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PART 2/4

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the document

Directive of the European Parliament and of the Council

amending Directive 2008/98/EC on waste

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ANNEX 1: PROCEDURAL INFORMATION

1- Lead DG, Decide Planning/CWP references

The preparation of this file was co-led by Directorate General (DG) Environment (ENV.B3) and DG Health and Food Safety (SANTE), with support from DG Joint Research Centre Units B.5 - Circular Economy & Industrial Leadership and D.3 - The Land Resources Unit. The file comprises a targeted revision of the existing Waste Framework Directive (2008/98/EC). The Waste Framework Directive (WFD)[1] sets the basic concepts and definitions related to waste management, including definitions of waste, recycling and recovery. This targeted revision considers two review clauses in the WFD that call on the Commission to consider the setting of preparing for reuse and recycling targets for textile waste and to examine the feasibility of establishing a Union-wide food waste reduction target to be met by 2030.

This file is the result of two separate items in the DECIDE/Agenda Planning database:

- Environmental impact of waste management - Revision of EU waste framework (PLAN/2021/12032)
- Food waste reduction targets (PLAN/2021/11886)

2- Organisation and timing

This initiative is a deliverable under the European Green Deal (EGD)[2] and the new Circular Economy Action Plan (CEAP)[3]. The revision of food waste and textiles aspects of the WFD is in the European Commission's Work Programme for 2023, in Annex I, under the heading 'A European Green Deal'.

The Call for Evidence for textile waste[4] was published on 25 January 2022 with a feedback period until 22 February 2022. The Inception Impact Assessment for the food waste reduction targets[5] was published on 30 September 2021 with a feedback period until 29 October 2021.

One Inter Service Steering Group (ISSG) for the WFD Impact Assessment was set up by DG Environment. It included the following DGs and services: AGRI (Agriculture), CLIMA (Climate Action), COMP (Competition), ECFIN (Economic and Financial Affairs), ENER (Energy), ESTAT (Eurostat), FISMA (Financial Stability, Financial Services and Capital Markets Union), GROW (Internal Market, Industry, Entrepreneurship and SMEs), INTPA (International Partnerships), JRC (Joint Research Centre), JUST (Justice and Consumers), MARE (Maritime Affairs and Fisheries), MOVE (Mobility and Transport), NEAR (European Neighbourhood and Enlargement

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[1] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste *(OJ L 150, 14.6.2018, p. 109–140),* EUR-Lex - 32018L0851 - EN - EUR-Lex (europa.eu).

[2] EUR-Lex - 4438420 - EN - EUR-Lex (europa.eu)

[3] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 11.03.2020 A new Circular Economy Action Plan For a cleaner and more competitive Europe, COM(2020) 98 final, EUR-Lex - 52020DC0098 - EN - EUR-Lex (europa.eu).

[4] European Commission, Have your say, published initiatives, Environmental impact of waste management – revision of EU waste framework, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13225-Environmental-impact-of-waste-management-revision-of-EU-waste-framework_en.

[5] European Commission, Have your say, published initiatives, Food waste-reduction targets, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13223-Food-waste-reduction-targets_en.

Negotiations), REGIO (Regional and Urban Policy), RTD (Research and Innovation), SANTE (Health and Food Safety), SG (Secretariat-General, including RECOVER), SJ (Legal Service), TAXUD (Taxation and Customs Union), as well as EUROSTAT (European Statistics), ECHA (European Chemicals Agency) and the EEA (European Environment Agency). Meetings were organised in October 2021 and May 2022.

Another Inter Service Steering Group (ISSG) was set up by the DG for Health and Food Safety. It consists of AGRI (Agriculture), CLIMA (Climate Action), CNECT (Communications Networks, Content and Technology), EAC (Education and Culture), EMPL (Employment), ENER (Energy), ENV (Environment) ESTAT (Eurostat), FISMA (Financial Stability, Financial Services and Capital Markets Union), GROW (Internal Market, Industry, Entrepreneurship and SMEs).

Once it was decided to combine the two initiatives, the WFD ISSG met again between October 2022 and January 2023 covering both textile and food waste with the addition of DG TRADE (Trade) and DG INTPA (International Partnerships) that nominated representatives later in the process.

The ISSG meetings have discussed the main milestones of the process: the impact assessment support study that also identified the problems and proposed relevant measures for the textiles stream and prevention more generally (consulting the group on the contract's terms of reference, and the results of first and second interim reports and the draft final report). The ISSG was also consulted on the scope of the study procured by the Commission to analyse lubricant and industrial oil EPR systems and waste oil collection schemes in Member States.

The ISSG was consulted on the draft Impact Assessment report and provided their input prior to its submission to the Regulatory Scrutiny Board. The impact assessment was revised addressing the services comments largely falling in the following categories. The structure of the report was revised to better integrate the assessments of food and textile options and measures, the types of impacts assessed were aligned where possible across the two initiatives, impacts on SMEs and third countries as well as on competitiveness highlighted in the report, links with other initiatives were clarified, description of measures and options was improved. Following the ISSG meeting of 26 January 2023, where the draft impact assessment was discussed, bilateral meetings were organised with several services to address their comments. A meeting with AGRI was held on 2 February 2023 to discuss monitoring of food waste levels in primary production as well as possible impacts of food waste reduction on this sector. A meeting with TRADE, INTPA, NEAR and EEA was held to discuss how to clarify the measures to identify if they have an impact on third countries and to compete the assessment of the impacts on third countries in relation to the import and export of textiles. Also, bilateral meetings with SG and GROW were held to discuss the SME test Annex, mentioning that the SMEs were addressed in impacts and stakeholder comments in every measure and that measures were designed to reduce the impact on SMEs (i.e., exemption of micro enterprises).

3- Consultation of the Regulatory Scrutiny Board (RSB)

After final discussion with the ISSG, a draft of the impact assessment was submitted to the RSB on 15 February 2023 and discussed at a meeting with the RSB on 15 March 2023. An informal upstream meeting with the RSB took place on 22 March 2022. The RSB issued a negative opinion on 17 March and provided comments that would need to be considered for a re-submission. Following a draft revised Impact Assessment, the ISG was consulted through written procedure on 24 April 2023, followed by a re-submission to the RSB on 3 May 2023. The RSB issued a positive opinion with reservations on 26 May 2023.

The following table details the RSB comments received for its first and second opinion and explains how and in which sections that have been addressed.

Table 1 - Overview of how the RSB comments are incorporated

Stage of opinion	RSB comment	How to address the comment?
Second opinion	The report does not demonstrate the effectiveness of setting the EU level mandatory Member State food waste reduction targets in addressing the identified problems. It does not convincingly explain how the targets should be implemented, nor assess how they are feasible	• The report further outlines the role of EU-level targets in catalysing the development and implementation of national food waste prevention strategies of sufficient breadth and scale to adequately address the behavioural and market drivers of food waste. • The role of EU-level measures in supporting Member States' actions is further explained (section 3.5), with further explanation as to what is required of Member States and expanded analysis of their technical feasibility (section 3.7).
	The report does not provide any alternative options for measures on food waste reduction other than mandatory targets.	• The presentation and analysis of other options considered is expanded in section 3.5. • A new option related to the setting of voluntary food waste reduction targets has been introduced and assessed.
	(1) The report should justify with evidence the setting of EU mandatory food waste reduction targets, when the problems and their drivers comprise behavioural issues such as consumer food management and lack of understanding of safety standards, and the cited examples of Member State best practice are largely based on behavioural nudging. It should also explain how Member States would be expected to implement these targets, and whether their implementation is feasible, in particular considering the contrasted situation between Member States.	• Section 3.5 has been significantly expanded to better justify the choice of options (targets), including analysis of other EU-level measures • It has been further explained, in section 3.5, how EU-level action will support Member States in reaching the targets (including possible additional measures, e.g., updating of guidance and a new text box providing overview of EU measures) and how Member States are expected to take action to achieve (see section 3.7 – feasibility analysis)
	(2) The report should provide and assess alternative choices to address the problems and their drivers other than only the choice of mandatory targets of differing levels for Member States. The report should explain why concrete measures aiming at addressing the specific problems such as consumer behaviour and inefficiencies in the food chain management have not been considered and assessed. Given the focus on reducing food waste at the point of consumption, it should explain why measures designed to promote behavioural change have not been assessed.	• Additional alternative choices are analysed in 3.5.2 including further justification as to why the main problem drivers need to be addressed at Member State level (e.g., supporting consumer behavioural change). • Additional option of setting voluntary targets (Option 4) has been considered (see 3.5.4 and further sections).
	(3) The report should better justify the choice of the preferred option. The effectiveness analysis should not simply assume that targets would be reached, but show that the preferred option is the best approach to ensure such outcome. The extent to which Member States have sufficient governance and enforcement capacity	• Additional option of setting voluntary targets (Option 4) has been considered (see 3.5.4 and further). • Further explanations in section on feasibility regarding what Member States need to do to achieve the targets (including governance and enforcement capacity, and

for the targets to be implemented should form part of the assessment of the effectiveness of the options. It should also better explain the methodology of the feasibility scoring.	concept of designating a national competent authority) and link with feasibility scoring (see 3.7).
(4) The report should present the estimates in a clear and comprehensive manner and ensure the consistency of the figures throughout. In particular, it should ensure that quantitative costs and benefits used throughout the report are consistent, should explain further the relationship between farmers' income, trade and other elements for the calculation of costs, and should include the costs identified in the overview table of benefits and costs.	• Additional explanations have been provided in section 3.6.5 (including regarding adjustment costs) and extension of table comparing benefits and costs table (see 3.8).
(5) The interpretation of the outcome from the MAGNET modelling should consider some conclusions of the feasibility analysis section, in particular the fact that the target for food waste reduction in primary sector for the most ambitious target is uncertain, based on the experience of countries already performing action plan in food waste reduction.	• Additional explanations have been added to section 3.6.1 • Revised feasibility analysis (section 3.7) also puts into perspective the MAGNET modelling results; further elements have been added to explain interpretation of Table 8 (overview assessment of the feasibility of different policy options)
(6) The report should more convincingly explain the EU dimension of food waste and better justify how EU-level intervention is consistent with the principle of subsidiarity.	• Further explanations of the EU dimension of food waste and justification of EU intervention have been added to relevant sections (3.3.2 and 3.3.3)
(7) The report should strengthen the comparison of options on textiles. The analysis should focus on the combination of policy measures with available policy choices and on providing a clear overview vis-à-vis effectiveness/efficiency and coherence. The basic information in the annexes should be summarised and presented better in the main report. The policy measures should be clearly compared in terms of effectiveness, efficiency and coherence with sufficient explanations. The comparison of options/measures should also include an overview table on the impacts on consumers, producers, waste management enterprises and public authorities.	• Included specific information on how options compare into the main document Section 2.7. • This includes a clear overview of the comparison across measures vis-à-vis effectiveness, efficiency and coherence. This includes additional explanations for the comparison across measures. • The comparison across measures also includes an overview table on the impacts on consumer, producers, waste management enterprises and public authorities that has been integrated into Table 3 of the main document
(8) The report should improve the presentation of the impact on competitiveness of the textile options. The key information from the assessment of individual policy measures addressing various competitiveness aspects currently in the annex should	• Additional details provided in Table 2 on the impact on competitiveness, summarised from the more detailed analysis that can be found in the Annex. • The focus is on price competitiveness, dynamic competitiveness and strategic competitiveness.

	be brought to the main report to substantiate the conclusions.	
	(9) The report should make it clear if all SMEs are exempted from the Extended Producer responsibility scheme or if the exemption is only for micro enterprises.	• Additional clarifications included Section 2.8 in the main document explaining that only microenterprises are excluded while other SMEs remain included in the EPR schemes.
	(10) The One In, One Out estimates for the textile area should be presented in the dedicated section in the main report. The section should also explain why certain elements were not estimated.	• Additional information included in Section 2.8.3 in the main document on the one-in-one-out estimates. • Included a footnote explaining which costs (and benefits) could not be estimated.
First opinion	(1) The report should present a more detailed, clearer, and more coherent intervention logic. It should better consider the specificities of both food and textile waste sectors and better explain the rationale behind the design of the policy options. These should refer clearly to the problems, their drivers and relevant specific objectives. In the area of food, the report should better explain to what extent a sole mandatory target will contribute to address the market and behavioural failures in different Member States with differing baselines.	**Textile waste** • Specific problem tree and intervention logic added in Section 2.4 and Annex 7 linking drivers, problems, consequences, general and specific objectives and policy options. • More detailed and improved description of drivers, subsidiarity, objectives and options in Sections 2.2.2., 2.3., 2.4., 2.5. and Annexes 7 and 10. • Added more elaborated description of and rationale underlying the design of measures in Annex 10, containing references to the specific problem drivers each of them aims to address. **Food waste** • Specific problem tree linking drivers, problems and consequences added as well as a specific intervention logic (see SWD, section 3.4.2, Figure 7) linking drivers, problems, options and measures, with clearer link between proposed measures and underlying drivers of food waste generation. • EU intervention focusses on excessive food waste generation and that the potential for reduction is not sufficiently addressed. Section on problem drivers (3.2.2) redrafted/expanded showing also actions needed in Member States (front runner case studies). • Improved description of EU actions taken to date and existing legal obligations (3.1.2) as well as substantiation of the need for binding targets to drive action including new section (3.5.2) describing other policy options considered. • Expanded section 3.5.4 to better explain how policy options were developed and analysed, including how expressing targets as a percentage reduction and consideration of possible earlier baselines takes into account different situations in Member States.
	(2) The report should provide a clear and evidence-based assessment of the EU dimension of intervention in the two sectors. It should better explain the cross-border	**Textile waste** • Additional data added corroborating the cross-border dimension of textile market

	nature of the textile re-use and waste management value chain following waste collection as well as the transboundary impacts of waste generation and treatment on the environment. It should provide clear evidence on the material/waste trade within the EU. It should explain the EU dimension of food waste and its prevention, and demonstrate how the imposition of equal level, binding, targets for food waste would respect the principle of subsidiarity given the widely differing situation in each Member State. In doing so, the report should be explicit as to why alternative measures, including setting mandatory or voluntary targets by Member States, would not be sufficient, taking into account the best practices of Member States. It should better substantiate the lack of effective and coordinated action by Member States reflecting more specifically the measures already in place, and explain how setting a target would be effective in addressing the identified deficiencies. It should better explain why mandatory EU level target[s] are considered as the only way to make food prevention a long-term political priority given that the cited case studies point to behavioural nudging as key. It should explain why it did not assess other potential concrete measures aiming at improving Member States' performance and coordination.	and textile flows in Section 2.1. and Annex 6, including the following: o turnover of EU textile and clothing sector and number of employees in 2019 o main textile producers MS and manufacturing hubs o transboundary effects of EU textile consumption, according to EEA (updated to 2020), including number of employees worldwide to produce textiles consumed in EU o imports 2019 (according to EEA) and exports 2021 (Euratex) of textile o intra-EU movements of textile goods in 2019 and 2021 o imports and exports of used textiles from third countries • Additional details provided highlighting cross-border environmental externalities in market drivers (distorted incentives) and key environmental drivers (Section 2.2.2) and information in pertinent sections of Annex 7. • Data added on textile exports and destination countries in Annex 7. • Additional evidence provided on diverging EPR schemes in Annex 7. • Additional justification and explanation provided on transboundary impacts in production and end-of-life in Annex 7 (highlighting the social impact the number of employee worldwide). • Further justifications on the cross-border nature in measures 1.1, 2.5, 2.6, 2.8 and 2.14 in Annex 10 **Food waste** • Redrafted section 3.3. focussing on transboundary dimension of food waste and need for EU action in order to more effectively address externalities and consequences of food waste. • Subsidiarity: revised explanation on how targets are expected to set the objectives but give full flexibility to Member States to define actions needed (section 3.5.3). Explanation related to expression of targets as a percentage reduction and consideration of possible earlier baselines takes into account different situations in Member States (3.5.4). • Explained need for targets as catalyst for change: political commitments made by Member States, existing legal obligations and EU supporting measures have not been sufficient to drive progress (sections 3.2.3, 3.3, 3.5.2). • More specific description of gaps in Member States' implementation of food waste prevention including front runner case studies to illustrate type of action needed/possible (3.2.2 and Annex 7). • Expanded section 3.5.4 to better explain how policy options were developed and analysed, including consideration of other possible measures (3.5.2) and possible

	role of voluntary targets (3.5.4).
(3) The baseline should be improved. It should further elaborate on the likely evolution of the problem given the implementation of existing and upcoming relevant legislation, in particular the upcoming separate collection obligation. The report should better explain why waste generation is expected to increase despite this legislation, efforts at Member State level and the EU commitment to Target 16 of the UN COP15 Global Biodiversity Framework. It should also further explain how the baseline takes into account the likely technological development and consumer trends and any post pandemic / energy crisis effects.	**Textile waste** • Inclusion of baseline estimates made based on JRC and McKinsey studies in Section 2.2.3 and Annex 7, including an elaborated discussion on the limitations of such estimates. • Detailing of the baseline impacts shown, including by taking into account the upcoming separate collection obligation, with ranging from estimated separate collection rate of 60-80% by 2035 (according to McKinsey) and under more realistic assumptions between 50-55% by 2035 and at a more conservative view and approach between 41-45% by 2035 (according to JRC). • Such estimates are further benchmarked to the experience with glass due to similarities, which further corroborates that the JRC estimates seem plausible. **Food waste** • Improved description of baseline and policies reflected, including separate collection obligation and how/which assumptions are made regarding factors such as economic growth, demography, or energy (section 3.5.1) • Described what aspects considered/non considered based on available data (section 3.5.1) • Detailed description of baseline and situation in MS presented in Annex 10
(4) Overall, the proposed targets should be precisely defined in terms of periodicity, numerator, denominator, and statistical base. The extent to which Member States have a sufficient governance structure and enforcement capacity in place for targets to work effectively should be addressed. If such governance and enforcement does not exist, the report should consider the consequences.	**Textile waste** • Further justification provided on how measure 1.2. (indicators) addresses to problem drivers in Annex 10. • Definition of the target added in Annex 10 for measure 3.6: scope, numerator, denominator • Explanations added in Annex 10 measure 3.6. how the feasibility of setting a target is assessed, how it is constructed, why this target is possible if all alternative policy measures are deemed not feasible • Additional evidence on the impacts on competent authorities to enforce the compliance with the collection target added in Annex 3 and 10 (including on the impact on competent authorities, administrative burden assessment and a table for impact on competitiveness). **Food waste** • More precise description of the formulation of targets, including how this varies for different stages of the food supply chain (section 3.5.4) • Detailed description of gaps existing in Member States implementation, including

	governance required (section 3.2.2), existing EU/international best practice and guidance to support action (sections 3.1.2, 3.5.2) with front runner case studies (3.2.2), other best practice examples (Annex 7, Annex 10) and feasibility analysis (section 3.7).
(5) In the area of food waste, the report should explain what the additional commitments added to the SDG Target 12.3 are and why no stand-alone SDG Target 12.3 option was considered, reflecting the existing EU and Member States commitments. Given technical feasibility issues for some of the options, the report should also explain why not staged options were considered. The report should explain how setting a binding EU level target would in itself ensure that Member States undertake efficient and effective measures and processes. It should also give a better idea of concrete measures that can be pursued to reduce waste and their effectiveness, for instance based on best practices identified. Alternatives such as voluntary or differentiated targets at Member State level should be considered.	**Food waste** • Section 3.5.4 outlines how policy options for targets were developed, the rationale for the proposed levels and stages of the food supply chain considered as well as their timeframe and relation to SDG Target 12.3. • Rationale for proposing binding (vs voluntary targets) set out in Sections 3.5.2 (d), 3.5.3 and 3.5.4. • Specific Member States case studies introduced (France, The Netherlands) in section 3.2.2, Annex 7 as well as Annex 10 (section 2.4)
(6) The report should better explain how the Extended Producer Responsibility (EPR) option is intended to work and what will be determined by the Commission (via implementing legislation) and what will be decided by Member States.	**Textile waste** • A much more detailed description of the EPR measure is provided in Section 2.5.2 in line with the detailed description of the measure and the features of the EPR scheme in Annex 10.
(7) The assessment of impacts for textiles is not sufficiently developed. The report should assess all relevant significant impacts. This should include the analysis of the changes in textile treatment under each option as well as the impact on prices (and the likely cost pass through to customers) and the competitiveness of producers and waste management operators. The report should be clearer about the additionality of the costs of the EPR option. It should clarify to what extent the expected quantified benefits can be attributed to the measures envisaged.	**Textile waste** • Additional justification and evidence provided in Annex 4, in particular on how prices and competitiveness impacts been calculated. • For those measures with a direct impact on prices the impacts are now identified in Annex 11. • Also, those economic and environmental impacts than cannot be quantified as well as a justification for why this is the case has been added in tables. • In relation to competitiveness, new tables have been added with underlying analyses for each measure addressing four competitiveness aspects (price, dynamic, export and strategic competitiveness) with likely impacts identified in Annex 11. • Competitiveness impacts were quantified, wherever possible. However, it should be noted that a fully-fledged competitiveness analysis would require more granular data (e.g. firm-level, individual/household data) as well as an adequate methodological design to identify causal effects (e.g. instrumental variable, regression discontinuity design). Within the timeline available, this fully-fledged analysis is not feasible since such data is either not available or challenging to obtain (e.g. requiring merging of various survey data sets) and the methodological

	approaches would require a new analysis that will likely require a significant amount of time to be conducted. • Included an explanation in Annex 11 that unless otherwise stated, the impacts identified in the Annex are directly attributable to the measures themselves (i.e. causal impacts). It should be noted that quantifying such impacts is not possible for all measures and impacts due to data and methodological limitations. • Updates made in particular to the EPR measure 2.9 to better distinguish the additional impacts of EPR beyond the baseline.
(8) The impact analysis for the food waste sector should better explain the key limitations and uncertainties of the modelling approach, in particular as the approach assumes that the targets would be reached. The results of the MAGNET model should be qualified by addressing the assumptions and the key uncertainties of the model related to the parameter choices and the underlying data. The report should further improve the presentation of the distributional impacts. It should be clear about the net benefits or costs for each actor of the agro-food value chain. The trade implications should also be further explained.	**Food waste** • Summary of limitations and uncertainties provided in section 3.6.1 and Annex 4 as well as those relating to specific results of the assessment (sections 3.6.4, 3.6.5 and 3.6.6). • Presentation of basic assumptions and key uncertainties related to parameter choices and underlying data (3.6.1). • Improved presentation of distributional impacts (3.6.5 and 3.6.6). • Clarified net benefits or costs in general (3.6.5, in particular Figure 8) and for each actor of food supply chain where data available i.e. per stage of food supply chain (see Table 6 in 3.6.5). • Trade implications further explained (section 3.6.5) .
(9) The report should improve the section on the One In, One Out approach to include the total estimates for business and citizens. It should also better explain why certain cost savings were not quantified.	**Textile waste** • Additional explanations on the calculations added to Annex 4, in particular on how the expected costs have been estimated. • Further granularity added distinguishing between the costs borne by businesses and/or citizens in Annexes 3, 12 and 13. While the exact level of incidence cannot be estimated, the financial costs are in a first instance borne by businesses. However, depending on many factors (including the level of market power business have in the market), such increased costs could be passed on to consumers. Therefore, the interval of costs borne by businesses and citizens have been added as explanatory notes (assuming either 100% of the costs being borne by business or consumers). • To further clarify the expected impacts on businesses and/or consumers, the estimated costs have been put into the context of how much a typical clothing item is likely to increase in final sales price under *ceteris paribus* assumptions. This demonstrates the relatively low price impacts to be expected from the measures considered in Annex 11. **Food waste**

		• Section 3.11 explains non-applicability of requirement as proposal introduces no new measures as such.
	(10) The comparison of options should be improved. The options should be assessed against relevant criteria reflecting effectiveness (relevant specific objectives), efficiency and coherence. The comparison of options should be based on a revised intervention logic with clearly specified specific objectives and linked specific problems allowing a more precise effectiveness assessment, including as regards the effectiveness of the envisaged measures towards actually meeting the targets. The technical feasibility aspects should be better brought out, so that the delivery risks associated with more ambitious options become clearer.	**Textile waste** • Revised and combined the effectiveness and efficiency tables already included with additional considerations added into Annex 5 in relation to coherence. • A more elaborated coherence analysis also added to Annexes 12 and 13, in particular related to the Sustainable Textiles Strategy. **Food waste** • Refined comparison of options in the light of (new) specific objectives. In particular, the efficiency analysis was refined and includes an overview of net benefits (table 10). • Delivery risks associated with more ambitious options more clearly outlined in section 3.9.
	(11) The current structure of the report is very difficult to read (swapping constantly between textiles and food). The report should consider ways to present the two issues in a clearer, more decision-maker supportive manner. The core report should be self-standing to the extent possible, and annexes should be confined to additional information on specific issues.	**Textile and food waste** • Restructuring of the main document into a common introduction, two separated sections (one on textiles and one on food waste) with a common section on cumulative impacts. • Added tables of Figures and Tables. • Given the nature and purpose of the document, the structure of the Annexes has remained unchanged. **Textile waste** • In Annex 6 added titles to subsections to better clarify. **Food waste** • In Annexes 7, 10 and 11 added titles to subsections to better present and refer data.

4- Evidence, sources and quality

The Commission procured a study to support this impact assessment of policy options for a revision of the WFD in 2023 – Specific Contract n° 090202/2021/861277/ENV.B.3. It was also supported by several experts and technical assistance studies listed below.

- Ramboll Deutschland GmbH: "Assistance to the Commission on technical, socio-economic, environmental and cost-benefit assessments related to the implementation and further development of EU waste legislation". The study provided analysis to support the development of the European Commission's Impact Assessment (IA) concerning revision to Directive 2008/98/EC on waste. The study initially covered the wider scope of the initiative and subsequently focussed on textile waste and on integrating the part on food waste led by DG SANTE. Publication envisaged along with the adoption of this initiative.
- The EEA developed a framework (publication due Q2 2023) to assess waste prevention progress in the context of policy measures as reflected in the waste prevention programmes (WPPs). It will be based on carefully selected indicators fit for monitoring waste prevention efforts and progress in Europe and will focus on waste prevention effectiveness and not efficiency (which considers the resources used/needed to implement waste prevention efforts).
- JRC technical report (publication due in Q2 2023) on good practices in separate collection of waste. The objective of the report is to identify and assess, based on an extensive stakeholder engagement from the local authorities to waste management operators, best practices in separate collection and based on a qualitative and quantitate assessment of the costs and benefits identify practices that deliver best environmental outcome.
- JRC technical report on "Circular economy perspectives in the EU Textile sector"[6] provided a detailed look at the volumes of post-consumer textiles available for collection, reuse and recycling in EU countries (based on available data) and it detailed existing capacities for the collection and sorting of old textiles, described recycling technologies in order to estimate future sorting and recycling capacities.
- The "Study on the technical, regulatory, economic and environmental effectiveness of textile fibres recycling"[7] improved the knowledge of the effectiveness of recycling capabilities of textile waste with an analysis of their economic and environmental effectiveness and a roadmap of the technologies under development.
- European Commission, Joint Research Centre. Techno-scientific assessment of the management options for used and waste textiles. 2023 (under development)
- Eunomia (2023) Online sales. The study supports this initiative in gathering the evidence base and stakeholder consultation in relation to the regulatory barriers for the enforcement of extended producer responsibility rules in the online sale domain as well as the assessment of the past and future development of the sector for the purposes of the impact assessment. Publication envisaged along with the adoption of this initiative.

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[6] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., *Circular economy perspectives in the EU textile sector: final report*, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144.

[7] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Duhoux, T., Maes, E., Hirschnitz-Garbers, M., et al., *Study on the technical, regulatory, economic and environmental effectiveness of textile fibres recycling: final report*, Publications Office, 2021. https://op.europa.eu/en/publication-detail/-/publication/739a1cca-6145-11ec-9c6c-01aa75ed71a1

- Oeko-Institute report (2020)[8]. Study to support the Commission in gathering structured information and defining of reporting obligations on waste oils and other hazardous waste". Oeko-Institute (2020). This study provided an analysis on good practices of waste oil collection and management in Member States and contains an overview of EPR systems for lubricating oils in different MS. However, a full survey and analysis of EPR system and collection schemes in place and the functioning of Producer Responsibilities Organisations dealing with waste oils was beyond the scope of that study.
- RDC Environment support study (publication due 2023). "Study to analyse lubricant and industrial oil EPR systems and waste oil collection schemes in EU Member States to support measures to increase collection rates". The objective of the study is to provide a detailed analysis of lubricant and industrial oil EPR systems and waste oil collection schemes in EU Member States, analysing best practices and their impact on waste oil collection rates. The study also assesses possible measures and to enhance (mineral) waste oil collection rates and the possibility to propose quantitative collection targets. The study included a questionnaire consultation with Member States, a targeted stakeholder consultation and a dedicated workshop.
- JRC LCA/LCC support study (publication due 2023). This study had the objective of performing a life-cycle-based comparison between waste oil regeneration and energy recovery for several scenarios. These comparisons aimed to: a) quantify the potential environmental impacts and life cycle costs resulting from managing waste oil in the EU via regeneration or energy recovery; b) identify the conditions under which a certain waste oil management options may be the most effective ones, from a life cycle perspective; c) calculate the total uncertainty of the outcome of the study, based on the uncertainty of all the parameters and model choices of the modelled waste management system. The study is due to be published as a JRC "Science for Policy report" following the adoption of the Commission's proposal.
- Eurostat provided an analysis of the data reported by Members States on waste oils and on textile waste. The first reporting on waste oils using the format defined in Annex VI of Decision (EU) 1004/2019 was done by Member States for the first time in 2022, for the reference year 2020. Information on oils placed on the market is the most robust, while collection and treatment data appear to be less reliable. Separately collected waste oils collection rates seemed either very low or very high, pointing to data collection problems. Treatment of waste oils seem plausible at the aggregated level, with inconsistencies in some countries between collection and treatment. Data is less comparable when treatment is broken down: generation and other recycling is not very comparable between countries (regeneration data missing in 9 MSs), and energy recovery shares varies a lot from country to country. Disposal is below 10% in all countries, with very limited exceptions.
- On 25 October 2022, Eurostat published the first dedicated statistical monitoring of the amount of food waste in the European Union – https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates
- JRC support study on food waste targets (2023). JRC has prepared two reports providing analysis to support the development of the European Commission's Impact Assessment (IA) concerning revision to Directive 2008/98/EC on waste on the feasibility of setting food waste reduction targets:

[8] European Commission, Directorate-General for Environment, Stahl, H., Merz, C., *Study to support the Commission in gathering structured information and defining of reporting obligations on waste oils and other hazardous waste : final report,* Publications Office, 2020, https://data.europa.eu/doi/10.2779/14834

- De Laurentiis, V, Mancini, L, Casonato, C, Boysen-Urban, K, De Jong, B, M'Barek, R, Sanyé Mengual, E, Sala, S. *Setting the scene for an EU initiative on food waste reduction targets*. Publication Office of the European Union, Luxembourg, 2023, doi: 10.2760/13859, JRC133967
- De Jong B, Boysen-Urban K, De Laurentiis V, Philippidis G, Bartelings H, Mancini L, Biganzoli F, Sanyé Mengual E, Sala S, Lasarte-López J, Rokicki B, M'barek R. *Assessing the economic, social and environmental impacts of food waste reduction targets. A model-based analysis.* Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/77251, JRC133971.

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These teams worked in close cooperation with the Commission, and partly in consultation with one another throughout the process, throughout the different phases of the study. Consistency of data sources and methodological assumptions was ensured to assemble a coherent evidence base, to develop the baseline and to assess, screen and adjusting policy measures and options.

ANNEX 2: STAKEHOLDER CONSULTATION (SYNOPSIS REPORT)

This Annex reports on all consultation activities undertaken as part of the WFD revision. In line with the Better Regulation requirements, it provides an outline of the consultation strategy, describes the consultation activities undertaken, presents the stakeholder groups that participated, and a description of the methodology and tools used to process the data gathered. The results of each consultation activity are briefly presented. More details are available in the studies listed in Annex 1 when these included stakeholder consultations. Stakeholder views are provided as relevant in the sections on the problem definition, the available policy options and the impacts of the policy options.

This document should be regarded solely as a summary of the contributions made by stakeholders to the consultation activities that took place in the context of the Impact Assessment on the revision of the Waste Framework Directive and setting EU-level targets for food waste. It cannot in any circumstances be regarded as the official position of the Commission or its services. Responses to the consultation activities cannot be considered as a representative sample of the views of the EU population.

Contributions have also been received through the Conference on the Future of Europe, held in April- May 2022 and the citizens' panel convened by the European Commission, between 16 December 2022 and 12 February 2023, to sound the views of citizens on actions needed by Member States and other players to step up efforts to reduce food waste. Citizens' recommendations complement the impact assessment and the public consultation to support the setting of legally binding food waste reduction targets and they have been considered in the preparation of this initiative. Outcomes from the Conference relevant to this initiative and the citizens' report including the panel's recommendations are presented in Annex 16.

1- Introduction

The consultation method and strategy were outlined in the Call for Evidence (CfE) for an impact assessment 'Environmental impact of waste management – revision of EU waste framework' [9] and the Inception Impact Assessment (IIA) 'Proposal for a revision of Directive 2008/98/EC on waste – part on food waste reduction target'[10].

The **objectives** of the consultation were to gather:

- Views on the scope of the impact assessment process, in particular to ensure that the correct problems were identified, and objectives were being targeted.
- Views about the options and measures under consideration.
- Further evidence to substantiate the analysis of the options and measures.

Relevant **stakeholders** to be addressed as part of the impact assessment were identified as:

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[9] European Commission, Have your say, Published initiatives, Environmental impact of waste management – revision of EU waste framework, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13225-Environmental-impact-of-waste-management-revision-of-EU-waste-framework_en.

[10] European Commission, Have your say, published initiatives, Food waste – reduction targets, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13223-Food-waste-reduction-targets_en.

- Member States and their authorities responsible for waste prevention and management including food waste prevention;
- Producers and producer responsibility organisations;
- Waste collectors, sorters and recyclers;
- Industrial/economic actors, including SMEs, of the textiles and food ecosystems;
- Environmental, consumer- and other NGOs (e.g. food banks) and citizens' organisations;
- Academia, research and innovation organisations and institutes; and
- Citizens.

Some specificities for the consultation on the setting of food waste reduction targets are as follows:

- waste collectors and recyclers were not targeted given the focus on prevention
- international organisations were also consulted as part of the EU Platform on Food Losses and Food Waste (FLW).

All stakeholders identified in this mapping were reached, including umbrella organisations that represent SMEs.

2- Methods for engagement of stakeholders

The following methods were used to engage stakeholders.

- IIA on food waste and CfE for other waste streams.
- Public consultation (PC) through an online questionnaire, including expert consultation as part of the same exercise, using the Commission consultation's website.
- Targeted consultations including stakeholder workshops, interviews, surveys on food waste prevention initiatives for Member States and stakeholders, a meeting of Member State representatives via the WFD Expert Group, a meeting of the Member States Expert Group on Food Losses and Food Waste and five meetings of the EU Platform on FLW (one jointly with the Advisory Group on Sustainability of Food Systems).

Inception impact assessment and call for evidence for an impact assessment

The CfE on the revision of EU waste framework included a description of the political context, the preliminary problems identified in the areas of waste prevention, recycling and reuse, and waste oils. The legal basis and practical need for EU action were provided. The CfE outlined the objectives and possible policy options and identified the likely impacts. Finally, it described the relevant better regulation instruments. The Commission received 197[11] separate responses to the CfE. Respondents are based in 25 different countries including four non-EU countries: 65 in Belgium reflecting the number of industry trade associations and NGOs in that country, 23 in Germany, 16 in France, 14 in the Netherlands and 12 in Italy.

A total of 118 documents were uploaded, mainly expanding on stakeholders' responses. Respondents provided several examples where the management of waste was perceived to be inconsistent but limited factual information was provided to support these. Feedback on the possible impacts of the measures foreseen was largely qualitative or based on external studies. This may reflect the difficulty of assessing the impact of theoretical measures and those inherent to isolating the impact of EU rules from other factors such as consumer behaviour or macroeconomic developments.

[11] 198 indicated on Environmental impact of waste management – revision of EU waste framework (europa.eu)because one is a duplication from WEEE forum.

More specifically in relation to textiles, stakeholders across several categories including NGOs, public authorities, business associations representing SMEs, and companies support EPR schemes for textiles. A business association[12] indicated that associated recycling schemes for textiles require long transition periods to allow the recycling capacity and systems to ensure input qualities to be set up. The association also indicated that the mixed composition of textiles is a challenge for recycling. Another business association[13] advocated for regulatory tools to boost demand for reused textiles and textiles recycling. A company/business association[14] noted that low disposal/incineration costs for textile wastes contribute to low levels of recycling. An NGO[15] pointed to evidence that second-hand clothing contributes to the reduction of textile waste by 50% and noted that separate collection of textiles is essential to ensure reuse. The same NGO suggested a greater application of the polluter pays principle for textile producers. A business association[16] emphasised the benefits of rented textiles to extend textile lifetime compared to owned textiles and the need to coordinate work on textiles under the WFD with ESPR. A company/business association[17] also supported this need for coordination. Several business associations pointed to the importance of clear definitions of reusable / recyclable textiles.

Concerning the part on food waste, the IIA offered all interested stakeholders and citizens the possibility to contribute to the policy-making cycle. The IIA included the description of the problem, the policy objectives and policy options with related expected economic, social and environmental impacts. It also presented the planned evidence base and data collection as well as the consultation of citizens and stakeholders. As the Inception IA focussed on the Commission's commitment to propose legally binding food waste reduction targets, voluntary targets were not part of stakeholders' consultations.

85 contributions were received from respondents in 17 EU countries and 2 third countries (United Kingdom and USA). Most contributions were from business associations (27), followed by NGOs (18, of which 12 with an environmental focus), companies (11), EU citizens (9), consumer (4) and environmental (3) organisations. Six public authorities (including 3 Member States[18]) provided input through the feedback mechanism.

Overall, stakeholders expressed support for the EU legislative initiative, seen as essential in order to achieve the Green Deal objectives of climate neutrality and transition to sustainable food systems as called for by the Farm to Fork Strategy [19] Most stakeholders affirm that food waste reduction targets should cover the whole supply chain (reflecting an integrated food systems approach), with the future EU target in line with Sustainable Development Goal (SDG) Target 12.3 (35 contributions versus 11 favouring the coverage of only selected stages of the food supply chain). Stakeholders in favour of such a holistic approach came from the food industry (12 contributions from various sectors from primary production up to retail and food services), NGOs (17 contributions, 4 from consumer-, 12 from environmental and 1 from social organisations), national and regional public authorities (3 and 1 contributions, respectively) as well as citizens (1 contribution) and academia (1 contribution). Some industry respondents (mainly from primary

[12] Wirtschaftskammer Österreich - Austrian Federal Economic Chamber
[13] Policy Hub - Circularity for Apparel and Footwear
[14] Ebimex grupa sp. z o.o. – PL textiles sorter and recycler
[15] ANA Members in Europe -
[16] ETSA (European Textiles Services Association)
[17] Ebimex grupa sp. z o.o.
[18] Czech Republic, Hungary, Slovenia
[19] Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions 20.05.2020 Farm to fork strategy for a fair, healthy and environmentally friendly food system, COM(2020) 381 final, EUR-Lex - 52020DC0381 - EN - EUR-Lex (europa.eu).

production - 4 contributions and processing sectors - 3 contributions) prefer a target focussed on retail and consumption only, with some arguing for intermediate, more realistic targets than that of halving food waste by 2030 (i.e., SDG Target 12.3). Other industry stakeholders and non-governmental organisations (NGOs) argue for a holistic approach to ensure shared responsibility and accountability of all actors, promote collaboration and avoid the transfer of food waste between different stages of the food supply chain. Several stakeholders stress the need for a solid evidence base for setting targets (12 contributions, mostly from the primary production and processing sectors, 3 national authorities and 2 environmental organisations) as well as a baseline that recognises efforts of early achievers (8 contributions mainly from NGOs/academia). Around one-third of contributions received (27) called for ambitious actions and an advanced target level (50%), including almost all NGOs (18 contributions out of 26); on the other hand, the three contributions from Member States suggested that basic or medium options are more realistic. In addition to these countries, there was very little support for the basic and medium levels of the targets (3 contributions). Some stakeholders (environmental NGOs, social enterprises consumers – 14 contributions) call, in addition, for integration of on-farm food losses in the future legislative proposal whilst primary producers (2 contributions) argue that such losses cannot be addressed (for both legal and operational reasons). Concerning the way the targets are set on Member States, stakeholders' feedback indicated a preference for setting an EU collective target based on Member States contributions (21, out of which 13 environmental and consumer- organisations, but also a few industry representatives and public authorities); 14 favoured the same target level for all Member States (6 environmental and consumer- organisations, 4 industry representatives, 2 national authorities, 2 EU citizens) and 5 supported differentiation of target levels by Member States[20](mainly industry representatives). As regards how targets should be formulated, stakeholders gave roughly equal support to expressing these as a percentage reduction in food waste from the baseline year (16 contributions, mostly from primary producers and food processors. environmental NGOs and EU citizens) or as absolute amounts of food waste to be reduced, in kg/capita (18 contributions, mainly environmental and social NGOs and fewer industry representatives). Several industry stakeholders and NGOs highlight that targets should reinforce the need to apply the food use hierarchy, with prevention and redistribution of surplus food for human consumption as the most preferred option (16 contributions). Some NGOs and a food redistribution company recommend additional regulatory measures at national level to facilitate food donation as well as financial support. Finally, many stakeholders call for policy coherence with other strands of the Farm to Fork Strategy (e.g., pesticides reduction, food labelling etc… and the need to build a culture of food value in order to address systemic issues linked to food systems (including but not limited to food waste). In addition, stakeholders comment on the measures needed to achieve any future targets, including both legislative and non-legislative initiatives.

Ad hoc contributions received outside the formal consultation context

In November 2022, 43 organizations led by Feedback EU and European Environmental Bureau have signed a joint statement expressing support for the EU commitment of setting legally binding targets for EU member states to reduce food waste and propose to set 50% reduction target in all food loss and waste from farm to fork and to launch a review of expanding the scope of food waste measurement and targets to include edible food left unharvested or used on farm in primary production[21].

[20] Commission assessment of these approaches is explained in Annex 10, as the same target level has been selected for all Member States.

[21] Statement on EU legally binding targets to reduce

Public consultation

A public consultation was open 24 May 2022 - 24 August 2022 to collect additional evidence on the baseline, seek opinions and insights about the problem, the feasibility and possible impacts of alternative actions, gather examples of best practices and views on the subsidiarity of possible actions. In total, 731 valid responses[22] were received. Of the total of participants, 336 (46%) requested their contribution to remain anonymous while 395 (54%), agreed to the publication of all information concerning their contribution. In addition, 207 respondents submitted written contributions.

Stakeholders could select a category amongst: Academic/research institution, Business association, Company/business organisation, Consumer organisation, EU citizen, Environmental organisation, Non-EU citizen, Non-governmental organisation (NGO), Public authority, Trade union. Respondents were mostly company/business organisations and business associations (40%, 299 replies) and EU citizens (36%, 255 replies). The other remaining 177 were: 8 Academic and research institutions, 11 Consumer organisations, 14 ENGOs, 7 non-EU citizens, 65 NGOs, 5 Non-classified organisations, 32 Public authorities, and 3 Trade unions.

