producers, helping to ensure that economic impacts are relatively equivalent. Once the correct level of data granularity has been established, it is likely that this will reduce, perhaps to between 0 and 0.5 FTE. This is because producers will be able to use the same data for multiple markets, thereby reducing ongoing resource needs. However, this impact might well be lower than what would be experienced under the counterfactual, whereby greater granularity is required, but

nature of the granularity and associated fee structure varies across different Member States

- The immediate economic impact on **EPR schemes** would depend on the difference between the approaches they would all take under the counterfactual situation and that which is needed under measure 42a. It is expected that relative to the *current situation*, EPR schemes would incur costs and be impacted economically due to the requirement for greater data handling and storage and additional demand for support from producers. With this in mind, the economic impact on EPR schemes may be equivalent to between 0 and 1 FTE during setup and between 0 and 0.5 FTE once up and running (per PRO). However, it should also be noted that harmonisation at EU-level would prevent PROs from researching and implementing more granular fee structures themselves, thereby resulting in a cost saving.
- **National Governments** are unlikely to experience a significant economic impact. While there could be a small additional requirement to introduce a greater number of performance targets, it is unlikely that this would translate to anything more than negligible resource.
- **The European Commission** would be required to update the PPWD and create devise an implementing act. Whilst this will require resource, it will be relatively short-term. Furthermore, as this is likely to also incorporate measures to harmonise eco-modulation criteria, this resource can be (at least in part) shared with measure 23 within the recyclability intervention area.

2.6.5 Social impacts

Given the increase in data reporting and handling associated with the implementation of measure 42a, much of the direct social impact is likely attributed to job creation. As data and reporting underpins and supports many of the other intervention areas, this measure could also indirectly support social impacts associated with their implementation.

2.6.6 Environmental impacts

It is not expected that this measure will result in significant environmental impact.

2.6.7 Stakeholder views

During an interview with stakeholders from Europen, a representative highlighted that they had observed that EPR schemes are becoming increasingly divergent from one another. They noted that the categories and granularity used by Belgian packaging PRO, Fost Plus, appeared to result in a good system, and that members of Europen generally agreed with this. However, stakeholders also drew attention to the fact that required data granularity was directly linked to administrative burden and therefore emphasized that harmonisation will be crucial to limit additional effort.

Following the webinars in June, the feedback provided by attendees showed almost unanimous support for harmonisation of EPR reporting requirements. Some respondents were careful to caveat their support stating that any move towards harmonisation should not disproportionately increase any administrative burden. Several attendees specifically highlighted that harmonising not just *what* is reported but also *when* it is reported would make it easier to plan for/schedule administrative duties.

2.7 Assessment of Measure 42b: EPR reporting harmonisation with de minimis threshold alongside Member State reporting of EPR data into the Commission

2.7.1 Effectiveness

Given the significant similarities between much of measures 42a and 42b, the assessment of effectiveness provided in Section 2.6.1 is also applicable here. However, as measure 42b also includes Member States reporting to the Commission, to be effective it also requires a managed flow of information. As has been previously noted, Annex III of the PPWD requires Member States to report placed on the market and waste data for in-scope packaging products to Eurostat. However, this is currently at broad material level (e.g., plastic, wood, metal). Therefore, for measure 42b to be effective, an update to Annex III is needed to include more granular reporting requirements.

To make use of the information gathered, the Commission would be required to collate and manage the data received. As this is currently already conducted by Eurostat under Annex III, it is expected that this process could continue albeit with a greater volume of data. Gathering the data at EU-level would provide an overview of the entire EU packaging market, but only if the data are effectively gathered, collated, and managed in a database or repository. This would allow for analysis to be undertaken and meaningful conclusions to be drawn.

2.7.2 Ease of implementation

In addition to the steps identified in Section 2.6.2, measure 42b includes collation of EPR data at EU-level. Under Annex III, this already occurs at a lower level of data granularity and is conducted by Eurostat. Implementing measure 42b may require:

- **Member States to collect and aggregate national packaging data**, potentially from multiple PROs where several service a single market. Whilst some countries already have packaging registries that carry out most of these tasks, registries are not established in every Member State. Therefore, in some scenarios, national governments may have to introduce appropriate resource;
- **A consistent and well-managed flow of information between Member States and the Commission**. Whilst Member States must, under Article 12 and Annex III of the PPWD, report packaging data to Eurostat, the requirements do no extend to the level of granularity needed for measure 42b. An update to Annex III may be needed in order to implement this measure. Further detail could be included within the implementing act previously discussed in measure 42a; and
- **The Commission to collate, store, and manage the data** to provide an overview of the EU packaging market. As similar activities are currently undertaken by Eurostat, it is expected that this method could reasonably continue.