The 94% of the respondents (693 replies) are based in the European Union (EU 27) and most of them are based in Belgium (16%, 119 replies), Germany (13%, 96 replies), Italy (11%, 82 replies) and France (8%, 63 replies). The high number of respondents from Belgium is assumed to result from the fact that Brussels hosts many of the organisations representing different groups of interest before EU Institutions, such as industry associations, non-governmental and consumers' organisations etc. Of the non-EU respondents (38 in total), most respondents were based in the United States (2%, 12 replies), Norway (1%, 10 replies) and the United Kingdom (1%, 9 replies).

High-level findings from the responses

This section presents a synthesis of the feedback received, noting that respondents could leave all questions blank, none of the answers was “mandatory”. The percentages presented below relate to the respondents that did provide a reply to the specific question (i.e., total number of respondents minus the respondents that left the question blank), and not to the total number of respondents.

General views on waste and waste generation

Respondents to the survey were generally concerned by the volumes of waste generated across all dimensions and types of waste, irrespective of their stakeholder group. They were mostly concerned by the impacts of waste on the environment (97% of the stakeholders, 648 replies, were either very concerned or concerned.

Even if a strong concernment is still shown by all stakeholder groups when it comes to the amounts of food waste (90%, 579 replies), this ratio is not as high as to the former due to the fact that companies and business associations show a lesser level of concernment on the amounts of food waste (81%, 235 replies) compared to the EU citizens, NGOs and public authorities’ perspective (93-97%, 360 replies). The same pattern applies on the amounts of municipal waste. While EU citizens, NGOs and public authorities convey to a vast preoccupation as regards municipal waste

food waste, https://eeb.org/wp-content/uploads/2022/09/Statement-on-EU-legally-binding-targets-to-reduce-food-waste-Sept-2022.pdf.

[22] All received contributions were considered valid.

(93%, 367 replies), companies and business associations merely reach an 80% of consensus (186 replies).

The numbers worsen when stakeholders were asked on their level of concernment considering textile waste. Only a 63% of the industry (145 replies) confessed being concerned whereas again EU citizens, NGOs and public authorities show at the very least an 86% of consternation. The tables turned on the cost of managing waste. In this case, companies, business associations and NGOs shown a greater level of concernment (82%) but EU citizens and public authorities were less worried towards this topic (69%).

Prevention

There is a consensus between respondents stating that they know what they can do to prevent waste. Irrespective of all the stakeholders being more or less in line with that statement, especially EU citizens (83%) and public authorities (96%) agreed more to that statement than companies, business associations (78%) and NGOs (67%) did. While public authorities (83%) were keener to strongly agree or agree to have the information needed to help them generate less waste, EU citizens (66%), companies and business associations (61%) and NGOs (52%) were not rising the same majority numbers.

In addition, at least 60% of respondents of each stakeholder group replied they agreed or strongly agreed that they take on fewer waste prevention activities than they would like due to shortcomings in relevant infrastructure and services (e.g., proximity of reuse or repair services, effort required). The stakeholder group that mostly agreed with that statement were EU citizens (75%, 179 replies). However, there was less consensus on the fact that they would take on fewer waste prevention activities than they would like due to the costs involved. Only public authorities reached positive ratio of agreements in that sense (58%), whilst NGOs (48%), EU citizens (36%), and business associations and companies (34%) rarely agreed to that argument.

EU citizens, NGOs, and public authorities identified 'prevention measures not being an explicit objective of commercial operations' as the most important barriers to waste reduction efforts. According to EU citizens and public authorities, second in that line it goes 'consumers are not used to taking prevention measures (e.g., trying to repair a broken item instead of replacing it). These two stakeholder groups also agreed that these 'prevention measures are economically unattractive' as the repair is too expensive compared to buying a new product. Meanwhile, companies and business associations, and NGOs, are more of the view that the second and third most important barriers to waste reduction efforts are the legal barriers to waste prevention and the lack of data to monitor and identify the most effective waste prevention actions.

Separate collection

Respondents indicated the factors that would increase participation in separate collection of municipal waste are more information about what happens to waste once it is collected and how it can serve a useful purpose; certainty that all the waste separated would be prepared for reuse or recycled; and more information on how to separate waste for collection (e.g., which waste goes into which bin). No distinct differences of opinion by stakeholder category were identified.

All stakeholders coincided determining that the most common effective measure to overcome the challenges and improve separate collection activities was found to be the following: sorting waste into more separate bins at home for door-to-door collection for an environmental benefit. Second was improved information on the products themselves about their composition and how to discard them in separate collection and third 'improved information on waste bins and from waste collection service providers on how to correctly separate waste in different waste containers would

be helpful'. The first measure received an 87% (225 replies) support from EU citizens, 82% (49 replies) from NGOs, 80% (20 replies) from public authorities, and a 62% (119 replies) from business associations and companies.

Overall, business associations and companies, NGOs and public authorities shared the view that the most effective measures to separately collect waste were found within their **workplace** more than at local/national/EU levels. In the contrary, EU citizens attributed that merit to the national and local authorities of their home countries. However, responses show that measures to prevent waste are not considered effective at these different levels at present.

Recycling

The majority of respondents (73%, 447 total replies), irrespective of their stakeholder group, disagreed with the fact that there are sufficient regulatory and/or market incentives for businesses to invest in recycling.

Textile waste

As it has been previously mentioned in 'general views on waste and waste generation' subsection above, it is important to stress that textile waste is the type of waste that least concerns the respondents consulted only reaching a 63% of concernment on companies and business associations. The remaining stakeholders (EU citizens, NGOs, and public authorities) showed greater levels of concern in the matter. More than half of the respondents agreed or strongly agreed that they were participating in the separate collection of textile waste, with a deferral on results depending on the stakeholder group they pertained to. EU citizens leaded the collection of textile waste, followed by public authorities; and leaving NGOs and companies and business associations the last positions. However, only 40% of public authorities, 32% of companies and business associations, 28% of EU citizens and 24% of NGOs agreed or strongly agreed (221 replies) that they were satisfied with the waste collection system in place where they live to collect textile waste.

Waste oils

Over 40% of those that responded to specific questions on waste oils indicated that they participate in the separate collection of waste oils while about 18% change their vehicle oil themselves (sometimes, often or always). 30% agreed or strongly agreed that they were satisfied with the waste oil collection system in the place where they live.

All respondents that provided a position paper stressed the importance of waste oil collection, generally with the argument that separation of waste oils at collection stage is key for proper end-of-life treatment as the quality of regenerated oils depends on the quality of the waste oil collected. Respondents recommended setting high and mandatory collection targets for waste oil and better enforcing their strict separate collection. Most stakeholders also advocated the introduction of mandatory targets for regeneration of waste oil.

Food waste[23]

Most respondents across all stakeholder groups agreed or strongly agreed with the benefits brought by reducing food waste (for all the presented benefits more than 50% of the respondents agree or

[23] More details on the public consultation on food waste can be found at: De Laurentiis, V, Mancini, L, Casonato, C, Boysen-Urban, K, De Jong, B, M'Barek, R, Sanyé Mengual, E, Sala, S. *Setting the scene for an EU initiative on food waste reduction targets*. Publication Office of the European Union, Luxembourg, 2023, doi: 10.2760/13859, JRC133967

strongly agree). They identified the most important benefits: 92% (577 replies) selected the option "help reduce environmental impacts (e.g., land use, water scarcity)". This percentage, however, was lower in the group of companies and business organizations (62% - 186 replies). 91% (562 replies) agreed or strongly agreed with the benefit to help mitigate climate change, with the groups of companies and business organizations and academia having a lower percentage of agreement (62% - 185 replies and 63%, - 5 replies respectively).

Respondents identified the main actors that need to take more action to reduce food waste as consumers (71%, 438 replies), retailers and other distributors (70%, 435 replies), food manufacturers (62%, 380 replies), and hospitality and food services (hotels, restaurants, canteens, etc.) (59%, 369replies). 73% (449 replies) also selected 'other' actors; however, they were not specified. The group of NGOs consumers/ environmental organizations attributed more importance to the food manufacturers (78% - 65 replies) and hospitality (70% - 58 replies) and less to consumers (41% - 34 replies). Instead, public authorities, academia and companies and business organizations give more importance to consumers as actors that need to the take more action (90% - 26 replies, 86% - 6 replies and 82% - 164 replies, respectively).

Respondents noted that the **most important challenge for the reduction of food waste** concern the need for consumers to adopt new habits, such as improved food management skills (61%, 381 replies-very important; 28%, 178 replies-important). This was the first option for citizens (90% - 237 replies), public authorities (88% - 28 replies), academia and research institute (88% - 7 replies), others (87% - 33 replies) and companies and business organizations (61% - 182 replies). The challenge on businesses needing to make food waste prevention part of their business operations was the second selected option considering the whole sample (52%, 325 replies- very important; 35%, 219 replies – important) but the first for the stakeholder group NGOs, environmental/consumers organizations (76% of the respondents identified this challenge as "very important"/"important" - 68 replies). Ensuring sufficient action is taken at the pace needed to reach global commitments to halve food waste by 2030 (50%, 314 replies- very important; 30%, 186 replies- important) was considered more important by public authorities than other groups (88% of respondents from this group says it is important or very important – 28 replies). Ensuring no compromise on food safety (47%, 291 replies- very important; 33%, 203 replies- important) was also more important for public authorities (78% - 25 replies) and the stakeholder group "other" (84% - 32 replies) As regards possible EU measures to improve waste prevention, 74% of respondents (488 replies) agreed or strongly agreed with the setting of legally binding food waste reduction targets, with even greater support expressed by public authorities (86%, 25 replies). NGO, consumer and environmental organizations expressed the highest support as 89% (of them either agree or strongly agree with the proposal, followed by EU citizens (87% - 73 replies). The consensus is lower in the case of business associations and companies (54% - 130 replies).

When asked **which measures would be most effective in reducing food waste**, over 4 in 10 respondents cited as "very impactful": 'improving efficiency along the food supply chain' (64%, 399 replies); education and training (55%, 340 replies); facilitating donation of surplus food (51%, 317 replies); measuring food waste to track progress (49%, 308 replies); setting food waste reduction targets (48%, 301 replies); and 'using surplus food and by-products (47%, 291 replies). Except for "other regulatory initiatives," all measures proposed were considered impactful or moderately impactful ((>50%). 'Clearer and more understandable date marking' was rated as impactful/moderately impactful by 70% of respondents (436 replies). The measure 'improving efficiency along the food supply chain' was the option with highest rates across all the stakeholder groups, except for 'others' (including non-EU citizen and trade associations, for which the measure with the highest support was 'sharing of best practices'). However, in the case of companies and business organizations the share of respondents considering this measure very or moderately

impactful is lower (56%, 167 replies) compared to other stakeholders. A large share of respondents across the stakeholders' groups agreed on considering as very or moderately impactful the measure 'education and training' (this was the case for 89%, of citizens - 234 replies - 82% of NGOs and consumer organisations – 74 replies - and 81% of public authorities – 26 replies), while the measure 'facilitating donation of surplus food' ranked highest across citizens (being cited as very or moderately impactful by 88% of respondents belonging to this group, 232 replies) compared to other stakeholders (e.g. it was cited as very or moderately impactful by 46% of companies, 138 replies). Amongst respondents belonging to academia and research bodies, 88% (7 replies) cited as very or moderately impactful the options: 'using surplus food and by-products', 'fiscal incentives' and 'clearer, more understandable date marking'. Instead, 'fiscal incentives' do not have high rates in the case of business organizations and companies (42% of the respondents, 126 replies, considered this option very or moderately impactful). The measure targeting date marking received support from most stakeholder groups (being cited as very or moderately impactful by 77% of NGOs and consumer organisations – 69 replies - and 70% of citizens – 184 replies), except for companies (43%, 130 replies, deeming it as very or moderately impactful). In the response papers, many advocated for the adoption of a reduction target on the amount of bio-waste disposed in residual waste by 2030.

Views from **SMEs** do not show significant differences compared to those of large companies as regards the support for setting food waste reduction targets, the expected benefits of reducing food waste, the associated challenges and the actors involved.

Position papers

Stakeholders were invited to submit additional information including position papers. There were more than 200 separate submissions, some of them were documents submitted multiple times by different stakeholders or by the same stakeholder at different points in the revision process. In this case, the document was logged and reviewed once. 75 position papers were received from Business Associations and from Company/Business Organisation. 27 position papers were received from NGOs, 8 from Public Authorities, 6 from other, 3 from Environmental Organisations, 2 from EU citizens and Trade unions and 1 from Consumer Organisations and Non-EU citizens.

Nearly 30 position papers covered the area of textiles waste, of which about half came from **SMEs** or organisations representing them. SMEs pointed out that there is currently no large-scale plan to process textile waste. They stressed the need to promote durable, high-quality textiles, improve their reuse, wherever possible prepare them for reuse and scale up sufficient sorting for reuse, recycling and processing infrastructure. They also recommended that changes in textiles' design and consumption patterns should take place, that the amount of textile waste should be decreased through ambitious waste policies. The same points on durability and reuse of textiles, as well as on sorting and recycling capacity were shared by the recycling industry that also noted that circular and social textile value chains should be developed. Among the recommendations were the need to set quantitative reuse and preparation for reuse targets and to improve separate collection systems. SMEs noted that EPR schemes should enforce the waste hierarchy by setting quantitative targets for waste prevention and preparation for reuse, ensure the eco-modulation of fees and fair competition in recycling markets, granting access to the waste stream to preparing for reuse operators, while also involving social enterprises as key stakeholders in the development, governance and functioning of these schemes. They also advocated consistency with other regulatory initiatives, such as the ESPR and WSR and the harmonisation of end-of-waste criteria at EU-level, which was also endorsed by the recycling industry. SMEs also pointed out the need for guidance to achieve high levels of separate collection of textiles and that mature fibre sorting and pre-processing is critical to scale the recycling of post-consumer waste. Some position papers reflect on a harmonised definition of textile waste.

Many position papers recommended to set waste prevention related targets, including ones on waste prevention for individual product groups and ones for durability and repairability of new clothes. However, others pointed out that while setting targets has been an effective means to create a more circular economy, they are not sufficient. They stressed the need for more economic and legislative incentives to promote waste prevention and reuse, such as tax incentives, innovation grants or financial support schemes. For example, many pointed out that repairers should be granted a VAT exemption or reduction and be legally allowed to remove spare parts from waste streams. Many respondents highlighted the need to reduce VAT on sale of second-hand clothes and introduce a circular tax credit for brands that carry out projects integrating the circular economy, such as take-back schemes or the offering of repairs for life. The need to differentiate support for durable high quality fashion items was stressed.

Respondents disagreed on the application of the waste hierarchy. While many stressed the need to prioritise waste prevention and reuse, others pointed out that in some cases recycling and reuse could not be placed in a strict hierarchy, such as in the case of packaging. Others claimed that recycling was the key solution, as reuse will inevitably end after a number of (re)uses. Several argued that the hierarchy should be adapted to promote high-quality recycling and reuse solutions. Many advocated for adding nuances to clarify the increase of impacts occurring as you go down the steps, differentiating between high quality recycling with preservation of all or almost all properties, recycling with reversible loss of properties, recycling with irreversible loss of properties and recycling to a product that is not circular.

Many position papers highlighted that the Waste Framework Directive should include a transparency provision for public access to nationally reported waste data. Several respondents noted in the response papers that they were in favour of introducing mandatory mixed waste sorting prior to landfilling and incineration to prevent used products from being damaged, thus safeguarding the reusability of products. They also indicated that unwanted products with a high reuse potential should not be mixed with other items. For that reason, clear information on where and how to discard them should be provided to consumers. Some position papers pointed out that it was essential for the directive to enhance its focus on recycling. In line with this point of view, several respondents pointed out that more targets should be developed to promote recycling. As a matter of example, it was considered essential to set mandatory targets for recycling of textile waste to pursue an ambitious implementation of the 'EU Strategy for Sustainable and Circular Textiles' (EU Textiles Strategy)[24].

Many position papers advocated for support to and investment in better waste treatment infrastructure, such as modern recycling facilities and new recycling technologies and excellence centres across member states, in particular high-quality recycling.

Among dissatisfactions, many response papers stressed the need to prevent fashion waste export. To address this issue, some recommended to designate EPR funds to support waste management in the importing locations; ensure the sorting of collected material according to quality specifications to keep clothes at a higher value; mandate the utilisation of digital product passports for all agreed products; and encourage local reuse and recycling of collected textiles based on the EU proximity principle. Furthermore, in keeping with the call for evidence general support for EPR was provided by public authorities, business associations, NGOs and companies businesses. However, the

[24] European Commission, *EU strategy for sustainable and circular textiles*, 2022, https://ec.europa.eu/environment/publications/textiles-strategy_en.

industry, other business and company representatives and some SMEs cautioned the application of EPR, identifying some specific challenges to be addressed in application of EPR to textiles.

53 position papers focused on food waste or included considerations on this topic. 26 papers including comments on food waste were received from business associations, 12 from non-profit organizations, 8 from companies and 7 from public authorities. Among the 8 companies, one has a medium size and 7 are large companies. Most of the position papers expressed agreement on the setting of food waste reduction targets, with 10 papers advocating the need for ambitious targets (50% reduction) and 18 papers in favour of applying targets in all the steps of the supply chain. However, two business organizations disagreed on setting targets at the primary production stage, due to the imbalance of power in the supply chain and market dynamics that cannot be controlled by farmers (e.g., price dynamics, cancellation of orders, etc.). Six papers from business associations stressed the need to take into account previous efforts made to reduce food waste. Concerning waste prevention actions, two papers from business associations, one from an NGO and one from a company stressed the importance of prioritizing those actions with the greatest environmental or climate impact, using a food use hierarchy approach. The role of packaging in preventing food waste, including use of innovative/high performance packaging with the potential to extend the life of food products and compostable and bio-based packaging, was stressed by 17 position papers, mainly from business associations. Concerning the actions and policy initiatives that the EU should undertake, rules on date marking and actions related to awareness raising and education were the most mentioned. The need for a harmonized food waste definition and a better monitoring system was also stressed by five business associations and two NGOs, and four stakeholders (two business organizations, one company and one NGOs) suggested to provide fiscal incentives to spur food waste prevention and incentivize food donation. Policy coherence between food waste and other related policies (e.g., labelling, climate action, Common Agricultural Policy) was also recommended by two NGOs, one company and one public authority.

Targeted consultations

Targeted consultation for used textiles and textile waste took the form of four virtual stakeholder workshops as detailed below using group discussions as a whole as well as break-out groups and use of digital white boards. Additionally, a meeting of the WFD Expert Group (Member States), interviews and a conference on the future of Europe were used to obtain more targeted evidence. Details on each of these are presented below. The white boards that operated during the workshops allowed anonymous comments to be made meaning that in several cases comments received could not be attributed to any particular stakeholder group.

Waste prevention, preparation for reuse and recycling and used textiles and textile waste

Stakeholder workshops

Workshop One concerned preparation for reuse and recycling and was held 30 March 2022. It focused on the preparation for reuse and recycling of bulky waste, hazardous household waste, construction and demolition waste from households, wood packaging, ceramics packaging, WEEE and batteries. Attendees included 20 Member State representatives (including government ministries and competent authorities), 19 company/business organisations, 8 Environmental NGOs and 3 Academia and research organisations. Numerous stakeholders' statements expressed their views regarding a lack of binding waste prevention targets at EU level in the WFD. Hereby a lack of ambitious mandatory waste reduction targets (overall for municipal solid waste and waste stream specific waste reduction targets) was frequently mentioned. Stakeholders from across all stakeholder groups also stated the need for a sound monitoring system for waste prevention. There was no dispute amongst the stakeholders demanding EPR requirements and fee modulation to be

better aligned with waste prevention (for example design, reuse and repair). Several general statements were issued by stakeholders on the need of changing the modes of (linear) production and (over-)consumption patterns and on the missing decoupling of economic growth and waste production. In this context, the legal framework was still perceived as too "linear" and that the concept of "waste" should be conceived in a more circular way.

Stakeholders from across the stakeholder groups agreed on the problem of low demand for repaired / refurbished products, existing market disincentives for more durable products and new products being too cheap, caused by the absence of a tax on virgin materials. Individual stakeholders, particularly NGOs emphasized the problem of control and enforcement of authorities, the problem of landfilling being the cheapest option for waste management and lack of incentives to promote the implementation of the waste hierarchy, with business representatives nothing the problem of soiled recyclables in the collection phase hampering further recycling / reuse.

Workshop Two concerning used textile and textile waste was held on 31 March 2022. The half-day workshop focussed on determining the problems concerning used textile and textile waste, their associated drivers and their likely impacts. Attendees were comprised of 20 Member State representatives, including government ministries and competent authorities, 19 Company / business organisations, 8 Environmental NGOs and 5 Academia and research organisations. Comments were made on the need to standardise definitions, rules, targets and EPR schemes across the EU. Stakeholders also mentioned the need to regulate the design of textiles, through eco-design measures and through consideration of eco modulation in the case of EPR. Some stakeholders, particularly business associations and NGOs indicated the need to facilitate changes in consumer behaviour, and some felt that regulations should address this issue. Comments indicated that priority for the management of textile should be given to sorting for reuse and then to recycling. Focus should also be given on reintroducing recycled textile into new textile products.

Specifically concerning recycling of textiles, industry stakeholders regretted the lack of economic attractiveness of recycled textile fibres, considering the very low cost of new fibres. It was considered that regulatory incentives could help reverse this pattern. Comments were also echoed across all stakeholder groups on the lack of infrastructure to absorb the volumes of textile waste and on the low quality and durability of textiles due to fast-fashion trends, which result in short product lifetime. Stakeholders, particularly industry stakeholders, identified that some of the main barriers to high quality recycling were due to the diverse mix of materials, coatings, dyes, and non-textile elements that make up garments, which are not designed for reuse or recycling.

Stakeholders overall agreed that the option of no further policy intervention was not sufficient to ensure the collected textiles be sustainably managed. They indicated that the separate collection obligation as of 2025 should be accompanied by other measures (targets). They also pointed out the current lack of harmonised definitions and whilst there was agreement that best practices should be shared, the need for more harmonisation of definitions across Member States was considered of primary importance.

Different aspects of EPR for textiles were highlighted. Stakeholders, particularly NGOs, mentioned that a focus should be given to repair and reuse, and that an EPR scheme should not incentivize recycling over reuse. All stakeholders agreed that collection, sorting and recycling infrastructures needs to be dramatically scaled up, and that EPR could provide the necessary funding to make that happen. However, in the interest of consistency there would also be a need for clear guidance on specific aspects of EPR schemes, such as the responsibilities of actors and governance if there were to be additional measures on EPR at EU level. Finally, the need to consider the overall regulatory framework when thinking of new measures was highlighted.

Different opinions emerged on the topic of targets and restrictions. Industry stakeholders mentioned the importance to consider available capacity (i.e., for sorting, recycling) when setting targets, and to include industry experts in the discussion. Binding targets on the use of recycled content in new textiles were also mentioned, as well as distinct targets between (preparation for) reuse and recycling. Some stakeholders, particularly NGOs, suggested separate targets for household and for commercial/industrial waste. Some concerns were also raised, on necessary monitoring and reporting to monitor targets, on the risk of misaligned application of targets in EU Member States, and on the importance to consider the current status of the different Member States with regards to management of used textile and textile waste when defining targets. Stakeholders mentioned that targets on prevention could also be considered.

Workshop Three concerning waste prevention was held on 5 April 2022. The attendees were comprised of 20 Member State representatives, including government ministries and competent authorities, 19 Company / business organisations, 8 Environmental NGO and 5 Academia and research organisations. Whilst the workshop focussed on Municipal solid waste / Total Waste, Food / Bio waste, Bulky waste, Construction and demolition waste, WEEE, Textile Waste, End-of-Life Vehicles (ELV) and End-of-Life Tyres (ELT) Task 1(b) the input from the workshop was, on the one hand very diversified and covered a wide range of aspects, but in relation to stakeholder feedback had a clear focus on bulky waste. However, as part of the discussions it must be emphasised that in general there were no strong different opinions from different groups. A further overriding theme from all stakeholders related to data limitations in respect to the problems and drivers related to waste prevention. All stakeholders agreed that current practices were insufficient to promote preparation for reuse and recycling and that this can be addressed through a mix of measures. There were universal calls for greater assistance in interpreting existing measures alongside any new provisions.

Workshop Four concerning used textiles and textile waste was held on 7 July 2022. Attendees at the workshop were comprised of 44 Member State representatives, including government ministries, national and regional competent authorities, 31 Company / business organisations, 19 Environmental NGOs and 2 Academia and research organisations. Attendees were presented with the options to address used textiles and textile waste under consideration with lower levels of support for lower ambition measures and higher levels of support for more ambitious measures. Common themes reported by all stakeholder groups included the need to greater consistency in determining the scope of textiles under the WFD and the need to support infrastructure development to manage the textile wastes generated. Correctly targeted and consistent application of EPR was seen as an important measure in this regard. Furthermore, in the context of EPR a Member State noted the need to include consideration of the needs of smaller Member States that may rely on neighbouring Member States when it comes to textile waste treatment.

Waste Framework Directive Member States Expert Group meeting. – 19 October 2022.

Several presentations were given at a virtual meeting of the WFD Member State Expert Group, two of which concerned the topics of this initiative: textiles and food waste. In relation to textiles, Member State representatives were presented with the problems identified, the objectives to be achieved, the policy options that could be applied to achieve the objectives including the specific proposed measures contained therein and a list of the preliminary impacts of the intervention. Member States generally considered that a mix of policy measures were required to address used textiles and textile wastes, with clarification of definitions, establishing minimum requirements on separate collection, mandating the use of EPR for textiles and banning the landfilling of textile wastes seen as the key priority measures to be applied. In relation to food waste, Member States were presented with the set up for policy options and the results of public consultations. As data on

food waste generation were not available yet (published on 25 October 2022), discussion on food waste was short and limited to clarification of elements presented.

Interviews

In April and May 2022 interviews were organised with selected stakeholders from across all stakeholder groups primarily focussing on a broader scope at first and then later focussing on used textile and textile waste. Twenty-seven one-to-one interviews / one-to-group interviews were held with regard to problem identification, the scope of the objectives and evidence gathering with regard to the impacts of options and measures. According to the stakeholders, an EU-wide EPR framework should include specific elements in order to be efficient. Measures on re-use, repair and separate collection need to include enforceable, binding targets to stimulate producers to make the transition to circularity. As regards the scope of the initiative, some of the stakeholders suggested that the collection should include textile waste generated by households and professionals that is comparable to household textiles such as clothes, home and interior textiles, bags made from textiles and textile accessories; however, they raised concerns on shoes and technical textiles. They also suggested to limit the scope at the beginning and to expand over time when the infrastructure is in place and to use the Customs Tariff CN codes to define the textiles covered by the suggested EPR scheme. The stakeholders expressed different views on the issue of guidance. In terms of targets, the stakeholders recommended that targets with a gradual increase in their level of ambition over time should be developed, depending on the levels of consumption, as well as enforceable resource reduction targets for textile production, by e.g., a recycled-content target. They also highlighted the fact that any targets should be combined with the scaling up of recycling technologies in the Member States and that the re-use targets should ensure that reuse is actually taking place. They noted that it is important to consider that targets for preparation for reuse and recycling of textile waste should be based on the waste hierarchy.

Prevention and management of food waste

Surveys on food waste prevention initiatives

Targeted consultations on food waste prevention initiatives were carried out by means of two surveys sent to Member State experts and stakeholders in the food value chain[25]. Both surveys aimed at collecting quantitative data on costs of the waste prevention initiatives and amounts of food waste prevented. The survey for Member States (MS) was open March - May 2022. Based on the country profiles published in the EU Food Loss and Waste Prevention Hub[26], the survey listed all the relevant food loss and waste prevention initiatives carried out by Member States. The survey requested to complete this information with general information on the initiatives, amount and value of food waste reduced, links to websites, and data on costs of the initiatives. Contributions were received from 20 countries, with a total of 145 initiatives reported. Data on the overall costs was provided for 18% of the initiatives reported, with 13% including data on the amounts of food waste reduced and 6% providing information both on costs of the initiatives and amounts of reduced food waste.

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[25] More details on targeted consultations on food waste can be found at: De Laurentiis, V, Mancini, L, Casonato, C, Boysen-Urban, K, De Jong, B, M'Barek, R, Sanyé Mengual, E, Sala, S. *Setting the scene for an EU initiative on food waste reduction targets*. Publication Office of the European Union, Luxembourg, 2023, doi: 10.2760/13859, JRC133967

[26] European Commission, EU Food Loss and Waste Prevention Hub, https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/eu-member-states.

The questionnaire for stakeholders involved in food waste prevention initiatives was published as an EU survey in April 2022 and promoted through various channels, including the EU Food Loss and Waste Prevention Hub. The survey closed in June 2022, with 62 replies received. The survey included a part that requested general information, including questions on the aim of the initiative, its geographical scope, typology, stakeholders involved, phases of the supply chain addressed, etc. The second part aimed at receiving quantitative data on costs of the initiative and amount of avoided food waste. The last part focused on social benefits, e.g., on possible jobs created by the initiatives, training opportunities and volunteer work. Some respondents were contacted by email in order to request further explanations or to confirm the information provided. When a website of the initiative was available, data reported in the survey was compared with information published online.

The survey for stakeholders allowed to collect quantitative data for about 50% of the initiatives reported. For these initiatives it was possible to calculate an average cost of food waste avoided for the various types of initiatives (the largest share of initiatives reported related to surplus food redistribution). The average costs per unit of avoided food waste (986 EUR/tonne) are high, compared to figures derived from the literature and previous estimates. Possible reasons for the high value can be found in the fact that some initiatives have other (or additional) objectives, like the support to disadvantage people and households for which they receive funds. The group of food redistribution initiatives showed lower average costs compared to the other types (475 EUR/tonne). Concerning the type of stakeholders running the initiatives, retailers, municipalities and consumers were the most selected options. The most represented type of initiative was the surplus food redistribution, but most of the initiatives have various purposes and reduce food waste in various stages of the supply chain. Concerning the social benefits, on average each initiative involved 23 volunteers and created 20 jobs. Concerning the additional social benefits created by the initiatives, food security, poverty reduction, awareness raising, education and social cohesion were the most mentioned by respondents.

Interviews

In the context of the targeted consultations on food waste, four interviews were held with selected stakeholders who replied to the survey (two companies, a no profit organization and a public authority). The interviews took place between May and August 2022 with the aim of collecting additional data and insights on their initiatives, or to clarify the information that they provided in the survey. Two additional interviews with WRAP and Wageningen University have been conducted in order to receive feedback on the data collected through the Member State and stakeholder surveys conducted as part of the targeted consultation (in particular, the quantitative data received on cost of the initiatives and on the representativeness of the type of initiatives reported through the survey). According to these stakeholders, the survey findings lack data from large-scale initiatives, which have a higher impact on the EU food system as well as data from food waste prevention initiatives undertaken by food businesses. An interview was conducted with a researcher of the Thünen Institute of Market Analysis, in order to compare data from the survey on food waste amounts and costs of initiatives with those from case studies run by the institute, aiming at improving supply chain efficiency at the manufacturing/processing level. Given that results of these studies are not published yet, they could not be used for the bottom-up assessment.

Meetings of the EU Platform on Food Losses and Food Waste (FLW) and other Expert groups

The targeted consultation meetings of the EU Platform on FLW included a dedicated meeting on 22 October 2021, and subsequent discussions with members at 3 plenary meetings held on: 18 November 2021, 17 February and 20 October 2022. The EU Platform on FLW includes international organisations, EU institutions, Member States' experts and stakeholders from the food supply chain including farmers, industry, environmental-, consumer- and other NGOs (including

food banks and other charities). Private sector organisations in the food value chain represent SMEs for their specific sector of activity (e.g., food manufacturing, retail, food services etc.)

The most frequent issues raised by stakeholders consist in the inclusion of all the steps of the supply chain in the scope of the targets, with some comments on the importance of monitoring and integrating food losses; the importance of taking into account food and feed safety (expressed especially by private sector organizations); the concern regarding the choice of 2020 as baseline due to the impact of COVID19 (highlighted by some Member States and NGOs); the possibility to differentiate and take into account edible and non-edible food waste (mentioned by private sector organizations); and to consider the results already achieved by Member States when setting the baseline, highlighted by Member States and private sector organizations. Some Platform members also highlighted the need to ensure coherence between the food waste reduction targets and the future reduction targets for municipal waste.

In the context of finalising the impact assessment, the Commission further convened a meeting of the Member States Expert Group on Food Losses and Food Waste (7 March 2023) and a joint meeting of the EU Platform on FLW and the Advisory Group on Sustainability of Food Systems (13 March 2023). In the meeting with national authorities, some countries (Belgium, The Netherlands) questioned whether it would be possible to set a target different from SDG 12.3, highlighting communications issues given the commitments made to the Sustainable Development Agenda since 2015, whilst, at the same time, underlining difficulties in achieving such a target covering both edible and inedible fractions (the latter being difficult for households to reduce). Belgium pointed out that the valorisation of food waste (the inedible fraction) was not the same as avoiding food being lost and that the inclusion of inedible parts of food will necessarily affect the target's level of ambition. Several Member States (Austria, Croatia, Finland and Portugal) questioned whether the 2020 food waste dataset was sufficiently representative to be used as a basis for setting targets, with Finland suggesting the setting of non-binding targets as a possible first approach. Some countries argued for greater simplicity (Latvia, Portugal), suggesting, for instance, the setting of one target covering the whole food supply chain. Several public authorities (Austria, Belgium, Croatia, Denmark and Finland) questioned setting the same target for all Member States (given different national situations) and asked whether efforts made by "early achievers" could be recognised (e.g., via an earlier baseline).

In the joint meeting with the two expert groups, held on 13 March 2023, several stakeholders (an international organisation, representatives of veterinarians in Europe and food services) raised concerns about the comparability of Eurostat data with earlier estimates (FUSIONS, 2016), highlighting that setting targets based on data (which some considered) of questionable quality would be risky. A few also doubted considering 2020 as the baseline year for the targets due to the impact of the Covid-19 pandemic on the food supply chain (representatives of retail and an NGO). Other stakeholders (representing academia and research, a consumer organisation and a regional NGO) expressed the wish to differentiate between edible and non-edible parts of food; moreover, due to differences in dietary patterns across Member States, this may introduce significant biases when setting targets across the EU. Concerning the expression of the targets, some stakeholders representing food services and a regional NGO advocated for expressing reduction targets in absolute amounts (i.e., kg per capita). Several environmental NGOs, as well as representatives of a social NGO and the food services sector, noted that the target options considered in the Impact Assessment were not ambitious enough in the light of the global SDG Target 12.3. As regards the targets' coverage of the food supply chain, a few stakeholders (from an environmental NGO, a research institute and food services sector) asked to cover the whole the food supply chain in order to avoid shifting food waste from one stage to another, while other stakeholders warned that setting targets for selected stages only could create silo actions (industry representatives and a research institute). Stakeholders expressed opposing views concerning setting targets for primary

production: representatives from two environmental NGOs and from the retail sector were in favour, while representatives of primary producers argued against, referring to the absence of an agreed definition for food losses and that, in this sector, waste may occur due to factors beyond producers' control. Representatives of the retail sector warned against setting a common target for consumption covering both retail and households, arguing that reducing consumer food waste would be more difficult and could shift the burden to retailers.

3- Use of the information gathered

The information gathered as part of the consultations and in the context of the support studies was combined to identify the problems, set the objectives and identify relevant measures. The evidence was analysed to identify contradictory or consensual views and to reach the conclusions contained in this report. In this context, all widely supported views are entirely considered, with less widely supported views identified as such.

The preliminary steps, including the CfE, the initial interviews and the first three stakeholder workshops conducted through the support study, covered a broad scope addressing waste prevention, preparation for reuse and recycling, used textile and textile waste and food waste. The analysis of these materials was conducted up to June 2022. Taking into account the ongoing efforts across the EU to implement "the 2018 waste package" and the variety of new and ongoing initiatives by the Commission (including the review of the Directive 94/62/EC on packaging and packaging waste (PPWD) [27], Batteries Regulation, Industrial Emission Directive, Eco-design for Sustainable Products regulation (ESPR)), the Commission then refined the scope of the policy initiative. The refined scope focuses on used textiles and textile waste as well as an assessment of the feasibility of setting food waste reduction targets to implement the Union's commitments under the UN Sustainable Development Goals and the Farm to Fork Strategy and limit the food supply chain's impact on the environment and climate.

Hence, the stakeholder consultations after June 2022 focused on textiles. Most of the views on textiles point to the challenges in understanding the nature of used textile and textile waste, the collection, sorting, reuse, recycling and disposal of textile waste and the relationship between the measures foreseen under the ESPR proposal and the expected impacts on textiles at their point of discard. The largest challenge regarding used textile and textile waste is identified as the scarce data on generation of textile waste and the infrastructure that exists for its subsequent treatment.

Stakeholders provided information on the policy measures that was used to expand the scope to assess matters such as online sales of textiles and end-of-waste provisions that were not part of the original inception impact assessment. Further, stakeholders raised concerns with regard to the impacts of EU discarded textiles on third countries and this was considered when designing the proposed measures. Finally, all stakeholders advocate for greater consistency in Member States' approach to textiles waste management. There were also number of matters raised by stakeholders that fall outside of the scope of the WFD, most notably in respect to textiles design for circularity that is better addressed by the ongoing work on ecodesign under the EU Strategy for Sustainable and Circular Textiles[28].

Information gathered during stakeholder consultations (IIA, targeted and meetings of the EU Platform on FLW) helped inform the definition of policy options, in particular that targets not be limited to the consumption and retail stages but that they cover the food supply chain more broadly.

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[27] European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste *(OJ L 365, 31.12.1994, p. 10–23)*, EUR-Lex - 31994L0062 - EN - EUR-Lex (europa.eu).
[28] See footnote 24.

The data on costs of food waste prevention collected through the survey for stakeholders showed a high variability and were generally higher than values found in the literature. Therefore, they were not directly used in the model to calculate the macro-economic impacts of targets.

ANNEX 3: WHO IS AFFECTED AND HOW?

1- Introduction

This annex sets out the practical implications of the preferred policy package for the different stakeholders concerned. It describes the actions that different stakeholders would need to take to comply with the obligations under the revised legislation and indicates the likely costs to be incurred in meeting those obligations, or where quantitative information is not available, the nature and order of magnitude of such costs. It also presents the implications for the public.

2- Practical implications of the initiative: for textiles and textile waste

Producers of textiles: Upon the date of application of the provisions on extended producer responsibility (EPR) (i.e. at or after the transposition date for the targeted amendments to the WFD) producers will be required to provide information on the quantity of textile goods subject to the EPR obligations that are placed on the market. Furthermore, as Member States enact their EPR systems in compliance with the harmonised framework set out in the revised Directive, producers will have to pay fees into the respective producer responsibility organisations (PRO) to cover the costs of collection, sorting, preparation for reuse, recycling, energy recovery and disposal of textile waste as well as other defined costs on reporting, awareness raising, R&D.

Producer responsibility organisations (PROs): The implementation of an EPR scheme would require the setting up of new PROs or the expansion of the activities into the textile sector for existing PROs. PROs will be required to ensure that the scope of textiles covers at least the scope set at the EU level and to comply with the minimum obligations set in the revised legislation. This includes reporting on the operations of the EPR scheme put in place. PROs, based on fees collected from producers, will fund the waste management enterprises, including social enterprises, to finance the collection, sorting and treatment of textile waste as well as in waste prevention activities at the national level.

Waste management enterprises including social enterprises: Upon the date of application of the revised legislation (i.e., transposition date for the WFD and entry into force at the national level) waste management enterprises will be required to comply with the revised provisions on textiles waste management. It is expected that these obligations will take several years to set up given the timeframe of the relevant infrastructure investments. The most important aspects in relation to investment in collection, sorting and treatment infrastructure will be to make sure that full scope of textiles defined at the EU level is managed effectively.

Social enterprises, one of the key stakeholder groups in the collection, sorting and reuse of textiles and textile waste in the EU, will be provided with a clearly defined role in the application of the new measures, ensuring that Member States and PROs engage with those enterprises to ensure the ongoing viability of their operating models. The obligations proposed on separate collection of textile waste should improve the quantity and quality of textile streams suitable for recycling, to the benefit of recyclers. Funding via the EPR scheme will be directed to innovation and the creation of closed loop recycling infrastructure.

Additionally, reporting on certain aspects of waste management activities will be required in terms of collection, sorting and treatment of textiles. In most cases this reporting is in place and the provisions of the initiative will add clarity to those provisions, rationalising reporting across the EU and reducing administrative burden. In a small number of cases, additional reporting would be required e.g., in relation to collection and sorting and subsequent treatment, to ensure that the obligations set at the EU level are complied with and the monitoring framework overall is improved and future proof. Enterprises that are involved in the shipment of used textiles will face additional data recording obligations to prevent illegal shipments.

Competent authorities: Competent authorities will have increased responsibilities in ensuring the management of used textiles and textile waste. This will include:

- the setting up of EPR schemes and permitting of PROs.
- ensuring that the necessary infrastructure is in place to comply with the collection target set.
- adapting the waste prevention programmes to monitor textile waste prevention based on harmonised EU indicators.
- applying the necessary compliance / inspection regimes in relation to collection, sorting and shipments of used textiles.
- providing revised and additional data in relation to textile waste management within their territory.
- support the development of the implementing acts to be developed by the European Commission.

The public: The new legal provisions should result in additional separate textile collection infrastructure being made available to the public, making collection easier. This will better feed the reuse market within the EU and provide additional second-hand clothing for sale to the public (in comparison to increased recycled fibres that will reach consumers through an indirect route).

Additionally, via the EPR scheme, the public should be better informed as to how they can contribute better to textile waste prevention as well as in relation to additional information on waste prevention measures taken across the EU via the waste prevention indicators. Furthermore, data collected at the EU level in relation to used textiles and textile waste management will lead to a better-informed public on the textile challenge and the success of actions put in place to address that challenge.

The application of EPR fees is going to increase the cost of placing textiles on the market. However, it is not certain whether the producers will or to what extent pass these costs to consumers. This increase in price is likely to be small – on average less than 0.6%, depending on the specific costs of waste management in country where the EPR fees are being collected.

Other: Under the preferred option, the European Commission will be required to:

- Develop, adopt and implement an implementing act setting out minimum sorting requirements for re-use and recycling;
- Develop, adopt and implement an implementing act on end-of-waste criteria at the EU level for waste textiles for re-use and recycling;
- Develop, adopt and implement an implementing act harmonising the reporting formats for reporting on textile waste management;
- Develop, adopt and implement an implementing act harmonising the fee modulation criteria under extended producer responsibility scheme;
- Develop, adopt and implement an implementing act setting out a harmonised methodology for the calculation of the collection target

- Establish and maintain a data flow management system for re-use of products data, including textiles (EEA);
- Establish and maintain a data flow management system for textile waste management (adaptation of the existing data flow management system on textiles);
- Support Member States in the transposition and the operationalisation of the new obligations through the Waste Committee.

3- Summary of costs and benefits for textiles and textiles waste

Table 2 – Overview of Benefits of the Preferred Option

I. Overview of Benefits (total for all provisions) – Preferred Option		
Description	***Amount***	***Comments***
Direct benefits		
Application of the polluter pays principle through EPR	Funding to address the collection, sorting and treatment costs of used textile and textile waste management to the value of 2.2 billion euro for the EU overall. Benefit to consumers reducing their volumes of mixed waste	
Reduction of pollution resulting from the discard to used textiles and textile waste in residual waste streams	The additional diversion of approximately 137 000 tonnes of waste from incineration and landfill to treatment higher up the waste hierarchy as a result of collection targets will reduce GHG emissions as well as other emissions to air, water and land.	Additional reductions through waste prevention measures are also expected. It has not been possible to quantify the benefits resulting from the waste prevention measures foreseen in relation to indicators or in relation to EPR prevention measures employed at the national level.
Increases in employment infrastructure for waste management	The additional obligations in relation to waste management would result in approximately 8 740 new jobs being created in the collection, sorting and treatment of used and waste textiles.	
Better data on used textile and textile waste generation across the EU	It has not been possible to quantify the benefits resulting from better data. However, the comparability of the situation of different Member States in relation to used and waste textiles will be significantly improved in comparison to the status quo, with additional information able to support development of new infrastructure, most notably in support of textile recycling.	
Reduction in volumes of waste textiles exported as reusable to third countries	The social and environmental impacts of waste textiles exported from the EU to third countries would be reduced as a result of greater sorting obligations as well as record keeping in relation to such exports.	
Increase in circularity of used and waste textiles	The development of sorting requirements and EU end-of-waste criteria will result in easier flows of textiles in the future whilst ensuring consistency of approach in determining when textile wastes are no longer wastes across all Member States. Greater reuse and recycling of textiles will result on the retention of the economic value of the textile materials contained therein. In some cases, this could cover 75% of the costs of management of the wastes themselves.	
Indirect benefits		
Increase in the volume of reusable textiles able to be placed on the market within	Measures targeting increased reuse will lead to greater volumes of goods made available on the second-hand market. Consumers will have a larger	

and outside the EU	offer of items to purchase on both price and ethical grounds.	
Administrative cost savings related to the 'one in, one out' approach*		
Reporting cost reductions resulting from clearer scope of textiles under the WFD as well as greater compliance against a clearer set of rules across the EU	It has not been possible to quantify the benefits but it is expected that alongside reduced costs of reporting greater consistency of approaches to addressing a more clearly defined scope of textiles will reduce costs for operators having to comply with a single set of rules across the EU in comparison to the baseline.	

*(1) Estimates are gross values relative to the baseline for the preferred option as a whole (i.e. the impact of individual actions/obligations of the preferred option are aggregated together); (2) Please indicate which stakeholder group is the main recipient of the benefit in the comment section;(3) For reductions in regulatory costs, please describe details as to how the saving arises (e.g. reductions in adjustment costs, administrative costs, regulatory charges, enforcement costs, etc.;); (4) Cost savings related to the 'one in, one out' approach are detailed in Tool #58 and #59 of the 'better regulation' toolbox. * if relevant*

Table 3 – Overview of Costs of the Preferred Option

II. Overview of costs – Preferred option							
		Citizens/Consumers		**Businesses**		**Administrations**	
		One-off	**Recurrent**	**One-off**	**Recurrent**	**One-off**	**Recurrent**
Action (a)	Direct adjustment costs	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good prices	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good prices	Revision of waste management permits, where necessary to adapt to the new regulatory requirements.	970 million euro per year sorting and treatment costs	Costs for setting up EPR schemes (inter alia producer register, permitting system for PROs). Revision of waste management permits, where necessary to adapt to the new regulatory requirements. Adaptation of the data collection systems and requirements on economic operators.	Operational costs in relation to ongoing collection, sorting and onward treatment of textiles collected if incurred by municipalities ought to be covered by the producers in line with the principle of necessary cost.
	Direct administrative costs	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where	Cost of registering in a producer register and a PRO.	6.8M euro for reporting of products PoM and eco-modulation data 750K euro per year for additional reporting by waste management operators 1M euro per year for producers	Revision of the Waste Prevention Programmes on prevention indicators.	EUR11.2–69K per year per Member State to operate producer registers Monitoring of waste prevention based on common indicators and more granular data collection on textile waste management. 208 euro per competent authority annualised for additional inspection

		textile goods in circumstances where EPR costs are added to textile good prices	EPR costs are added to textile good prices		to assist PROs 78 euro per exporter annualised per inspection		
	Direct regulatory fees and charges						Landfill tax loss of 26.5 million euro for Member States due to textiles diverted from landfills but tax gain on the sale of secondary materials
	Direct enforcement costs						4 euro million costs of operating PRO registers and inspections
	Indirect costs						
Costs related to the 'one in, one out' approach							
Total	Direct adjustment costs	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good prices	Revision of waste management permits, where necessary to adapt to the new regulatory requirements.	970 million euro per year sorting and treatment costs		

		prices					
	Indirect adjustment costs						
	Administrative costs (for offsetting)	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good prices	Note that the one-off and recurring costs identified for businesses in this row may instead fall upon citizens and consumers through increased prices for textile goods in circumstances where EPR costs are added to textile good prices	Cost of registering in a producer register and a PRO.	6.8M euro for reporting of products PoM and eco-modulation data 747K euro per year for additional reporting by waste management operators 1M euro per year for producers to assist PROs 300K for exporters		

(1) Estimates (gross values) to be provided with respect to the baseline; (2) costs are provided for each identifiable action/obligation of the preferred option otherwise for all retained options when no preferred option is specified; (3) If relevant and available, please present information on costs according to the standard typology of costs (adjustment costs, administrative costs, regulatory charges, enforcement costs, indirect costs;). (4) Administrative costs for offsetting as explained in Tool #58 and #59 of the 'better regulation' toolbox. The total adjustment costs should equal the sum of the adjustment costs presented in the upper part of the table (whenever they are quantifiable and/or can be monetised). Measures taken with a view to compensate adjustment costs to the greatest extent possible are presented in the section of the impact assessment report presenting the preferred option.

4- Practical implications of the initiative for food waste

Competent authorities

The first affected stakeholders will be public authorities. They will have to review their existing food waste prevention programmes and decides if the measures included there are sufficient to meet the food waste reduction targets. While the initiative does not set any new obligations on Member States, meeting the targets would require more effective implementation of current rules. In order to meet the targets, Member States will need to implement efficient food waste reduction strategies. Key components of such strategies would include carrying out a food waste diagnosis;

defining and implementing actions required to address the major hotspots identified; national coordination of efforts by public and private stakeholders and regular assessment of progress made. Competent authorities will be expected to help coordinate efforts of stakeholders in the food chain as well as will be key in helping in education and awareness raising. Examples of measures taken by Member States so far are described in Annex 7. Exact scope of actions will depend on national situation and decisions to be taken by Member States.

Food business operators

May be requested to review their operations with a view to search for opportunities to reduce food waste by organisational, technical or social innovations. Business organisations may be requested to participate in different cooperative forms (e.g., voluntary agreements, platforms) to improve communication and collaboration along the food supply chain. Measures taken so far by Member States was of voluntary and supporting character. Reduction of food waste may in longer term impact the incomes of food producers (e.g., farmers) and sector of food processing and manufacturing. More details is included in the Annex 11 – section on economic impacts. On the other hand, reduction of food wastage in their operations should improve their profits and competitiveness.

The public

The public should be better informed about practical way to reduce food waste as well as issues of systemic impacts of food in general. By reduction of food waste households are expected to reduce their spending on food which was not consumed and use these either for food of better quality or for other purposes. Food waste reduction may be linked to some inconveniences (e.g. more attention to food preparation, more trips to the supermarket, less choice at the close of shopping etc.).

Waste management enterprises

In longer term reduction of food waste, especially at consumer level, is expected to reduce amount of waste destined for recycling. This may be partly compensated by recycling of food waste which are currently landfilled or incinerated, which is expected to be supported by obligation of separate collection of biowaste, entering info force from 31 December 2023.

Other

The European Commission will be required to continue support to Member States in practical implementation of food waste policies and measures and in the sharing of best practice between Member States, in particular via the EU Platform on Food Losses and Food Waste and knowledge development (e.g., dedicated Horizon Europe projects, European Consumer Food Waste Forum, etc). The support will also include dedicated grants already envisaged under Single Market Programme.

5- Summary of costs and benefits for food waste

Table 4 – Overview of Benefits of the Preferred Option

I. Overview of Benefits (total for all provisions) – Preferred Option		
Description	***Amount***	***Comments***
Direct benefits		
Reduced climate change impact	Up to 62 million tCO2eq avoided emissions, when calculated with footprint bottom-up analysis	This does not include the rebound effect.
Reduced land use	Food consumption land footprint reduced by	As calculated with the MAGNET model.

	2%	
Reduced impacts on soil	Impacts on soil due to land use of the food system reduced by 4%	As calculated with the bottom-up analysis
Reduced impacts on water	Impacts caused by water use of the food system reduced by 3%	As calculated with the bottom-up analysis
Reduced impacts on marine eutrophication	Impacts on marine eutrophication caused by the food system reduced by 4%	As calculated with the bottom-up analysis
Reduced energy consumption	Food consumption energy footprint reduced by around 680 MJ per capita per year equivalent to a 2.6% decrease.	The food consumption energy footprint is calculated with MAGNET. Food waste reduction helps to reduce the demand for gas, oil and electricity.
Reduced food prices	Reduced food prices, e.g. vegetables (-2,5%) fruits (-1,5%), other food smaller reductions	Increased food affordability.
Additional income available for higher quality food or non-food consumption	About 100 Euros per citizen per year	The share of food expenditure in total expenditure decreases because of the lower food prices, offering additional spending possibilities. (MAGNET)
Increase of agri-food exports	Extra-EU exports increase between 1 and 5 % for main agri-food commodities.	This increase is compensating to some extent the income loss of farmers due to the reduced demand within the EU. (MAGNET)
Less dependence for agri-food imports from world markets	Extra-EU imports decrease between 1 and 9% for main agri-food commodities	Given the strategic importance of the agri-food sector, this is a contribution to strengthen the open strategic autonomy. (MAGNET)
Reduced waste collection and treatment	About 170 Euros per tonne of avoided food waste/ Approximately 2.2 billion Euros~~...~~	Estimated considering the cost to society of waste collection (including subsidies, taxes and collection)
Indirect benefits		
Increase of other economic sectors	Increase of value added for services by 0.3%, manufacturing by 0.1%	(MAGNET)
Potential for bio-based industry	The reduction of food demand frees up land, which can be used for other purposes.	The uptake of bio-based industrial applications to reduce fossil-based production, depends on additional instruments/policies
Reduction of food packaging	Around 3% reduction of glass and paper waste	It should be noted that this number assumes a status-quo of packaging in the food chain.
Virtual trade of land and CO_2 emissions	Less demand for food imports, leads to a reduction of virtual land imports (-4.2%), and a reduction of virtual emission imports (-3.3 %).	Reducing food waste could indirectly contribute to reducing deforestation and to mitigating emissions in other countries.
Administrative cost savings related to the 'one in, one out' approach*		
(direct/indirect)	n/a	n/a
	n/a	n/a
	n/a	n/a

Target-setting does not require Member States to take additional actions compared to what has already been established by the WFD as amended in 2018, as the necessary elements are already included there (i.e., obligation to reduce food waste at each stage of the food supply chain, preparing food waste prevention programmes, implementing related actions, monitoring and reporting on progress achieved). Moreover, Member States have already committed, since the

adoption of the Sustainable Development Agenda in 2015, to take action to reduce food waste in order to achieve SDG Target 12.3, which is a non-binding, aspirational target. For this reason, it is expected that the proposal does not entail additional cost for administrations.

Concerning impacts on farmers, business and consumers specific impacts will depend on the measures to be taken by Member States. Literature and case studies generally show that food waste prevention is profitable for food business operators[29]. However, such change in food system requires adaption from all its participants. General cost of change into less wasteful economy, for the proposed option have been assessed in the model at following levels:

Household and food services: 43 EUR/ton to 70 EUR/ton

Retail : 34 EUR/ton to 53 EUR/ton

Processing and manufacturing: 7 EUR/ton to 22 EUR/ton

All values are given per ton of avoided food waste and are insignificant in comparison to value of saved food.

Table 5 – Overview of Costs of the Preferred Option

II. Overview of costs – Preferred option							
		Citizens/Consumers		**Businesses**		**Administrations**	
		One-off	**Recurrent**	**One-off**	**Recurrent**	**One-off**	**Recurrent**
Action (a)	Direct adjustment costs	none	none	none	Farmers loss of income [give value]	none	none
	Direct administrative costs	none	none	none			
	Direct regulatory fees and charges	none	none	Not expected	Not expected	Not expected	Not expected
	Direct enforcement costs	none	none	Not expected	Not expected	Not expected	Not expected
	Indirect costs	none	none				
Costs related to the 'one in, one out' approach							
Total	Direct adjustment costs	n/a	n/a	n/a	n/a		
	Indirect adjustment costs	n/a	n/a	n/a	n/a		
	Administrative costs (for offsetting)	n/a	n/a	n/a	n/a		

[29] See e.g. Champions 12.3, *The Business Case for Reducing Food Loss and Waste*, 2017.

6- Relevant sustainable development goals

Table 6 – Overview of relevant Sustainable Development Goals for the Preferred Option

III. Overview of relevant Sustainable Development Goals – Preferred Option(s)		
Relevant SDG	**Expected progress towards the Goal**	**Comments**
SDG no. 3 - good health and well-being: ensure healthy lives and promote well-being for all at all ages,	The project is linked especially with target **3.9** which aims to the substantial reduction of the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination. Through the amendment an improvement in public health and safety due to decrease in pollution from waste disposal practices is expected.	Trade-offs with targets 1.5: "By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.", 10.6: "Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions.", 15.5: "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species." and 16.8: "Broaden and strengthen the participation of developing countries in the institutions of global governance".
SDG no. 8 - Decent work and economic growth: promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	The project is linked with targets **8.3:** "Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services.", **8.4:** "Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead." and **8.7:** "Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms". Combating the fast fashion phenomenon will address the issue of workers suffering poor working conditions with long hours and low pay, with evidence, in some instances, of modern slavery and child labour. The measures aim to ensure that textiles are reused as much as possible and when they do become waste, they are	Trade-offs of target 8.3 with targets 8.4, 14.2: "By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans." and 14.5: "By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information".

	treated as high up the waste hierarchy as possible. The higher steps of the waste hierarchy are more labour intensive than the lower ones. Hence, the proposed measures are expected to enhance the development of SMEs, and in particular social enterprises active in the reuse market that often also have social integration objectives.	
SDG no. 9 – Industry innovation and infrastructure	The project links with target **9.4** on increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, and target **9.5** on enhancing scientific research, upgrade the technological capabilities of industrial sectors.	Possible trade-offs with targets 12.4 and 12.5. These trade-offs will be mitigated through the EPR scheme.
SDG no. 11 - Make cities and human settlements inclusive, safe, resilient and sustainable	The target **11.6** refers to the reduction of the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management. This will be achieved by increasing the proportion of municipal solid waste collected and managed in controlled facilities.	Trade-offs with targets 12.4 and 12.5. The trade-offs will be mitigated by introducing requirements for recyclability of components and availability of spare parts for 7-years after the end of production.
SDG no. 12 - Responsible production and consumption: Ensure sustainable consumption and production patterns	The specific targets linked to the project are: **12.1** "Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.", **12.3** 'By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.' **12.4** "By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.", **12.5** "By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.", **12.6** "Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their	Trade-off of target 12.1 with target 17.11 "Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports". Trade-off of target 12.4 with targets 6.3, 7.1, 8.1, 9.2, 9c and 17.8. Trade-off of target 12.5 with targets 6.3 and 17.11. Trade-off of target 12.8 with target 3.3.

	reporting cycle." and **12.8** "By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature". WFD's primary objective is the prevention of waste, namely the reduction of textile waste generation including through reuse. Further, adopting clarified definitions would help people and businesses to have all the relevant information on textiles.	

Values of SDG indicators linked to food waste reduction:

As food waste reduction have very wide environmental and economic impact, the most relevant SDG indicators linked to food waste reduction was identified for each of the four environmental impact categories considered in this analysis. The outcome is presented in Annex 11, section 2.5.1.

7- Summary of overall costs and benefits

Table 7– Summary of overall costs and benefits

Preferred combined option	Description of impact	Overall balance
Option 2 - Additional regulatory requirements + 2 targets for textiles	**Economic costs**: €913 million per year for sorting obligations Register development costs of €2-12.3 million across Member States and maintenance costs of €11 200 and 69 000 per Member State per year €4.53 million per year for producers to report for the purpose of EPR €2.34 million costs of operating PRO registers and inspections €39.2 million euro per year for additional textile collection, sorting and treatment in Member States that are unlikely to meet a 50% collection target by 2035 €208 euro per competent authority and €78 per exporter annualised per inspection €750 000 per year for EU enterprises to comply with EU reporting	**Costs**: €970 million (these costs may fall on consumers, producers or a mix of both). Combined costs of 84 euro / tonne to 145 euro per tonne of food produced for food. **Benefits**: Direct benefits of €656 million of reusable and recyclable textiles for the EU reuse and recycling market as well as support to €3.5-4.5 billion annual overall returns from EPR investments A reduction in household food costs of 439 euro per year. Additional GHG emission reduction equal to €16 million per year from textiles and additional GHG

	obligations €26.5 million landfill tax loss for Member States due to textiles diverted from landfills Reduction in demand for food of 4.2% and a change in value of agri-food production of -1.8% alongside a fall in market prices of between 0.1 and 2.58%. A fall in farm income of euro 4.2 billion euro per annum. Implementation costs of 43 EUR/ton to 70 EUR/ton for household, 7 EUR/ton to 22 EUR/ton for producers and 34 EUR/ton to 53 EUR/ton for retailers. **Economic benefits** EPR: €3.5-4.5 billion annual overall returns on recycling investment (including the benefits indicated for the other measures) Additional sorting: €534 million per year of reuse value and €94 million per year of recycling value Additional collection**:** €28 million per year of combined reuse and recycling value **Economic benefits of savings in household food expenditure** of 439 euro per year **Env benefits**: €16 million from GHG emission reduction from textile waste as well as reduction in release of pollutants to air, water and land that would otherwise result from poor waste management 4.1 million tonnes GHG emission reduction as well as reduction in release of pollutants to air, water and land that would otherwise result from poor waste management. Reduced impact on land use of 2.16 trillion Pt, reduction in marine eutrophication of 532 million kg of Neq and reduction of water use of 80 billion m3 per	emission reduction equal to 62 million tonnes per year (overall environmental savings monetised - €9-23 bn), 8 740 jobs created in waste management but up to 135 000 lost in agri-food sectors (expected to be compensated in other sectors) **Overall effectiveness, efficiency and coherence**: positive

	annum. **Social benefits**: 8 740 jobs created in relation to textiles and social impacts of EU waste in third countries mitigated. 135 000 jobs lost in agri-food sectors.	

ANNEX 4: ANALYTICAL METHODS

The assessment presented in this report establishes the impacts of measures that may be used to address the challenges identified in the current EU legislative framework addressing waste generation, reuse, and preparation for reuse and quality recycling.

1. Textiles

Methodology

The method used for the analysis was as follows:

- Identifying the problems that need to be addressed through an examination of the results of existing literature and a small number of pilot interviews with stakeholders, including Member States, waste management actors (mainly SMEs) and non-governmental organisations.
- Defining the baseline by considering:
    - Static aspects – the existing framework for waste management, namely the Waste Framework Directive and experiences to date in implementation including in relation to quality of data.
    - Dynamic aspects – including the expected interaction of the Waste Framework Directive with other EU policies including circular economy and bioeconomy policies, the European Green Deal and the Waste Shipment Regulation. Given the uncertainty on measures in relation to textiles under the ESPR, the JRC baseline has not considered this initiative.
- Defining policy objectives. These objectives were defined based on the problems identified and with the input from stakeholders and the Inter-Service Group.
- Assessing the effect of possible measures to achieve the objectives. The measures were assessed using a specific modelling to estimate the effects on consumption, waste generation and treatment of waste. For other measures that could not be modelled to estimate a quantitative effect, a qualitative explanation of the expected effects is provided.
- Modelling economic impacts of the measures (Annex 11). Modelling considers i) the effects of changes in both the volume and nature (in terms of reuse and recycling potential) of waste generated that will require investment in additional collection, sorting and recycling capacity under the baseline – this is particularly important in respect to the application of extended producer responsibility ii) the effects of additional measures beyond the baseline that would require additional investment iii) the resulting potential savings made by moving waste management higher up the waste hierarchy and recovering the economic value of the waste concerned by this shift in treatment.
- Modelling environmental impacts. Focussing on the environmental impacts of changes in consumption, waste generation (in particular waste prevention) and waste treatment. This includes the estimation of climate impacts in terms of GHG emissions.
- Modelling social impacts in terms of the likely changes in waste generation within the EU and its treatment routes, including impacts on employment.

Assumptions

This report assumes the following:

- Without further policy intervention, until at least 2030, waste management in the EU will remain largely aligned with the varying levels of compliance identified in the European Commission's Early Warning Report (EWR) planned for adoption Q2 2023. In addition, Directive 2019/904 [30] on the reduction of the impact of certain plastic products on the environment (the SUP Directive), the proposal for the revision of the PPWD [31] and the impacts of the proposal for a Regulation establishing a framework for setting ecodesign requirements for sustainable products [32] will have an impact on the baseline. The support study used the impact assessment materials developed under those initiatives to ensure full consistency of the baseline (Annex 10).
- The support study used the most reliable data and statistics available. The sources were analysed and discussed amongst the study team, the Commission services (including the JRC and Eurostat), and the European Environment Agency (EEA). Priority was given to the data and statistical sources of evidence referred to in the European Commission's Better Regulation Toolbox.

Assumptions made in relation to individual policy measures are included in the description against each of the measures in Annex 10. There are instances when views from stakeholders appear in contrast with hard evidence, within unavoidable (presumed or stated) uncertainty margins. Where such differences were encountered, the approach taken to assess the impacts is further explained in the specific instances. Further, determining the impacts of preventing waste generation in the EU is complex because of the lack of available and harmonised indicators and because of the relatively recent amendments in the '2018 waste package'.

Calculations performed in the analysis

This section describes the calculation methods employed and the source data used in the modelling work undertaken. It is important to note, however, that not all impacts can be assessed quantitatively. A description of the quantitative and qualitative approaches is provided below.

Quantitative Assessment

In relation to examining trends in textile waste generation, collection and sorting the basis of calculations is the JRC study [33]. It examined materials flows and value chains of textiles products and the subsequent flows and treatment of post-consumer textiles. The study considered raw fibres, yarns and fabrics as well as finished garments and home textiles. Given the majority of textile waste generated stems from finished garments and home textiles this part of the report has been used for determining future trends.

The JRC study uses information from both ProdCom and Comext.

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[30] Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment *(OJ L 155, 12.6.2019, p. 1–19),* EUR-Lex - 32019L0904 - EN - EUR-Lex (europa.eu).

[31] European Commission, All Environment Publications, Proposal for a revision of EU legislation on Packaging and Packaging Waste, https://environment.ec.europa.eu/publications/proposal-packaging-and-packaging-waste_en.

[32] Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting eco-design requirements for Sustainable Products and repealing Directive 2009/125/EC, COM(2022) 142 final, EUR-Lex - 52022PC0142 - EN - EUR-Lex (europa.eu).

[33] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work).

- Eurostat's ProdCom database[34] comprises statistics on manufactured goods and services together with trade data for the same products. The study notes that at the 8-digit disaggregation level, the database includes approximately 3900 distinct product types defined using a Prodcom code which is derived from 6-digit CPA headings and 4-digit NACE codes. Broadly speaking, the Prodcom data includes for each product category: — the volume of production (sold and/or produced) given in a physical unit selected according to the product type (pieces, kg, m2 etc.) — the physical volume of the product exported and imported in the same physical unit — the value of production sold in Euros — the value of imports and exports In each reporting country, the National Statistics Institute carries out a survey of industrial production in that country, collates the results and transmits them to Eurostat. Eurostat calculates EU totals and publishes the national and EU data together with the related external trade data. Individual EU and EEA countries can be selected as reporting countries or groupings of countries including the grouping EU-27_2020.EU Comext[35] is Eurostat's' reference database for detailed statistics on international trade in goods. Data included in Comext addresses imports and exports to and from the EU both by value (Euro) and by weight (100 kg) of all goods including textiles. Data is captured in two different ways within COMEXT:
    - Extrastat: data on trade in goods with non-EU countries collected by customs authorities and based on the records of trade transactions in customs declarations. The dataset on trade with third parties is considered particularly robust as it is based on all reported customs movements.
    - Intrastat: When the EU was created and the original member states became part of the EU Single Market, customs and border formalities were removed. The dismantling of customs clearances and controls within the EU meant it was no longer possible to obtain information about the movement of goods (i.e. dispatches and arrivals) between EU member states from customs documents. Intrastat was developed to address this gap in data the statistical system. It replaces the customs declarations and collects information directly from traders about dispatches and arrivals of goods among the Member States by collecting data directly from intra-EU trade operators once a month.
- There are a number of points in relation to Intrastat data in particular that may be considered shortcomings in the comprehensive nature of the data, albeit these shortcomings are considered minor in relation to the overall quality of the data available. These shortcomings include:
    - Businesses and private individuals that are registered for VAT purposes and that dispatch or receive goods are required to submit Intrastat declarations only if the dispatches or the arrivals exceed the relevant threshold.
    - The Intrastat system is based on EU Regulation No. 638/2004 (EU Regulation) and supplemented by Commission Regulation (EC) No. 1982/2004. Since the main Intrastat rules are provided in the Regulation the rules should normally be applied uniformly across the EU. However, there are differences in implementation as some Member States provide guidelines on how the general principles in the Regulation should be applied in specific situations (e.g., commercial samples, return of goods, etc.). Consequently, these guidelines may produce different results for various situations in EU member states.

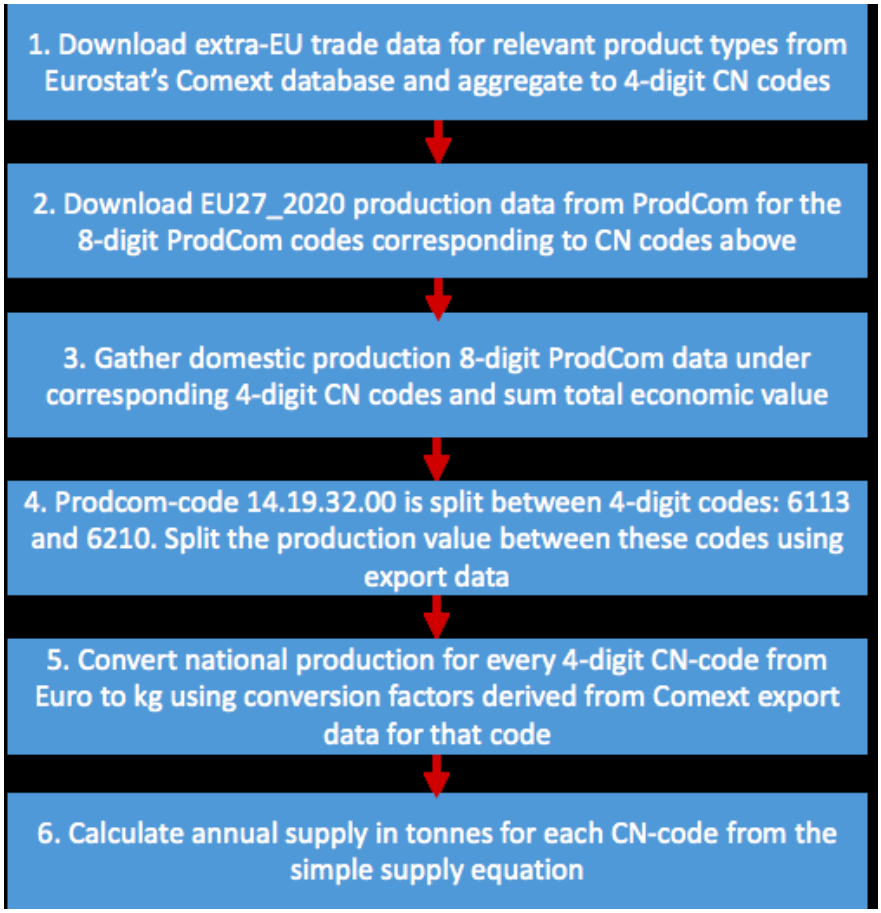
[34] https://ec.europa.eu/eurostat/web/prodcom.
[35] https://ec.europa.eu/eurostat/web/international-trade-in-goods/data/focus-on-comext.

- The authorities responsible for Intrastat reporting differ from country to country. Some Member States delegate oversight of Intrastat to their tax or customs authorities, others to their statistics office and still others to their national bank. The nature of reporting by each Member State may, therefore, vary in approach.

- Domestic production data for finished garments and home textiles is available from Prodcom in Euro, but the physical unit is not a weight but provided in 'pieces' or m2. Moreover, Prodcom codes and the CN8 codes given in the Comext database are not immediately compatible despite there being a many-to-one relationship between Prodcom 8-digit and CN4 4-digit codes in Comext. In the case of the JRC report this allowed for estimating weights of production for each 4-digit CN code by using a Euro/kg conversion factor derived from the Comext trade data.

An overview of the method for calculating supply of new clothing and home textiles to EU final users and, thereby, the generation of textile waste is presented below.

Figure 1 – Method used for calculating total supply of new clothing and home textiles to European final users



Source: JRC, 2021[36]

The support study team was provided with the data used by the JRC covering the period 2004-2018. It is noted that these data are limited to apparel and home textiles, and do not include other

[36] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144.

textiles included by households (e.g., cleaning wipes) and industrial textiles. Nonetheless, apparel and home textiles make up a major share of the total post-consumer textile waste. To forecast resulting trends in textile consumption up to 2035 a linear regression was applied with a 95% confidence rate applied to determine the likely high and low trends over the same period. Linear regression provides the opportunity to predict trends based on an observed set of values – the 2004 to 2018 data in this case – with a degree of certainty. This is important in the case of textiles given the somewhat wide variation in predictions of textile waste available from existing literature. The data used is also comparable to the one used in the context of the EU strategy for sustainable and circular textiles[37] that also refers to the JRC figures.

Impacts calculations

The Better Regulation Toolbox groups impacts in three main categories, economic, social, and environmental, as well as their mutual combination. However, for the purpose of this impact assessment, the different impacts have been grouped by the three main categories, according to the table below.

Table 8 – Categorisation of impacts

Specific impacts	Broad categories according to Better Regulation Toolbox (BRT)	Broad categories that will be used in this assessment	Change compared to BRT
Conduct of business Position of SMEs Administrative burdens on business Sectoral competitiveness, trade and investment flows Public authorities and budget	Economic	Economic	No change
Working conditions, job standards and quality Public health and safety, and health systems Governance, participation, and good administration	Social	Social	No change
Climate Quality of natural resource Biodiversity, including flora, fauna, ecosystems, and landscapes	Environment	Environment	No change
Education and training, education and training systems Employment Income distribution, social protection, and social inclusion Consumers and households	Economic, Social	Social	Change
Technology development/ Digital	Economic, Social	Economic	Change

[37] European Commission, EU strategy for sustainable and circular textiles, 2022, https://ec.europa.eu/environment/publications/textiles-strategy_en.

economy			
Sustainable consumption and production Efficient use of resources (renewable and non-renewable)	Economic, Environmental	Economic	Change
Land use The likelihood or scale of environmental risks	Economic, Environmental	Environmental	Change
Innovation and research	Economic, Social, Environmental	Economic	Change
Waste production, generation and recycling Sustainable development	Economic, Social, Environmental	Environmental	Change
Third countries, developing countries, and international relations	Economic, Social, Environmental	Social	Change

The assessment includes a mix of qualitative and quantitative assessments of costs and benefits. To make the assessment robust and make it possible to compare all the measures in terms of their respective net impact, a qualitative scoring indicating the direction of impact has assigned to each sub-category of impact. The qualitative assessment uses a + and – approach to determine the direction of impacts with – indicating a negative impact or cost and + indicating a positive impact or saving. The quantitative assessment was performed using the methods outlined below.

In addition, to simplify the assessment, each measure is assessed individually and the changes in impacts stemming from a combination of measures will not be calculated.

Determining economic costs and benefits

Measures resulting in changes to the volumes of textiles collected and managed carry both administrative and waste management costs.

Administrative costs have been calculated using the ENV Admin burden calculator v2 that is based on the Eurostat Structure of earnings survey, Labour Force Survey data for non-Wage labour Costs (last updated 2021). The average hourly wage of 26 euro per hour was applied to the actions needed to improve the management of used textiles and textile wastes. This value was multiplied by the estimated time required to perform a particular action as well as the number of entities that would be required to perform the action to determine the total administrative burden resulting from the measure concerned. In some cases, the number of entities concerned is not known. In such cases a cost per entity has been provided only.

The following assumptions have been used in the calculations of administrative burden.

Table 9: Assumptions made to calculate the administrative burden

One-off admin costs		
Target group	**Description of the action**	**Initial cost (EUR)**
Textile producers	Registration of producers in producer register	€108 comprising four hours to complete the necessary registration process in a national register
Recurrent admin costs		

Target group	Description of the action	Time required per action per year in hours
Used textile exporters to third countries	Filling in forms in relation to exports for reuse	8 hours
Used textile exporters to third countries	Cooperating with competent authority inspections	3 hours
Producers of textiles	Reporting on volumes of goods placed on the market and eco-modulation data	20 hours
Producers of textiles	Cooperating with Producer Responsibility Organisation inspections	3 hours
Textiles waste management operators	Submission of waste management data	21 hours
Competent authorities	Inspections of enterprises involved in the export of used textiles	21 hours (per inspection)
Producer Responsibility Organisations	Operation of the producer register	1 716 hours (1 FTE per Member State)
Producer Responsibility Organisations	Inspections of producers	3 384 hours (2 FTEs per Member State)
Reduced administrative obligations		
Target group	**Description of the action**	**Time required per action per year in hours**
Used textile reuse companies	Simplification of data reporting through better scope of textiles to be reported against	4 hours
Textile waste management operators	Simplification of data reporting through better scope of textiles to be reported against	4 hours

Waste management costs result from changes in the way in which used textiles and textile wastes would be collected, sorted, reused, recycled and subject to further treatment in comparison to the status quo. Two different sources have been used to determine the costs of collection and the costs of subsequent sorting and management as described below.

Costs of collection: The costs of collection are dependent on the type of additional infrastructure that would be required to be added. In keeping with most of the collection being made via separate bins, the costs of collection have been based on the operation of separate textile collection bins.

Data from the CESME project that considered the Humanita textile recycling programme in BG [38] indicates that addressing approximately 3 400 tonnes of textile per year came with combined container, transport and storing costs of 367 000 euro of costs per year leading to an average cost of 108 euro per tonne collected. However, this figure appears low in comparison to data from the ECAP study on used textile collection in European Cities[39] that indicates costs of collection in the NL of 165 euro per tonne. The BG figures are considered to be at the low end of costs within the EU and the NL figures at the higher end. The high value was used to perform the calculations of collection costs to avoid their underestimation.

Costs of sorting and treatment: In keeping with the Staff Working Document[40] accompanying the proposal for a Regulation on shipments of waste (WSR)[41] the costs of treating textile wastes need to consider the capital and operational expenditure related to material sorting and treatment costs. The source material for the WSR Impact Assessment in relation to textile waste has been used in this assessment to ensure consistency in the calculations performed given the significant crossover between the WSR proposal and this initiative in relation to textiles. The sorting and treatment costs of 650 euro per tonne have been used which are taken from a COWI, Eunomia Study on investment needs in the waste sector and on the financing of municipal waste management in Member States[42]. The costs consider a textile reuse/recycling process based including sorting and grading, preparation for reuse for high and low value clothes/other items that require no further treatment, mechanical recycling to low quality recycled fibres and chemical recycling for high quality recycled fibres. The economic values of the wastes retained under certain measures because of their treatment higher up the waste hierarchy is challenging due to the wide variety of textile types that are addressed by separate collection, with the reuse value of, for example, collected t-shirts lower than that of jackets and coats. This variation in terms of types of materials collected is addressed by the JRC[43] at table *Table* 25 in Annex 6.

It is not possible to determine an accurate resale value for each of these constituent parts for reuse or recycling separately. Consequently, the market value of used and waste textiles sold on the market have been applied using sales values per tonne from Fashion for Good for 2022[44]. These values are broken down as in the table below.

Table 10 – Sales value by textile treatment route, euro per tonne

Textile treatment route	**Sales value in EUR per tonne**

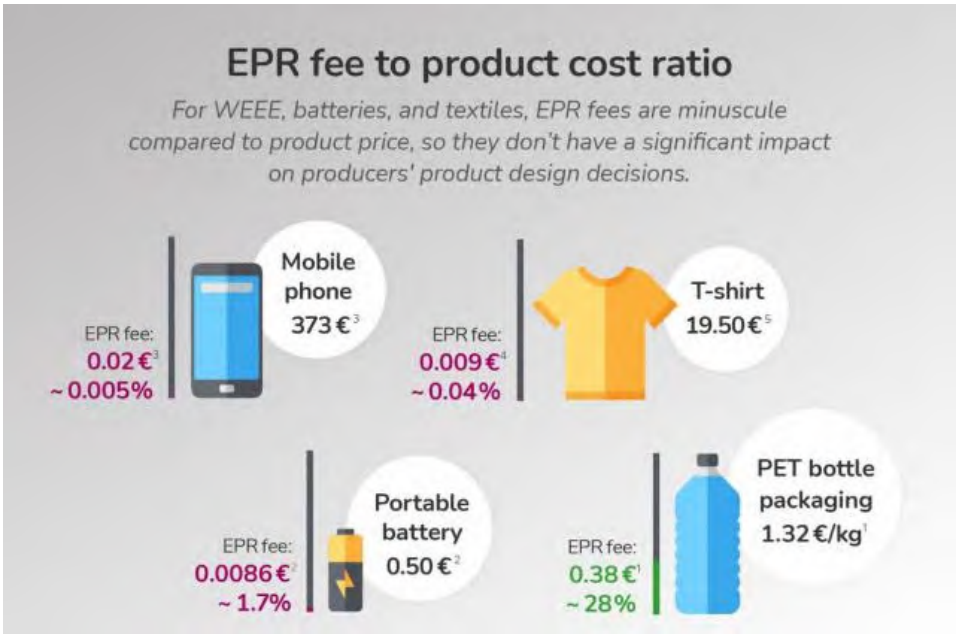
[38] CESME, "3.1.5 HUMANITA textile recycling", *The CESME White Book,* https://www.cesme-book.eu/book/level-1-d/3.1-best-practices/3.1.2-humanita-textile-recycling.
[39] ECAP, *Used Textile Collection in European Cities*, 2018.
[40] Commission Staff Working Document Impact Assessment Accompanying the document Proposal for a regulation of the European Parliament and of the Council on shipments of waste and amending Regulations (EU) No 1257/2013 and (EU) No 2020/1056, SWD(2021) 331 final.
[41] Proposal for a Regulation of the European Parliament and of the Council on shipments of waste and amending Regulations (EU) No 1257/2013 and (EU) No 2020/1056, COM(2021) 709 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0709.
[42] COWI, Eunomia, *Study on investment needs in the waste sector and on the financing of municipal waste management in Member States*, 2019.
[43] JRC, Technical report on Material Flow Analysis of textile, forthcoming'
[44] Fashion for Good, *Sorting for Circularity Europe. An evaluation and commercial assessment of textile waste across Europe*, 2022.

Value of textiles suitable for reuse per tonne for export outside the EU (EUR)	760
Value of textiles suitable as feedstock for closed loop recycling per tonne (EUR)	230
Value of textiles suitable as feedstock for open loop textiles per tonne (EUR)	120

Subsequently, in determining the economic benefits stemming from the movement of used textiles and textile waste up the waste hierarchy to the tonnes of textiles affected.

Calculation of the impacts on prices of individual items as a result of the proposed measures is complicated by the sheer variety of textile goods collected (see Table 9 above) and the fact that the prices of textile goods also vary. In the case of fees that may be applied in the case of extended producer responsibility schemes Ecologic[45] examined the EPR fees in comparison to product costs for a number of product types including textiles as shown in the figure below.

Figure 2 EPR fee to product cost ratios identified by Ecologic



In the case of textiles, it was identified that the costs currently applied in FR represent a small cost in comparison to the product cost – approximately 0.04% of the total cost.

In order to consider the maximum increase that may apply on an item whereby all waste management costs for all discarded textiles are applied to the cost of a product, a T-shirt has been used as an example item in keeping with the Ecologic example above. The costs of sorting and collection per tonne of discarded textiles is presented above as €815 per tonne encompassing €165

[45] Ecologic, 2021. Extended Producer Responsibility and Ecomodulation of Fees

per tonne collection costs and €650 per tonne sorting and treatment costs. Using a theoretical example of a T-shirt which, as noted under determining environmental costs and benefits weights on average 155g, in a tonne of textiles waste that were composed entirely of T-shirts there would be 6,450 T-shirts contained therein. Dividing the total costs per tonne by the number of T-shirts would give a maximum cost of €0.12 per T-shirt. This represents an extremely conservative estimate of cost given that T-Shirts are generally easier to treat than other textile products. However, even at this cost the potential fee applicable would represent 0.6% of the total cost of the product. Where possible impacts on costs are presented against the measures assessed.

In some cases, measures would have an impact on a fraction of the total discarded textiles. This may be the case where a target is set for collection that would require an additional percentage of discarded textiles would be required to be collected but the costs of that collection could be applied to all goods placed on the market. In such cases the relative value is presented as a fraction of the 0.6% used as the maximum total cost calculated above.

There are several economic costs and/or benefits that could not be calculated as part of this assessment as outlined in the table below.

Table 11 - Economic costs and benefits that are relevant for the assessment but could not be quantified

Type of cost and/or benefit	**Reason for lack of quantified assessment**
The costs of reusing and recycling textiles that are not generally approached by Member States at present	The levels of collection, reuse and recycling of textiles that are not generally separately collected by Member States at present are not well known, with little research in existence in respect to possible innovations that would increase reuse and recycling for products including carpets and mattresses. This prevents an assessment of the full costs and benefits that might result from the additional collection of those materials in future.
Total EU reduction in costs of waste management licensing for textile waste collectors	Member States employ a variety of approaches to the collection of textile wastes and for determining whether a waste license is required for collectors of such materials. Consequently, no data exists that identifies the number of licenses that currently apply at the EU level for such collection. This makes it impossible to determine the total reduction in costs that might result from removal of waste licensing requirements where it is currently obligatory.
Total costs and benefits from the application of end-of-waste criteria for textiles	The impacts of end-of-waste criteria for textiles are dependent on the eventual scope of textile types that may be included and so the environmental impacts cannot be determined. However, given the need under

	Article 6 of the WFD to not overall adversely impact the environment or human health the assessment considers that impacts would be minimal accordingly.
Financial impacts of changes in waste management of EU textile wastes in third countries	The financial impacts that presently result from EU wastes being treated in third countries cannot be calculated given the diverse range of countries that receive used EU textiles and a lack of data on textile waste generation, textile waste collection and treatment costs in third countries.
Savings resulting from treatment of separately collected waste in comparison to mixed waste	Treatment of mixed waste is more expensive that treatment of separately collected waste. However, the application of the polluter pays principle in respect to waste management is not applied by all municipalities in the EU and where it is, it is implemented in a variety of ways, by weight, by volume, by collection, by bag etc rendering a cost saving calculation for the EU not possible.