2.7.3 Administrative burden

Due to the similarities in measure design, the administrative burden associated with measure 42b would be largely identical to those explained in Section 2.6.3 for measure 42a.

For Member States, there might be a small additional administrative burden associated with gathering packaging data and passing it on to the Commission. As Member States are already required to do this (to Eurostat), albeit at less detail, this is unlikely to be significant. The implementing act previously mentioned will outline what data must be reported. Member States will simply be required to obtain it from PROs and pass it on to Eurostat.

For the Commission, there are two primary sources of additional administrative burden. The first is with regards to any required legislation amendments. This may be similar to the administrative burden outlined for measure 42a but may also include a revision to Annex III. The second, and likely more significant, relates to the management of the gathered data. Given this measure's requirement for packaging data to be reported at a more granular level, the Commission will receive a large amount of data which may translate to increased administrative burden.

2.7.4 Economic impacts

If implemented, the economic impacts of measure 42b are similar to those outlined in Section 2.6.4 for measure 42a. Under measure 42b, it is expected that only the Commission will experience any real change in economic impact. As Member States will be passing packaging data to the Commission at a great level of granularity, there will be an increase in the data they are required to handle. Whilst this may result in a slight increase in economic impact, it is expected that this will be negligible.

2.7.5 Social impacts

The social impacts resulting from the implementation of measure 42b are expected to be similar to those listed in Section 2.6.5. Given the need for the creation of an EU-level databased and Member State data aggregation services, the number of jobs created may increase slightly.

2.7.6 Environmental impacts

The environmental impacts associated with measure 42b are expected to be the same as those listed in Section 2.6.6.

2.7.7 Stakeholder views

The stakeholder views noted for measure 42a in Section 2.6.7 remain relevant for measure 42b.

In addition, following the webinars in June, stakeholders provided mixed responses to the possibility of passing PRO data onto the Commission. Several respondents raised concerns about data confidentiality, stressing the need for sufficient aggregation so as to protect sensitive information. Stakeholders will require confidence that confidentiality will be ensured. This is not expected to cause any problems as similar data (albeit less granular) is already transferred from Member States to the Commission under Annex III, which has thus far caused no confidentiality issues.

2.8 Summary and conclusion

Table A-2 Summary of Impacts for Measure 42

Impact category	Measure 42a	Measure 42b
Effectiveness	Reliant on implementation of the correct legal tool	Similar to 42a
Ease of implementation	Mostly determined by the ease of updating an existing, or including of a new, article/annex in the PPWD alongside introducing an implementing act	Similar to 42a. Requires MS to report packaging data to Eurostat. This is already done at less detail under Annex III of the PPWD
Administrative burden	Harmonised reporting for producers to reduce MS differences	Similar to 42a. Increase in burden for the Commission due to increased volumes of data
Economic impacts	Minimal. Some FTEs needed by producers and PROs to manage reporting requirements	Similar to 42a. Increase for the Commission due to increase volumes of data
Social impacts	Job creation as per above	Similar to 42a
Environmental impacts	No direct environmental impact. Negligible impact from data processing and storage	Similar to 42a
Stakeholder Views	Harmonisation welcome, currently too much divergence. Annual reporting recommended.	Similar to 42a. Mixed responses to passing data from MSs to the Commission – confidentiality must be ensured

3.0 Discarded measures

3.1 Measure 42c. Packaging registry set up at EU-level

This measure would involve developing an EU wide data portal to aid compliance and minimise reporting burdens. This would constitute a top-down approach where an EU packaging compliance data portal receives data, which could then be fed down to national level registries. Producers would only have to submit data returns across the EU once and avoid the efforts and costs associated with submitting data to different registers in multiple Member States. This would compensate for the additional time that would be required to submit more data per packaging item than is currently required. Since smaller Member States have limited capacity for developing their own databases this would provide a clear starting point for the national packaging registries required under the above measure. Under this approach national governments could maintain their own databases, and potentially save effort by receiving relevant data from the EU data portal.

The majority of the interviewees expressed concerns as to the difficulty to establish and maintain an EU-wide registry. There were concerns that the amount of data required would increase over time. This approach is therefore not included within the impact assessment.

Another variant was explored, where the data would then be aggregated by the PRO and submitted to an EU-level data repository but it was discarded due to the nature of the legal instrument – the EU cannot require (without a regulation) a national PRO to report directly to a registry.

3.2 Measure 43. EU packaging compliance data portal

The EU packaging compliance portal would enable citizens to report packaging non-compliance directly to an online portal, providing information and evidence. The details provided could then be used to identify producers failing to meet packaging requirements such as, for example, over-packaging limits.

Whilst this measure is favoured by NGOs, some stakeholders raised concerns over the costs associated with set up and operational maintenance. In addition, further consideration is needed to determine the appropriate process to undertake following a reported incident.

Ultimately, this measure was discarded as anecdotal evidence provided regarding the compliance portal in Belgium suggested that over half of the reported cases were either incorrect or irrelevant. Representatives from Fost Plus noted that operating the compliance portal diverted resources from other more impactful areas of packaging monitoring and reporting.

3.3 Measure 44. Member States enforcement reporting

Measure 44 would require Member States to report every 2 years their packaging-related enforcement activities. This measure was suggested by some stakeholders to promote information-sharing and transparency, but it was finally considered not to be effective on its own and it was not taken forward to impact assessment. Additionally, this could be perceived as

excessive measure – Member States are obliged to ensure the enforcement of EU directives and, should they fail to do so, an infringement can be launched against them.

3.4 Measure 45. Reinforcement of the Market Surveillance Authorities

Measure 45 would require Member States to undertake activities designed to reinforce their market surveillance efforts. However, it is not currently clear whether concerns regarding any inability to enforce the Essential Requirements are as a result of insufficiencies in the existing market surveillance efforts or ambiguities in the Essential Requirements themselves. Stakeholder feedback suggests that the Essential Requirements currently lack sufficient definition to be reasonably enforced. Other intervention areas include measures designed to add clarity to the Essential Requirements (for example, definitions of key terms) which should increase the ability of market surveillance authorities to recognise non-compliant products.

Until the impact of strengthening the Essential Requirements is understood, it remains unclear whether market surveillance authorities, as they currently stand, require reinforcement. Furthermore, the recent Market Surveillance Regulation may assist efforts to check product conformity regardless. Such Regulation will require every in-scope product placed on the market in the EU to have an EU-based 'economic operator' that is responsible for the conformity (and associated documentation) of that product. Point 1 of Article 2 of the Market Surveillance Regulation states that

> *This Regulation shall apply to products that are subject to the Union harmonisation legislation listed in Annex I.*

where the ninth Directive within Annex I is the European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. Thereby including packaging and packaging waste within the scope of the Regulation.

Outside of the Market Surveillance Regulation, an Administrative Cooperation Group (AdCo) for packaging could be one option for further reinforcing market surveillance efforts. AdCos are informal groups designed to coordinate Member State surveillance efforts at EU-level. Whilst setting up and implementing an AdCo for packaging is expected to enable better cross-Member State sharing of information regarding packaging compliance, the demand for such a group must come from Member State representatives. As a result of the factors listed above, it has been decided that measure 45 is not appropriate to be carried forward to impact assessment.

APPENDIX P - IMPACTS PER MEMBER STATE

In this document we describe the impacts of the preferred option in each of the 27 Member States. Further details on the Cost-Benefit Model (CBA), the measures and the preferred option can be found in the following documents:

- Appendix B – Baseline Methodology
- Appendix D – Impact Modelling Methodology
- Appendices J to O – Impact assessment of the measures
- Synthesis Report, section 7.0 – Policy options and preferred option

Unless noted otherwise, all values shown represent the change of the preferred option in 2030 vs the baseline in 2030. It is worth noting that the impacts of some measures will take place after 2030, so these are not shown here.

1.0 Mass Flow impacts

1.1 Waste Generation

Table 1-1 presents the impact of the option on waste generation for each Member State. Overall, there are large reductions in the quantity of waste generated but these numbers vary greatly throughout the EU. The subsequent columns of 'Recycling', 'Incineration', 'Landfill' and 'Litter' demonstrate how the reductions in waste generated for each Member State are divvied out among waste destinations. Accordingly, for each Member State, the sum of these four waste destinations is equal to the total waste generation.

All modelled data points are rounded to the nearest thousand tonnes, explaining why many of the 'Litter' values are 0 kt.