Determining ***social costs and benefits***

There are two large social impacts stemming from some of the measures foreseen:

- Those related to additional employment within the EU as a result of greater collection and treatment of used textiles and textile wastes that are currently disposed of.
- Those related to the social impacts on standards of living i.e., the living conditions of citizens that are or would be impacted as a result of the disposal of used textiles and textile wastes both within the EU and outside of the EU for used and waste textiles that are exported to third countries that would be mitigated under certain measures.

To calculate the employment benefits of greater collection and treatment of used textiles and textile waste the results of a report published by the Scottish government that averages the results of four earlier studies[46] have been applied as shown below.

Table 12 – Employment benefits of textiles waste management

[46] Gray, A., Jones, A. and Percy, S, Jobs, 2004. from Recycling: Report on Stage II of the Research, Local Economy Policy Unit, London South Bank University; Cascadia, *Recycling and economic development: a review of existing literature on job creation, capital investment, and tax revenues,* King Country Linkup, 2009, https://kingcounty.gov/~/media/depts/dnrp/solid-waste/linkup/documents/recycling-economic-development-review.ashx?la=enhttps://kingcounty.gov/~/media/depts/dnrp/solid-waste/linkup/documents/recycling-economic-development-review.ashx?la=en; Friends of the Earth, *More Jobs, Less Waste: Potential for Job Creation Through Higher Rates of Recycling in the UK and EU,* 2010, https://www.foeeurope.org/sites/default/files/publications/foee_more_jobs_less_waste_0910.pdf; Eunomia, Development of a modelling tool on waste generation and management, Final Report for the European Commission DG Environment under Framework Contract No. ENV.C.2/FRA/2011/0020, 2014.

FTEs/10 000 tonnes of waste per year					
Source				**Value**	
Gray et al 2004	Cascadia 2009	FOTE 2010	Eunomia 2014	Average	FTEs/tonne/year
50	85	50	50	58.8	0.005875

Calculation of the employment benefits resulting from the retention of wastes in the EU, i.e., the additional collection, sorting and recycling of wastes that would have otherwise been exported in the absence of the measures proposed, have used the FTE/tonne figure in the right-hand column. It should be noted that this assessment considers a partial equilibrium only and does therefore not factor in general equilibrium considerations that may arise, including negative employment effects.

Determining ***environmental costs and benefits***

Calculating the environmental benefits stemming from the measures concerned is also challenging given the different impacts that may result but which are subject to uncertainty (i.e. indirect uncertain costs and benefits) in comparison to those that are direct and more easy to measure. An explanation of calculations discarded or retained is provided below.

Table 13 – Discarded and retained environmental benefits

Environmental impact	**Direct or indirect**	**Rationale for retention or discard**
CO2e emissions resulting from changes in management at the point of discard for used textiles and textile wastes	Direct	Retained as the emissions can be calculated based on the volumes of used textiles and waste textiles that would be moved from one stage of the waste hierarchy to another
CO2e emissions resulting from the replacement of new clothing and household textiles by reused clothing and household textiles as well as use of recycled textile fibres	Indirect	Retained as the emissions resulting from reusing textiles in comparison to their replacement with a new textile or reusing textile fibres in comparison to their primary counterparts addresses the knock-on effects of primary production GHG emissions that would be avoided.
Non-GHG Emissions from production of textiles	Indirect	Discarded as there is uncertainty as to impacts of second-hand sales may have on primary sales figures and the knock-on effects of primary

			production emissions other than GHG that would be avoided.
Water use reductions resulting from the replacement of new clothing and household textiles by reused clothing and household textiles as well as used of recycled textile fibres	Indirect		Retained as the emissions resulting from reusing textiles in comparison to their replacement with a new textile or reusing textile fibres in comparison to their primary counterparts addresses the knock-on effects of primary production water use that would be avoided.
Transport emissions		Direct in relation to exports and indirect in relation to imports	Some of the measures would result in direct reductions in emissions related to the transport of used and waste textiles to third countries. However, the extent of the impact is highly uncertain as Member States may still export to third countries as a waste under the WSR where sorting would take place so such a calculation has been discarded. Indirectly, emissions resulting from the transport of new textile products into the EU that would be replaced by second-hand clothing sales within the EU is also subject to a large degree of uncertainty and has been discarded.
Emissions resulting from the open burning and landfilling of textiles in third countries in comparison to the EU	Direct in relation to exports	Some of the measures would result in retention of textile wastes for disposal within the EU that would otherwise have been disposed on in third countries. The difference in CO2eq emissions and externalities has been calculated where relevant.	

In relation to the calculation of changes in CO2e emissions resulting from changes in management at the point of discard of used textiles and textile wastes the European Environmental Bureau (EEB) [47] value have been applied as presented below.

Table 14 – CO2 equivalent emissions saved by destination of textile at EoL (in tonnes per tonne of textile), EEB

Route	**Cotton t-shirt**	**Wool jumper**
Direct reuse	12.8	9
Preparing for reuse	11	8
100% recycling	<1	<1
100% landfill	-0.2	-0.2

In relation to the value of one tonne of CO2e emissions, in keeping with Commission Staff Working Document Impact Assessment[48] accompanying the proposal for a Directive concerning urban wastewater treatment[49] a value of 100 euro per tonne has been applied.

Water use has also been calculated on the basis of water savings through reuse and recycling of used textiles. In its January 2023 study, EuRIC[50] identified the water savings resulting from the reuse and recycling of certain qualities of European used textiles. Several scenarios were developed based on reuse and recycling of different grades of t-shirt as detailed below.

Table 15 – Overview of the three considered quality levels and associated scenarios used by EuRIC

Scenario	**Quality level**	**Reused garment**	**New garment**
1	Crème	100% cotton second-hand shirt sorted in Europe and sold in Europe	100% cotton new shirt produced in Asia and sold in Europe
2	B-grade	30/70 polycotton second-hand shirt sorted in Europe and sold in sub-Saharan Africa	30/70 polycotton new shirt produced in Asia and sold in sub-Saharan Africa
3	C-grade	100% polyester second-hand shirt sorted in Europe and sold in Pakistan	100% polyester new shirt produced in Asia and sold in Pakistan

[47] European Environmental Bureau, *Advancing resource efficiency in Europe*, 2014.
[48] SWD(2022) 541 final
[49] COM(2022) 531 final
[50] Norion consult for EuRIC, LCA-based assessment of the management of European used textiles, 2023.

The EuRIC study considered grades representing various qualities of t-shirt with fibre types selected to ensure the affordability on global markets. Countries of production and consumption were based on the EUs export of second-hand clothing that generally involves sub-Saharan Africa and Pakistan and the lifetime of the textiles was determined on the number of wears and washes. The water savings that have been derived from the LCA[51] and applied in the calculations for this study are listed in the table below.

Table 16 – Overview of waste savings used by EuRIC

Quality level	**Reused water saving compared to new equivalent**	**Recycling closed-loop water saving compared to new equivalent**	**Recycling open-loop water saving compared to new equivalent**
Crème	30.7m^3 per item	0.7m^3 per item	2.6m^3 per item
B-grade	21.4m^3 per item	0.2m^3 per item	No value provided
C-grade	0.9m^3 per item	0.2m^3 per item	No value provided

To determine the potential savings per tonne of collected textiles the average weight of a t-shirt was taken from the same EuRIC study – 155 grams. The following values per tonne were derived accordingly.

Table 17 – Values of water savings per tonne used by EuRIC

Quality level	**Reused water saving compared to new equivalent per tonne of textiles collected**	**Recycling closed-loop water saving compared to new equivalent per tonne of textiles collected**	**Recycling open-loop water saving compared to new equivalent per tonne of textiles collected**
Crème	198 000 m^3	4 500 m^3	16 800 m^3
B-grade	138 000 m^3	1 290 m^3	No value used
C-grade	5 800 m^3	1 290 m^3	No value used

Clearly there are shortcomings in the approach applied to calculating water savings given that:

- T-shirts are just one of the textile types collected, and the savings per textile item type are likely to vary.
- There are assumptions made about the water use in recycling that are difficult to reconcile with the relative immaturity of the textile recycling market at present.
- There are assumptions made about the destinations of used textiles exported from the EU.

In relation to the environmental impacts of landfill and incineration in the EU and in third shipments of textiles are made for a variety of reasons but are predominantly made in relation to reuse. However, not all textiles that are shipped for such purposes are able to be reused or recycled

[51] The EuRIC study provides values in relation to mechanical recycling (taken as open loop in the context of the calculations for this study) and chemical recycling (taken as closed loop in the context of the calculations for this study. Where more than one value was provided an average was applied.

and a proportion of the materials shipped will fall lower down the waste hierarchy. In such cases these materials will either be sent for recovery through incineration or uncontrolled disposal, mainly consisting of open dumps and open burning. For the purpose of the calculations made in this report, we assume that 1) the quantity of material recycled and the corresponding process losses would be the same if the waste was retained within the EU (i.e. no differences in efficiency between EU and third countries); we also assume that 2) the environmental impact (burdens and savings of primary virgin materials) of such recycling operations would be the same in EU and third countries (i.e. no differences in environmental control of emissions between EU and third countries). This means that ultimately, we only account for the different impacts associated with the management of the rejects generated during the sorting operations. On this basis, in calculating the environmental benefits stemming from management of the rejects within the EU in comparison to third countries, the performance of EU treatment facilities in comparison to third country management (e.g., open dumps and open burning) has been quantified using the available scientific literature and datasets.

The first part of the calculation requires an estimation of rejection rates for textiles shipped. For textiles 10% of the volumes have been considered as rejects – this is in keeping with the impact assessment accompanying the revision of the Waste Shipments Regulation and is based on 2019 data from Norup et al 2019. With this rejection rate applied a comparison or reject management in third countries in comparison to the EU needs to be considered. In this case the impacts of the open dumping or open burning in third countries of those rejects in comparison with energy recovery in the EU. To identify these differences, the dedicated waste LCA-model EASETECH used, among the others by JRC has been used applying the datasets describing open dump and open burning activities for textile wastes as provided by the latest ecoinvent 3.7 database . In the absence of specific dataset for textile, the impact of textile waste has been approximated as a mix of plastic (15%) and paper/cardboard (85%) based on the assumption that ca. 15% of the textile is composed of biological fibres while the rest is synthetic (Riber et al., 2009).

The impact of landfilling and incineration in EU has been obtained using the same tool but applying typical datasets for EU landfills and incineration (Manfredi & Christensen (2009); Manfredi et al. (2010); Manfredi et al. (2011). Notice that these, on top of the environmental emissions associated to the treatment itself, also include the downstream environmental savings obtained through energy recovery (i.e. incineration generates as co-products electricity and heat that are assumed to displaced the average EU electricity and heat production mix). The substituted mix of electricity and heat follows the logic applied in similar recent studies (Tonini et al., 2021 ; Nessi et al., 2020) and in the Product Environmental Footprint and represents the current situation of the EU energy system. The pricing of environmental emissions is based on the CE Delft Environmental Prices Handbook EU 28 version as is the case of transportation externalities detailed later on. The report provides a state-of-the-art dataset of the shadow prices of environmental emissions, i.e. the external costs of emissions that are not monetised in the current market/financial prices (also known as externalities or shadow prices as opposite to financial prices).

While there is no definitive source of data that reflects on the amounts of waste subject to open burning or open dumping in third countries, scientific sources estimate that about 40% of the waste globally generated is subject to open-burning, mainly in developing and populous countries (China, India, Brazil, Mexico, Pakistan, and Turkey). Open burning occurs for many reasons, e.g., to get rid of waste in residential areas/streets, in open-dump sites (e.g. to free space for dumping more waste) as well as because of natural firing occurring in uncontrolled open dumpsites. It is clear according to the materials collected during this assessment that both take place.

An examination of the likely destination of rejects for the waste types considered under this study indicates that landfilling of waste represents by far the largest method of disposing of textile wastes. To determine the ratio between open dump and open burning, the support study assumes that 60%

of the reject material is subject to open dump and 40% to open burning. This ratio is applied consistently across all materials investigated, as dumping/burning would take place regardless of the nature of the material (dump sites consist of a mix of heterogeneous waste materials).

The first calculation, therefore, relates to the emissions resulting in third countries resulting from waste management per tonne. In this case the third country impacts from the open dumping and burning of textiles in third countries equates to 1 151kg CO2-eq per tonne of textile waste with additional externalities of 308 euro per tonne disposed. The emissions resulting from waste management in the EU are -391 kg-eq per tonne of textile waste managed in the EU and 23 euro per tonne in terms of externalities. The net benefits of managing rejects within the EU in comparison to third countries is 1 701 kg CO2-eq and 285 euro in externalities saved per tonne of textile waste concerned.

There is one environmental benefit that could not be calculated as part of this assessment as outlined in the table below.

Table 18 - Type of environmental costs and benefits that could not be quantified

Type of benefit	**Reason for lack of quantified assessment**
Total costs and benefits from the application of end-of-waste criteria for textiles	The impacts of end-of-waste criteria for textiles are dependent on the eventual scope of textile types that may be included and so the environmental impacts cannot be determined. However, given the need under Article 6 of the WFD to not overall adversely impact the environment or human health the assessment considers that impacts would be minimal accordingly.

Qualitative Assessment

As noted above, in some cases it has not been possible to quantify impacts of measures or parts thereof. In such cases a qualitative assessment using a + and – approach to determine the direction of impacts with – indicating a negative impact or cost and indicating a positive impact or saving has been made. Alongside the + and – scoring a description of the likely impacts has been included.

2. Food Waste

Two modelling approaches were adopted in the analysis[52]:

- The MAGNET general equilibrium model
- A bottom-up modelling approach based on life cycle assessment

The following subsections provide details of the two approaches.

2.1 Extended modelling framework for the assessment of food waste reduction targets

This study employs and further extends the Modular Applied GeNeral Equilibrium Tool (MAGNET) to assess the impacts of a set of food waste reduction target scenarios. MAGNET is an economy-wide dynamic global computable general equilibrium (CGE) simulation model (Woltjer & Kuiper, 2014). It is well suited to run sustainability analysis from an economic, social, and environmental perspective at the medium-to-long-run time horizon. The MAGNET model is suited to assess the impacts of agricultural, trade, land, (bio)energy and other policies at the national and global level with a particular focus on the impacts on land use, agricultural prices, nutrition and food security. For the present study, the model is further extended to account for food waste reduction throughout the full supply *chain.*

2.1.1 MAGNET model and database

MAGNET (Modular Applied GeNeral Equilibrium Tool) is a global general equilibrium model. The MAGNET consortium includes Wageningen Economic Research (lead), the European Commission's Joint Research Centre, and the Thünen-Institute. The model has been widely used for policy support and its scientific excellence is proven through diverse scientific publications in high-ranked journals and scientific policy reports for the European Commission and other international organizations. It is one of the 47 models listed in the Modelling Inventory and Knowledge Management System of the European Commission (MIDAS). It is also a core model of the integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP) hosted by the JRC (M'barek, 2012; M'barek & Delincé, 2015). Examples of MAGNET applications for policy analysis are M'barek *et al.* (2017) on the CAP reform, Sartori *et al.* (2019) on land issues, Philippidis *et al.* (2020) on sustainable development goals (SDGs), Ferrari *et al.*, (2021) on the cumulative impact assessment of trade agreements on EU agriculture, and Boysen-Urban *et al.* (2022) on impacts of food loss and waste reduction and dietary changes. The MAGNET consortium also contributes to different European Commission research projects such as BioMonitor, BatModel, Brightspace, and Lamasus.

Figure 3 employs economic optimisation theory (i.e., welfare maximisation, cost minimisation) to characterise the behaviour of consumers and producers to endogenous price changes, where producers exhibit constant returns to scale technologies and zero long-run economic profits. A further series of factor and commodity market clearing equations enforce the condition that supply must equal demand, for which equilibrium prices emerge. Finally, to 'close' the macro circular

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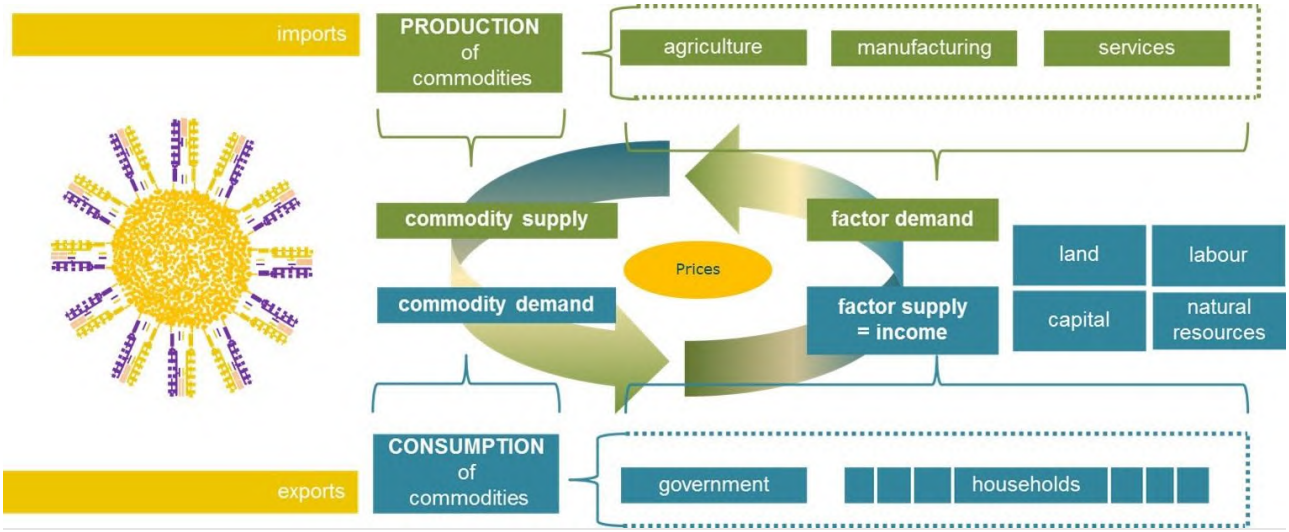
[52] This assessment is based on: De Jong B, Boysen-Urban K, De Laurentiis V, Philippidis G, Bartelings H, Mancini L, Biganzoli F, Sanyé Mengual E, Sala S, Lasarte-López J, Rokicki B, M'barek R. *Assessing the economic, social and environmental impacts of food waste reduction targets. A model-based analysis.* Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/77251, JRC133971.

flow, accounting equations ensure that the value of income from production factors, expenditures and output are assumed equal, whilst the net balance between the current account (exports minus imports) and the capital account (savings minus investments) amounts to zero.

Figure 3 – Graphical representation of the CGE model framework



Source: MAGNET 2023

MAGNET is built on the Global Trade Analysis Project (GTAP) model and data structure at its core, which is widely accepted and regularly used for global and EU impact assessments. The GTAP model consists of an input-output accounting framework. The behaviour of households, firms, and the government in the global economy is included in the model. Households opt for utility maximization and firms are cost minimizing, while all agents are price takers (Corong, 2017). All income is collected by a representative regional household and allocated to private or government consumption or savings to maximize regional utility. Factors of production (i.e., land, skilled and unskilled labour, capital and natural resources) are supplied by the household and employed by the producers. The model is fully equipped with economy-wide bilateral trade flows between regions; trade barriers are also included. Hence commodities given in the model can be locally supplied or imported. Total income is determined by the sum of factor income and tax revenues (Aguiar *et al.*, 2019a).

For this study, version 10 of the GTAP database with a benchmark year of 2014 and completed with 65 tradable sectors, eight primary factors and 141 regions, is used (Aguiar *et al.*, 2019b). In addition to bilateral trade and protection data, the GTAP database also includes information on the input-output structures of each of its 141 economies – including intermediate input purchases and final demands by private households, governments, and investors. All transactions within the database are measured at basic, producer and purchaser prices including relevant tax/subsidy distortions and international transport margin data. In the development of the MAGNET model only minimal changes are done to its foundation GTAP core. One of these changes is the introduction of by-products which enables the distinction between production sectors and produced commodities. This results in an extended MAGNET database that covers 113 sectors and 127 commodities, consisting of 14 by-products (MAGNET, 2022).

2.1.2 The MAGNET model in policy assessments and science

MAGNET is a CGE model and therefore suitable for economy-wide simulation of the impacts of policy scenarios. In fact, Tool #61 (Simulation tools) of the Better Regulation Toolbox mentions explicitly general equilibrium models (such as MAGNET, see also Tool #35). With regard to Tool #18 (Identification of impacts), the whole-economy model MAGNET covers several of the impact

categories mentioned as well as a broad range of SDGs. Lately, the European Parliament in its "Assessment of current initiatives of the European Commission on better regulation" (2022) suggested that "future research and public sector training should be oriented towards using enhanced simulation (e.g. "digital twins"; *general equilibrium models*) to perform resilience testing of existing rules and policies. These implies a rather new set of skills, which future policymakers will need to develop."

The Modelling Inventory and Knowledge Management System of the European Commission (MIDAS) includes MAGNET as one of the models used for impact assessments. Apart from different policy relevant studies e.g. on trade issues, transition pathways, MAGNET is mentioned in the impact assessment on modernising and simplifying the Common Agricultural Policy and described in SWD(2018) 431 final on the Bioeconomy Strategy[53] as a model "including various features for assessing policy coherence" (p. 68). MAGNET studies on diets are presented in SWD IMPACT ASSESSMENT REPORT accompanying the COM(2021) 554 LULUCF. MAGNET is based on the Global Trade Analysis Project (GTAP, the EC being a consortium member), which is used by almost all CGE models. Recently it has also been used by FAO (State of Food and Agriculture 2019) and IFAD (Rural Development Report 2021). In 2021, the GTAP model assessed global economic impacts of environmental change.

MAGNET was selected by UN-DESA as one of the 16 outstanding SDG Good Practices across the world and features also in this 2021 OECD/JRC report on "Spillovers and Transboundary Impacts of Public Policies". Several scientific articles witness the methodological developments and applications over a broad range of topics.

The Better regulation toolbox Tool #60 *Baselines* mentions the Agricultural Market Outlook and GECO (Global Energy and Climate Outlook, see also Tool #61) as examples for the consistency of baselines, employed also in the current model set-up.

In the yearly EU agricultural outlook report, published European Commission in December 2022, a short chapter analyses some dimensions of food security using a selected set of indicators, provided also by the MAGNET model (see section 5 in report Medium-term (europa.eu)).

2.1.3 Extension of MAGNET modelling framework

One of the key specifications of MAGNET is its modular design (Woltjer & Kuiper, 2014). Multiple adaptions and extensions can be added to the model. This modular design enables users to select among the extensions depending on the interest of the policy question. For this impact assessment, the standard MAGNET core has been enriched by modules that improve the depiction of nutrients (Rutten et al. 2013), bio-based sector coverage (Philippidis et al., 2018), Common Agricultural Policy (Boulanger et al., 2021), footprints and virtual trade (Philippidis et al., 2021). These extensions allow for a holistic assessment of the impacts of food waste reduction on the food system. Some of the following questions arising from reductions in EU food losses and waste can be addressed:

- **Food Loss reductions:** how do reduced losses in food supply chains impact upon consumer demand via price changes?
- **Food Waste reductions:** how does reduced final food demand affect market prices and thus the use of biomass in non-food activities?

[53] European Commission, Directorate-General for Research and Innovation, *A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment: updated bioeconomy strategy*, Publications Office, 2018, A sustainable bioeconomy for Europe - Publications Office of the EU (europa.eu).

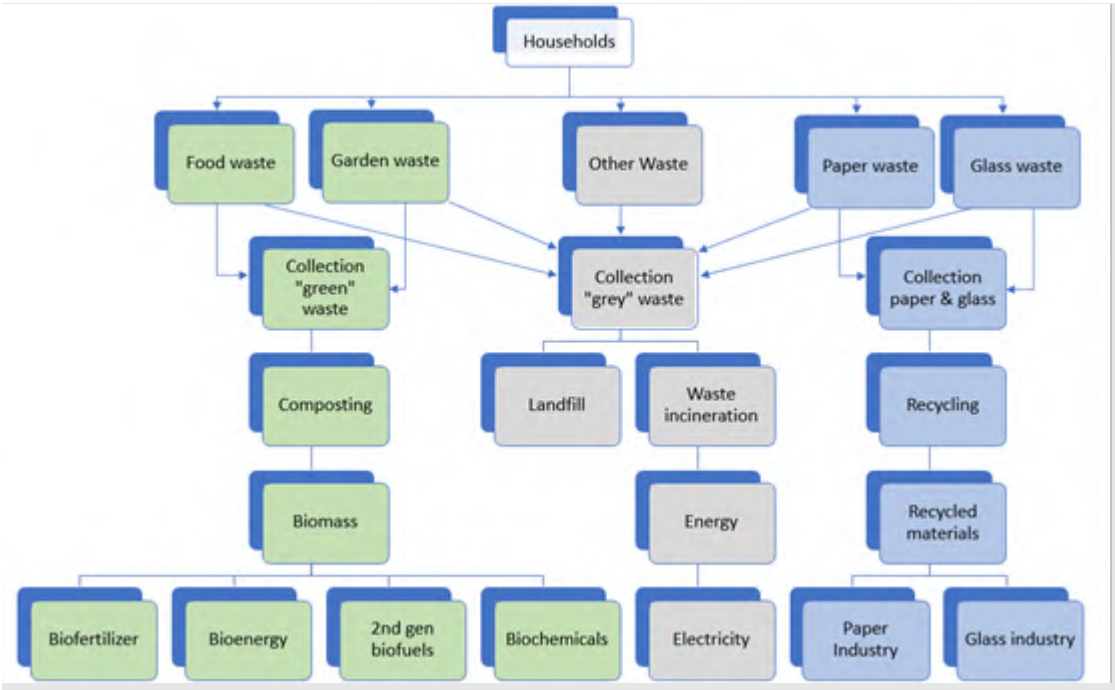
- **Processed food:** how is processed food production and consumption affected via changed input costs, how does this affect final demand? Diets?
- **Cost:** To correct for the externality of food loss and waste, what are the costs that must be internalised by the market?
- **Trade:** What are the impacts on non-tradable virtual commodities (i.e., land and emissions) and resulting leakage effects?
- **Labour:** what is the impact on employment in the agri-food sector, biobased industries? Are the impacts heterogeneous across EU MS?
- **Farm2fork:** dietary change, food waste reductions, less fertilizer use etc… how do these policies affect each other?
- **(Economic) development:** how do different development pathways impact on the outcome (e.g., recovery from COVID, increased green investments)?

In previous work, the MAGNET model has been used to assess the impact of food waste and loss reductions (Boysen-Urban et al., 2022; Kuiper & Cui, 2021; Philippidis et al., 2019) using an approach, where the cost of internalising such an externality was not explicitly modelled. A key development of the current study is that it improves the depiction of food waste in the MAGNET modelling framework building on (Bartelings et al., 2021), whilst additional model code is inserted to accommodate the adjustment costs associated with food loss and waste reductions. The extensions are described in the following sections.

Waste module set up in MAGNET

The waste module in MAGNET enables the model to account for waste streams, covering the entire cycle from generation of waste to collection, treatment and disposal (Bartelings et al., 2021). The MAGNET model therefore captures a degree of circularity. The model calculates waste as a product that is generated automatically through consumption of products. The private households generate waste in the process of consumption and demand waste collection services to collect the waste. Consumption of a commodity can generate one or more of the five types of waste – food waste, garden waste, paper waste, glass waste and other (unsorted combination) waste. **Figure 4** offers an overview of the waste stream scheme in the model. Depending on the waste material generated, there are different options of collection and treatment. Three types of waste collection services exist: 1) collection of rest waste or grey waste (WCR), 2) collection of organic or green waste (WCG), 3) collection of glass and paper (WCGP). Food and garden waste is collected by either WCG or WCR services. Paper and glass waste is collected by WCGP or WCR services. WCR can collect all five kinds of waste, but other waste can only be collected by WCR and not the other two waste collection services.

Figure 4 – Waste stream schematic as implemented in MAGNET



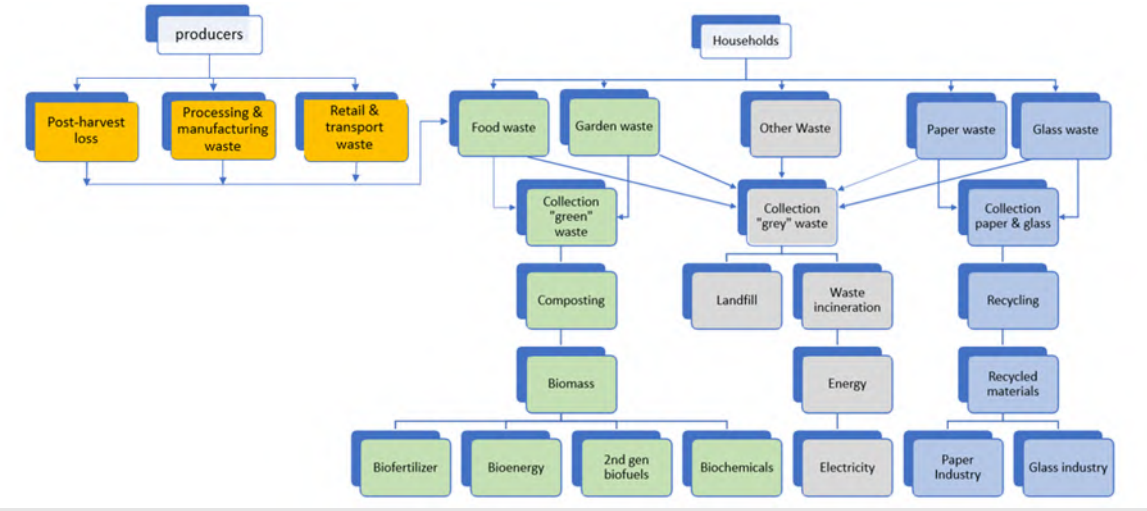
Source: Bartelings et al., 2021

Waste collected by WCR is sent to final disposal delivered by two different sectors: landfills and incinerators. WCG waste collection is then sent to a composting sector which produces biomass to be used in the bio-fertilizer sector or in the second-generation bioeconomy sectors: bioenergy, 2nd generation biofuels or bio-based chemicals. The use of biomass in bioeconomy sectors substitutes for residuals and pellets. Finally, WCGP collection is sent to the recycling sector. Recycled paper and glass are then used in the paper and glass industry as a substitute for virgin materials. The incineration sector produces electricity using waste. Landfill is the only waste disposal option which does not provided any usable material or energy.

Extension of the waste module

Originally the waste module in MAGNET captured only municipal waste. For this study, the module has been extended to account for food waste generation along the full supply chain from primary production to processing, retail and consumption. Producer food waste is modeled in a similar way as household food waste. A waste margin commodity is added to the intermediate demand of certain food commodities. **Figure 5** shows an overview of the new module, which is depicted on the left-hand side of the picture. Producers can now generate food waste and demand waste collection services. Like household food waste, they can demand either green waste collection or rest waste collection. If producer food waste is collected as green waste, the waste is sent to a composting unit and is composted. If it is collected as rest waste, it goes to final disposal: landfilling and incineration.

Figure 5 – The new waste stream schematic including food waste producers



Source: Bartelings et al., 2021

Like for the household waste, production of producer food waste is modelled as a margin commodity. Hence, a link between consumption of goods that generate waste and type of waste that is generated/collected/treated is introduced as a margin commodity in the model – meaning if a household consumes a good, it will also need to demand some waste collection services. With the extension to the waste module, the consumer price for a commodity includes now both the price for the original commodity and the price of collecting waste generated as a result of consumption of said commodity. In this way, the new commodity can be seen as a composite bundle of the original commodity and waste collection services required to collect waste associated with the consumption of that commodity. In addition, a waste margin commodity is also added to the intermediate demand of certain food commodities.

Modelling changes in waste quantities

In MAGNET, households and industries are assumed to generate waste in relation to the changes in demand for the commodity upon which the waste flows are based. More specifically, there is a price substitutability between the purchase of commodity 'c' and the waste flows that accrue upon that transaction. There are two effects that need to be considered when modelling changes in waste quantities, namely, the "price effect" and the "quantity effect".

Examining the price effect, the logic is that if the unit cost of generating waste on purchases of (food) commodity 'c' rises relative to the price of (food) commodity 'c', then by only focusing on relative price changes, the waste rate will fall as more commodities will be purchased and less waste will be generated.

In addition, however, it is logical to assume that if (food) waste generation is falling, there is a degree of complementarity (i.e., 'quantity effect') such that less of the (food) commodity will be demanded in concert with less waste, since some of the original waste is virtually recovered for human consumption.

In order to avoid overly strong 'price' effects (i.e., rising demands for commodity 'c' when the waste generated falls), the sensitivity of this price substitutability (i.e., elasticity) must be small. The result is that the quantity effect will dominate the price effect.

Further considerations are, however, necessary. In modelling the reductions in waste quantities, one assumes that agents are rational to the point that waste generation in production accompanies the lowest cost production technologies. In a similar vein, waste generation in consumption (at least in western societies) is a by-product of the most convenient lifestyle choices of consumers. These are

considered as market externalities as the full cost of this behaviour is not internalised by the market.

Any attempt to move away from these 'optimum' points is therefore assumed to be accompanied by a cost, either apportioned to the producer in terms of an adjustment to the production technology, or to the consumer in terms of 'inconvenience' or the so-called 'labour-leisure' trade-off (lost time preparing food more carefully, more trips to the supermarket etc.). Thus, for a realistic treatment of food loss and waste reductions, the maintained hypothesis is that it should be modelled with an accompanying cost to the responsible agent.

In this study, these added costs are characterised by employing taxes. Thus, by inserting pre-tax and post-tax price variables on residential (i.e., household and food services) and industrial (i.e., post harvest, processing, retail and distribution) waste generation demands, tax variables can be used as a policy instrument to target predetermined household, foods service, primary, processed and retail food waste reductions. This approach also implies that price effects must play a role in helping to target waste quantity reductions, which means that some price sensitivity (i.e., non-zero elasticity) must be included in the waste generation functions. The resulting rise in post-tax prices will encourage a reduction in the behaviour of generating waste on commodity 'c' relative to the demand of commodity 'c'.

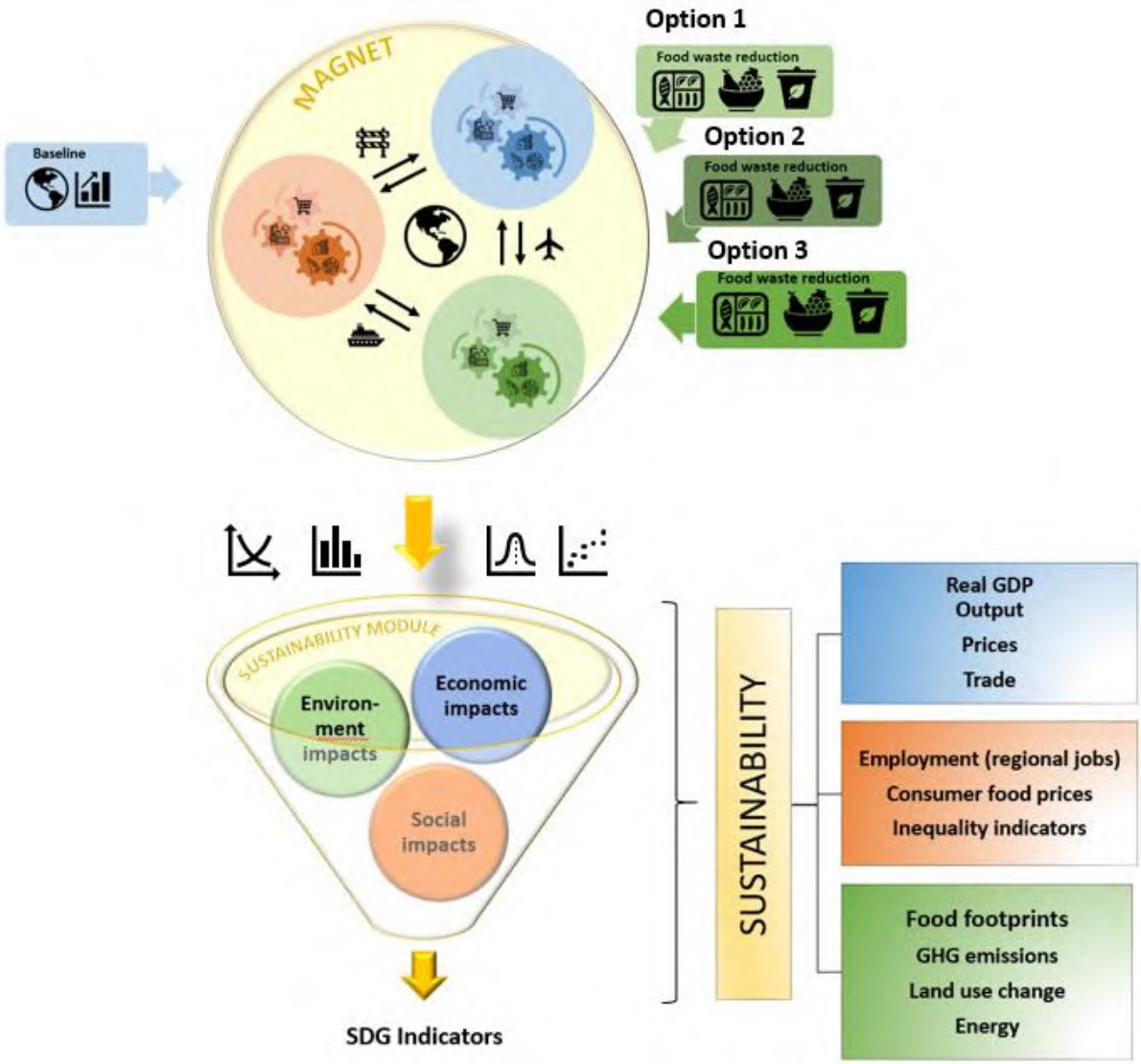
The shocks on waste reductions are not enough in order to produce accompanying consistent reductions in demands for commodity 'c'. This is because of the strong price substitution effects discussed above, between rising waste costs and purchases of commodity 'c'. As a result, further shocks are imposed as associated exogenous reductions in household final demand. The magnitude of these private household demand reductions by commodity 'c' are calculated employing secondary data on total household consumption quantities by commodities and their associated waste quantities.

MAGNET indicator framework

According to the focus of the study on achieving the SDG target 12.3, one feature of the envisaged approach is to evaluate the effects with a focus on multiple indicators across the SDG dimensions. While some indicators are calculated in MAGNET as in the SDG framework, most of the indicators are not matching the official SDGs listings, but rather are a series of model outputs that are indicative of the spirit of each of the SDG dimensions. For example, to enable the tracing of food consumption and production on environmental impacts such as land use and emissions, the CGE model is extended by a module that calculates footprints such as the average per capita per year land use related to household food consumption or the food production. This module allows the tracking of non-tradable virtual commodities (land, water, emissions) along the food supply chain associated with household food consumption and food production (Philippidis et al., 2021).

Figure 6 summarizes the general modelling approach that is used to first set-up a baseline and then to assess the impact of different scenarios on multiple SDG indicators covering economic, social and environmental impacts as well as using footprint measures

Figure 6 – Overview of the modelling approach



Source: Based on Boysen-Urban et al., 2022

2.1.4 Database and model aggregation

The main data source for this impact assessment is version 10 of the GTAP database, with reference year 2014 (Aguiar, Chepeliev, et al., 2019). The GTAP database covers 141 countries and regions and 65 tradable sectors.

The MAGNET variant of the GTAP version 10 database includes additional sector splits covering fruits, vegetables, meat, fish products, bioenergy, bio-based industry, and municipal waste. These additional sector splits give the modeller some choice regarding the different biomass sources and their uses as e.g., food, feed, energy or industry. The underlying database is aggregated to 22 individual EU MS, two aggregated MSs and five larger regions and covers 80 commodities as outlined in Table 19.

Table 19 – Overview regional and sectoral aggregation

Regional disaggregation (29 regions)

Individual MSs (22) Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Latvia, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden **Aggregated MSs (2)** Greece, Cyprus and Malta (GreCypMlt); Belgium and Luxemburg (BelgLux). **Non-EU countries (5)** USA and Canada (USACAN); Latin America (LATAM); Africa (Africa); Asia (Asia); rest of the world (ROW).
Commodity disaggregation (80 commodities)
Crops (11) Paddy rice (pdr); wheat (wht); other grains (gro); vegetables, pulses, roots and tubers (veg); fruits and nuts (fruit); oilseeds (osd); other crops (ocrops); sugar cane and beet (c_b). **Livestock (5)** Beef cattle (bfctl); sheep, goats and horses (ctl); poultry (pltry); raw milk (rmk); pigs (oap). **Food products and food service (11)** Beef meat (bfcmt); rest of cattle meat (cmt); poultry meat (poum); pork meat (omt); dairy (dairy); vegetable oils and fats (vegoil); processed sugar (sugarpro); processed rice (ricepro); processed fish and crustaceans (fishp); other food products (ofood); food service (foodserv). **Fertiliser (1)** Fertiliser (fert). **Feeds (4)** Animal feed (feed); fishmeal (fishm); oilcake (oilcake); 1st generation bioethanol by-product distillers dried grains and solubles (DDGS). **Bio-based activities and natural resources (13)** Fishing (fishing); forestry (forestry); crude vegetable oil (cvol); residue processing (res); by-product residues from rice (r_pdr); by-product residues from wheat (r_wht); by-product residues from other grains (r_grain); by-product residues from oilseeds (r_oilsd); by-product residues from horticulture (r_hort); by-product residues from other crops (r_crops); by-product residues from forestry (r_frs); pellets (pellets); energy crops (egycrops); biomass for compost and bioenergy (biom). **Bio-fuels (8)** 1st generation biodiesel (biod); 1st generation bioethanol (biog); 2nd generation thermochemical technology biofuel (ftfuel); 2nd generation biochemical technology biofuel (eth); bio-ethanol (bioe); bio-kerosene (bkero); bio-heat (bheat); energy from waste (wely). **Fossil-based energy (10)** Coal (coa); crude oil (c_oil); gas (gas); heat generation (heat); kerosene (kero); petroleum (petro); electricity and heat generation (elyheat); coal-fired electricity (ely_c); gas-fired electricity (ely_g); gas manufacturing and distribution (gdt). **Nonbio-based renewable energy (3)**

Nuclear electricity (ely_n); hydroelectric (ely_h); solar and wind (ely_w).
Waste services (8)
Composting (comp); incineration (inc); landfilling (landf); recycling (recy); waste collection green waste (wcg); waste collection services glass and paper (wcgp); waste collection rest waste (wcr); recycled paper and glass (pagl).
Manufacturing (3)
Beverages and tobacco products (bevtobac); paper products and publishing (pap); other manufacturing (manu).
Services (2)
Trade (trade); services (serv).
Transportation (1)
Transportation (trans).

Source: Authors' own elaboration

2.1.5 Food waste data in the model

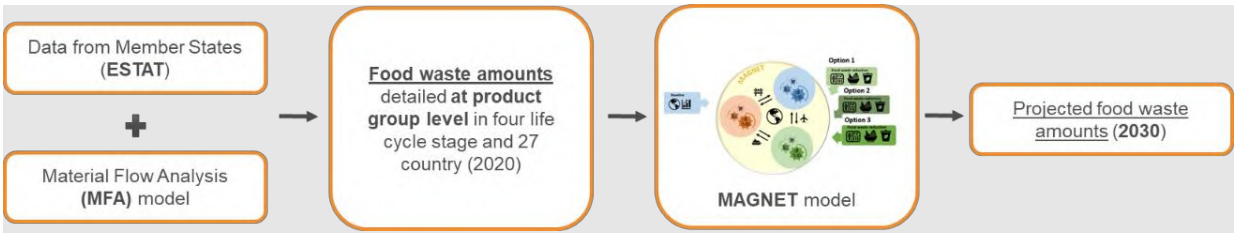
In the standard GTAP database, waste is included in the sector waste and water ("wtr"). Based on this, we assume that intermediate demand for waste collection services is already present in the underlying database, but that this is included in the intermediate demand for "wtr". Therefore, we subtract the demand for waste collection services from the intermediate demand for "wtr" and add it to demand for waste collection services. This means that the total production value of the different sectors in the underlying database remains unchanged.

The consumer waste module (Bartelings et al., 2021) uses data taken from the World Bank Report "What a Waste2 – A Global Snapshop of Solid Waste Management to 2050" (Kaza et al., 2018) and data from various other sources (RDC-Environment and Pira International, 2003) providing information on the cost structure. Kaza et al. (2018) provides information about organic waste for 217 countries and economies, however, the work does not distinguish between food and green waste. Therefore, the consumer waste from the Food Waste Material Flow Analysis (FW MFA) developed by the JRC (Caldeira et al., 2021; De Laurentiis et al., 2021) is used to split organic waste into food waste and garden waste. Food waste is linked to the consumption of food products and food services, while garden waste is linked to the consumption of the commodity dwellings. By linking the production of food waste and garden waste to different commodities, the model can estimate how both food waste and garden waste will develop in future time periods. In some regions the organic waste data from World Bank (Kaza et al., 2018) is lower than the food waste generation in the FW MFA model. For these countries total organic waste generated is adjusted.

For this impact assessment, an additional module was developed, which includes waste collection and treatment related to production and distribution activities. In the implementation of food waste data, three stages are distinguished for the food waste generation at the supply side: primary food production stage, processing and manufacturing stage, and retail and distribution stage. The primary food waste collection has been included in the primary agricultural sectors; retail and distribution food waste collection has been included in the food service, retail and transport sectors. The processed food waste collection has been included in any non- retail sector that uses over 1% of the total intermediate demand of the primary product in the country. This excludes the possibility of a primary sector using its own primary commodity as this is considered waste generation during the primary process. Finally, the production of waste collection services and waste treatment are increased to collect and treat the extra producer food waste.

Food waste amounts for Member States provided by ESTAT (2022) were disaggregated by food chain stage. Since this data is not specific for products, the Material Flow Analysis model developed by JRC (De Laurentis et al. 2021) was used in order to derive amounts of food waste for individual product groups, to be used in MAGNET for projections to 2030 (**Figure 7**).

Figure 7 – Methodology for deriving data on food waste amounts for 2030, disaggregated by product group



Source: Authors' own elaboration

The FW MFA model is combined with data from Corrado et al. (2020) to derive information on waste treatment. Although this model includes different shares for waste treatment per supply chain stages, it uses an EU average to determine how waste is treated for all MSs. In order to account for MS differentiation for waste treatment, World Bank database is used, which provides detailed information per country on waste treatment options. By multiplying the quantity with food collection prices gathered in the household waste module, we can calculate the value of waste collection. FW MFA provides data on food waste at different stages of the production nests product groups. All the food waste data coming from this database is mapped to the MAGNET commodities. Table 20 below shows the link between commodities in the FW MFA model and the MAGNET commodities.

Table 20 – Mapping between the FW MFA and MAGNET models in terms of commodities

Food commodities MFA	***MAGNET commodities***
Cereals	Paddy rice (pdr), processed rice (ricepro), wheat (wht) and other grains (gro)
Dairy	Raw milk (rmk), dairy products (dairy)
Eggs	Poultry live animals (pltry)
Fish	Processed fish and crustaceans (fishp), fishing (fishing)
Fruits	Fruits and nuts (fruit)
Meat	Beef cattle (bfctl), sheep, goats and horses (ctl), poultry (pltry), pigs (oap), beef meat (bfcmt), rest of cattle meat (cmt), poultry meat (poum), pork meat (omt)
Oilcrops	Oilseeds (osd)
Sugarbeets	Sugar cane and beet (c_b)
Vegetables	Vegetables, pulses, roots and tubers (veg)
Potatoes	Vegetables, pulses, roots and tubers (veg)

Source: Authors' own elaboration

Note: In addition to the FW MFA commodities, additional MAGNET commodities include other food, which comprises of mostly packaged and prepared food, and processed sugar which is mapped as others.

2.1.6 Discussion of the modelling approach

As for all simulation modelling exercises, a number of general caveats are also true for the MAGNET approach employed in this study.

Economic simulation models are a conceptual framework representing the economy in a structured but schematic and simplified manner. By definition, they cannot reproduce the reality in its full complexity and thus have shortcomings and limitations, which affect the results of the studies based on such models.

The model employed is designed as a tool for conducting policy experiments in which a reference scenario or baseline is first simulated over a future period and then, after changing one or more underlying assumptions (e.g., policy settings, exogenous macroeconomic developments) a new scenario incorporating these changes is run over the same time period. The deviation between the new scenario and the baseline scenario at a given point in the simulation period establishes the direction and relative magnitude of the impacts on all the endogenous variables (e.g., prices, quantities, incomes etc.). In this study, the deviation year of interest is 2030, and the alternative states of the world correspond to different, hypothetical rules of waste reduction.

Although the model can be used to project individual values of particular variables, it must be stressed that it is not a forecasting model and users should be aware that the projections should not be taken as accurate predictions of the state of the world in any given future period. A no change, or status quo baseline is set up to include, as far as reasonably possible, what we currently understand and can reasonably assume about medium-term future market developments to preserve the economic structure (i.e., relative importance) of different economic activities. It is not typically appropriate for capturing potentially short-term market developments nor unforeseen events (i.e., bad weather, economic crises). If one understands these limitations, then the subsequent deviations in model outcomes purely reflect exogenously controlled changes in those market mechanisms of interest (i.e., technology change, preference changes, tax changes).

General (and partial) equilibrium model solutions become less reliable the further into the future outcomes are simulated. Given the very large number of assumptions, estimated or calibrated parameters, and stylised specification features that these models assemble, each of which is 'correct' only up to an (unknown) probability, it is difficult to establish confidence intervals or margins of error around individual projected numbers.

Specific caveats are relevant with a view to the implementation of the food waste baseline and scenarios.

First of all, model results can only be as good as the underlying databases and are influenced by the assumptions made of treating those within the context of the model. In the case of this assessments, **food waste statistics** have been made available only end of October by ESTAT (published 25 October 2022 under this link). These numbers, provided by Member States, are very different from earlier estimates and do not provide time series. ESTAT explains in a detailed methodology description: "In this first data collection, several countries have used estimates or have indicated that for some data points their definitions differ. Estimates and differences in definitions are due to limitations in sample size, exclusion of small subsectors or of small companies or activities, incompleteness of sector surveys, suboptimal estimation of coefficients for the fresh mass calculation, misinterpretation of definitions by data reporters, difficulties in attributing the waste measurement in between two or more sectors."

The limitations of the data set above have important impacts on the preparation of the baseline, more specifically the **projections** of food waste over the next decade. Details are explained in the next section on the baseline.

This study does not account for **changes in consumer attitudes** to food waste in the baseline. Following for example, Verma MvdB et al. (2020), future studies could account for the evolution of food waste as a function of (*inter alia*) wealth, applying time series information on food waste development. In addition, the baseline does not consider potential technological changes that might have contributed to reducing food losses in agricultural production and post-harvest losses in the baseline.

Another issue is related to the **edible and inedible parts of food waste**. According to the UNEP food waste index report "understanding the split between edible and inedible food waste is not a requirement for reporting on SDG 12.3 using the Food Waste Index, and SDG 12.3 is a target to halve total consumer food waste, including inedible parts." In this modelling exercise we do not distinguish edible/inedible waste.

As shown in the surveys, there are **costs** associated with the reduction of food waste and losses, however, with a high degree of uncertainty regarding the size of these costs. For this reason, an approach has been chosen to fix the reduction target and approximate costs needed through variable swaps.

In line with the objective of this study, the MAGNET model simulates the impact of achieving the **SDG 12.3 target**. It does not provide a detailed analysis of the concrete instruments to implement the policy.

Furthermore, the MAGNET model includes households as one representative household per region. As a result, this study does not depict the impact of the different scenarios on poverty, food accessibility and food affordability of specific households.

The MAGNET model depicts the **interlinkages and rebound effects** of the whole economy. A rebound effect arises when through efficiency gains (in this case due to food waste reduction), resources (physical and monetary) are released, which then can provoke an increased consumption of the same good (called direct rebound effect) or a reallocation of the resources to other sectors (called indirect rebound effect). In this study, for instance in the case of households consuming less agri-food products, the released economic means can be used for other purposes and consumption, thus increasing again emissions, which have been saved in the agri-food sector. Therefore, results are different from partial or linear models, and in general show smaller savings of resources such as greenhouse gas emissions.

In the applied modelling approach, the **benefits of ecosystem services** cannot be measured. At the time the study was conducted, to the best of our knowledge, there was no global economic model available that explicitly considered ecosystem services. However, ecosystem service models provide information on how production changes that affect the ecosystem structure lead to changed values of ecosystem services. Linking CGE models such as MAGNET to ecosystem services models would provide an interesting springboard for future research but is far beyond the scope of this study. Such an approach would also require an ecosystem services database covering multiple ecosystem services in EU member states. To overcome this gap, this study provides a qualitative discussion of the potential implications of model results for ecosystem services provision and associated benefits.

The reduction of food waste leads to a decrease in labour demand in the agricultural sectors. In this version of the MAGNET model, unemployment is not taken into account as the long-run equilibrium corresponds to the natural rate of unemployment, which is a common assumption in deterministic global CGE models.

2.2 Bottom-up Life Cycle-based analysis of food waste reduction targets

In this section, we describe a complementary modelling approach that was applied to the analysis of food waste prevention targets in order to support the policy impact assessment. The approach relies on the application of **Life Cycle Assessment (LCA)** method, which allows assessing the environmental impacts of food and food waste by modelling individual food products in their entire life cycle (from agriculture production to food waste management).

2.2.1 Methodological approach

The JRC developed over time a number of studies on the environmental impacts of food and the food system adopting a product perspective (bottom-up)[1]. In particular, the **Consumption Footprint indicator** includes the area of consumption "Food" as part of EU consumption (Castellani et al., 2017; Sanyé Mengual et al., 2023a), which is composed of a so-called Basket of Products with 45 representative food products[2] (associated with more than 70% of EU food and beverage consumption in mass). These representative products have been assessed by applying the LCA methodology and calculating their impacts for the 16 impact categories of the Environmental Footprint (EC - JRC, 2021; Zampori & Pant, 2019; Andreasi Bassi et al., 2023). The impact of each representative product is then multiplied by annual EU consumption of each product in terms of mass[3], allowing for the calculation of the Consumption Footprint due to the EU food consumption (EC - European Commission, 2022; Sala & Sanye Mengual, 2022; Sanyé Mengual & Sala, 2023). The same approach was used for other areas of consumption (i.e. appliances, household goods, mobility, housing), in order to derive the overall Consumption Footprint. The Consumption Footprint – Food can also be assessed with methods to quantify the biodiversity footprint (Crenna et al., 2019; Sanyé-Mengual et al., 2023b)

The life cycle assessment-based approach aims at complementing the outcomes of the macroeconomic model described in the previous chapter providing additional insights from a bottom-up perspective (i.e., starting from the analysis of single products) on the effects of setting food waste reduction targets.

In particular, it allows the estimation of the environmental impacts associated with the food waste that would be prevented in 2030 according to the different policy options (i.e., specific targets for different stages of the supply chain). Three different data sources have been combined in order to obtain these results:

- Quantities of food waste avoided in the different policy scenarios (at food group level), calculated as presented in Section 2.1.5
- The environmental impact of individual food products from the Consumption Footprint, calculated by performing life cycle assessment of a set of 45 representative products and multiplying these impacts by the amounts of avoided food waste, calculated by applying the reduction targets to the food waste generated in the 2030 baseline.
- The environmental impact of avoided waste treatment, based on the Food Waste Prevention Calculator (De Laurentiis et al., 2020). This impact was calculated by multiplying the quantities of avoided food waste by the impacts of waste treatment, as presented in (Notarnicola et al., 2017), considering an average EU mix of waste treatment options.

Within the framework of the Consumption Footprint, environmental impacts of the production of imported goods consumed in the EU are included in the analysis, whereas the impacts of production of exported goods are not.

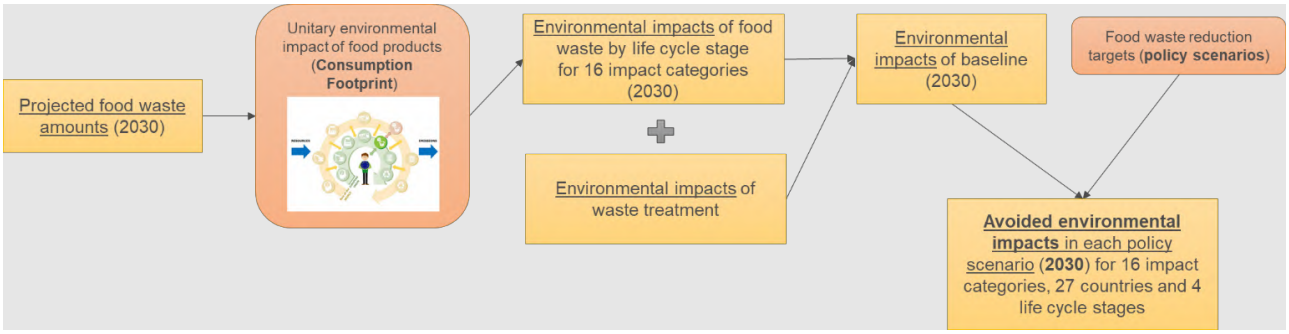
The methodological steps are illustrated in **Figure 8**. In a first step, the projected amounts of food waste generated in 2030 (derived from MAGNET, Section 2.1.5) at product group level are

multiplied by the environmental impacts of food products calculated performing process-based LCA of representative products from the Consumption Footprint.

In a second step, the impacts of waste treatment, calculated as presented in Notarnicola et al., (2017) and considering an average EU mix of waste treatment options - following the approach of the Food Waste Prevention Calculator (De Laurentiis et al., 2020), are multiplied by the amount of food waste generated in the baseline, and added to the impacts of the wasted food products calculated at the previous step to calculate the overall impact of food waste generation in the baseline. In a third and final step, the food waste reduction targets envisaged by the different policy options are applied to calculate environmental savings (i.e. avoided environmental impacts) brought by each policy option.

The same approach was used to quantify the environmental impacts of food waste generated in 2020, based on the food waste data published by Eurostat.

Figure 8 – Modelling approach for the macro-scale assessment of projected environmental impacts deriving from the setting of food waste reduction targets



The Life Cycle Assessment-based approach has the advantage of estimating environmental impacts due to EU food consumption and related food waste, considering the whole life cycle of products and 16 different impact categories (including a comprehensive list of emissions to the environment and resources use). At the same time, the proposed framework shows certain limitations and is affected by different sources of uncertainty: e.g., in the data used in the modelling of representative products (Consumption Footprint) and in the impact assessment models of the Environmental Footprint, including temporal and regional representativeness. Moreover, the Consumption Footprint scope is limited to the currently modelled product groups. Finally, this approach does not consider the rebound effects or effects of re-exports when dealing with transboundary impacts (Sanyé-Mengual & Sala, 2023).

The resulting environmental impacts that are avoided in the three policy options can be translated in monetary terms by applying conversion factors compiled by Amadei et al., (2021)[54]. Although these combine different methodological approaches, they can be employed for an estimation of the magnitude of the externalities associated to the environmental impacts calculated with the Environmental Footprint method. The monetary valuation coefficients used are provided in Table 21.

Table 21. Monetary valuation coefficients based on Amadei et al., (2021).

Climate change	Land use	Marine eutrophication	Water scarcity

[54] Amadei, A.M., De Laurentiis, V. and Sala, S., 2021. A review of monetary valuation in life cycle assessment: State of the art and future needs. Journal of Cleaner Production, 329, p.129668.

Euro/kgCO_2eq.	Euro / Pt	Euro /kg N eq.	Euro /m^3 water eq.
0.076-0.272	0.000178	6.02-10.3	0.00508

2.2.2 The Consumption Footprint model in policy assessment

The Consumption Footprint assessment framework has been used to:

i. monitor the evolution of impacts over time (Sanyé-Mengual et al., 2019)(EC - European Commission, 2022);
ii. test scenarios of impact reduction along the food value chain, both as technical (e.g. efficiency improvements) or behavioural transitions (e.g. dietary shift) (Castellani et al., 2017; Polizzi di Sorrentino et al., 2016; Sanyé-Mengual & Sala, 2023);
iii. assess the impacts of the EU food system against the Planetary Boundaries as absolute sustainability reference (Sala et al., 2020).

The Consumption Footprint was also used to support different European Green Deal ambitions in impact assessments (e.g., 2030 climate target plan[55], ecodesign for sustainable product requirements[56], legislative framework for sustainable food systems[57]) and in monitoring frameworks (e.g., resilience dashboards[58], 8th Environment Action Programme[59], Circular Economy Action Plan[60]). The Consumption Footprint also features in the 2021 OECD/JRC report on "Understanding the spillovers and Transboundary Impacts of Public Policies"[61].

[55] European Commission, Climate Action, 2030 Climate Target Plan, https://climate.ec.europa.eu/eu-action/european-green-deal/2030-climate-target-plan_en.
[56] European Commission, All Environment Publications, Proposal for Ecodesign for Sustainable Products Regulation https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation_en.
[57] European Commission, Food safety, Farm to Fork strategy, Legislative framework for sustainable food systems, https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy/legislative-framework_en.
[58] European Commission, 2020 Strategic Foresight Report, Resilience Dashboards, https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2020-strategic-foresight-report/resilience-dashboards_en.
[59] Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030 *(OJ L 114, 12.4.2022, p. 22–36),* EUR-Lex - 32022D0591 - EN - EUR-Lex (europa.eu).
[60] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 11.03.2020 A new Circular Economy Action Plan For a cleaner and more competitive Europe, COM(2020) 98 final, EUR-Lex - 52020DC0098 - EN - EUR-Lex (europa.eu).
[61] OECD, *Understanding the Spillovers and Transboundary Impacts of Public Policies, Implementing the 2030 Agenda for More Resilient Societies,* 2021, https://www.oecd.org/gov/pcsd/understanding-the-spillovers-and-transboundary-impacts-of-public-policies-862c0db7-en.htm.

ANNEX 5: POLITICAL AND LEGAL CONTEXT

The WFD sets the fundamental waste management principles applicable in the EU. Over its lifetime, the WFD has evolved to address the changing way waste is perceived by society, away from a significant focus on disposal to one that gives greater priority to prevention and obtaining value from waste as a resource. In addition, it has considered how waste policy interacts with other environmental policies as explained below.

The WFD includes the basic concepts and definitions related to waste management, including definitions of waste, recycling and recovery. It requires waste to be managed without endangering human health and harming the environment, without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours and without adversely affecting the countryside or places of special interest. EU waste management is based on the five-step "waste hierarchy", which establishes an order of preference for managing and disposing of waste: prevention first (including reuse) followed by waste management operations: preparing for reuse, recycling, recovery and last disposal.

Figure 9 – The waste hierarchy

The WFD tasks Member States to take measures to limit waste generation, regulate and monitor waste treatment operations and operators, set up separate collection of waste to facilitate recovery of waste and attain preparing for reuse and recycling targets for municipal waste. It also implements the polluter pays principle by setting general requirements for extended producer responsibility (EPR) schemes to strengthen reuse, waste prevention, recycling and other recovery of waste. The Directive also mandates the Member States to adopt waste prevention programmes, including dedicated food waste prevention programmes, and waste management plans to define their strategic planning in waste management aiming to decouple waste generation from economic growth and the transition towards a circular economy.

In 2015, the European Commission adopted its first CEAP[62]. It included measures to help stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs.

Together with that action plan, the Commission adopted a legislative proposal on waste, which resulted in the 2018 waste package (described below). The '2018 waste package' introduced a significant number of changes to the EU waste management rules. The most important changes are listed below some details of the provisions is provided in the order of the WFD articles.

- Clarified key concepts such as the definitions of waste, recovery and disposal.
- Increased preparing for reuse and recycling targets for municipal waste and packaging waste.
- Set a target on the maximum amount of municipal waste that can be landfilled.
- Harmonised and simplified the legal framework on by-products and end-of-waste status.
- Tasked EU Member States to take measures to limit waste generation.
- Introduced general requirements for Extended Producer Responsibility schemes.
- Introduced an EWR as a compliance promotion tool.
- Introduced a whole life cycle approach of products and materials and not only the waste phase.
- Focused on reducing the environmental impacts of waste generation and waste management.
- Simplified and streamlined reporting obligations.
- Aligned the legislation to Articles 290 and 291 TFEU on delegated and implementing acts.
- Specific provisions of the WFD and the 2018 revision are detailed below.

In December 2019, the European Commission adopted the Communication on a EGD which sets out an ambitious roadmap to transform the EU into a **modern, resource-efficient and competitive economy**. One of the objectives of the Green Deal is "mobilising industry for a clean and circular economy". This initiative is part of the Commission's current ambition to bring about a Green Transition in the EU and is one of several initiatives in the area of waste.

A major component of the Green Deal is the new CEAP, adopted in March 2020. Managing waste in an environmentally sound manner and making use of secondary raw materials are key elements of this plan. The CEAP calls for the Commission to put forward waste prevention measures, including waste reduction targets for specific streams. It also calls for the Commission to enhance the implementation of extended producer responsibility schemes and to provide incentives and encourage sharing of information and good practices in waste recycling.

The European Commission's 2020 industrial strategy for Europe [63] sets out the EU's overarching ambition to foster a 'twin transition' to climate neutrality and digital leadership. It echoes the European Green Deal in highlighting the leading role that Europe's industry must play in this, by reducing its carbon and material footprint and embedding circularity across the economy. It underlines the need to move away from traditional models, and revolutionise the way we design, make, use and dispose of products. In 2021, the Commission published an update to the industrial

[62] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Closing the loop - An EU action plan for the Circular Economy, COM(2015) 614 final, EUR-Lex - 52015DC0614 - EN - EUR-Lex (europa.eu).

[63] Communication from the Commission A New Industrial Strategy for Europe, 2020, COM(2020) 102 final, EUR-Lex - 52020DC0102 - EN - EUR-Lex (europa.eu).

strategy, [64] which reinforces the main messages of the 2020 strategy and provides a range of additional implementation tools.

The EU Textiles Strategy sets out the vision and concrete actions to ensure that by 2030 textile products placed on the EU market are long-lived and recyclable, made as much as possible of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. It indicates urgent action is needed across the entire lifecycle of textile products since that ecosystem is the fourth highest-pressure category for the use of primary raw materials and water and fifth for GHG emissions. It calls for a sustainable product policy and circularity to retain value of textiles is retained in the economy for as long as possible through reuse, repair and recycling to reduce dependencies on virgin raw materials. The proposed specific measures include eco-design requirements for textiles, clearer information, a Digital Product Passport and harmonising EU EPR rules. To address fast fashion, the Strategy also calls on companies to reduce the number of collections per year, take responsibility and act to minimise their carbon and environmental footprints, and on Member States to adopt favourable taxation measures for the reuse and repair sector. Design requirements for an extended lifetime and durability of textiles, EPR schemes, collection, preparation for reuse and recycling operations are currently partially implemented or mandated in Members States.

Article 4a of the WFD established definition of food waste – as all food (in the meaning of General Food Law), which has become a waste.

Article 6 of the WFD specifies that Member States must take appropriate measures to ensure that waste which has undergone a recycling or other recovery operation is considered to have ceased to be waste if it complies with specific conditions outlines in the article. End-of-waste criteria specify when certain waste ceases to be waste and becomes a product (non-waste). According to Article 6 (1) and (2) of the Waste Framework Directive, certain specified waste ceases to be waste when it has undergone a recovery operation (including recycling) and complies with specific criteria, when:

- The substance or object is commonly used for specific purposes.
- There is an existing market or demand for the substance or object.
- The use is lawful (substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products).
- The use will not lead to overall adverse environmental or human health impacts.

Relevant product legislation, in particular Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) [65], Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP) [66]and requirements specific to textile products apply to textiles recovered from waste. As in the case of other relevant waste streams, the presence of forbidden hazardous chemicals in textiles, the use

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[64] European Commission, A Europe fit for the digital age, European industrial strategy, European industrial strategy | European Commission (europa.eu).

[65] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC *(OJ L 396, 30.12.2006, p. 1–849),* EUR-Lex - 32006R1907 - EN - EUR-Lex (europa.eu).

[66] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 *(OJ L 353, 31.12.2008, p. 1–1355),* EUR-Lex - 32008R1272 - EN - EUR-Lex (europa.eu)

of which may have been previously allowed, can have a detrimental effect on the safety and quality of the recovered textile material, be it recycled fibres or textile articles for reuse. The presence, nature and amount of such substances may also have an impact on the amount of textile material than can be prepared for reuse or recycled. REACH already imposes restrictions on certain substances in textiles, contained in its Annex XVII. This includes a restriction on certain azocolorants and azodyes (entry 43 and appendices 8 and 9), nonylphenol ethoxylates (entry 46a), hexavalent chromium (restriction entry 47) and on a list of 67 specific CMR[67] substances (entry 72 and appendix 12). The Commission is currently working on the preparation of a further restriction under REACH, on skin sensitising substances in textiles[68], based on an opinion of the European Chemicals Agency. Limit values in Annex I of Regulation (EU) 2019/1021 on Protecting health and the environment from persistent organic pollutants[69] are also relevant to the placing on the market of recycled fibres. Furthermore, the recently published Regulation (EU) 2022/2400[70], has introduced limit values relevant to the waste management of textile waste containing certain persistent organic pollutants (POPs), particularly PFOA, PFHxS and their salts and related compounds. The relevance of these restrictions depends on their precise scope, the limit values defined for the different substances and on the concentrations found of the relevant substances in recycled fibres, in textile waste prepared for reuse and in non-waste articles destined for reuse. It should be noted that some of the referred restrictions specifically exclude from their scope second-hand articles.

Article 8a of the WFD sets the general minimum requirements for all extended producer responsibility (EPR) schemes set up within the EU. The Directive does not propose specific rules on EPR for textiles. The OECD indicated that EPR "is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals. Within the OECD the trend is towards the extension of EPR to new products, product groups and waste streams such as electrical appliances and electronics." [71] Indeed, the EU, EPR is mandatory within the context of the WEEE and ELV Directives as well as the Batteries Regulation and PPWD. Additional waste streams have been most identified for an EPR scheme within the EU, including tyres, waste oil, paper and card, and construction and demolition waste. In addition, a much broader range of waste streams are subject to obligatory or voluntary producer responsibility systems in some Member States, including farm plastics, medicines and medical waste, plastic bags, photo-chemicals and chemicals, newspapers, refrigerants, pesticides and herbicides, textiles, mattresses, and lamps, light bulbs and fittings.

Article 9 of the WFD requires Member States to "encourages the reuse of products and the setting up of systems promoting repair and reuse activities" for textiles, and it cites in recitals that specific end-of-waste criteria should be considered for textiles. It furthermore requires Member States to take measures to:

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[67] Carcinogenic, mutagenic, toxic for reproduction.

[68] ECHA, Registry of restriction intentions until outcome, https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e182446136.

[69] Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (recast) (*OJ L 169, 25.6.2019, p. 45–77*), Regulation (EU) 2019/1021 of the European Parliament and of ... - EUR-Lex (europa.eu).

[70] Regulation (EU) 2022/2400 of the European Parliament and of the Council of 23 November 2022 amending Annexes IV and V to Regulation (EU) 2019/1021 on persistent organic pollutants *(OJ L 317, 9.12.2022, p. 24–31)*, EUR-Lex - 32022R2400 - EN - EUR-Lex (europa.eu).

[71] Extended producer responsibility - OECD

- Promote and support sustainable production and consumption models.
- Encourage the design, manufacturing and use of products that are resource efficient, durable, reparable, reusable and capable of being upgraded.
- Target products containing critical raw materials to prevent those materials becoming waste.
- Encourage the reuse of products and the setting up of systems promoting repair and reuse activities.
- Promote the reduction of the content of hazardous substances in materials and products.
- Stop the generation of marine litter.

Article 9 requires the Commission, by 31 December 2024, to examine data provided by Member States and consider the feasibility of measures to encourage the reuse of products, including the setting of quantitative targets as well as other waste prevention measures. In 2020, the Commission adopted an implementing act with a common methodology to measure and report on product reuse. The first reporting year is 2021 and Member States will report on reference year 2021 in June 2023.

Article 9 sets a general requirement to reduce food-waste generation as a contribution to the United Nations Sustainable Development Goal Target 12.3 by 2030. It establishes a hierarchy of food waste prevention operations (ADD) and requires measuring the levels of food waste on the basis of the methodology established by the delegated act referred to in Article 9(8). On the basis of that data, the WFD calls the Commission, by 31 December 2023, to examine the data with a view to considering the feasibility of establishing Union-wide food waste reduction target to be met by 2030.

Article 10 of the WFD requires Member States to take the necessary measures to ensure that waste undergoes preparing for reuse, recycling or other recovery operations. Where necessary to facilitate or improve preparing for reuse, recycling and other recovery operations, waste shall be subject to separate collection and shall not be mixed with other waste or other materials with different properties. The Green Deal calls on the Commission to propose an EU model for separate waste collection and CEAP specifies some of the elements to be considered: the most effective combinations of separate collection models, the density and accessibility of separate collection points, common bin colours, harmonised symbols for key waste types, product labels, information campaigns and economic instruments, and the standardisation and use of quality management for collection systems.

Article 11 of the WFD specifies that Member States shall take measures to promote high-quality recycling and, to this end, requires Member States to set up separate collection for at least for paper, metal, plastic and glass, and, by 1 January 2025, for textiles. It also sets preparing for reuse and recycling targets (by weight) for municipal waste to 55% by 2025, 60% by 2030 and 65% by 2035. In addition, Article 11 calls for the Commission to consider by 31 December 2024, the setting of targets for (preparing for) reuse and for recycling of separately collected textiles.

Article 21 of the WFD requires Member States to ensure collection and treatment of waste oils (WO). It also indicates a priority for regeneration (here used synonymously with ‘recycled’) as regenerated lubricant oil reduces the demand for virgin fossil resources. Combustion for energy recovery is another option, but less desirable than regeneration according to the EU’s waste hierarchy. The WFD requires the Commission, by 31 December 2022, to examine information on WO provided by Member States and to consider the feasibility of adopting measures, including quantitative targets and other measures to promote the regeneration of WLO.

Article 22 of the WFD requires Member States to ensure that, by 31 December 2023, bio-waste is either separated and recycled at source, or is collected separately and is not mixed with other types of waste.

Article 29 of the WFD mandates Member States to establish waste prevention programs, including food waste prevention, that describe existing and planned instruments and measures and their contributions to decoupling waste generation from economic growth. It also requires them to monitor and assess the implementation of their food waste prevention measures by measuring the levels of food waste on the basis of the methodology established by the delegated act referred to in Article 9(8) (i.e., 2019/1597/EC), as of reference year 2020.

This initiative will assess whether Member States are on track to meet the separate collection obligation for textiles and amongst other measures, whether specific EPR rules are needed for textiles products in addition to the general minimum requirements in Article 8a and address the review clause for waste oils in Article 21

1- Textiles

The Waste Statistics Regulation (WStatR) [72] provides for data collected biennially. Textile waste is included under W076 'Textile Waste' and it is measured in tonnes. Textile waste comprises two entries in separately collected municipal waste fractions (20 01 10 clothes, and 20 01 11 textiles).

In addition, the '2018 waste package' introduced a new definition of municipal waste that includes textiles in the list of mixed waste and separately collected waste from households, this will be reported annually from reference year 2020 (in June 2022).

According to the guidance prepared by Eurostat, countries should estimate waste generation by material breakdown (including a specific class for textiles) by applying waste composition analysis to the different waste streams. In the light of the data received, 14 countries out of 22 seem not to have applied such waste composition analysis. For those countries, the municipal textile waste generation reported is very low, and comparing it with recycling is not meaningful. The table below shows the breakdown of waste generation by material as reported by Member States.

[72] Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics *(OJ L 332, 9.12.2002, p. 1–36),* EUR-Lex - 32002R2150 - EN - EUR-Lex (europa.eu).

Table 22 – Breakdown of waste generation by material

	AT	BE	BG	CZ	DE	DK	EE	FI	FR	HR	HU	IT	LT	LU	LV	MT	NL	PT	RO	SE	SI	SK
Metals	11.00%	2.00%	4.50%	5.40%	0.70%	3.50%	3.80%	3.90%	3.10%	2.30%	3.90%	2.40%	9.90%	1.60%	0.90%	0.60%	0.80%	0.10%	3.70%	4.30%	9.90%	14.80%
Metals separated after incineration of waste	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Glass	5.50%	4.80%	0.60%	3.00%	4.90%	3.20%	8.20%	2.40%	8.50%	2.60%	1.00%	8.00%	4.30%	6.60%	4.90%	2.10%	4.00%	3.70%	6.40%	6.10%	4.20%	3.10%
Paper and cardboard	20.50%	14.70%	4.90%	7.60%	12.90%	11.70%	24.70%	16.10%	9.10%	11.80%	8.40%	21.70%	9.80%	22.00%	12.70%	5.90%	8.30%	4.00%	13.50%	14.10%	19.60%	8.30%
Plastic	6.60%	2.90%	1.50%	3.20%	1.70%	2.10%	15.20%	3.20%	6.70%	3.90%	0.70%	12.60%	4.10%	8.70%	1.60%	0.80%	0.40%	0.20%	13.70%	7.50%	10.40%	3.00%
Wood	6.20%	10.40%	0.40%	1.30%	2.70%	4.70%	1.50%	3.40%	3.30%	1.40%	0.40%	3.40%	1.10%	3.00%	5.70%	2.70%	4.80%	0.60%	2.10%	3.60%	6.40%	1.60%
Textiles	1.90%	1.00%	0.00%	0.70%	0.40%	0.10%	4.10%	0.00%	2.40%	0.20%	0.00%	3.60%	0.30%	1.90%	0.10%	0.40%	1.00%	0.10%	1.00%	1.40%	0.20%	0.90%
Electrical and electronic equipment	2.00%	1.40%	2.40%	1.60%	1.50%	1.90%	2.20%	2.30%	2.10%	2.20%	1.30%	0.00%	1.20%	1.50%	0.60%	0.90%	2.10%	0.10%	0.90%	3.60%	1.30%	1.10%
Batteries	0.10%	0.00%	0.00%	0.00%	0.00%	0.20%	0.10%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.20%	0.40%	0.00%	0.30%
Bio-waste	31.80%	15.20%	1.60%	15.10%	22.00%	26.50%	24.70%	16.90%	28.10%	7.00%	10.50%	34.50%	21.40%	27.70%	4.40%	9.80%	27.80%	3.30%	56.80%	36.70%	15.40%	12.60%
Bio-waste separated and recycled at source	0.00%	7.30%	0.00%	0.00%	4.80%	0.00%	0.00%	0.00%	4.70%	0.00%	0.00%	1.00%	0.00%	3.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.70%	0.00%	0.00%
Mixed waste	8.20%	34.90%	78.50%	47.90%	40.90%	34.50%	12.60%	45.90%	8.10%	59.20%	67.30%	12.70%	39.60%	14.80%	64.70%	53.90%	34.20%	82.10%	0.00%	12.00%	25.90%	45.60%
Bulky waste(6)	5.00%	4.10%	3.50%	12.20%	5.60%	8.50%	2.80%	0.30%	12.50%	7.80%	5.30%	0.00%	3.60%	3.50%	4.30%	20.60%	6.20%	4.00%	0.80%	8.90%	5.70%	7.60%
Other	1.20%	1.30%	2.10%	2.10%	2.00%	3.10%	0.30%	5.50%	11.20%	1.60%	1.10%	0.00%	4.80%	4.90%	0.00%	2.10%	10.50%	1.80%	1.00%	0.70%	0.90%	1.10%

There is a lack of reliable data on textile waste generation and how much it represents of total municipal solid waste but from several sources it seems that a reasonable estimate is 3-4%. In the best performing Member States, about a third of it is separately collected and about two thirds end up in the mixed waste bin.

Regulation (EC) No 1013/2006 on shipments of waste [73] (Waste Shipments Regulation or 'WSR') applies to shipments of waste:

- Between EU countries within the EU borders or transiting via non-EU countries;
- Imported into the EU from non-EU countries;
- Exported from the EU to non-EU countries;
- In transit through the EU, on the way from or to non-EU countries.

There are two control procedures for the shipment of waste:

1. General information requirements apply to shipments for recovery of wastes, listed in Annex III ('green' listed wastes - non-hazardous, such as paper or plastics) or IIIA; and
2. Prior written notification and consent applies to other types of shipments of wastes, including:
   a. shipments of wastes listed in Annex IV ('amber' listed wastes containing both hazardous and non-hazardous parts) or in Part 2 of Annex V (EWC Codes (European Waste Codes) [74], e.g., wastes from mining, quarrying and physical and chemical treatment of minerals); and
   b. shipments for disposal of wastes listed in Annex III ('green' listed wastes).

The Regulation aims to protect the environment and public health from the adverse effects of the shipments of waste and its subsequent treatment. It requires that waste is managed in an environmentally sound manner, respecting EU and international rules, throughout the shipment process and when it is recovered or disposed of.

Coherence Analysis

Links with other EU policies

The following initiatives, adopted or planned in the Commission work programme, will have an impact on the themes being investigated. They are summarised in the Table below and more details are provided after the table.

Table 23 – Mapping of the main links to WFD

Policy area	WFD contribution and relevance
The 8th Environment Action Programme (8th EAP)[75]	Speed up the transition to a climate-neutral, sustainable, non-toxic, resource-efficient, renewable energy-based, resilient and competitive circular economy to attain the EU's 2050 vision of

[73] OJ L 190, 12.7.2006, p.1.
[74] 2000/532/EC: Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C(2000) 1147), EUR-Lex - 32000D0532 - EN - EUR-Lex (europa.eu).
[75] EUR-Lex - 32022D0591 - EN - EUR-Lex (europa.eu).

	living within planetary boundaries.
Circular Economy Action Plan (CEAP)	Increase circularity of resource intensive sectors, such as textiles and food[76] for people, regions and cities. Prevent or reduce waste generation. Enhance the implementation of the polluter pays principle. Strengthened markets for secondary raw materials and more circularity. Reduce environmental impacts through waste management.
Bioeconomy Strategy[77]	It calls for actions for the reuse, reduction and recycling of waste streams of a biological nature. Principles such as the circular economy, cascading use of biomass and the waste hierarchy are at its core.
Ecodesign for Sustainable Products Regulation (ESPR)[78]	Make sustainable products the norm in the EU by setting minimum requirements to improve their circularity, energy performance, promote/support sustainable production and consumption models and stimulate re-use, repair and recycling.
EU Strategy for Sustainable and Circular Textiles' (EU Textiles Strategy)	Calls for urgent action across the entire lifecycle of textile products to ensure sustainable textile products and circularity to retain textiles' value in the economy for as long as possible and to reduce dependencies on virgin raw materials.
Farm to Fork Strategy	Reduce food waste levels. Establish a baseline for food waste levels, considering new data measured by Member States and propose legally binding targets to reduce food waste across the EU by 2023.
Commission analysis of the drivers of food security[79]	Food waste is one of the main drivers affecting food security from both the supply and demand sides. Food waste reduces productivity and can reduce food availability. Moreover, reducing food waste could contribute to food price decreases, thereby potentially improving economic access to food.
Proposal for a legislative Framework for a Union Sustainable Food System ('FSFS') – (planned for Q3 2023).	Food waste reduction will be part and parcel of the future legislative proposal establishing a framework for a Union Sustainable Food System. There will be a cross-fertilisation between the two initiatives. For instance, when Member States implement national food waste prevention programmes to meet the set targets, they would need to take into account the general principles of FSFS where applicable and relevant.
Food Information to Consumers - revision of EU rules on date marking	Clarify wording of 'use by' and 'best before' dates in order to prevent food waste linked to the misunderstanding and/or misuse of these dates.
REPowerEU[80]	Increasing production from 3,5 (2021) to 35 (2030) bcm of biomethane from sustainably sourced feedstock, including food waste, to strengthen security of energy supply and reduce dependence on imported Russian natural gas. While food waste reduction is not expected to contribute to this target, indirect effects (e.g., freeing land for non-food uses) may have limited impact.

[76] https://single-market-economy.ec.europa.eu/industry/transition-pathways_en.
[77] A sustainable bioeconomy for Europe - Publications Office of the EU (europa.eu).
[78] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022PC0142
[79] *Drivers of food security. SWD(2023) 4 final,* Analysis of main drivers on food security (europa.eu).
[80] EUR-Lex - 52022DC0108 - EN - EUR-Lex (europa.eu)

Social Economy Action Plan[81]	Sets waste management rules to provide opportunities for social enterprises and circular business models.
Chemicals Strategy for Sustainability[82]	Protect citizens and the environment from harmful chemicals, ensuring all chemicals are used more safely and sustainably and prioritising innovation for substituting substances of concern across sectors, such as textiles, construction materials, etc.
Zero pollution	Mandate that waste is managed without endangering human health and harming the environment. Promote waste hierarchy to reduce pollution.