Table 1-1: Change in 2030 Waste Generation by Destination, Thousand Tonnes

	Waste Generation	Recycling	Incineration	Landfill	Litter
Austria	-299	-162	-127	-10	0
Belgium	-565	-436	-126	-3	0
Bulgaria	-114	-55	-30	-29	0
Croatia	-55	-28	-13	-14	0
Cyprus	-44	-29	-7	-8	0
Czech Republic	-251	-136	-65	-49	0
Denmark	-373	-224	-123	-25	0
Estonia	-98	-53	-35	-10	0
Finland	-159	-79	-79	-2	0
France	-4,421	-2,589	-1,183	-646	-2
Germany	-4,132	-2,259	-1,839	-34	-1
Greece	-237	-150	-50	-37	0
Hungary	-317	-130	-105	-82	0
Ireland	-709	-432	-238	-38	0
Italy	-1,553	-703	-574	-276	0
Latvia	-112	-56	-33	-23	0
Lithuania	-160	-94	-36	-30	0
Luxembourg	-39	-25	-12	-2	0
Malta	-22	-11	-5	-7	0
Netherlands	-937	-641	-266	-30	0

	Waste Generation	Recycling	Incineration	Landfill	Litter
Poland	-2,610	-1,427	-672	-510	-1
Portugal	-354	-193	-84	-78	0
Romania	-567	-284	-159	-125	0
Slovakia	-136	-74	-33	-29	0
Slovenia	-78	-49	-16	-14	0
Spain	-2,754	-1,832	-452	-469	-1
Sweden	-494	-300	-95	-99	0

1.2 Recycling Rates

Table 1-3 and Table 1-4 display the change in recycling rates for different materials in each Member State, for 2025 and 2030 respectively. There are some common trends between the Member States, for example plastic is the material with the greatest increase to recycling rates for all 27 countries, whereas paper/board is usually the smallest. What is more, by presenting tables for both 2025 and 2030, the variable impact rate of the option is easier to interpret, with plastic recycling rates between the baseline and the option differing significantly in 2030 when compared to 2025.

The countries with lower baseline recycling rates are generally those most improved by the proposed option. To illustrate this point, correlation tests were run on the changes in recycling rates (option-baseline) and the baseline recycling rates (Table 1-2). This table indicates how effectively the proposed option targets those Member States with lower baseline recycling rates. The closer the r value is to -1, the more effective the option is at targeting Member States with lower baseline recycling rates. The correlations are negative for all waste materials which means that broadly those countries with lower baseline recycling rates are predicted to have their rates improve more than those countries with higher baseline recycling rates. However, this trend varies by material, with 'Paper / Board' having the strongest negative corelation and 'Aluminium' showing little-to-no correlation. When it comes to 'Plastic', as time passes, the option starts to target those countries with lower baseline recycling rates more, with the 2030 correlation significantly stronger than the 2025. This suggests that for plastic waste, the option will have an increasingly positive impact on the recycling rates of those Member States with lower baseline recycling rates.

Table 1-2: Correlations Between 'Change in Recycling Rates (option-baseline)' and 'Baseline Recycling Rate', Pearson's r

	Glass	Steel	Aluminium	Paper / Board	Plastic
2025	-0.61	-0.76	-0.29	-0.81	-0.31
2030	-0.54	-0.69	-0.19	-0.85	-0.60

For aluminium, there are Member States in which the option is modelled to reduce recycling rates. For 2030, these countries are: Denmark, France, Greece, Ireland, Lithuania, and Sweden. However, these are all less than a 1% reduction. Wood waste was also modelled but the option predicted no change in recycling rates for any of the Member States.

Table 1-3: Change in 2025 Recycling Rates by Material and Comparison to 2025 Baseline