- The EU Textiles Strategy addresses the production and consumption of textiles, whilst recognising the importance of the textiles sector. It presents the Commission's 2030 Vision for Textiles. Particularly relevant for waste management is that it announced harmonised EU rules on extended producer responsibility for textiles, and economic incentives to make products more sustainable ("eco-modulation of fees"). Furthermore, it highlighted the Commission's aim to address the challenges related to halting the export of textile waste. In alignment with the Strategy, Measure 2.9 presented in this assessment addresses extended producer responsibility for textiles.
- The revision of the PPWD will aim to reduce waste generation of packaging waste. Together this initiative and the PPWD initiative will tackle over 65% of all municipal waste generated (packaging, food waste and textile waste) therefore contributing to the overarching objective of the WFD and the EGD/CEAP policy objectives of minimising waste. Textile waste packaging is specifically excluded from this assessment so as to eliminate any possible incoherence.
- The Commission proposal for the Waste Shipments Regulation was proposed on 17 November 2021. It aims to ensure that the EU does not export its waste challenges to third countries and to facilitate shipments for recycling, while discouraging shipments to disposal. Measures include criteria to better distinguish between mixed and non-mixed waste, as well as between used vs waste goods, that may be established for textiles. Also, a stricter export regime to non-OECD third countries is proposed, as well as an obligation to audit the performance of recovery facilities in third countries. Finally, measures are proposed to step up the efforts on enforcement of the waste shipment rules, including for textile waste. The impacts of the WSR proposal are factored into the assessment performed. Furthermore, the measures that address shipments of materials (measures 2.6 and 2.9) distinguish textiles that are for reuse and no longer waste (and, therefore, not subject to the WSR) and those that are waste for which the measures in the proposal are referred to directly.
- The proposal for a Regulation on a Single Market for Digital Services (Digital Services Act) aims at improving consumer protection and their fundamental rights online and to ensure transparency and accountability of online platforms. The new rules foster innovation, growth and competitiveness, and facilitate the scaling up of smaller platforms, SMEs and start-ups. The responsibilities of users, platforms, and

[81] Communication form the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Building an economy that works for people: an action plan for the social economy, COM(2021) 778 final, EUR-Lex - 52021DC0778 - EN - EUR-Lex (europa.eu).
[82] Communication form the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Chemicals Strategy for Sustainability Towards a Toxic-Free Environment, COM(2020) 667 final, EUR-Lex - 52020DC0667 - EN - EUR-Lex (europa.eu).

public authorities are rebalanced according to European values, placing citizens at the centre. Specifically in relation to measure 2.9 on extended producer responsibility the impacts and measures foreseen under the Digital Services Act are explicitly referred to.

- The General Product Safety Directive mandates the producer to place only safe products on the market. While this legislation does not cover EPR compliance, this obligation is consistent with the current requirements under the waste legislation to take back products already used or their waste under the EPR. Indeed, both legal instruments require the relevant actors to organise collection and treatment of the product.
- The Commission proposal to review the Industrial Emissions Directive[83] increases the focus on the circular performance of industrial installations in terms of requirements on resource efficiency and waste prevention. Furthermore, under this proposal operators are required to have an environmental management system in place, addressing the management and substitution of hazardous chemicals and, from 2030, would require the inclusion of a transformation plan towards a clean, circular and climate neutral industry.
- The Commission adopted a proposal for a directive on sustainability due diligence[84] aimed at supporting EU companies' sustainability transition. It introduces a horizontal framework requiring businesses across all sectors of the economy to respect human rights and the environment in their own operations, their subsidiaries and through their value chains. The due diligence duty is aligned with internationally recognised human rights and labour standards as well as international environmental commitments. The proposal covers large companies based in EU but also non-EU companies generating a significant turnover on the EU market and excludes SMEs. The textiles sector is identified as one of the high impact sectors. The Commission may issue guidance on the topic as additional support to companies.
- The Zero Pollution Action Plan[85] (ZPAP) provides a compass for including pollution prevention in all relevant EU policies, maximising synergies in an effective and proportionate way, stepping up implementation and identifying possible gaps or trade-offs. It also provides a vision according to which by 2050, air, water and soil pollution is reduced to levels no longer considered harmful to health and natural ecosystems and that respect the boundaries our planet can cope with. As also reflected in the CEAP, the ZPAP addresses the ambition for a more environmentally friendly production and consumption where waste generation and pollution are minimised, also as regards impacts beyond EU borders. The ZPAP includes targets for 2030 for preventing and better managing waste, calling for significant reductions in waste generation and halving the amount of residual municipal waste generated in the EU.

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[83] Proposal for a Directive of the European Parliament and of the Council amending Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, COM(2022) 156 final, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2022%3A156%3AFIN.

[84] Proposal for a Directive of the European Parliament and of the Council on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937, COM(2022) 71 final, EUR-Lex - 52022PC0071 - EN - EUR-Lex (europa.eu).

[85] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions The path to a healthy planet for all EU Action Plan: 'Zero pollution for air, water and soil', 2021, COM(2021) 400 final, EUR-Lex - 52021DC0400 - EN - EUR-Lex (europa.eu).

- The Chemicals Strategy for Sustainability[86] states that in order to move towards toxic-free material cycles and clean recycling it is necessary to ensure that substances of concern in products and recycled materials are minimized and that, as a principle, the same limit values for hazardous substances should apply to both virgin and recycled materials, except in exceptional circumstances, subject to case-by-case analysis, where derogation from this principle may be necessary and under the condition that the use of the recycled material is limited to clearly defined applications and there are no negative impacts to human health and the environment. The REACH Regulation is the overarching chemicals legislation in the EU and provides the means to ensure the safe use of chemicals.
- The ecodesign for Sustainable Products Regulation (ESPR)[87] sets a framework to set ecodesign requirements for specific product groups to significantly improve their circularity, energy performance and other environmental sustainability aspects. Ecodesign requirements can be of key importance for waste prevention and high-quality recycling, as they can improve product durability, reparability, recyclability and recycled content. The development of such requirements can also serve as a basis for the setting of harmonized financial contributions to Extended Producer Responsibility Schemes. Ecodesign requirements for textiles are expected to be in place by 2025 or 2026. In addition to the introduction of ecodesign requirements, ESPR introduces measures to counter the destruction of unsold consumer products. Firstly, it introduces a requirement for large enterprises to publicly disclose information on the number and types of unsold consumer products they discard. This measure is intended to function as a reputational dis-incentive for this practice while it is also envisaged to create an improved evidence base on the extent to which the destruction of unsold consumer products takes place. Secondly, ESPR includes an empowerment to adopt delegated acts prohibiting the destruction of specific groups of unsold consumer products, such as textiles, taking into account the information from the general disclosure obligation.
- The recently adopted Proposal for a Directive on empowering consumers for the green transition and annex | European Commission (europa.eu) will be complemented with the upcoming legislative proposal to substantiate Green claims, which sets minimum requirements on substantiation and communication of voluntary green claims on products and organisations. This proposal incentivises the use of Product Environmental Footprint methods (add reference) as the method will be compliant with the rules on minimum criteria for substantiation of claims). This is relevant for textiles, because the industry (supported by the Commission) is finalising PEF category rules for apparel and footwear (planned by end of 2023). These rules will standardise the measurements of impacts of apparel and footwear, allowing for a comparison of products. The rules can feed into other policy developments in the field of textiles. For instance, in the preparation of the Delegated act for the ESPR and in the context of the revision of Regulation (EU) No 1007/2011[88] (Textiles Labelling Regulation). The proposal also indicates that the Commission will monitor the

[86] Chemicals Strategy for Sustainability Towards a Toxic-Free Environment. Chemicals strategy (europa.eu).
[87] See footnote 32
[88] European Commission (2018). Regulation (EU) No 1007/2011 on textile fibre names and related labelling and marking of the fibre composition of textile products *(OJ L 272 18.10.2011, p. 1),* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02011R1007-20180215

evolution on the substantiation of claims so that following a review it can decide to change/reinforce the use of PEF.

- The Commission is finalising an initiative to reduce the release of microplastics on the environment, including textiles. The preparatory work of the initiative has shown that there is a need to develop a standardised methodology to quantify microplastics releases from textiles. This standardised methodology would allow to introduce ecodesign requirements in the context of the upcoming delegated act of the ESPR and could be used to include microplastic releases as part of the modulation of fees in the Extended Producer Responsibility Scheme proposed in this impact assessment.
- The Social Economy Action Plan[89] aims to raise the social economy's visibility and create an environment that enables the social economy to thrive and grow. These organisations create and retain quality jobs and contribute to social and labour market inclusion. They drive sustainable economic development, promote the active participation of citizens, and play an important role in Europe's welfare systems.

As regards implementation of the ESPR framework, Delegated Acts will be developed for product groups and horizontal measures following a dedicated Working Plan. In preparation of such Working Plan, a JRC Report[90] is providing a preliminary proposal of product groups and horizontal measures that should be considered as a priority for the ESPR framework. The product groups and horizontal measures identified in the Report should be considered in addition to the ones already identified in the Ecodesign and Energy Labelling Working Plan 2022-2024.

Textiles have been confirmed as a priority product following the stakeholder consultation[91], and the technical work supporting the Delegated Act on textiles under the ESPR is underway. It is estimated that the Delegated Act would be adopted in 2024/25 which coincides broadly with the possible adoption and entry into force of the Waste Framework Directive rules on Extended Producer Responsibility considered in this assessment. Therefore, full alignment is possible both at the policy development and implementation stage. Full alignment between the two legislations in terms of scope and standards (e.g. on the design factors and measurement tools) is a top priority for the Commission. In practice, it is important to ensure that fee modulation under EPR is fully consistent with the ESPR sustainability criteria and their measurement standards. This will provide the clearest policy signal and prevent unnecessary administrative burdens. This approach is also strongly supported by the textiles industry.

The nature of that ESPR legislation would be determined following an Impact Assessment in line with the Commission's Better Regulation Guidelines, and hence it is too early to specify its nature. However, it would have a clear impact on textiles and would be complementary to the WFD revision. For example, it could:

- Reduce the amount of textiles waste by improving durability and repairability,

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[89] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Building an economy that works for people: an action plan for the social economy, 2021, COM(2021) 778 final, EUR-Lex - 52021DC0778 - EN - EUR-Lex (europa.eu).

[90] Product groups documents | Product Bureau (europa.eu)

[91] Have your say, Published initiatives, New product priorities for Ecodesign for Sustainable Products, New product priorities for Ecodesign for Sustainable Products (europa.eu).

- Improve the recyclability of textiles waste and increase recycled content,
- Identify characteristics that could be used for EPR fee modulation.

This would complement the separate collection requirements that come into force in 2025, ensuring that textile waste once collected is easier to reuse and recycle.

The methodology followed in the JRC report selected product groups based on three steps: the products' environmental impacts, market relevance and policy coverage. The identified product groups are then evaluated based on criteria such as environmental impacts, improvement potential, policy gaps and proportionality of costs related to the improvement potential identified, to propose a preliminary ranking. A quantification of the potential environmental impacts of the identified product groups is provided based on the improvement scenarios.

From an initial list of 34 product groups referenced in recent policy documents, 20 products (12 end-use and 8 intermediary products) were first shortlisted based on environmental, market and policy considerations. The 20 shortlisted product groups are then assessed in terms of environmental relevance (i.e., impacts and improvement potential) for ten impact categories addressing the main climate, environmental and energy objectives of the EU (see Figure I): water effects; air effects; soil effects; biodiversity effects; waste generation and management; climate change; life-cycle energy consumption; human toxicity; material efficiency; and lifetime extension.

Horizontal measures are proposed on the basis of main product aspects (see Article 5 of ESPR legal proposal) for groupings of products that demonstrate sufficient technical similarity and can be subject to the same set of potential provisions. As a result, five horizontal measures are proposed: "Durability", "Recyclability", "Lightweight design", "Post-consumer recycled content", and "Sustainable sourcing" (see Table III), each covering a specific set of proposed product groups and each accompanied by an analysis of the proposed provisions. The provisions proposed are intended at this stage to be applicable to a set of proposed product groups, albeit with proportional adjustment in the level of ambition per product group. Many of the horizontal measures could be applied to textiles, although this would depend on whether the considered aspects are already addressed in a delegated act specifically for textiles rather than a horizontal measure.

Several potential horizontal provisions relating to the "durability" measure include textiles in their potential product coverage. Provisions could for instance relate resistance to stresses or ageing mechanisms, the minimum durability of function, the introduction of a reparability scoring index/label, the availability of repair (+ upgrade) information and maintenance instructions to independent operators and/or end-users, spare part availability and delivery time, disassembly generally or related to Tools, Fasteners, Working Environment and Skill Level, number of materials and components used and modularity, transformability, detachable elements, adjustable sizing. The potential horizontal provision relating to the "Recyclability" measure that could be applied to textiles is the ability to easily separate the product into different materials. Last, the potential horizontal provision relating to the "post-consumer recycled content" measure that could be applied to textiles is the provisions on minimum content of post-consumer recycled material expressed either as a fraction of the total material input (in %) or in absolute numbers.

Article 16(1) of the ESPR proposal lists the criteria that should be taken into account by the Commission when prioritising the products to be covered by ecodesign requirements. These include the products' potential contribution to achieving the European Union's climate,

environmental and energy efficiency objectives, the potential for improving products' circularity and environmental impacts, the absence or insufficiency of EU law, and the volume of sales and trade.

A public consultation and targeted thematic consultations are held to involve relevant stakeholders at European and international level. The objective of the ongoing consultations is to gather further information on the environmental and circularity characteristics of the proposed priorities, as well as to improve the understanding of how their value chains work and what the potential for improvements is. Based on the feedback received from stakeholders, and building on further work and analyses, the Commission aims to adopt the first ESPR Working Plan after the final adoption of the ESPR by legislators.

The top scoring product group according to the assessment methodology used by the JRC [92] for scoring was, by far, Textiles and footwear, which obtained a total environmental score of 43 points, 13 points higher than the second highest -scoring product group. Textiles obtained the highest score in water effects, waste generation, climate change, energy consumption, material efficiency and lifetime extension, due to the large impacts caused by sourcing, producing, using and discarding materials, but also due to the large improvement potential in all these aspects, especially in terms of circularity, which is still largely untapped. Indeed, reuse and recycling of used textiles could bring significant savings in terms of water use and pollution, biodiversity, climate change and energy use, in addition to reducing waste generation of course. This represents a significant improvement potential since textiles' current value chain include little or no reuse and recycling[93]. Solutions towards increased recycling include reducing the complexity of materials used to produce textiles and textile products, adopting product passports and materials labelling at the design stage (Ellen MacArthur Foundation, 2017), and harmonised collection systems across the EU (EC, 2020; Palm et al., 2014). Also, measures that ensure and increase the durability of the items and the resistance to shrinkage/weather could double the average product life, which was estimated to save 44% of GHG emissions (Ellen MacArthur Foundation, 2017). Finally, large improvement potential could also be identified in substituting polluting compounds with biodegradable and less toxic alternatives, sustainable sourcing of primary materials (especially cotton), and energy efficiency measures.

While it can be expected that an ESPR Delegated Acts cannot address, for example, all textiles, and while the impacts and improvement potential of a cotton t-shirt are different to those of a wool sweater, the scoring results can still be considered representative of the whole product group. Further work on prioritised products will establish the adequate granularity for each prioritised product group. The regulated aspects of textiles are emissions during production, fibre names and labelling, separate collection of textiles waste, EU Ecolabel criteria (voluntary) and GPP criteria (voluntary), while some improvement potential aspects not currently regulated in the EU are improved reuse, recyclability and recycled content, on demand production, lending, renting, repair, use of alternative materials, energy efficiency measures, less frequent and low temperature washing and drying, durability measures, substituting toxic compounds with biodegradable and less toxic alternatives, sustainable sourcing of materials, water conservation programs during production and switching to renewable energy.

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[92] JRC, Individual product group assessment for textiles, preliminary.

[93] European Environment Agency, *Textiles in Europe's circular economy,* 2019, Textiles in Europe's circular economy — European Environment Agency.

The production of textiles, clothing, and footwear has one of the most complex global value chains, with most products on the internal EU market manufactured outside the EU, often in countries with lower labour and environmental standards[94]. In the EU, the level of emissions from the textile industry is regulated via the Industrial Emission Directive (IED), which is however only addressing EU installations. Non-EU production, which is expected to cover most textile products, is not covered by the IED. The EU also lays down European standards relating to textiles and clothing, relating to performance for certain types of textile products and to self-declared environmental claims [95]. Currently, there are no recycling targets for textile waste. The EU has also a voluntary EU ecolabel for textiles, establishing criteria such as limited use of substances harmful to health and environment, reduction in water and air pollution, extension of the lifetime of clothes (e.g., resistance to shrinking during washing and drying and colour resistance to perspiration, washing, wet and dry rubbing and light exposure)[96]. Finally, the EU GPP criteria for textiles facilitate the inclusion of green requirements in public tender documents that MS and public authorities can implement to the extent to which they themselves wish[97].

Water conservation and reuse programs can have large benefits through decreased costs of purchased water and reduced costs for treatment of wastewaters, leading to short pay-back periods[98]. Measures to reduce the usage of water and chemicals during dyeing have been found to have a pay-back period of about 2-3.5 years[99] and estimated cost savings of nearly 500 000 USD[100]. A case study on 33 factories found that with an up-front investment of 17.3 million USD, resulted on average in 9% of water saved and 6% of energy saved, with a payback time for the whole program of only 14 months[101]. On the other hand, certification and monitoring of organic crop cultivation is a costly procedure, which may ultimately offset the economic benefits due to less use of chemicals and higher returns from organic crop sales[102]. Estimations identified that a circular economy for fashion can address the 500 000 million USD of value lost annually due to clothing underutilisation and the lack of recycling, while supporting the creation of safe, healthy conditions for textile workers and users[103]. Finally, textile-to-textile recycling can be worth more than 100 000 million USD[104].

Both the Council [105,106] and European Parliament [107,108] called for and welcomed the Commission's comprehensive approach to improve the sustainability and the circularity of

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[94] European Parliamentary Research Service, 2019.
[95] CEN/TS 16822:2015
[96] EU Ecolabel, online page, https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/product-groups-and-criteria/clothing-and-textiles_en, (accessed 26.09.2022).
[97] European Commission, *EU green public procurement criteria for textiles products and services*, SWD(2017) 231 final, 2017.
[98] Shaikh, M.A., *Water conservation in textile industry*, College of Textile Engineering SFDAC, 2009, https://sswm.info/sites/default/files/reference_attachments/SHAKIH%202009%20Water%20conservation%20in%20the%20textile%20industry.pdf.
[99] Beton, A., Perwueltz, A., Desaxce, M., et al., edited by: Cordella M., Kougoulis J., Wolf O., Dodd N., Joint Research Centre, Institute for Prospective Technological Studies, 2014.
[100] NRDC, *Encourage Textile Manufacturers to Reduce Pollution*, 2022.
[101] Greer, L., Keane, S., Lin, C., Zhou, A., Yiliqi Tong, T., *The Textile Industry Leaps Forward with Clean by Design: less environmental impact with bigger profits,* Natural Resources Defense Council, 2015.
[102] See footnote 87
[103] Ellen MacArthur Foundation, and Boston Consulting Group, *Circular business models – Redefining growth for a thriving fashion industry,* 2021.
[104] Ellen MacArthur Foundation, 2021.
[105] Council of the European Union, *More circularity - Transition to a sustainable society - Council conclusions,* 2019, https://www.consilium.europa.eu/media/40928/st12791-en19.pdf.

the textiles sector, in particular, expressing their expectations in relation to a strong sustainable product policy, prioritising waste prevention, introduction of EPR, stimulating recycling and high-quality recycling technologies and capacities in the EU and demand for recycled textiles, adopting EU end-of-waste criteria for textiles and increasing the resilience and socially just value chain, including calling on the Commission to consider sector-specific legislation. The European Parliament is preparing an own initiative report on EU Strategy for Sustainable and Circular Textiles due in Spring 2023 (May). The Report endorses the vision of the Textiles Strategy for the sector and calls for swift implementation of its actions, among those the possibility of setting harmonised EPR schemes for textiles.

2- Food Waste

Political context

Before 2015, food waste was not a dedicated subject of EU legislation but was addressed as a part of biodegradable municipal waste or, since 2008, as a part of bio-waste.

In 2011 in the Communication on Roadmap to a Resource Efficient Europe (COM(2011) 571 final) the Commission proposed several actions to reduce environmental impacts of food production and consumption as well as of treatment of food waste. The Communication included a milestone that, by 2020, disposal of edible food waste should have been halved in the EU. Further assessment on how best to limit waste throughout the food supply chain and consider ways to lower the environmental impact of food production and consumption patterns was to be done in a Communication on sustainable food foreseen in 2013. The Communication was cancelled and, instead, a voluntary target on prevention of food waste was proposed, in 2014, as part of a proposal to revise the Waste Framework Directive (COM/2014/0397 final).

The 2014 proposal aimed to establish the framework for Member States to collect and report levels of food waste across all sectors in a comparable way, and request developing national food waste prevention plans aimed at meeting an aspirational objective of reducing food waste by 30 % by 2025.

The 2014 proposal has been further withdrawn in March 2015 as part of a package of 73 proposals. The Commission declared that it will continue work to prepare more a ambitious proposal concerning the Waste Package, by the end of 2015, to promote Circular Economy. The proposal was published, together with the Circular Economy Action Plan (CEAP), in December 2015, and was adopted in May 2018.

The Commission's approach was reinforced by global efforts. In September 2015, as part of the 2030 Sustainable Development Goals, the United Nations General Assembly adopted a target of halving per capita food waste at the retail and consumer level and reducing food losses along production and supply chains (SDG Target 12.3). The EU and its Member States have committed to meeting this target.

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[106] Council of the European Union, *Draft Council conclusions on Making the Recovery Circular and Green - Approval,* 2020, https://data.consilium.europa.eu/doc/document/ST-13852-2020-INIT/en/pdf.

[107] European Parliament resolution of 27 April 2017 on the EU flagship initiative on the garment sector, https://www.europarl.europa.eu/doceo/document/TA-8-2017-0196_EN.html?redirect.

[108] European Parliament resolution of 10 February 2021 on the New Circular Economy Action Plan, https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html.

Food waste prevention measures in CEAP 2015

The CEAP named food waste as one of four priority areas for action and, in parallel to development of the WFD, envisaged series of non-legislative actions at EU level aimed at supporting the achievement of SDG Target 12.3 on food waste and to maximise the contribution of actors in the food supply chain. The actions were as follows:

- Establishment of the EU Platform on Food Losses and Food Waste, involving Member States and stakeholders in order to support the achievement of the SDG Target 12.3 through the sharing of best practice and the evaluation of progress made over time. The Platform has a status of informal Commission's expert group[109]. The first meeting of the Platform took place in November 2016 and, in 2021, its mandate has been extended until end 2026;
- Adoption of a guidance document clarifying how relevant provisions in EU legislation (e.g., food hygiene, food information to consumers) apply to food donation – EU guidelines on food donation (2017/C 361/01);
- Adoption of a guidance document on the use of former foodstuffs to feed animals – EU guidelines on the feed use of food no longer intended for human consumption (2018/C 133/02);
- Examination of ways of improving the use of date marking by actors in the food chain and its understanding by consumers, in particular the "best before" label. The Commission is currently considering the most efficient ways to facilitate the understanding and use of date marking (i.e., 'best before' and 'use by' dates) aiming to prevent food waste without jeopardising food safety;
- An indicator on the amount of food waste generated has been included in the Circular Economy Monitoring Framework.

Food waste in the WFD

The WFD includes the following regulatory measures:

- Definition (Art 4)
  'food waste' means all food as defined in Article 2 of Regulation (EC) No 178/2002 of the European Parliament and of the Council (3) that has become waste;
- general provisions on prevention including the food use hierarchy (Art 9)
  Member States shall take measures to prevent waste generation. Those measures shall, at least
  (g) reduce the generation of food waste in primary production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services as well as in households as a contribution to the United Nations Sustainable Development Goal to reduce by 50 % the per capita global food waste at the retail and consumer levels and to reduce food losses along production and supply chains by 2030;

[109] https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?lang=en&do=groupDetail.groupDetail&groupID=3189

(h) encourage food donation and other redistribution for human consumption, prioritising human use over animal feed and the reprocessing into non-food products;

- planning (Art 29)
  2a. Member States shall adopt specific food waste prevention programmes within their waste prevention programmes.
- setting up monitoring framework (art 9)
  Member States shall monitor and assess the implementation of their food waste prevention measures by measuring the levels of food waste on the basis of the methodology established by the delegated act (...).
  The data are to be reported every year. The detailed provisions are included in the related secondary legislation:
  - The Delegated Decision establishing a common EU methodology to measure food waste – EU(2019)1957
  - Implementing Decision laying down a format and quality check report for reporting the data on the levels of food waste generated in Member States – EU(2019)2000.

Downstream management of food waste

The collection and treatment of food waste is already well regulated on EU level.

If food waste cannot be prevented, treatment of food waste should be subject to further steps in the waste hierarchy: recycling (e.g. composting, anaerobic digestion with use of digestate) and, to a less extent, energy recovery and disposal (landfilling).

The landfilling of food waste (as part of biodegradable municipal waste) is discouraged since 1999 by virtue of the Landfill Directive. Due to high water content, food waste is not a particularly efficient source of energy during incineration with energy recovery, hence it is only treated this way as part of mixed waste.

Biological treatment is the most effective way of dealing with food waste, allowing the return organic matter and nutrients back to soil. Food waste can be composted directly but can also be subject to anaerobic digestion in order to produce biogas and still use digestate for fertilizing purposes.

In order not to contaminate soil, efforts are made to ensure that recycled food waste is free from contaminants both hazardous (e.g. heavy metals) and non-hazardous (e.g. pieces of plastics or glass). To this end, the WFD introduced the obligation for Member States to introduce separate collection of bio-waste from 31 December 2023 (see Art 22). The compost/digestate which meet quality requirements (so called *end-of-waste criteria*) are regarded as new products and can be freely traded.

The technical criteria of food waste treatment operations are set in the Industrial Emissions Directive (2010/75/EU, to be modified by COM/2022/156 final/3). This Directive also includes best available techniques references documents (BREFs) which set up the conditions for operating of industrial plants, including methods to reduce arising waste. The latest Best

Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries was published in 2019. [110]

The European Parliament has called for the reduction of food waste and advocated setting specific food waste prevention targets: at least 30 % and 50% reductions by 2025 and 2030 respectively. [111, 112, 113, 114] In 2016[115], the Council called on Member States to confirm their commitment to the achievement of SDG 12.3 through a range of initiatives, supported by the European Commission in key areas such as food waste monitoring. Subsequent updates on progress made in Member States were adopted through Council Conclusions in 2018 and 2020[116].

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[110] European Commission, European IPPC Bureau, Food, Drink and Milk Industries, https://eippcb.jrc.ec.europa.eu/reference/food-drink-and-milk-industries.

[111] European Parliament resolution of 19 January 2012 on how to avoid food wastage: strategies for a more efficient food chain in the EU, https://www.europarl.europa.eu/doceo/document/TA-7-2012-0014_EN.html?redirect.

[112] European Parliament resolution of 9 July 2015 on resource efficiency: moving towards a circular economy, https://www.europarl.europa.eu/doceo/document/TA-8-2015-0266_EN.html?redirect.

[113] European Parliament resolution of 15 January 2020 on the European Green Deal, https://www.europarl.europa.eu/doceo/document/TA-9-2020-0005_EN.pdf.

[114] European Parliament resolution of 16 May 2017 on initiative on resource efficiency: reducing food waste, improving food safety, https://www.europarl.europa.eu/doceo/document/TA-8-2017-0207_EN.html?redirect.

[115] Council conclusions on Food losses and food waste, adopted on 28 June 2016 (10730/16).

[116] European Council, *Timeline - Food loss and food waste,* https://www.consilium.europa.eu/en/policies/food-losses-waste/timeline-food-loss-and-food-waste/.

ANNEX 6: FACTS AND FIGURES

1- Textiles

Terminology

As per the Textiles Labelling Regulation, 'textile product' means any raw, semi-worked, worked, semi-manufactured, manufactured, semi-made-up or made-up product which is composed at for least 80% of textile fibres, regardless of the mixing or assembly process employed. Three main categories of textile applications can be discerned:

- Clothing and footwear (trousers, t-shirts, sweaters, coats, footwear, dresses, apparel accessories such as scarves, handkerchiefs, etc.).
- Household textiles (other textiles used in households, curtains, bed linen, carpets, etc.).
- Technical textiles, any textile product manufactured for non-aesthetic purpose, where function is the primary design criterion for industrial applications (automotive applications, medical textiles, agricultural textiles, protective equipment, etc.).

Some textiles are used for household, commercial and industrial applications (e.g., cleaning articles), and available data often does not enable to clearly differentiate between final consumers.

Waste is generated at different stages in the life cycle of textiles, and is defined as:

- Post-industrial waste: Waste generated during the manufacturing of textile products and their precursors.
- Pre-consumer waste: Waste generated at retail stages (e.g., unsold textiles).
- Post-consumer waste: Textiles that have been disposed of after consumption and use by the citizen or end-users of commercial and industrial activities (hotel, hospitals, schools, etc.), commonly referred to household and commercial post-consumer textile waste.

Post-industrial, pre-consumer, and post-consumer (household and commercial) waste, representing an estimated 11%, 3% and 87% respectively[117].

The textile market

The textile market is highly globalised and involves millions of producers and billions of consumers across the world. The global textile market is worth USD 3 trillion, accounts for about 2 % of the world's GDP and employs more than 75 million people, primarily in developing nations[118] [119]. It relies on agriculture for raw materials. The global production of

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[117] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (under development)

[118] Migiro, G., *Top 10 Textile Importing Countries In The World*, WorldAtlas, in Economics, 2020, "https://www.worldatlas.com/articles/top-10-textile-importing-countries-in-the-world.html."https://www.worldatlas.com/articles/top-10-textile-importing-countries-in-the-world.html.

textile fibres (mostly virgin and synthetic[120]) has almost tripled since 1975[121] and doubled from 2000 to 2015. The market contracted during the COVID-19 crisis with the shutdown of retail outlets and disruptions in the logistics sector. However, it made a fundamental contribution to its management by supplying protective and medical equipment (face masks, gowns and nonwoven raw materials for medical use). [122]

The largest producer by value of textiles and clothing exports is China, followed by the European Union. In 2020, manufacturers in Asia-Pacific accounted for almost 50% of the global textile and apparel exports value. The value of Chinese textile exports increased drastically through the COVID-19 pandemic as medical masks and other medical textile products were in high demand worldwide. [123] The labour-intensive clothing and textile industry is highly dependent on the wide availability of cheap labour as the market is highly competitive[124].

The EU textiles, wearing apparel and leather manufacturing market consists of around 226 600 companies in 2021, over 99% of which are SMEs[125], and employed around 1.7 million people[126]. In 2021, the EU textile and clothing sector had a turnover of 191 billion EUR[127].While the industry is an essential part of EU manufacturing, its share of value (in USD) of the global market has been decreasing with the EU exports' share going from 33% in 2000 to 18% in 2020[128]. These are primarily comprised of intermediate textile products, such as technical fibres and high-quality fabrics. This decrease is mainly driven by increasing demand in emerging economies that due to the cost advantages of production is mainly satisfied regionally[129]. The imports into the EU have also decreased in terms of their share of global value (in USD) from 30% in 2000 to 24% in 2020[130].

The European textile sector has undergone a profound transformation over the past two decades. Since 2004, the EU textile sector has increased its productivity by 36%. Mass low value-added production, standard fibres, textiles, and clothing are no longer being produced

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[119] OECD, *Germany supports sustainable textile production,* Development co-operation tips tools insights practices in practice, 20222, HYPERLINK "https://www.oecd.org/development-cooperation-learning/practices/dynamic/dcd-best-practices/89276a44/pdf/germany-supports-sustainable-textile-production.pdf"Germany supports sustainable textile production - OECD.

[120] Ellen MacArthur Foundation (EMF), A New Textiles Economy: Redesigning fashion's future, 2017.

[121] Atkar, A., Pabba, M., Sekhar, S.C., Sridhar S., *Current limitations and challenges in the global textile sector,* Fundam Nat Fibres Text, pp. 741-764, 2021.

[122] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Data on the EU textile ecosystem and its competitiveness : final report, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2873/23948

[123] Statistics on extra-EU trade are calculated as the sum of trade of each of the 27 EU Member States with countries outside the EU.

[124] Scheffer, M.R., 'Shishoo, R. (ed.). The global textile and clothing industry Technological advances and future challenges', *Trends in textile markets and their implications for textile products and processes,* Cambridge: Woodhead Publishing Ltd, 2012, pp. 8– 28.

[125] The European Commission defines SMEs as having less than 250 persons employed. They should also have an annual turnover of up to EUR 50 million, or a balance sheet total of no more than EUR 43 million (Commission Recommendation of 6 May 2003).

[126] Eurostat data set 'Enterprise statistics by size class and NACE Rev.2 activity' (SBS_SC_OVW), combing NACE codes C13, C14 and C15.

[127] Ibidem.

[128] World Trade Statistical Review 2021. Calculations by the Commission services.

[129] World Trade Statistical Review, 2021.

[130] World Trade Statistical Review 2021. Calculations by the Commission services.

in Europe, which has resulted in a reduction in total turnover and employment on the one hand and an improvement in the competitiveness of the industry on the other[131].

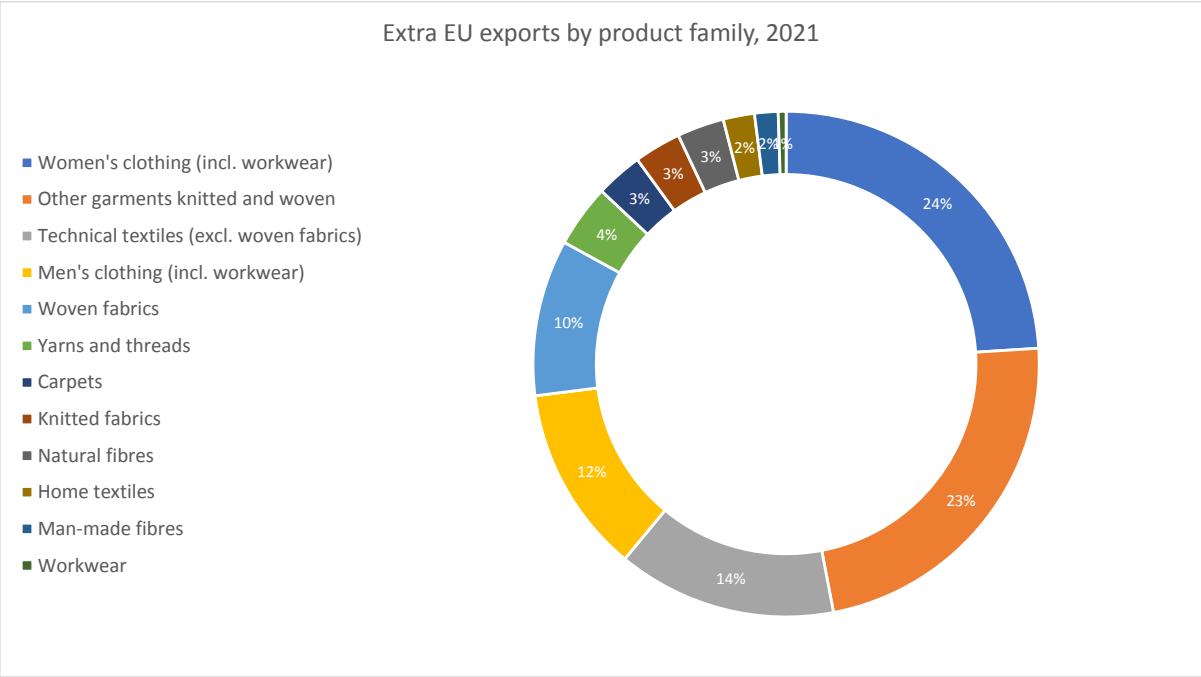
The EU textile ecosystem has seen a recovery during the second quarter of 2021, with a rebound in exports, turnover and retail sales. The textiles turnover increased by 3.3% in Q2 2021. Similarly, the business activity in the clothing sector expanded by 7%. Compared to the pre-pandemic levels, EU turnover is up 3.6% in textiles, whilst it is down 11.5% in clothing[132].

Most production of the textiles consumed in the EU-27 takes place in third countries, mainly in Asia[133]. Consequently, most of the environmental pressures of the European consumption of textiles occur in third countries (see Annex 7. ***Error! Reference source not found.)***.

Textiles are highly globalised, with Europe being a significant importer and exporter.

It has been estimated that in 2019 EU imported 13.5 Mt of fibres, yarns, fabrics and particularly finished products from third countries[134].

According to Euratex, women's clothing and other knitted and woven garments are the main exported textile products from the EU to third countries, accounting for 24% and 23% of total exports from the EU in 2021[135]. The values for all exports by product family presented by Euratex are shown below.



Source: Euratex, 2022

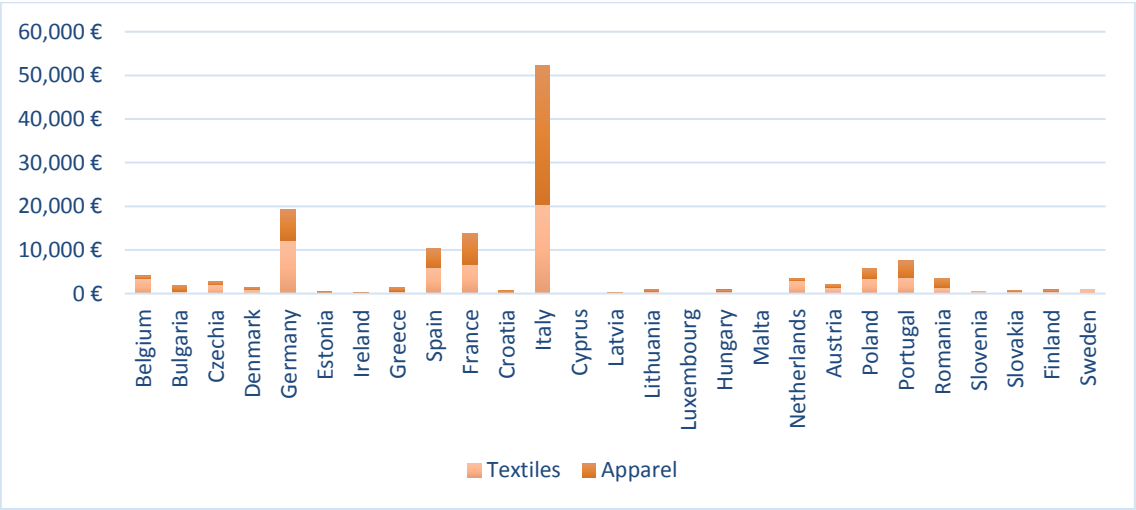
[131] ETP, *Towards a 4th Industrial Revolution of Textiles and Clothing,* Brussels, 2016, 6.
[132] Euratex Economic Update 2Q2021.
[133] Textiles and the environment: the role of design in Europe's circular economy. Available at: https://www.eea.europa.eu/publications/textiles-and-the-environment-the.
[134] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (under development)
[135] Euratex, 2022/ Facts & Figures 2022

Euratex considers that European clothing (i.e. trousers, overcoats, pullovers, skirts and dresses) is the most attractive product category for customers worldwide. Switzerland, the UK, USA and to a lesser extent China are the main destinations of EU textile exports accounting for 46% of total EU textile exports. This is an important consideration in relation to the impacts of possible measures on the costs of EU textile products with the destination markets unlikely to be affected by small increases in product costs due to the high quality products, especially in high-end fashion and technical textiles, that are key facets of the EU textile sector[136] for which consumers in third countries are willing to pay higher prices.

Manufacturing Hubs

The highly competitive and cost-oriented market structure of the EU textiles market plays an essential part in the creation of local jobs and business opportunities with Italy, Germany, France, Spain, Portugal, Poland, Romania, Netherlands, Austria and Belgium representing the most important Member States in terms of textile and apparel production in the EU. Further, textile production is frequently clustered in manufacturing hubs that are concentrated in Italy, Poland, France, Germany, Romania, Sweden and Spain. The industries that compose this ecosystem have a strong territorial component, being organised around clusters and industrial districts and contributing to regional development. The clusters are found in Milano, Biella and Prato (IT), Terrassa, Arnedo and Ontinyent (ES), Zileonki/Krakow (PL), Chemnitz and Frankfurt am Main (DE), Boras (SE), Savinesti (RO), Ecully and Aix-en-Provence (FR)[137]. Southern European States tend to focus on clothing, and technological intensive textile industries are mainly located in Germany, Italy and Austria. The turnover is concentrated in Italy and Germany as their manufacturers are focused on high-end and luxury goods. Italy is specialised on the production of luxury textiles and clothing sold with price premiums resulting in high production values (Figure 9).

Figure 10 – Production value of textile and apparel, 2019 in EUR million



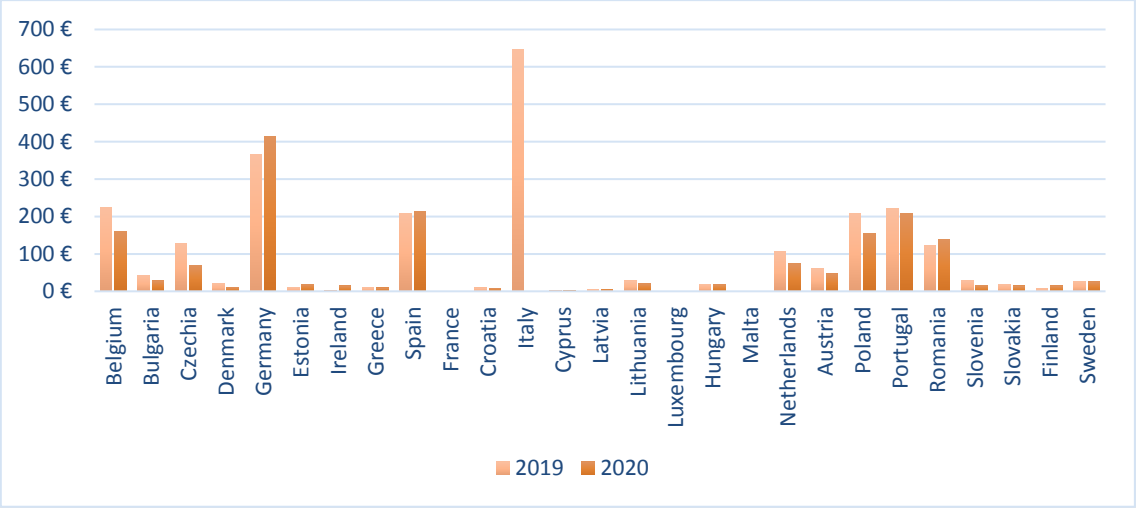
Source: Eurostat. Calculations by the author.

[136] https://single-market-economy.ec.europa.eu/sectors/fashion/textiles-and-clothing-industries/textiles-and-clothing-eu_en

[137] ECCP Visual Reporting Site (clustercollaboration.eu)

The high income stemming from the value of the produced goods also correlates with the gross investments in the textile sector, which is again focused on Germany and Italy (10). As both countries are specialised on producing high-tech fibres and materials high investments are necessary to ensure competitiveness.

Figure 11 – Gross investment of textile manufacturers, 2019 in EUR million



Source: Eurostat. Calculations by the author.

The textiles manufacturing employees are concentrated in Italy, Poland, Romania, Portugal and Germany. Italy employs the largest absolute workforce (320 000 FTEs) while the percentage working in textiles compared to overall FTEs is especially high in Bulgaria (3%), Portugal (2.9%), Lithuania (2%), and Romania (1.9%), predominantly because of cheaper labour and production costs.

The Role of SMEs

SMEs are at the core of the EU industry, representing 99.7% of the 226 600 enterprises as shown in Table 24[138]. The large number of SMEs in the sector has benefits and disadvantages. On one hand, high numbers of enterprises ensure a competitive market, create jobs, especially for women and are essential for local economies. On the other hand, SMEs often lack the necessary investment capacity to ensure competitiveness and have low bargaining power regarding materials. EURATEX representing the European apparel and textile industry, has confirmed that their members' composition is similar to the market's with over 98% SMEs.

Table 24 – Company sizes in the EU textile sector, 2021

Size of Companies (number of employees)	Share (%)
Small and Medium sized Enterprises [0 – 249]	99.7%
Large > 250	0.3%

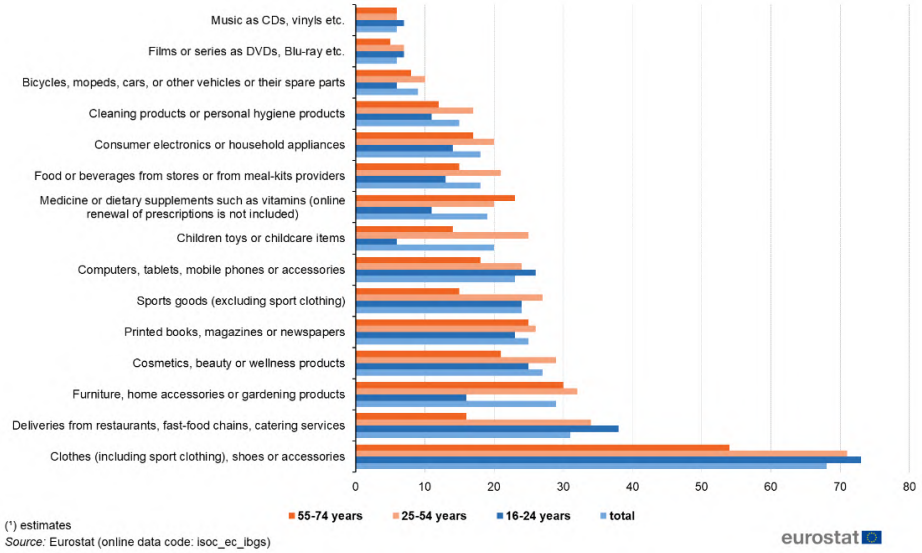
[138] Eurostat data set 'Enterprise statistics by size class and NACE Rev.2 activity' (SBS_SC_OVW), combing NACE codes C13, C14 and C15.

Source: Eurostat. Calculations by the Commission services.

E-commerce

Given the shift in consumer behaviour towards increased digital shopping, the effects of e-commerce on the textiles sector have become increasingly important. Turnover generated by e-sales has more than doubled since 2009 driven mainly by apparel and clothing. Over 70% of young e-buyers bought clothes online, making it the most popular purchase of online goods in the EU in 2021 (Figure 12).

Figure 12 – *Online purchases of goods in the EU, 2021*
(% of individuals who bought or ordered goods or services for private use in the previous 3 months)

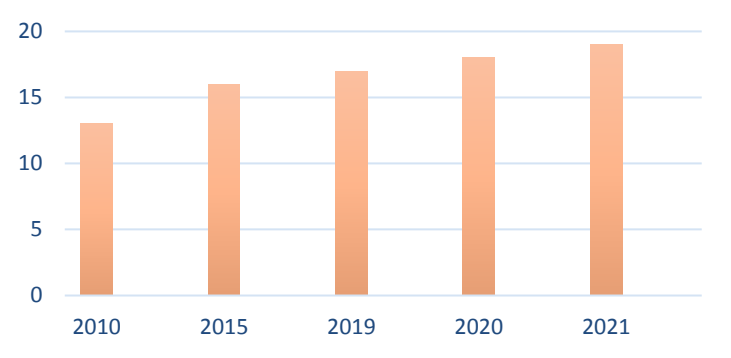


Source: Eurostat. URL: E-commerce statistics for individuals (europa.eu)[139].

This is also reflected in the increase of e-commerce sales in the EU, as shown in Figure 12. This increased demand is primarily driven by young internet users and consumer groups and in parts of the COVID-19 pandemic and the restrictions of in-person shopping[140]. The additional rise of pay-per-use or subscription models will accelerate the shift of the T&A sector to new digital business and consumption models that brings both challenges and opportunities for the industry and policymakers.

Figure 13 – *Enterprises in the EU with e-commerce sales in percentage*

[139] EUROSTAT, E-commerce statistics for individuals, 2022, E-commerce statistics for individuals - Statistics Explained (europa.eu).
[140] EURATEX, 2022, EURATEX Facts & Key Figures of the European Textile and Clothing Industry 2022.

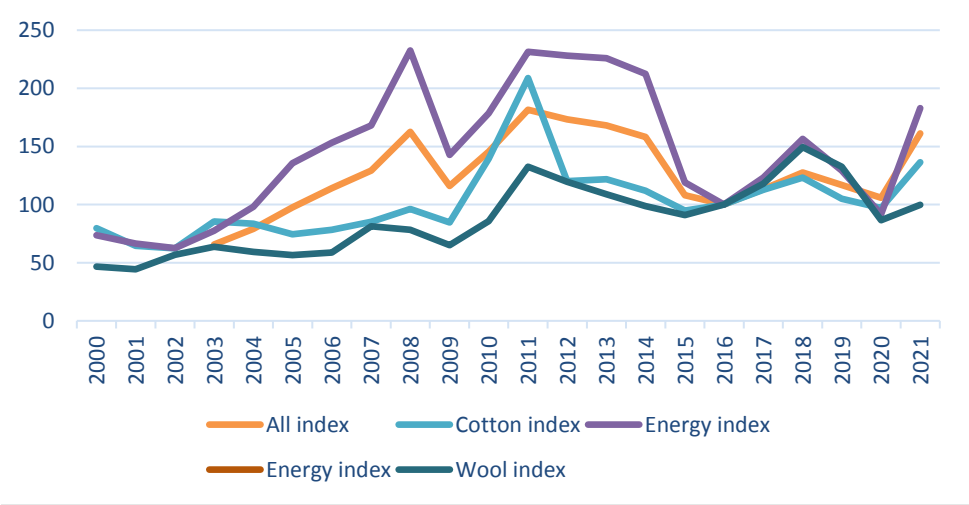


Source: Eurostat. Calculations by the Commission services.

Dependency on raw materials

Raw materials are the major cost component in manufacturing process and make manufacturers dependent on imports of cotton, wool, raw silk and energy. [141] As Figure 14 shows, the overall commodity prices are fluctuating, but overall – especially energy prices and prices of certain raw materials like wool, have seen price spikes.

Figure 14 – *Primary commodity prices (2016 = 100)* [142]



Source: IMF. URL: Source: Primary Commodity Price System – IMF Data.

According to the EEA, most of the pressures and impacts related to the consumption of clothing, footwear and household textiles in Europe occur in other regions of the world.

This is the case for 80% of the primary raw materials use, 88% of the water use, 92 % of the land use and 73 % of the greenhouse gas emissions in the production of the textiles and footwear consumed in EU-27 in 2020[143]. This highlights the importance of recycling and implementing circular business models that will reduce import dependencies and lower the use of new materials with its negative environmental consequences.

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[141] See footnote 109, p. 78.

[142] Benchmark prices are representative of the global market and determined by the largest import markets of a given commodity.

[143] Textiles and the environment: the role of design in Europe's circular economy. Available at: https://www.eea.europa.eu/publications/textiles-and-the-environment-the.

Textile reporting

There are a number of reporting obligations for Member States in relation to waste (or textile waste) as listed below.

- Regulation (EC) No 2150/2002[144] on waste statistics that addresses the gathering of regular and comparable data on waste statistics that are transmitted to Eurostat reporting on waste generation as well as recovery and disposal by waste category, economic activity and waste management operation (Waste Statistics Regulation).
- The WFD requires reporting by Member States on prevention of waste by monitoring reuse (Article 9 (4)), and on the attainment of targets of preparation for reuse and recycling for municipal wastes (Articles 11 (2) (a), (c), (d) and (e), and Article 11 (3)), as specified under Article 37. The WFD has been supplemented by the following Commission Implementing Decisions:
  - Commission Implementing Decision 2019/1004 that specifies how to calculate municipal waste prepared for reuse, recycled municipal waste, recycled municipal bio-waste and recycled metals separated after incineration of municipal waste.
  - Commission Implementing Decision 2019/1885 that specifies how to calculate municipal waste reported as landfilled.
  - Commission Implementing Decision 2021/19[145] laying down a common methodology and a format for reporting on reuse.
  - Commission Implementing Decision 2011/753/EU (until 2025) that specifies how to calculate municipal waste and construction and demolition waste.

Two problems arise with these reporting data: (i) there is no consistent and generally applicable definition of "textile waste" laid down in EU legislation, and (ii) Member States are free to decide on the data collection methods (e.g., surveys, administrative sources, statistical estimations or some combination of methods). This leads to inconsistencies and incomplete datasets on textile waste. This is explained in more detail in Annex 7.

Consumption trends

All the evidence shows that volumes of textile consumption and waste generation are increasing. Global textiles production almost doubled between 2000 and 2015, and the consumption of clothing and footwear is expected to increase by 63% by 2030 compared to 2019, from 62 million tonnes now to 102 million tonnes in 2030.

'Fast fashion' is characterised by increased number of collections per year and often replicates new higher end fashion trends. Where brands once had two fashion seasons a year, many now produce 52 micro-seasons, flooding the market with new styles[146]. This **leads to making textiles and accessories with low labour costs to achieve low prices for new products**. These low prices do not consider the environmental externalities of the textile ecosystem[147]. The low prices are an incentive for customers to replace or increase the clothes

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[144] Regulation (EC) No 2150/2002 on waste statistics *(OJ L 332, 9.12.2002, p. 1–36)*, EUR-Lex - 32002R2150 - EN - EUR-Lex (europa.eu).

[145] Commission Implementing Decision (EU) 2021/19 of 18 December 2020 laying down a common methodology and a format for reporting on reuse in accordance with Directive 2008/98/EC of the European Parliament and of the Council (notified under document C(2020) 8976) *(OJ C(2020) 8976)*, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021D0019.

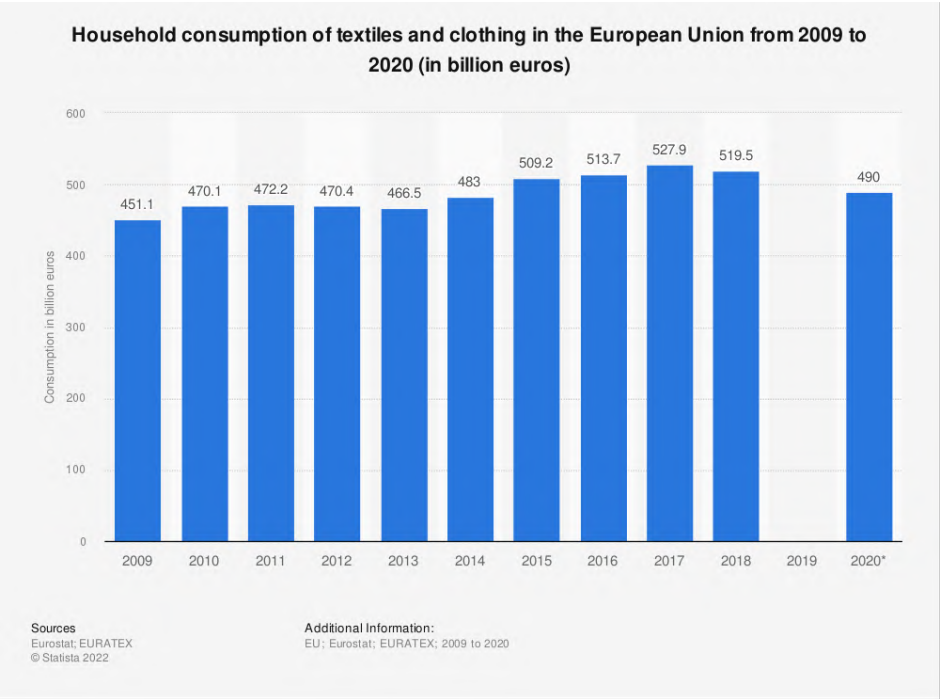
[146] Lai, O., *What is fast fashion,* Earth.org, 2021, https://earth.org/what-is-fast-fashion.

[147] Stakeholder workshop.

they purchase[148]. Consumers replace goods much more rapidly than in the past, not only for functional reasons but also for fashion and novelty. This results in more intensive disposal of textile products as their reuse and recycling potential reduces due to their lower quality[149].

Practices by industry and retailers like instore collection with discount coupon in exchange of take-back, green/sustainable or recycled collections (ex. Use of recycling fibre from pet bottles instead of recycled textiles) lead to even more consumption[150]. The Covid-19 pandemic has led to a decrease in the consumed textile goods, negatively affecting the sector. Statista data on consumption of textiles and clothing in euro in Figure 14 below shows that spending increased by about 15% from 2009 to 2018[151]. In combination with the fact that the price of clothes has fallen relative to inflation, this means that quantities consumed are increasing[152].

Figure 15 – *Household consumption of textiles and clothing, billion tonnes, 2009-2020*



The **increasing consumption of textile in the EU leads to increasing volumes of textile waste.** However, there are highly variable quantitative estimates on textile consumption and textile waste generation between countries in the EU, depending on the data source and on what is included in the scope of textiles.

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[148] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

[149] ABC News, 2021, Dead white man's clothes: How fast fashion is turning parts of Ghana into toxic landfill - ABC News

[150] Stakeholder workshop

[151] STATISTA, *Household consumption of textiles and clothing in the European Union from 2009 to 2020,* 2022, Textile & clothing EU household consumption 2009-2020 | Statista.

[152] See footnote 83, p. 72.

Textile flows in the EU for the 2019 reference year (baseline)

Since the publication of the 2019 EEA study and the emphasis of textiles as one of the key products associated to a high environmental footprint, different studies have further explored the textile mass flows in the EU. Due to differences in the scope of these studies in terms of textile products covered, reference years, data sources used, and geographical scope, reported study outcomes vary somewhat in their absolute numbers presented. This report presents the results of an ongoing JRC study[153]. For that further builds upon the previous studies and brings forward results and conclusions that are largely aligned to previous works, particularly in terms of relevant conclusions and take-away messages reasons of simplifications, averages or reasonably small confidence ranges have been presented in the document, acknowledging uncertainties for specific flows.

At the JRC analysis, 'textiles' is defined as apparel and home textiles (e.g. bedlinen, towels, tablecloths, curtains etc.) consumed by households, and similar products consumed by government and business (e.g. uniforms and workwear used by all public and private sectors, bedlinen and towels etc. consumed by hotels, restaurants, healthcare services etc.) as well as footwear and technical textiles (such as truck covers). It excludes products for which textiles are not the dominant component (e.g. upholstery textiles, carpets mainly made of plastics, duvets, pillows) and leather.

Textile production

The JRC estimates[154] the apparent consumption of textiles[155] for the reference year 2019 to be around 12 Mt[156], composed of the flow coming from the net production of finished textiles (3.0 Mt) and from imported textiles (9.0 Mt). This flow includes the production of all textiles, including apparel, household textiles, and textiles used for technical and industrial applications.

Intra-EU movements of textile goods

As a producer and importer of textiles from third countries the EU overall undertakes a significant amount of intra-EU movements of textiles and textile products. This, in turn, frequently means that producers of textiles and textile products in one Member State will ship those products to one or more other Member States. This reflects the somewhat fragmented supply chain for such goods but also the fact that textile goods are generally traded over national borders.

The figure below looks at intra-EU movements of a selection of textiles in 2019 as well as in 2021 (given that this was the most recent data available at the time of conducting the assessment) using data from Eurostat[157].

Figure 16 Reported movements of textile goods within the EU in 2019 and 2021 in tonnes

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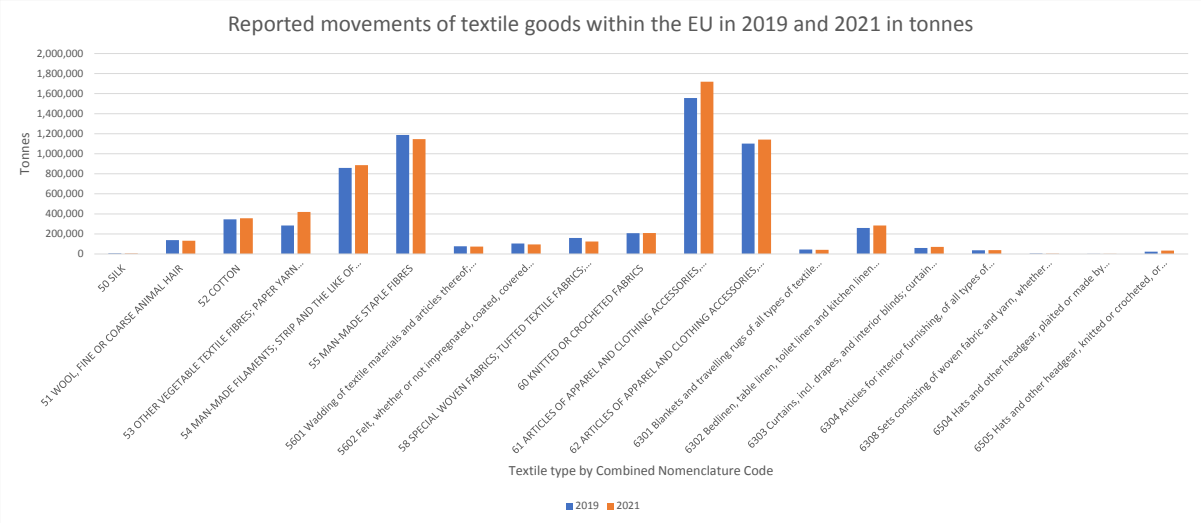
[153] Joint Research Centre. 2023. "*Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets*" (unpublished work)

[154] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work)

[155] Import of finished textiles + finished textiles produced in the EU – finished textiles produced in the EU that are exported.

[156] Flows are represented as tonnes, and refer to annual mass units

[157] EU trade since 1988 by HS2-4-6 and CN8 (DS-045409)



In total 6.45 million tonnes of textiles goods moved within the EU in 2019 increasing to 6.79 million tonnes in 2021. Of that total Articles of clothing and apparel represent 41% of movements in 2019 (2.66 million tonnes) and 42% in 2021 (2.86 million tonnes) of all goods that moved between one Member State and another and man-made filaments and fibres accounting for 31% in 2019 (2.05 million tonnes) and 30% in 2021 (2.03 million tonnes) of such movements. The remaining product types account for 6% or less of all movements in both years. This cross-border movement is an important consideration in both the challenges that exist in relation to textile waste management as well as the possible measures that may address such waste management in terms of consistency of approaches between Member States.

Generation of textile waste

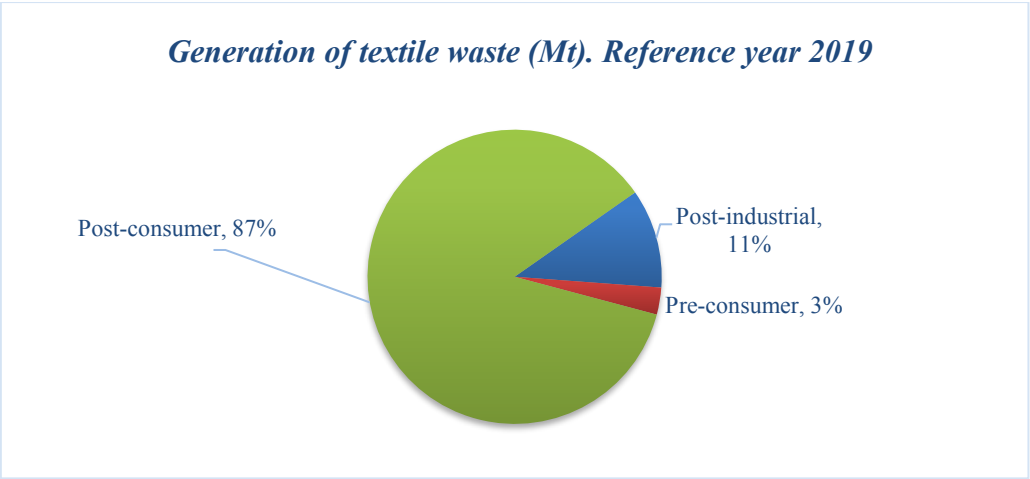
Summary overview

For 2019, **textile waste generated** in EU is estimated at **12.6 Mt**[158], including fractions that are discarded during textile production (post-industrial waste), discarded at the retail stage (pre-consumer waste), deposited and discarded by households and commercial entities (post-consumer waste). Post-production and pre-consumer waste are estimated to be a relatively small share of the total textile waste (~11% and 3% respectively). **Post-consumer textiles waste generated** amounted to **10.9 Mt** (87% of total waste generated) but only clothing and household textiles as well as footwear in some Member States are covered by the collection systems in Member States. This is a preliminary estimation and that may change as the JRC work progresses[159]

Figure 17. Generation of textile waste in the EU at different stages of textile life cycle.

[158] Flows are represented as tonnes, and refer to annual mass units

[159] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (not published)



Around 8.5 million tonnes of waste generated is currently being disposed.

Post-production waste and pre-consumer textile waste

Data for production plants located outside the EU indicate that the total amount of residues generated during the manufacturing processes (post-production waste) of textiles is estimated at 41%, where 8%, 13% and 20% are attributed to the production of yarns, fabrics and finished textiles productions, respectively[160]. The manufacturing of other textile articles (e.g., non-wovens, and certain household textiles) is likely associated to lower post-production losses. Limited data on residue generated from plants located in the EU is available, and the shares indicated above could be overestimated due to greater inefficiencies at plants located outside the EU. In addition, not all post-production residues are waste and can be reused or recycled. Some residues are already recycled on-site or used as input materials for other production processes and can therefore classify as a by-product (e.g., as stuffing or insulation material, following mechanical treatment). Based on a limited data set reported by EU plants, it is indicated that solid waste generation from the finishing of textiles is lower in the EU compared to the number reported above[161]. In line with these observations, actual post-production waste going to landfill and/or incineration has been estimated at 10% of the total textile production in the EU, or at about 0.6 million tonnes (Mt) per year.

JRC estimates the post-industrial waste flow in EU at 1.34 Mt for the reference year 2019, accounting for 11% of all textile waste generated[162].

Pre-consumer waste generated at the retail stage (e.g., unsellable overstock of producers, brands, distributors, or retailers) is estimated at 0.33 Mt per year (3% of the textile waste generated). The exact fate of this fractions remains unknown, but likely involves disposal as a

[160] Sadowski, M. I. C. H. A. E. L., L. E. W. I. S. Perkins, and E. M. I. L. Y. Mcgarvey. "Roadmap to net zero: delivering science-based targets in the apparel sector." World Resources Institute. https://doi.org/10.46830/wriwp 20 (2021).
[161] European Commission. 2022. Best Available Techniques (BAT) Reference Document for the Textiles Industry. Pages 311-318.
[162] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets". (unpublished work).

main route[163]. To improve the available information, the Commission proposed a transparency obligation under the revision of the Ecodesign for Sustainable Products Regulation[164] for companies to disclose the number of products they discard and destroy, including textiles and their further treatment in terms of preparing for reuse, recycling, incineration or landfilling. No similar provisions exist for post-industrial waste. According to McKinsey brands and retailers generally collect their overstock with around 70 percent of overstock expected to be retained to be sold at a lower price either by the original retailer or a professional counterpart in Europe i.e., through a discount store. The share of retail volumes that is relevant for textile recycling is only the volumes that are truly unsellable due to defects that is estimated to be between 3 and 5 percent of total pre-consumer volumes[165].

The DG GROW study[166] indicates that, in comparison to post-consumer waste pre-consumer and post-industrial waste is likely to consist of a smaller variety of fibre types and material blends with the identification of the material composition simpler in relation to post-consumer waste Additionally, post-industrial and pre-consumer textile wastes are generally not contaminated by soiling and are less likely to contain disruptors such as buttons and zips. This means that the waste materials generated are more suitable for recycling than post-consumer textiles and that is why some recycling technologies limit themselves to processing these wastes or pre-consumer textile waste streams[167]. This makes these types of waste a valuable input to supporting the development of recycling infrastructure across the EU.

Post-consumer textile waste

When discounting pre-consumer waste, JRC report[168] estimates the apparent consumption for 2019 at 11.7 Mt. Based on historic data of apparent textile consumption and expected lifespan of the textile products that make up the consumption, it is estimated that 0.6 Mt are stored by consumers, leading to a post-consumer textile waste flow of 10.9 Mt tonnes generated in 2019. An uncertainty range of 10.2-11.5 Mt is associated with these flows due to the variations in textile lifespans.

The post-consumer waste is estimated to consist mostly of clothing, footwear, and household textiles, with lower shares of technical textiles and articles that have multiple uses (e.g., non-wovens).

Table 25 –Estimated composition of flows at category and subcategory level of the estimated post-consumer textile waste

Category	**Subcategory**	**Post-consumer waste**

[163] Hedda Roberts, Leonidas Milios, Oksana Mont, Carl Dalhammar. 2023. Product destruction: Exploring unsustainable production-consumption systems and appropriate policy responses, Sustainable Production and Consumption, 35, 300-312.
[164] See footnote 32
[165] See footnote 46, p. 47.
[166] See footnote 7
[167] Elander, M., *Automated feeding equipment for textile waste: experiences from the FITS-project*, Mistra Future Fashion, 2019.
[168] Joint Research Centre (2023). "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work).

		Category share	Subcategory share
Clothing and footwear	Jackets and coats	48.2%	9.7%
	Sweaters and midlayers		7.6%
	Pants and shorts		6.4%
	T-shirts		4.8%
	Closed-toed shoes		4.6%
	Apparel accessories		3.4%
	Shirts and blouses		3.1%
	Leggings, stockings, tights and socks		2.8%
	Dresses, skirts and jumpsuits		2.2%
	Boots		2.0%
	Underwear		0.9%
	Swimwear		0.8%
Home textiles	Carpets	15.7%	7.2%
	Bedding		4.3%
	Toilet and kitchen linen and towels		1.8%
	Curtains		0.9%
	Blankets		0.6%
	Table linen		0.4%
	Furnishing		0.2%
	Other personal care		0.1%
	Sleeping bags		0.0%
Technical textiles households	Non-woven articles	20.8%	7.8%
	Cleaning articles		7.0%
	Sacks and bags		6.0%
Technical textiles professional use	Non-wove articles	15.1%	7.5%
	Mixed technical articles		3.5%
	Cleaning articles		2.6%
	Workwear and protective clothing		0.9%
	Carpets		0.5%
Total		**100%**	

Separate collection schemes for textiles

Separate collection of textile waste in the EU

Summary overview

Separate collection systems for textiles vary from country to country but also regionally and even locally between cities. They mainly target post-consumer clothing and household textiles and avoided the other categories of textiles.

It is estimated that, at present, **an average of 57%** of the total amount **of the post-consumer textile waste generated** (~6.2 Mt) are **covered under the established collection schemes** of Member States, and around **38% of the textile wastes subject to separate collection schemes are effectively collected in EU.**

A significant share of the post-consumer textile waste generated in the EU, including textiles that have applications in households and industry (e.g., woven cleaning articles, non-wovens), **is not separately collected (~78%, or ~ 8.5 Mt**[169]). Together with supplementary fractions of post-production and pre-consumer waste, > 9.7 Mt textile waste are being disposed of, through incineration (58%, >5.6 Mt) or landfilling (42%, >4 Mt) in EU[170].

Separate collection systems for post-industrial, pre-consumer and post-consumer textile waste.

Separate collection of textiles is different to many other waste streams because the textiles have a very high reuse potential and environmental benefit and therefore same collection and subsequent sorting systems are used for reuse and recycling purposes.

Their best method of treatment against the waste hierarchy (that is the reusability and recyclability of material collected) can only effectively be assessed after collection, at the sorting stage, either through manual or automatised sorting. The primary driver for single collection points is emphasised by studies that have shown that consumers are not able to determine whether a textile is suitable for reuse or not, which leads to reusable textile being discarded as waste and non-reusable textile to be considered as reusable, requiring additional sorting by professionals.

The different ways of management for post-consumer household textiles waste encompass reuse by informal C2C channels (donating, exchanging or selling the clothes to someone else physically or through online platforms) or through C2B channels (charities, social enterprises or businesses active in the reuse sector), deposit at separate collection points or disposal in the mixed fraction of municipal waste. The collection of post-consumer household textiles engages municipalities, social and commercial enterprises.

Post-industrial, pre-consumer and post-consumer commercial textiles waste is typically collected by waste collectors based on commercial contracts. These types of wastes that are

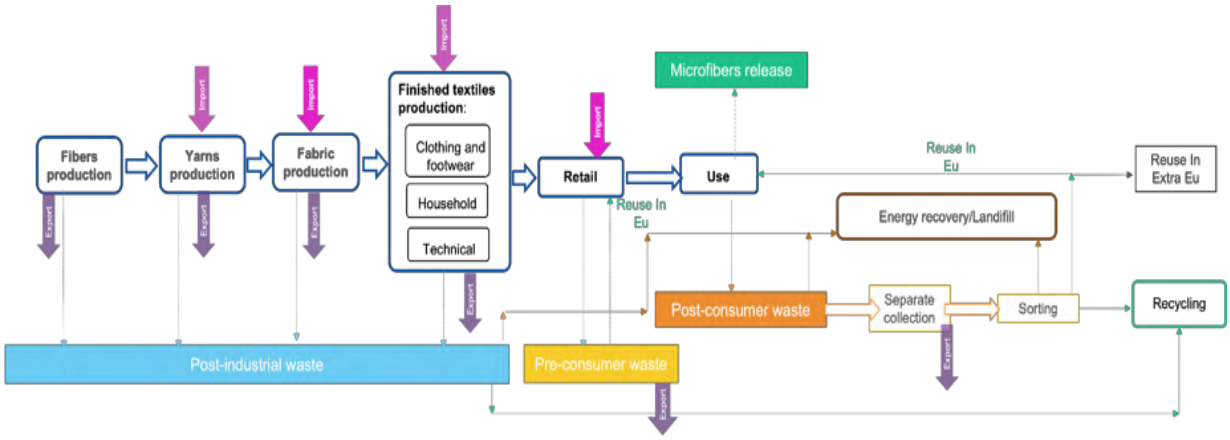
[169] Flows are represented as tonnes, and refer to annual mass units.

[170] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work).

generally excluded from the household separate collection schemes defined by Member States. They account for 15-30% of textile waste generated but address a complex value chain consisting of many production stages and involving many companies spread across the globe.[171],[172] (see *Figure 18. Overview of the textile ecosystem*)

Separate collection systems for textiles vary from country to country but also regionally and even locally between cities. The factors of these differences between geographical areas are mainly: cultural differences, policy measures, intensity of charities activities and density of collection points. How Member States classify and manage post-industrial, pre-consumer and post-consumer commercial textile waste under national law is unclear under national provisions. Additionally, the obligations under the existing WFD and how they apply to these three categories of wastes appears to be subject to disagreement by Member States who have mainly targeted post-consumer clothing and household textiles and avoided the other categories of textiles.

Figure 18. Overview of the textile ecosystem



Source: JRC (2023)

Scope of separate collection schemes for post-consumer textile waste in the EU Member States

Several Member States collect post-consumer textiles waste separately.

Member States were asked about the scope of textiles addressed within their implementation of the WFD. Information was available for 11 Member States and is summarised in *Table* 26.

Based on the information collected from Member States, most collection schemes focus on the collection of small textile items from households. Many have a scope of textiles that covers clothing and household textiles with professional textiles covered in Greece. Several Member States include shoes in this scope of textiles and one Member State includes carpets and textile floor coverings. For the remaining Member States for which information is not,

[171] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144
[172] See footnote 46, p. 47.

the picture is unclear albeit in the two stakeholder workshops that considered the scope of textiles the focus of discussions tended to be in relation to clothing and, to a lesser extent, other household textiles.

Additional to textiles, leather clothing and apparel are frequently collected alongside textile goods. However, leather goods themselves are not textiles and are not addressed in the textile labelling Regulation.

Two important product categories containing for textiles recycling are mattresses and carpets.

Up to 30 million mattresses reach their end of life in the EU each year and given the average mattress weight of 20kg that means that up to 600 000 tonnes of mattress waste is generated across the EU per year. Of that, according to the JRC, about 25% is a textile component amounting to about 150 000 tonnes per year. In addition, there are an estimated 1.6 million tonnes of carpets that are disposed of in the EU annually.

Mattresses, carpets and other similar bulky materials (~10-15% of the total waste) containing textiles are typically collected kerbside or in civic amenity sites.

Member States have generally not addressed mattresses as textile waste for the purpose of their textile waste management schemes. They are rather classified as furniture/bulky waste. For mattresses, scoping studies are being done by Greece and Croatia while BE and FR already apply EPR to mattresses. However, it is apparent that the method of collection and recycling of mattresses, as well as other bulky complex products containing fractions of textiles (e.g., furniture) varies from that applied to other textiles including post-industrial, pre-consumer and post-consumer commercial textile waste, clothing, household textiles or similar as well as shoes.

Rugs and floor covers are a broad category that includes both floor covers generally collected and treated as part of construction and demolition waste and commercial waste and rugs that are collected as bulky waste or manages as commercial waste as well as small rugs (e.g., bathmats similar to towels) that may likely be disposed of by citizens as part of the household linens. Information provided by the NL authorities, with the NL being one of the largest producers of carpets, made clear that carpets are excluded from national textile waste management systems because they are considered to belong to a completely different sector both at the front of the chain (production and sales) and at the back (collection, sorting, recycling). Carpet does not go into textile bins, is not handled by textile sorters and is not addressed in the Dutch textiles monitoring and reporting.

Textiles such as tents and awnings as well as umbrellas appear to be excluded from the scope of textiles for all Member States. As is the case with mattresses, Member States have generally not addressed carpets as textile waste for the purpose of their textile waste management schemes.

Table 26 – Scope of separate collection schemes in the EU Member States, 2022

Member State	**Scope of textiles**

BE	Flanders: Clothing and accessories (belts, bags, shoes per pair) – Bedding (pillows, sleeping bags, sheets, blankets and duvets) – Kitchen and bathroom textiles – Home textiles (tablecloths, curtains, seat covers) – Cuddlies – Clean rags, textiles with small defects. Brussels: clothing, household textile, footwear, bedlinen, towels.
BG	EPR: textile and footwear.
CZ	Clothing, household textile, footwear
DE	Separate collection: clothing, household textiles and footwear
DK	Separate collection on textile waste: clothing and other household textile waste that is not suitable for reuse. Footwear is not included.
EL	Clothing, household textiles, professional clothing and textiles. Also, an EPR for mattresses under study.
FI	Clothing, textiles
FR	Clothing, household textiles and footwear
HR	Clothing, household textile, professional clothing and textiles. Also, an EPR for mattresses under study.
HU	Currently: clothing, shoes. Planned EPR: clothing, household textiles, curtains, carpets and textile floor coverings.
NL	Clothing, household textiles, shoes. EPR: clothing

It is estimated that, at present, **an average of 57% of the total amount of the post-consumer textile waste generated** (~6.2 Mt) consist of small items from households that **are covered under the established collection schemes of Member States** (clothes, footwear, household textiles, plus some additional shares of non-woven textiles and cleaning articles) [173]

Separate collection rates for textile wastes in the EU-Member States

It has been calculated that **an average of 38%[174]-39% of the textile wastes subject to separate collection schemes are effectively collected in EU**.

The collection rates vary widely across the EU with some Member States collecting a significant share of textile waste (for example DE collects approximately 62% of all textile waste generated with SE (62%), BE (55%), FI (47%), NL (46%), DK (42%) and FR (39%) also showing good rates of collection) and others collecting small proportions (LV, SI and SK currently collect only approximately 12% of textile wastes). In addition, also a large share

[173] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (under development

[174] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work).

of the technical textiles is separately collected, though these actions may involve using a different collection scheme. Based on these numbers, that is effectively collected is estimated at about 2.0-2.4 million tonnes[175].

According to information collected from the JRC, McKinsey & Company, Member State reports and a specific questionnaire table sent to Member States as part of this study, separate collection of clothing and household textiles currently stands as specified in the table below.

Table 27 – Textile waste generation and collection in Member States, tonnes and collection rate

Note: only textile waste that is commonly subject to separate collection schemes have been considered into "waste generation" to calculate the share of collection.

Member State	Waste generation (tonnes)	Waste collected (tonnes)	Waste collection percentage
AT	146 000	43 120	30%
BE	213 000	116 100	55%
BG	33 000	6 000	18%
CY	3 000	600	20%
CZ	78 000	14 100	18%
DE	1 267 000	784 640	62%
DK	85 460	36 000	42%
EE	22 400	3 900	17%
EL	98 000	17 850	18%
ES	451 000	95 160	21%
FI	85 500	40 000	47%
FR	517 000	204 000	39%
HR	53 000	10 200	19%
HU	79 000	14 400	18%
IE	167 500	57 500	34%
IT	615 000	242 200	39%
LT	45 000	14 000	31%
LU	4 000	1 000	25%
LV	20 000	2 400	12%
MT	2 000	750	38%
NL	305 100	136 100	45%
PL	362 000	65 700	18%
PT	144 000	20 880	15%
RO	149 000	27 000	18%
SE	62 000	38 300	62%
SI	14 000	1 700	12%
SK	44 000	5 300	12%
Total	5 064 960	1 998 900	39%

[175] Joint Research Centre. 2023. "*Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets*" (unpublished work)

Collection methods for post-consumer textile waste in the EU-Member States

The different collection methods for post-consumer textiles include the following[176]:

- **Bring banks:** citizens bring textiles to containers in streets, in residential or office/public buildings or at civic amenity sites. The main actors involved in bring banks are citizens, charities and waste collection companies.
- **Deposit directly in charity premises** (drop-off): citizens bring textiles directly to charity premises (shops or sorting centres (often a first screening is done, and only reusable textiles are accepted). The main actors are citizens and charities.
- **Deposit directly in stores** (retailer drop-off): citizens bring textiles (typically of all brands) directly to retailer shops that have this type of scheme. The main actors are citizens and retailers.
- **Door-to-door collection**: some charities collect textiles directly from citizens' homes. The main actors are citizens and charities.
- **Brand mail-back**: consumers send their textiles (of that brand) back to brands by mail. The main actors are citizens and retailers.
- **Kerbside collection**: households separate out textiles and deposit it at the kerbside.
- **Mixed municipal waste**: non-reusable textile wastes are typically collected by municipal actors in mixed municipal waste that is frequently incinerated or landfilled. Separate collection for the sole purpose of recycling is undertaken in no Member State according to the information identified as part of this study.

Collection via bring banks is reported to be the dominant form of used textile collection in all countries with data. Kerbside collection is significantly less prevalent, in part due to higher costs but also due to risk of theft[177].

Different actors are responsible for the separate collection:

- **Municipalities and public or privately owned waste management companies** began to collect textile waste separately in recent years.
- **Charities** have carried out used textile collection for decades, typically sorting and selling them. Any surplus that the operations of charities generate, often goes to a specific non-profit-making purposes, in EU or abroad.
- **Commercial collectors** (social reuse organisations, second-hand shops and retailers, etc.) can collect used textile with the economic objective of reselling them. In the case of social enterprises, the surplus that the operations of charities generate goes to non-profit-making purposes like social integration or training.
- **Clothing brands or retailers:** can ask their customers to bring back, by mail or directly to shops their unwanted textiles (especially clothes) in return for a discount.

Data on the breakdown of textiles collected by actor is limited within the EU. In all countries with mapping studies, the major share of used textile collection is currently carried out by charitable and commercial collectors. In Denmark, Finland, Latvia and Sweden, the collection is dominated by charitable organisations. In Lithuania, commercial collectors are

[176] See footnote 108, p. 78.
[177] EcoTLC, *Annual Report 2018*, 2019.

responsible for 54 % of collection.[178] In France, Germany and the Netherlands, commercial collectors also have a reportedly high share of the market, though there are no concrete figures on how big this share is.[179] Municipal waste companies play an increasing role in used textile collection in many countries. In Estonia, due to legal obligations, municipalities carry out 37 % of all collection, and in Lithuania they have a 30 % share.[180] Collection by municipal waste companies in Denmark, Netherlands and Sweden are thought to be lower. In Denmark for example municipalities had a share of 5 % in all collection in 2017, but this is increasing over time.[181]

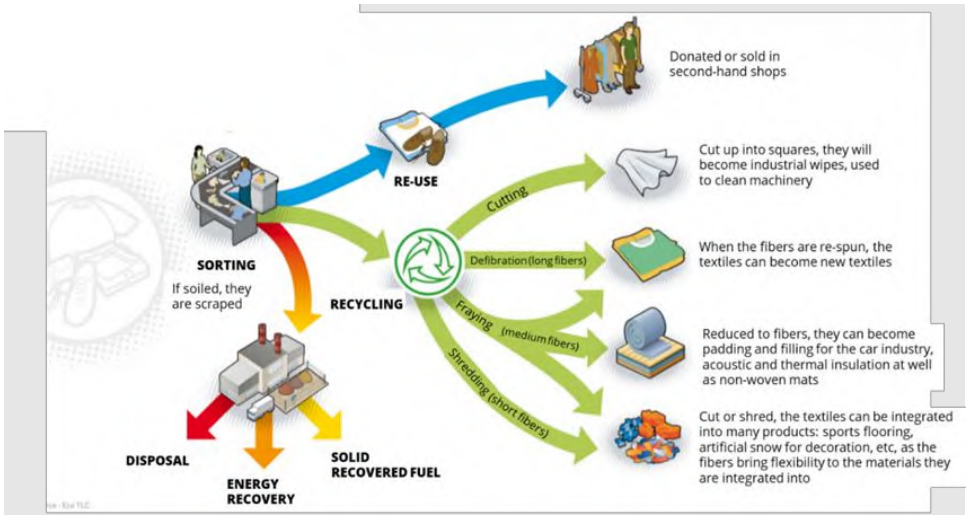
Separate collection schemes of clothing and household textiles have existed for many years for reusable used textiles with charities initially running second-hand shops to provide the poor with affordable clothes (for example, the salvation army in the 19th century[182]). While the end-of-life management of textile waste is not currently addressed by specific EU legislation, a small number Member States have established their own national regulations with regards to the management of used and waste textiles, placing physical and financial responsibility on manufacturers and distributors to collect and process textile waste and reduce the share of textile waste sent to incineration or landfill. The regulation of charitable organisations is not of the same nature – it does not oblige charities to collected textiles but rather takes the form of registration of charities to enable them to operate within a particular territory. There is a wide variety of practices in the EU depending on the existence (or not) of an EPR scheme, on legal requirements for separate collection of textile waste or on its voluntary practice.

Sorting of separately collected waste in the EU

Sorting is the process that immediately follows the separate collection of used textiles and textile waste.[183] Collected textiles are transported to sorting facilities, often crossing country borders. **Textiles need to be sorted after collection to separate the reusable and the recyclable fractions**.