***%** Relative to 2025 baseline recycling rate (option-baseline) in light gray*

	Glass		Steel		Aluminium		Paper / Board		Plastic	
	%	%*	%	%*	%	%*	%	%*	%	%*
Austria	83.9%	0.0%	91.6%	0.1%	77.4%	0.3%	84.5%	0.0%	51.8%	1.8%
Belgium	99.9%	0.0%	99.1%	0.0%	97.5%	0.0%	95.7%	0.0%	51.9%	1.9%
Bulgaria	77.6%	0.0%	89.2%	0.0%	71.1%	0.2%	67.7%	0.2%	60.7%	1.6%
Croatia	66.3%	0.1%	59.3%	0.3%	35.6%	0.0%	94.0%	0.0%	40.9%	1.4%
Cyprus	62.3%	0.1%	99.9%	0.0%	99.8%	0.0%	98.0%	0.0%	55.8%	1.5%
Czech Republic	74.8%	0.0%	79.0%	0.1%	42.9%	0.1%	85.9%	0.0%	58.7%	1.7%
Denmark	84.7%	0.0%	89.2%	0.2%	71.0%	-0.1%	92.0%	0.0%	51.7%	1.7%
Estonia	68.7%	0.1%	88.5%	0.1%	69.6%	0.3%	86.4%	0.0%	45.0%	1.7%
Finland	99.3%	0.0%	94.9%	0.0%	87.1%	0.0%	99.8%	0.0%	43.8%	1.8%
France	76.3%	0.0%	91.0%	0.0%	64.2%	-0.1%	92.2%	0.0%	42.4%	1.8%
Germany	83.0%	0.0%	92.3%	0.0%	91.4%	0.2%	86.9%	0.0%	52.7%	2.0%
Greece	59.0%	0.2%	83.4%	0.0%	43.8%	-0.2%	99.6%	0.0%	42.8%	1.4%
Hungary	59.2%	0.1%	80.9%	0.1%	54.0%	0.3%	68.8%	0.1%	41.5%	1.6%
Ireland	82.3%	0.1%	66.3%	0.7%	42.7%	0.0%	79.3%	0.1%	43.3%	1.8%
Italy	73.4%	0.0%	78.3%	0.0%	79.3%	0.1%	80.3%	0.1%	46.1%	1.4%
Latvia	68.9%	0.0%	83.5%	0.2%	59.3%	0.2%	83.4%	0.0%	42.7%	1.8%

	Glass		Steel		Aluminium		Paper / Board		Plastic	
	%	%*	%	%*	%	%*	%	%*	%	%*
Lithuania	65.7%	0.1%	85.3%	0.2%	66.0%	-0.2%	78.0%	0.1%	71.4%	1.3%
Luxembourg	98.3%	0.0%	93.2%	0.1%	93.2%	0.0%	80.4%	0.1%	51.7%	1.7%
Malta	52.2%	0.0%	66.4%	0.3%	38.2%	0.8%	63.9%	0.1%	37.1%	2.3%
Netherlands	86.2%	0.0%	97.5%	0.0%	93.3%	0.1%	87.5%	0.0%	54.5%	2.0%
Poland	66.7%	0.0%	89.7%	0.1%	54.6%	0.0%	88.4%	0.0%	42.7%	1.8%
Portugal	63.7%	0.0%	67.3%	0.3%	41.6%	0.5%	71.6%	0.1%	42.1%	1.5%
Romania	65.1%	0.1%	75.9%	0.2%	37.8%	0.0%	89.1%	0.0%	44.3%	1.3%
Slovakia	68.7%	0.1%	83.8%	0.1%	60.2%	0.1%	77.2%	0.1%	53.1%	1.6%
Slovenia	98.5%	0.0%	83.6%	0.1%	58.1%	0.3%	76.7%	0.1%	62.0%	1.6%
Spain	76.8%	0.1%	91.3%	0.1%	76.9%	0.0%	75.0%	0.0%	52.7%	1.8%
Sweden	92.7%	0.0%	94.8%	0.1%	74.4%	-0.1%	77.7%	0.0%	52.3%	2.1%

Table 1-4: Change in 2030 Recycling Rates by Material and Comparison to 2030 Baseline

***%** Relative to 2030 baseline recycling rate (option-baseline)*

	Glass		Steel		Aluminium		Paper / Board		Plastic	
	%	%*	%	%*	%	%*	%	%*	%	%*
Austria	83.9%	0.0%	92.1%	0.4%	79.1%	1.2%	85.2%	0.2%	68.9%	13.9%
Belgium	100.0%	0.0%	99.2%	0.0%	97.7%	0.1%	95.9%	0.1%	68.8%	13.8%
Bulgaria	77.7%	0.1%	89.6%	0.1%	71.9%	0.6%	77.4%	0.7%	70.9%	11.7%
Croatia	71.7%	0.2%	71.7%	1.1%	48.6%	0.2%	94.4%	0.2%	60.4%	13.4%
Cyprus	69.2%	0.4%	99.9%	0.0%	99.8%	0.0%	98.1%	0.0%	67.6%	13.3%
Czech Republic	74.9%	0.1%	79.7%	0.3%	53.4%	0.2%	86.2%	0.2%	70.1%	13.1%
Denmark	84.8%	0.1%	90.1%	0.8%	71.6%	-0.1%	92.2%	0.1%	69.0%	14.0%
Estonia	72.7%	0.2%	89.0%	0.3%	70.8%	0.8%	86.8%	0.3%	63.9%	14.5%
Finland	99.3%	0.0%	95.2%	0.1%	87.8%	0.0%	99.8%	0.0%	64.5%	16.0%
France	76.3%	0.0%	91.5%	0.2%	65.4%	-0.1%	92.4%	0.1%	62.3%	14.5%
Germany	83.0%	0.0%	92.6%	0.2%	92.2%	0.6%	87.1%	0.1%	69.0%	13.8%
Greece	67.1%	0.6%	83.9%	0.1%	53.4%	-0.6%	99.6%	0.0%	60.8%	13.5%
Hungary	67.0%	0.3%	81.6%	0.3%	59.1%	0.6%	79.1%	0.3%	60.6%	13.3%
Ireland	82.4%	0.2%	76.4%	1.3%	52.7%	-0.5%	81.0%	0.3%	62.7%	14.4%
Italy	74.0%	0.0%	79.7%	0.2%	80.6%	0.7%	83.5%	0.3%	62.5%	12.3%
Latvia	73.2%	0.1%	84.5%	0.8%	61.4%	1.0%	84.0%	0.3%	63.3%	15.4%

	Glass		Steel		Aluminium		Paper / Board		Plastic	
	%	%*	%	%*	%	%*	%	%*	%	%*
Lithuania	71.3%	0.2%	86.3%	0.7%	67.6%	-0.4%	82.3%	0.3%	80.4%	10.5%
Luxembourg	98.3%	0.0%	93.6%	0.2%	93.5%	0.1%	85.2%	0.2%	67.5%	12.5%
Malta	61.0%	0.0%	75.0%	0.7%	50.3%	2.2%	74.5%	0.3%	57.7%	14.9%
Netherlands	86.2%	0.0%	97.6%	0.0%	93.7%	0.2%	87.9%	0.2%	68.8%	13.8%
Poland	71.9%	0.1%	90.3%	0.4%	58.6%	0.0%	88.8%	0.2%	61.6%	13.7%
Portugal	69.8%	0.0%	76.9%	0.9%	53.7%	1.6%	81.0%	0.3%	60.3%	12.6%
Romania	70.2%	0.2%	76.8%	0.6%	48.4%	0.0%	89.4%	0.2%	57.9%	11.8%
Slovakia	73.2%	0.1%	84.4%	0.2%	61.6%	0.2%	82.1%	0.3%	64.4%	12.8%
Slovenia	98.5%	0.0%	84.2%	0.2%	60.8%	0.8%	85.3%	0.3%	72.1%	11.7%
Spain	76.9%	0.2%	91.9%	0.5%	78.0%	0.1%	85.2%	0.2%	67.9%	12.9%
Sweden	92.7%	0.0%	95.2%	0.4%	75.3%	-0.3%	82.9%	0.2%	66.5%	16.2%

2.0 Economic Impacts

Cost impacts are borne by various types of economic actors, and impacts passed on indirectly via supply chains. Furthermore, economic impacts are relative to the position of each actor within the market i.e. a cost to one actor is a revenue to another. The actor to which impacts are measured relative to is indicated in brackets in the table below, using the following nomenclature: producers (P); various actors (V); retailers (R).

Table 2-1: 2018-2030 Change in Financial Costs (relative to baseline in 2030), Million €

	Waste Management Costs (incl. collection) - EPR Fees (P)			Food Waste Treatment and Contamination Removal (non-packaging) (P)	Avoided Cost of one-way DRS Schemes (P)	Direct Producer Costs, Million € (P)		Capital and Operational Costs of Reuse Schemes (V)	Additional Labour Costs for E-commerce Under Void Space Measure (R)
	Recycling	Incineration	Landfill			Producer Turnover	Material Cost Savings		
Austria	-58	-13	0	-3	0	-978	-135	79	3
Belgium	-172	-13	0	-4	-8	-1,527	-219	130	4
Bulgaria	-22	-3	-1	-1	-4	-256	-45	27	0
Croatia	-8	-1	0	0	-2	-135	-21	14	0
Cyprus	-7	0	0	0	-2	-98	-16	10	0
Czech Republic	-58	-6	-2	-2	-3	-726	-104	64	1
Denmark	-80	-13	-1	-2	-4	-948	-143	84	2
Estonia	-19	-5	0	0	-1	-243	-37	20	0
Finland	-34	-10	0	-1	-2	-368	-55	36	1
France	-745	-128	-26	-20	-121	-10,329	-1,599	911	27
Germany	-862	-181	-1	-23	5	-12,257	-1,711	969	42
Greece	-33	-5	-1	-1	-8	-659	-108	68	1
Hungary	-56	-8	-3	-2	-4	-871	-126	74	1

	Waste Management Costs (incl. collection) - EPR Fees (P)			Food Waste Treatment and Contamination Removal (non-packaging) (P)	Avoided Cost of one-way DRS Schemes (P)	Direct Producer Costs, Million € (P)		Capital and Operational Costs of Reuse Schemes (V)	Additional Labour Costs for E-commerce Under Void Space Measure (R)
	Recycling	Incineration	Landfill			Producer Turnover	Material Cost Savings		
Ireland	-140	-20	-1	-2	-18	-2,018	-291	169	3
Italy	-367	-43	-10	-19	-41	-4,565	-595	391	15
Latvia	-22	-3	-1	0	-2	-201	-30	16	0
Lithuania	-38	-4	-1	-1	-3	-336	-54	31	0
Luxembourg	-6	-1	0	0	-1	-100	-15	9	0
Malta	-2	0	0	0	0	-73	-10	6	0
Netherlands	-324	-31	-1	-5	-3	-2,390	-349	197	7
Poland	-477	-62	-19	-8	-33	-5,588	-822	444	4
Portugal	-64	-8	-3	-2	-5	-1,258	-165	98	2
Romania	-92	-16	-5	-4	-17	-1,085	-191	109	1
Slovakia	-28	-3	-1	-1	-3	-376	-57	35	0
Slovenia	-15	-2	-1	0	-2	-200	-32	19	0
Spain	-478	-42	-18	-13	-64	-8,633	-1,271	765	15
Sweden	-118	-12	-4	-3	-8	-1,242	-190	114	4

3.0 Environmental Impacts

The net impact of the preferred option is to decrease tonnages of waste going to all final destinations (driven by the overall reduction in waste generation). This includes recycling tonnages, which decrease in the preferred option despite gains in recycling rates. Reductions in residual disposal (landfill and incineration) lead to GHG savings (as these activities are net emitters of GHGs). The reduction in recycling has the opposite impact – resulting in a net gain in GHG emissions, as reduced recycling leads to a decrease in avoided GHG emissions (i.e., recycling activities would have led to negative emissions had they taken place, via the reduced use of raw materials in subsequent manufacturing). An increased rollout of reuse schemes also leads to an increase in GHG emissions, primarily from transportation of reusable packaging.

Table 3-1: Change in 2030 Greenhouse Gas Emissions, Thousand Tonnes CO_2e

	Manufacturing	Transport	Collection	Sorting	Recycling	Incineration	Landfill	Reuse*	Total
Austria	-317	-54	-13	-1	-11	-157	-1	103	-451
Belgium	-546	-102	-25	-2	135	-168	0	156	-552
Bulgaria	-128	-21	-5	0	32	-19	-3	32	-112
Croatia	-62	-10	-2	0	3	-16	0	16	-72
Cyprus	-50	-8	-2	0	26	-6	0	10	-29
Czech Republic	-248	-45	-11	-1	-5	-34	-4	80	-268
Denmark	-389	-67	-17	-1	71	-139	5	100	-438
Estonia	-107	-18	-4	0	21	6	-1	24	-78
Finland	-171	-29	-7	0	29	-63	0	42	-200
France	-3,553	-796	-199	-10	160	-1,430	31	1,064	-4,733
Germany	-3,366	-744	-186	-9	-325	-418	-2	1,276	-3,774
Greece	-267	-43	-11	-1	49	-56	2	73	-253
Hungary	-351	-57	-14	-1	8	-133	-4	91	-461

	Manufacturing	Transport	Collection	Sorting	Recycling	Incineration	Landfill	Reuse*	Total
Ireland	-743	-128	-32	-2	177	-189	-8	187	-739
Italy	-1,530	-280	-70	-3	-260	-517	-14	488	-2,185
Latvia	-86	-20	-5	0	16	-15	0	20	-91
Lithuania	-143	-29	-7	0	62	-19	-2	34	-104
Luxembourg	-36	-7	-2	0	5	-7	0	10	-37
Malta	-21	-4	-1	0	-2	-3	-1	8	-25
Netherlands	-766	-169	-42	-3	105	-155	-2	247	-786
Poland	-2,040	-470	-117	-6	298	177	24	520	-1,613
Portugal	-415	-64	-16	-1	-18	-148	-14	118	-557
Romania	-538	-102	-26	-1	115	-147	3	119	-576
Slovakia	-145	-24	-6	0	14	-51	-4	41	-176
Slovenia	-79	-14	-4	0	22	-13	-2	21	-68
Spain	-2,709	-496	-124	-7	501	-695	-104	855	-2,779
Sweden	-452	-89	-22	-1	62	10	-12	135	-369

The change in externalities (GHG and air quality) associated with manufacturing, recycling, incineration and landfill are shown in Table 3-2. Similarly to the GHG emissions, there are savings at some stages to the packaging lifecycle (manufacturing, residual treatment) while other stages (recycling and reuse) create more impacts. Transport, collection and sorting has not been included.

Table 3-2: Change in 2030 Externality Costs (Greenhouse Gas Costs + Air Quality Costs) by Waste Management Process, Million €

	Manufacturing	Recycling	Incineration	Landfill	Reuse*	Total
Austria	-104	14	-16	0	21	-85
Belgium	-170	73	-37	0	143	10
Bulgaria	-30	9	-3	-1	5	-19
Croatia	-17	2	-2	0	13	-4
Cyprus	-12	6	-1	0	1	-6
Czech Republic	-71	8	-1	-1	15	-50
Denmark	-102	28	-27	1	2	-98
Estonia	-25	6	3	0	0	-16
Finland	-39	8	-12	0	0	-43
France	-1,115	267	-298	1	0	-1,145
Germany	-1,150	125	113	0	4,890	3,978
Greece	-61	14	-10	0	282	226
Hungary	-98	10	-28	-2	26	-92
Ireland	-200	65	-34	-2	70	-99
Italy	-459	-11	-72	-7	219	-329
Latvia	-20	5	-3	0	4	-14
Lithuania	-35	17	-4	-1	0	-22
Luxembourg	-16	7	-2	0	4	-7
Malta	-5	0	-1	0	4	-2
Netherlands	-254	80	-24	-1	887	688
Poland	-549	127	90	1	22	-309
Portugal	-92	-1	-28	-3	338	215
Romania	-141	40	-25	0	18	-109
Slovakia	-40	8	-10	-1	27	-16
Slovenia	-22	9	-2	-1	0	-15
Spain	-645	167	-134	-22	932	298

	Manufacturing	Recycling	Incineration	Landfill	Reuse*	Total
Sweden	-109	23	4	-3	116	31

4.0 Social Impacts - Employment

Table 4-1 show the impacts in employment across the packaging lifecycle, with job losses in manufacturing, recycling and residual treatment, and job gains in reuse.

Table 4-1: 2018-2030 Change in Employment by Sector, FTEs

	Manufacturing	Recycling*	Residual Treatment*	Reuse	Total
Austria	-8,167	-204	-96	32,093	23,626
Belgium	-12,687	-775	-90	47,555	34,003
Bulgaria	-2,173	-133	-41	9,149	6,803
Croatia	-1,139	-32	-19	4,492	3,302
Cyprus	-796	-82	-11	2,736	1,847
Czech Republic	-6,137	-156	-80	24,735	18,362
Denmark	-7,753	-499	-104	28,067	19,711
Estonia	-1,934	-137	-32	6,567	4,465
Finland	-3,105	-83	-56	11,290	8,045
France	-85,824	-3,948	-1,281	320,194	229,141
Germany	-103,881	-2,562	-1,311	407,981	300,228
Greece	-5,557	-320	-61	21,762	15,824
Hungary	-7,127	-163	-131	26,619	19,197
Ireland	-16,039	-1,111	-193	53,804	36,460
Italy	-38,335	340	-595	147,751	109,161
Latvia	-1,634	-110	-39	5,318	3,535
Lithuania	-2,740	-296	-46	9,463	6,381
Luxembourg	-828	-38	-10	3,162	2,286
Malta	-620	-11	-8	2,453	1,815
Netherlands	-20,212	-974	-207	76,765	55,372
Poland	-45,630	-2,987	-827	154,565	105,121
Portugal	-10,155	-205	-113	36,681	26,209
Romania	-8,930	-665	-198	33,550	23,757
Slovakia	-3,142	-118	-43	12,372	9,068
Slovenia	-1,684	-116	-21	6,466	4,645

	Manufacturing	Recycling*	Residual Treatment*	Reuse	Total
Spain	-71,536	-3,891	-645	266,044	189,972
Sweden	-10,474	-463	-136	39,335	28,262

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