Figure 19 – Textiles sorting process

[178] Watson, D., Kant Hvass, K., Moora, H., Martin, K.; Nausėdė, V., Gurauskiene, I., & Akule, D., *Textile circularity in the Baltic countries: current status and recommendations for the future,* Nordic Council of Ministers TemaNord Report, 2020b.
[179] Watson, D., Trzepacz, S., Kiørboe, N., Elander, M., Ljungkvist Nordin, H., Lander Svendsen, N., & Wittus Skottfelt, S, *Towards 2025: Separate Collection and Treatment of Used Textiles in 6 EU countries*, 2020a.
[180] Watson, D., Kant Hvass, K., Moora, H., Martin, K.; Nausėdė, V., Gurauskiene, I., & Akule, D, 2020b.
[181] Watson, D., Aare, A. K., Trzepacz, S. and Dahl Petersen, C., *Used Textile Collection in European Cities,* Study commissioned by Rijkswaterstaat under the European Clothing Action Plan (ECAP), 2018a.
[182] https://www.salvationarmytrading.org.uk/about/our-history.
[183] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144



Source: Refashion, 2022[184]

The reusable part is sorted into suitable for the EU market versus for the global market. In addition, the recyclable fractions need to be separated in terms of composition for different types of recycling and non-textile pieces such as zippers, need to be removed according to the relevant input requirements of the specific recycling technology to be used. The sorting facilities are typically owned by social enterprises of private companies and the sorted textiles are sold in bales. Data on exactly what is being sorted and the volumes that are sorted, is not available across the EU, which is partially due to the fragmented nature of the textile sorting market in the EU. McKinsey reports in fact that around 40 to 50 percent of textile sorting is done by small companies who process less than 25 000 tonnes annually[185].There is significant uncertainty in relation to the sorting capacity of separately collected textiles within the EU – even more so than in relation to collection rates. Estimates based on reported data by Member States and the JRC study[186] point to **a sorting capacity of about 1.8 Mt**. However, data collected directly from Member States is deemed more reliable than a value that indicates an EU sorting capacity at 100% of collected, which would not explain why textiles are being exported unsorted.

This implies that **a significant share of the separately collected textiles (~0.5-1.0 Mt) is exported as unsorted textile waste**. The actual level of sorting of this material remains unknown.

Following sorting, the majority is **reused in EU (8%) and outside the EU (38%). Of the sorted separately collected waste, 32% is converted into low value products** such as wipers/cleaning cloth/insulation materials by means of mechanical recycling**; 7% is incinerated, 5% is landfilled** and only **2% is recycled into higher value applications** as textile fibres to make new garments.

Within the EU national **sorting capacity is not solely dedicated to sorting of domestic textile** waste – **some textiles are imported from other EU Member States** and subsequently sorted.

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[184] https://refashion.fr/en
[185] See footnote 46, p. 47.
[186] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (under development)

While there are also imports of textiles **from outside of the EU**, most textile movement is **intra-EU**.

Data on shipments of used textiles in Comext[187] does not distinguish between used textiles that are waste and used textiles that are not categorised as waste. It is impossible to state, therefore, for the quantities reported how much in total is considered as waste and how much is not. The display of flows of used textiles presented in this study needs to be read with this shortcoming in mind. However, it is apparent in relation to both collection rates and sorting capacity data from Member States that movements of collected textiles for sorting in both non-EU and EU Member State countries takes place, meaning that the handling of textile wastes is not restricted to the country of generation only but has potentially significant transboundary impacts. This is supported by the JRC[188] that states that manual sorting of textiles is currently not evenly spread across Europe but is clustered in a number of countries that specialise in sorting and wholesale activities including France, Germany, Poland, the Netherlands, Belgium, Romania, Hungary and Spain. Fashion for Good[189] notes a similar trend with sorting capacity not always fully utilised for textiles collected domestically providing examples of the Netherlands where 55% of collected textiles are sorted abroad, and most of the local sorting capacity being used to sort textiles from Germany. Fashion for Good considers that these current intra-EU trade dynamics may be explained due to lower costs of purchasing collected textiles from other countries as a result of differences in the fees paid for collecting textiles in each geography. Consequently, they consider that for sorting facilities in countries where collected textiles are more expensive to buy, collected textiles from neighbouring countries are attractive feedstock for their operations.

Table 28. Import and export of used textiles from and to third countries for EU Member States in 2020

This table shows the nature of imports and exports to third countries from the EU according to Eurostat in 2020 in tonnes of worn clothing and clothing accessories, blankets and travelling rugs, household linen and articles for interior furnishing, of all types of textile materials, incl. all types of footwear and headgear, showing signs of appreciable wear and presented in bulk or in bales, sacks or similar packings (excl. carpets, other floor coverings and tapestries).

[187] EU trade since 1988 by HS2-4-6 and CN8 (DS-045409)

[188] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

[189] Fashion for Good, *Sorting for Circularity Europe. An evaluation and commercial assessment of textile waste across Europe*, 2022.

Member State	IMPORT tonnes	EXPORT tonnes
AT	13,152	1,776
BE	6,017	194,697
BG	10,611	24,564
CY	7	2,661
CZ	1,332	12,984
DE	8,023	202,535
DK	46	1,971
EE	792	4,201
ES	3,229	95,164
FI	39	5,815
FR	1,456	94,086
EL	397	9,821
HR	7	615
HU	12,344	32,955
IE	62	8,518
IT	9,992	143,244
LT	11,826	41,524
LU	0	247
LV	7,819	8,514
MT	6	533
NL	6,676	100,204
PL	29,813	173,225
PT	184	23,180
RO	2,026	2,774
SE	12,368	6,221
SI	7	3,399
SK	1,390	13,322
Total	139,623	1,208,750

JRC estimates a higher share (**0.3 Mt)** for the amount of separately collected **textile fractions imported from outside** EU mainly the UK and Turkey, for further sorting and processing at EU facilities, or to be sent to recycling operators. in 2019[190] and at **1,83 Mt** the total amount of textile waste exported in the reference year 2019[191].

In relation to **intra-EU shipments** of the same worn clothing and used textiles using the same Eurostat dataset it is clear that a significant amount of internal movements took place in 2021 totalling almost 555 000 tonnes. However, such imports are not distribute equally with NL accounting for over 25% of received used clothing and textiles, followed by PL, HU, RO and IT.

Table 29. Imports of used textiles from within the EU by Member States in 2021.

[190] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets"(unpublished work).

[191] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work)

Member State	Value in tonnes
AT	3,945
BE	29,166
BG	38,813
CY	0
CZ	13,153
DE	26,260
DK	73
EE	5,034
ES	7,876
FI	60
FR	1,862
EL	1,534
HR	1,082
HU	49,373
IE	0
IT	43,593
LT	39,221
LU	30
LV	9,650
MT	0
NL	140,928
PL	57,617
PT	3,474
RO	48,104
SE	60
SI	112
SK	33,896
Total	554,916

Types of sorting

The sorting process can potentially be an important component of economic and environmental costs of the recycling process, as the better the textiles are sorted into pure fractions (e.g., 100 % cotton), the bigger the chance of selling the textiles to a recycling facility where it can be recycled whereas the lower the quality of sorting the more likely that reusable and recyclable textiles will be 'lost' and environmental costs will result. Manual sorting is time-consuming and costly, but essential to sort out textiles for reuse.

The JRC[192] suggests that the sorting of textiles falls into three general types:

- Manual sorting
- Manual sorting with sophisticated aiding techniques
- Automated sorting

[192] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

As noted by the JRC, manual sorting is not a technology as such given that it is performed by humans and usually done without technological aids apart from conveyor belts and other textile feeding technologies.[193] It is the most widespread textile sorting approach used in Europe with hundreds of sorting facilities sorting hundreds of thousands of tonnes of used textiles. Indeed, as indicated by the EuRIC[194], **manual sorting is essential to separate the reusable fraction of post-consumer textiles and is very often required even for the recyclable fraction**.[195] The JRC also notes that manual sorting is often more expensive than automated sorting due to the higher labour costs, it is primarily used for sorting of textiles with an expected high percentage of reusable textiles that are sellable on global reuse markets.[196] Indeed, sorters indicated that their business is profitable when maximum 20% of the received textiles are waste.

Manual sorting with sophisticated aiding techniques is also often referred to as semi-automated sorting. It operates the same way as manual sorting but includes some automation for assisting in the actual sorting of fibre types and grades for reuse and recycling. For example, hand-held scanners can be used by the manual sorters to assist them in determining material content, but these scanners only detect the surface material so full composition is difficult to detect. The main advantage of assisted manual sorting compared to fully automated sorting of non-reusable textiles is that the sorting for high-quality recycling can be carried out at the same time as sorting for reuse rather than requiring a new facility and processing stage.

Automated systems are generally used to sort non-reusable textiles and to identify those that are suitable for recycling. Automated sorting can fasten the sorting process and thus processing higher volumes of waste. As noted in a European Commission technical study[197] the quality of the output of all recycling processes is highly dependent on the quality of the input material. Consequently, sorting textiles according to their material content is an important pre-treatment step in the recycling process.[198] This is especially the case for post-consumer textile waste that often consists of a larger variety of fibre types and material blends than industrial or pre-consumer waste.[199] The study also notes that there are various methods available for the accurate determination of textile material contents, but they often require sample preparation and are too time-consuming for automation.[200] The study also identifies near infrared spectroscopy (NIR) as an interesting technique already widely for different applications, including automated sorting of paper and plastics.[201] Indeed, as part of

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[193] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

[194] The European Recycling Industries' Confederation (EuRIC) is the umbrella organisation for European Recycling Industries.

[195] See footnote 7

[196] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

[197] See footnote 7

[198] Cura, Kirsti, Rintala, N., Kamppuri, T., Saarimäki, E., and Heikkilä, P., *"Textile Recognition and Sorting for Recycling at an Automated Line Using Near Infrared Spectroscopy."*, 2021.

[199] See footnote 145, p. 87.

[200] See footnote 7

[201] Cura, Kirsti, Rintala, N., Kamppuri, T., Saarimäki, E., and Heikkilä, P., 2021.

the Swedish Innovation Platform for Textile Sorting (SIPTex) government-funded project, a sorting facility using NIR technology for textile sorting was put into operation in Malmö.[202]

Fully automated sorting has the potential to provide accurate, low-cost sorting of non-reusable textile wastes by material compositions. Many such technologies are in development phase but experience difficulties to develop at industrial scale. Sorting for recycling can also integrate a step to remove hard or metallic accessories (zippers, etc.) or buttons to facilitate recycling. This removes the need for these contaminants to be addressed by the recyclers themselves.

Sorting in relation to mattresses is different than for clothes and other household textiles because the sorting and removing of contaminants for mattresses is typically undertaken by the recyclers themselves. Steel and polyurethane foam are generally both the main contributors to the weight of the materials recovered, as well as to the revenues from selling the materials to their existing end markets, as they have a positive market value. They are followed by textile fibres which are usually grouped together, as they are difficult to separate into the different materials due to the construction of the mattress and are sold on to mixed textiles markets as low-quality fibres (short fibre length), often in the form of shredded mixture[203].

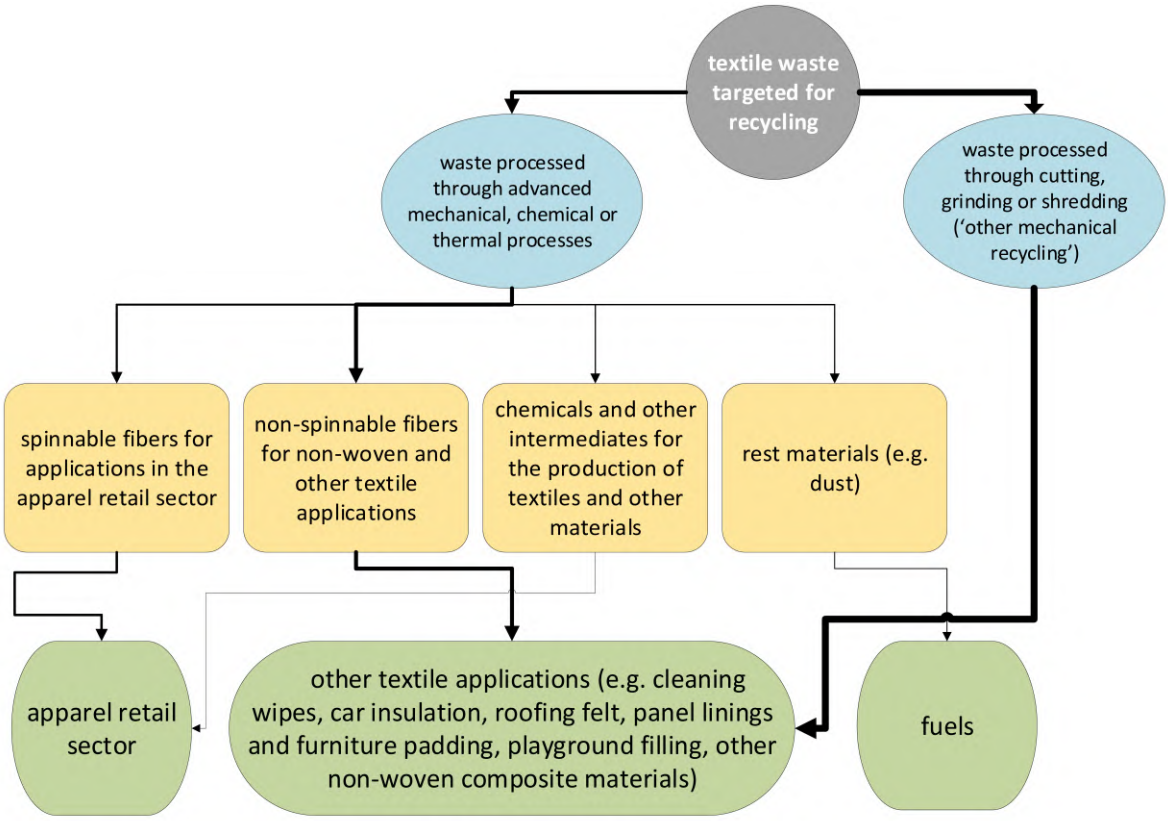
Figure 20 was developed by the JRC and displays the recycling techniques in the EU[204].

Figure 20 - Recycling techniques in the EU

[202] Recycling Magazine, *World's first fully automated textile sorting plant in Malmö*, 2021, World's first fully automated textile sorting plant in Malmö - RECYCLING magazine (recycling-magazine.com).

[203] JRC, *Best Environmental Management Practice – Treatment of mattresses for improved recycling of materials*, 2016.

[204] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets.



Sorting capacity in the EU

According to information collected from the JRC, McKinsey & Company, EURIC, Member State reports and a specific questionnaire table sent to Member States as part of this study, separate collection of clothing and household textiles as well as textiles, sorting capacity stands around 1.52 Mt/year, as specified in the table below.

In his recent study, JRC has recently calculated a higher share, estimating at **1.77 the sorting capacity for textile waste in the EU**[205]

Table 30 – Textile waste sorting capacity compared to collection in Member States, tonnes

[205] Joint Research Centre. 2023. "Techno-scientific assessment of the management options for used and waste textiles - Preparatory study for the possible setting of preparation for re-use and recycling targets" (unpublished work)

Member State	Waste collected (tonnes)	Sorting capacity (tonnes)
AT	43 120	21 000
BE	116 100	120 000
BG	6 000	35 000
CY	600	
CZ	14 100	27 889
DE	784 640	190 500
DK	36 000	10 600
EE	3 900	15 000
EL	17 850	
ES	95 160	95 400
FI	40 000	40 000
FR	204 000	200 000
HR	10 200	
HU	14 400	100 000
IE	57 500	57 500
IT	242 200	155 464
LT	14 000	40 000
LU	1 000	
LV	2 400	10 454
MT	750	
NL	136 100	155 200
PL	65 700	118 383
PT	20 880	25 000
RO	27 000	66 928
SE	38 300	10 000
SI	1 700	
SK	5 300	30 000
Total	1 998 900	1 524321

Source: JRC, McKinsey & Company, EURIC, Member State reports

Reused textiles

Textile reuse refers to various means for prolonging the life span of textile products by transferring them to new owners[206], with or without prior modification (e.g., mending). This can for example be done through renting, trading, swapping, borrowing and inheriting, facilitated by, for example, second-hand shops, flea markets, garage sales, online marketplaces, charities and clothing libraries. In the academic literature, various forms of

[206] Fortuna and Diyamandoglu, 2017 in Gustav Sandin and Peters G. M., "Environmental impact of textile reuse and recycling – A review", *Journal of Cleaner Production,* Vol. 184, 2018 https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

reuse have been conceptualised in terms such as collaborative consumption, product-service systems, commercial sharing systems and access-based consumption.[207]

There are variations in the assessment of reusability of discarded textiles, particularly focussing on clothing and household textiles – with values of 45%[208], 50 to 60%[209] and 65%[210] quoted. A JRC study[211] reports that **reuse shares of separately collected textiles typically range between 50 % and 75 % depending on the country** where the textiles were collected. It is useful to consider that Commission Implementing Decision (EU) 2021/19 of 18 December 2020 lays down a common methodology and a format for reporting on reuse. This will provide data on reuse activities and subsequently allow the effects of reuse activities on waste reduction to be assessed.

The reuse textiles sector is highly competitive as it is the most profitable use of used textiles. Different actors are involved in this step:

- **Charities**: sort and sell used textiles for non-profit-making purposes. On average, a social enterprise creates 20-35 jobs per 1 000 tonnes of collected textiles with a view to reuse[212].
- **Direct reuse companies** (reuse organisations, second-hand shops and retailers, etc.) sell used textiles for profit making purposes.
- **Indirect reuse companies**: online marketplaces such as Vinted or Vestiaire Collective facilitate peer-to-peer purchases, sales and exchange of used clothing and shoes.

Some organisations have been set-up to promote the interests of reuse actors. RREUSE, for example, is the international network representing social enterprises active in reuse, repair and recycling products, including textiles[213]. Many researchers are also contributing to the improvement of textile waste recycling and its reuse[214].

The formal reuse sector, mainly dominated by social enterprises, is currently the most active in the separate collection and manual sorting of textiles mainly for the purpose of reuse. The textiles collected need to be in a good enough state to be reused (and this will depend on their initial quality) but also need to be clean, dry and marketable, i.e., meeting the

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[207] Sandin G. and Peters G. M., 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

[208] Alcin-Enis I., Kucukali-Ozturk M., Sezgin H., "Risks and Management of Textile Waste". In: Gothandam K., Ranjan S., Dasgupta N., Lichtfouse E. (eds) *Nanoscience and Biotechnology for Environmental Applications. Environmental Chemistry for a Sustainable World*, vol 22. Springer, Cham, 2019. https://doi.org/10.1007/978-3-319-97922-9_2.

[209] EURATEX, *ReHubs: A joint initiative for industrial upcycling of textile waste streams & circular materials,* 2020. ReHubs - EURATEX.

[210] Tojo, N., Kogg B., Kiørboe N., Kjær B. and Aalto K., *Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments*, NORDEN, 2013, http://dx.doi.org/10.6027/TN2012-545.

[211] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

[212] RREUSE, *Job creation in the reuse sector: data insights from social enterprises,* 2021.

[213] RREUSE website: https://rreuse.org/.https://rreuse.org

[214] MDPI, *A Systematic Literature Review for the Recycling and Reuse of Wasted Clothing*, 2021, https://www.mdpi.com/2071-1050/13/24/13732/pdf.

demand in a particular receiving market. The reuse sector's business model is based on the sale of the best quality textiles, the so called 'crème'.

It is worth noting that while **second-hand purchases where traditionally primarily driven by the buyers' financial situation, motivations have evolved into more complex choices driven by different factors**. These include economic motivations (income, household situation, frugality and prices), psychology motivations (values, image, nostalgia, desire for uniqueness[215], authenticity and originality, as well as peer pressure) and situational motivations (customers, sellers and general dimensions such as cultural and ethnic ideology, the image of second-hand clothes, shops and sales staff and environmental awareness)[216]. Indeed, non-second-hand clothing consumers are mainly concerned with quality, cleanliness, style, and social image[217].

Recycling

Textile recycling is the action of reprocessing pre- or post-consumer textile waste to obtain a recycled material. Recycled materials from non-textile products such as polyethylene terephthalate from bottles for example, can also be added in new textile products[218]. The process of **recycling** converts a material into something of roughly the same value as it originally was. If the quality or the value of the recycled material is lower than the original product, the recycling route is called **downcycling**. Most textiles recycling routes are downcycling because fibres are damaged by wear and laundry. If it is the opposite and if the new product from recycled material has a similar or higher value or quality than the original product, the recycling route is called **upcycling**[219]. Recyclability is affected by the products characteristics, the presence of hard and soft parts, coatings and colours, fabric constructions, and oil stains[220].

There are three types of recycling technologies.

Mechanical recycling is a process based on physical forces which may be used in isolation for fabric or fibre recycling or as pre-processing for chemical or biochemical recycling. Mechanical recycling consists in cutting, rearing and needling textiles and leads mainly to lower quality textiles which are used as wipes, padding, filling, insulation and non-woven mats. Mechanical recycling can address all types of fibres, as the material composition of the textile waste will become the composition of the recycled product. Mechanical recycling is currently at Technology Readiness Level 9 (TRL 9) and is an established technology. The survey conducted by DG GROW among technology holders revealed a wide range in production capacities, going from 5 000 to 10 000 tonnes/year to as much as 36 000 tonnes per year. Small shares of textile waste (<1%-2%) are fibre-to-fibre recycled following

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[215] The Conversation, 2022, Do you shop for second-hand clothes? You're likely to be more stylish (theconversation.com).

[216] Herjanto, H. & Scheller-Sampson, J. & Erickson, E., "the increasing phenomenon of second-hand clothes purchase: insights from the literature", *Jurnal Manajemen dan Kewirausahaan*, 18. 10.9744/jmk.18.1.1-15, 2019.

[217] Hur, E., "Rebirth Fashion: Secondhand clothing consumption values and perceived risks", *Journal of Cleaner Production*, Vol. 273, p.122951, 2020, https://doi.org/10.1016/j.jclepro.2020.122951.

[218] See footnote 7;
Sandin, G. and M. Peters, G., *Environmental impact of textile reuse and recycling – A review*, 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

[219] https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib5 ; see footnote 7

[220] See footnote 46, p. 47.

mechanical recycling, because the current capacity for these processes as well as Technology Readiness Level of such process is very limited[221].

Chemical recycling is a process using chemical dissolution or chemical reactions that is employed in polymer recycling (system for disassembling used fibres, extracting polymers and re-spinning them for new uses) or monomer recycling (system for breaking down polymeric textile materials into their constituent monomers and rebuilding polymeric fibres for new uses). It can process manmade cellulosic fibres into a pulp used to produce other fibres, polyester and polycotton fibres into PET, and polyester and polyamide into fibres at monomer level. Chemical recycling uses fibre-to-fibre recycling techniques possibly resulting in re-spun fibres, yarns and textiles that can be remade into high quality finished textile products. The technologies to process closed-loop recycling currently require minimum levels of fibre purity to operate and are at a very early development stage. [222] Chemical recycling can be realised with different processes, but three major technologies have been identified as described below.

- **Polymer recycling of cotton via a pulping process** is a process that generates cellulosic pulp which can be obtained via different types of pulping processes. This process can recycle cellulose from different sources (e.g., wood, cotton, viscose, cardboard) but as they differ in chemical structure and viscosity, most technology holders indicated that changing the source would require adaptations to the pulping process or pre-treatment. Most technologies have already reached a high TRL of 7 to 9, at least for pure cotton textiles as input material. The TRL 7-8 technologies are expected to reach TRL 9 by 2025 at the latest. **Process capacities range from 10 kg/day to thousands of tonnes per year**.
- **Monomer recycling of PA6 and PET (biochemical recycling)** is a depolymerisation process where the polymer chains are broken down into monomers. Chemical recycling of PA6 textiles via depolymerisation is already an established technology with TRL 9. For PET textiles, the TRL-levels vary from 4 to 7, with **500 tonnes/year** being the largest available production capacity to date. The first technologies are expected to reach TRL 9 by 2023 as an industrial production line is currently being built.
- **Recycling of polycotton blends** can be done via different methods as several technologies (can) focus on recycling of both cotton and PET from polycotton blends. For example, a method applies solvent-based dissolution and filtration processes to separate different materials and extract the desired components (polymer recycling). This technology is currently at TRL 5 and is expected to reach TRL 6 in 2022 and TRL 9 in 2024/2025. Sorting of textiles waste is required as knowledge of the composition is required for a good process efficiency. Current process **capacities range from 15 to 2800 tonnes/year**.

Thermal recycling is a process based on heating with the aim to recover either polymers or low molecular weight building blocks. There are two thermal recycling technologies as detailed below.

- **Thermo-mechanical recycling** is a process used in a recycling system that melts a polymer. It is used to recycle thermoplastic textiles, e.g., polyester, polyamide, polypropylene, etc. by melting them into a regranulate and/or new fibres. This

[221] See footnote 46, p. 47.
[222] ReHubs, 2020.

recycling process is particularly interesting for the recycling of post-industrial waste and some specific post-consumer waste that has been collected in specialised centres. However, the addition of virgin material is required and only a limited amount of recycled material will be present in the final fibre. TRL 9 is expected to be reached by 2022/2023, with still a limited percentage of recycled content and the same input material limitations.

- **Thermo-chemical recycling** is a process using partial oxidation reaction of polymers to produce low molar mass components or heat to degrade polymers to monomers that can be used as feedstock for the chemical industry, with the exclusion of fuels used for energy production or other combustion or energy recovery processes. It is considered a mature technology, although developments to allow the production of raw materials for the chemical industry (as opposed to energy recovery or fuel production) are very recent. Not many waste gasification processes had been piloted and tested in 2021 but a few had already been implemented as industrial plants (TRL 9) processing actual waste.

Recycling routes are often made up of a mix of these three processes. For instance, before chemical depolymerisation (chemical recycling), textile material is often treated mechanically. [223] Recycling can be defined by the type of routes used and technologies (mechanical, chemical or thermal) but also by the type of recovered materials: **fabric recycling** (material reuse), **fibre recycling** (if the original fibres are preserved), **polymer/oligomer recycling** (if polymers are preserved) or monomer recycling. [224]

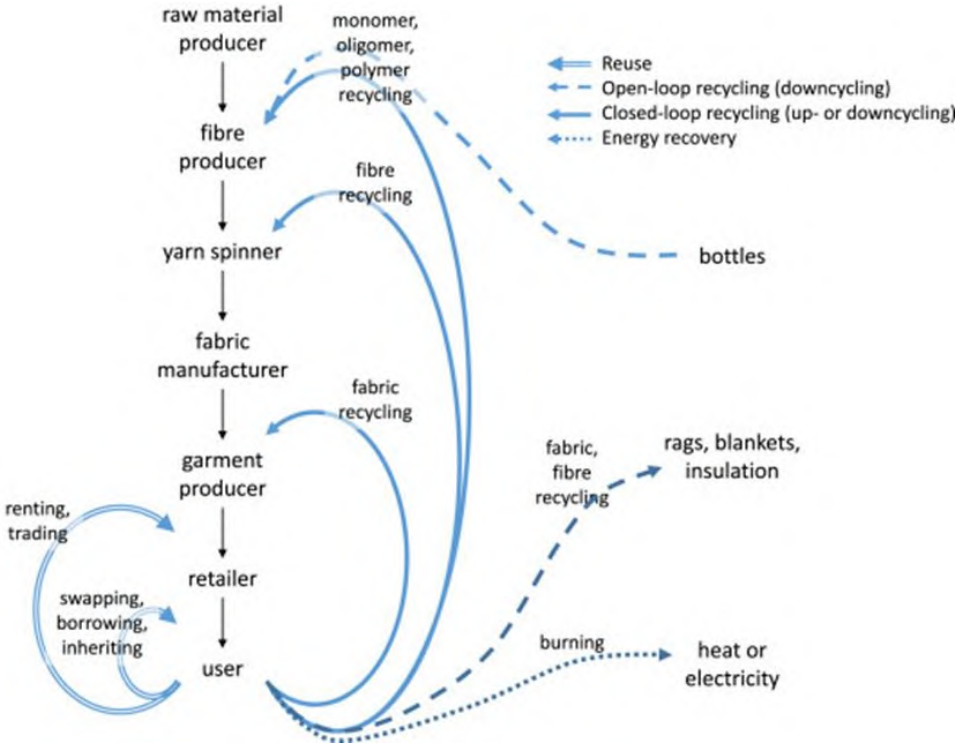
Another classification for recycling routes is into **closed- or open-loop recycling**. Closed-loop recycling refers to when the material from a product is recycled and used in a (more or less) identical product, whereas open-loop recycling (also called cascade recycling) refers to processes in which the material from a product is recycled and used in another product. [225] The support study estimated that around 51 thousand tonnes were recycled closed-loop in 2021 and over 460 thousand were recycled open-loop.

Figure 21 – *Classification of textile reuse and recycling routes*

[223] https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib5 .https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib5 . See footnote 7

[224] See footnote 7; Sandin, G. and M. Peters, G., 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

[225] See footnote 7; Sandin, G. and M. Peters G., 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

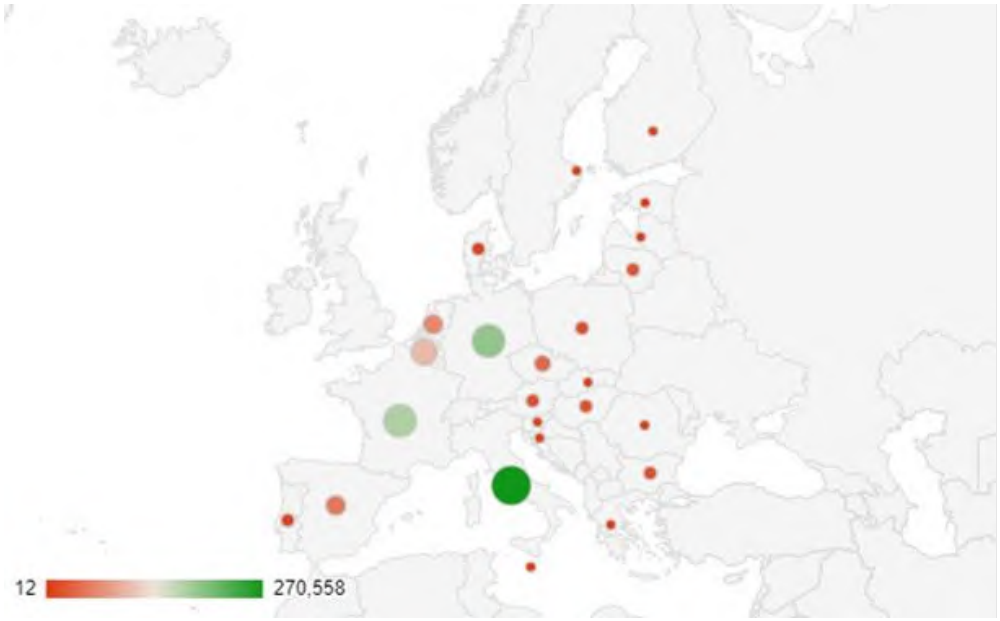


Source: Sandin, G. and M. Peters, G., 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21

The recycling capacity of Member States is based on data published by Eurostat[226]. It should be noted that the volumes indicated are the actual volumes of textiles reported as recycled in 2020 which are likely overestimated, as under Waste Statistics Regulation these volumes include also textiles prepared for re-use. Moreover, the documented "landfill" and "incineration" are likely underestimating the real values. Additionally, as a result of the types of textiles that are captured under this dataset leather and other wastes from textile production are included that accounts for the higher volumes reported to Eurostat than the volumes of clothing and household textiles that are recycled within the EU at present. However, the figure gives an idea of the scale of recycling at present.

Figure 22 – Map of textile recycling in 2020

[226] Eurostat, *Waste generation and treatment* (ENV_WASTRT), 2023.



Source: Eurostat 2023.

As noted above, most of the textile recycling undertaken at present is open-loop recycling. Four Member States recycled 100 000 tonnes of more of textiles in 2020 (BE 100k tonnes, FR 173k tonnes, DE 191k tonnes and IT 271k tonnes) comprising 72% of all textiles recycling in the EU.

Recycling mainly focuses on cotton-rich products. Currently, there is no significant recycling of synthetic textiles and the limited fibre-to-fibre recycling that does occur is mainly mechanical recycling of 100 % cotton products[227]. Mechanical recycling technologies, where the waste textile is physically manipulated to recover materials, fibres or fabrics, are currently the most prevalent. [228] The market value for these materials is indicated in Annex 4.

Table 31 – Recycling processes for major fibres/recycling[229]

[227] EEA, *Plastic in textiles: potentials for circularity and reduced environmental and climate impacts,* 2021.
[228] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144
[229] European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al., Circular economy perspectives in the EU textile sector: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144

Material	Mechanical recycling	Chemical recycling
Polyester	Sorting by type and colour, washing and chopping. Extrusion into yarn	Depolymerisation, repolymerisation and extrusion into chips
Nylon /polyamide	Cleaning and pelletisation (for homogenous flows only)	Depolymerisation and repolymerisation to make new yarn
Cotton	Separation by colour, shredding and re-spinning	Promising innovative development
Wool	Separation by colour, pulling the garment back into a fibrous state	Not available
Polycotton	Small scale processes for producing insulation materials and other lower grade applications	Requires pre-separation into cotton and polyester. Still in pilot phase

Source: Rengel (2017)

Textile recycling companies (small, medium and large companies) involved in recycling and trade of textile resource stream are key actors for the industrial uptake of textile fibre recycling technologies. Recyclers are gathered in federations that represent their interests at the international, European, and national levels:

EuRIC (European Recycling Industries Confederation), textiles branch, is the Confederation representing the interests of the European recycling industries at EU level.

- The **Bureau of International Recycling (BIR)**[230] is the only global recycling industry federation representing more than 30 000 companies around the globe.
- The **European Recycling Industries Confederation (EuRIC**)[231], textiles branch, is the Confederation representing the interests of the European recycling industries at EU level.
- Each country has **one or several associations**, for instance: Association of Recyclers and Traders of Second-Hand Clothes in Bulgaria, Assorecuperi in Italy, FEDEREC in France, Textrade in Hungary, Trasborg in Denmark, etc.

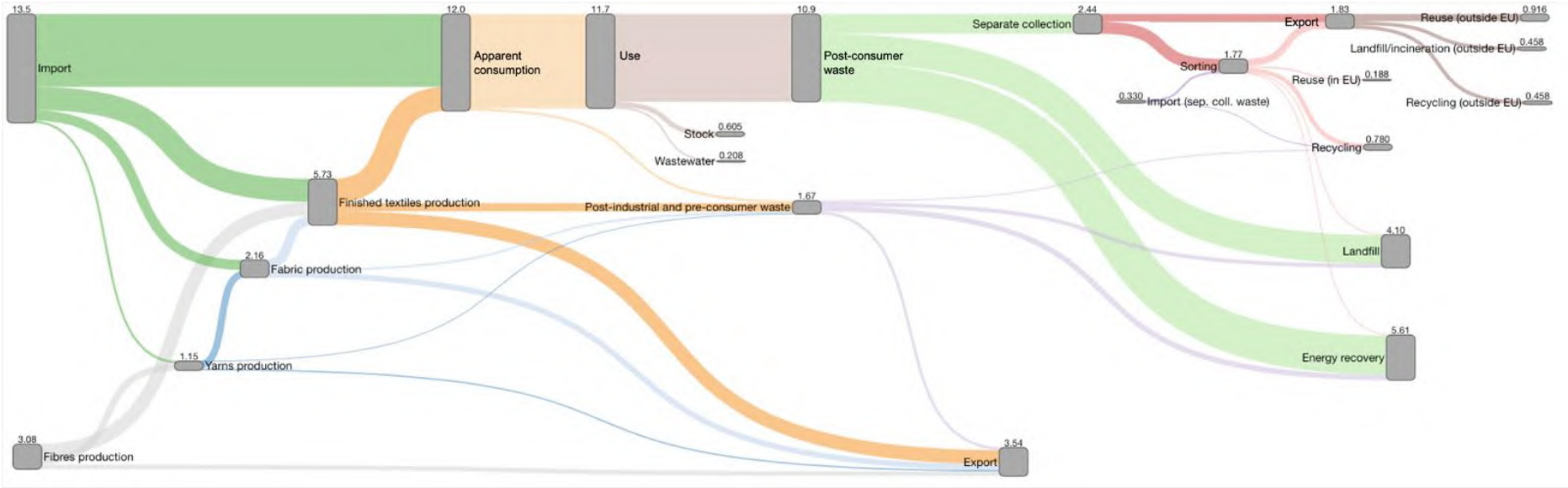
In 2021, the French PRO, Refashion, as part of its mission to accelerate the recycling of textiles and footwear, created a digital platform to connect recycling actors. This free networking tool is for recycling professionals and presents a mapping of the materials available after recycling of textile and footwear. It aims to promote transformation processes and incorporation of the recycled materials into new products by connecting the different actors[232]. In November 2022, 280 stakeholders were registered and provided 52 recycling solutions in France and in Europe.[233]

Figure 23 summarises the mass flows analysis for textile generation and waste management in the EU-27 (for the reference year 2019) that has been detailed within this section. It rests on the results of an ongoing JRC study[234] for the reference year 2019, which covers all kinds

[230] BIR website: https://www.bir.org/the-industry/textiles.
[231] EuRIC textiles website: https://www.euric-aisbl.eu/branches/eurictextiles.
[232] Refashion press release, *Lauch of RECYCLE by Refashion,* 2021, https://refashion.fr/pro/en/press-releases ; https://www.textile.fr/actualite/recycle-plateforme-digitale-de-mise-en-relation-des-acteurs-du-recyclage-de-refashion.
[233] RECYCLE platform by Refashion: https://recycle.refashion.fr/en/.
[234] European Commission, Joint Research Centre. *Techno-scientific assessment of the management options for used and waste textiles*. 2023 (under development)

of textiles along the whole value chain, starting from fibres production to the end-of-life of textile products.

Figure 23– Mass flow analysis for textile generation and waste management in the EU-27 (for the status quo reference year 2019) The mass flows in each node are expressed in Mt/year. The mass flows in each node are expressed in Mt/year



EPR schemes for textiles

The Netherlands (from summer 2023) and **France** (from 2008) have established mandatory EPR schemes for textiles. The French scheme was implemented to increase collected amounts of both reusable and waste textiles, to support the sustainable development of the sector and to respect the polluter-pays principle for the management of end-of-life textile.

In the context of the EPR, textile waste is subject to separate collection, through the four main channels of voluntary collection points (VCP) listed below.

1. Over the counter collection in reuse shops or other organisations' premises.
2. Via containers/bring banks, located in private or public spaces.
3. Via take-back systems in stores.
4. Via occasional collection campaigns (e.g., during events, garage sales, door-to-door).

Refashion is the sole French producer responsibility organisation (PRO) for textiles and the following EPR and modulated fees for textiles apply. Local authorities are also involved in the French EPR. They are responsible for household waste collection and receive financial support from Refashion to raise awareness amongst citizens on how to give/discard textiles and not to throw them in household mixed waste. In 2020, 535 local authorities had committed to working with Refashion in a nationwide drive towards greater recovery rates for used textiles. The sorting centres contracted by the PRO, are partly financed through the EPR fees. The collection points can be managed by businesses, associations or social enterprises active in the reuse market. In most cases the collection points are located on public ground, hence the local authority is the responsible party. A particular priority of the French scheme is to create jobs to reintegrate people in the labour market, and the system is designed so that most of the sorting takes place in France. The higher costs of domestic sorting means that in France only small funds can be dedicated to research and development of new recycling technologies.

While the French EPR model is seen under many aspects as a forerunner, underlying difficulties have been experienced:

- Free riding, especially by "ultra-fast fashion" online brands.
- Enforcement difficulties to bring actors to pay their eco-fees (some producers refuse to submit to the EPR scheme).
- Growing but still relatively limited collection rates.

Several EU Member States (i.e., Sweden, Germany, Bulgaria, Belgium, Italy, Spain and Slovakia) are planning to adopt EPR schemes within the next years. These schemes mainly intend to include clothing and household textiles, while some of the proposals also include other textiles such as professional textiles or footwear. The specific features of the EPR schemes that each country envisages are different. Some Member States are focusing on stimulating textile to textile recycling and reuse through targets for textiles prepared for reuse and recycled, some on the separate collection for reuse and recycling, some are imposing obligations for producers and other stakeholders, others are considering to set a minimum financial guarantee which will be required from each producer responsibility organization at the start of its operations, while others have set up voluntary systems to facilitate waste prevention, separate collection, sorting and valorisation of pre-consumer and post-consumer textile flows or organisation-based initiatives. On the contrary, Finland has proceeded with the implementation of the separate collection

organisation through municipal services which would become effective by 2023. However, none have yet been implemented and the information on their impacts is, therefore, unavailable. A summary of the available details is provided below. Little information is available at this stage on other countries and their perspectives on EPR schemes which is also in part due to the uncertainty linked to the announcement by the Commission that it is assessing the feasibility of mandating EPR at EU level.

In comparison to other jurisdictions, the EU can be considered a frontrunner in the textile waste management with regard to the collection and subsequent re-use and treatment practices and scale. Parts of USA[235], Nordic countries, including Norway,[236] and UK[237] are also considering measures to scale up re-use and recycling and the introduction of an extended producer responsibility.

EU funded projects on sustainable management of textiles

Different EU resources were used to fund related projects:

- For recycling activities alone, in the period 2014-2020 LIFE financed a total of 86 projects with an overall investment of around 350 million euro. LIFE contribution was around 160 million euro.
- If we include reuse operations, the number of projects increases to 113 with an overall investment of 410 million euro and our contribution being approximately 190 million euro.
- Finally, if we include projects that contribute to resource efficiency (reducing resource usage and thus waste), we have a total of 144 projects with a global investment of almost 0.5 billion euro and an EU contribution of approximately 230 million euro.
- In 2014-2020, Horizon 2020 financed 1737 projects dedicated to circular waste management. Up to 2018, 1.4 billion euro from Horizon 2020 was targeted towards areas such as sustainable process industries, waste and resource management, closed loop manufacturing systems or the circular bio-economy.
- In 2016-2020, over 7 billion euro from **Cohesion policy** have been used towards the transition to circular economy, of which 1.8 billion euro for uptake of eco-innovative technologies among SMEs and 5.3 billion euro to support the implementation of the EU waste legislation. The new programming period under the Cohesion policy (2021-2027) also envisages significant financial resources for the improvements in waste management practices, including textiles, namely, for the improvements in separate collection and waste treatment capacity expansion with focus on preparation for re-use and recycling as

[235] The Responsible Textile Recovery Act of 2023 proposed in California State.

[236] More recycling and reuse of textiles in the Nordics benefits the environment and the economy (norden.org)

[237] "Our Waste, Our Resources, A Strategy for England 2018" strategy.

well as promotion and use of recycled materials. Textiles sector figures in the national programmes for several countries such as Latvia, Lithuania, Croatia.

- Financing for waste management improvement and specifically for the collection, sorting and recycling and reuse of textiles is also covered by **the Recovery and Resilience Facility** regulation. Four countries (Denmark, Italy, Portugal and Hungary) have identified projects for investing in the development of separate collection network as well as in research to develop sustainable solutions for resource productivity, waste reduction and use of reusable materials in the textile value chain.
- Financing facilities such as **the European Fund for Strategic Investments and Innovfin** granted 2.1 billion euro towards the transition to circular economy.

More specifically, the LIFE programme financed the following three (3) projects with regard to textile waste:

- Project LIFE ECOTEX (LIFE20 ENV/FR/000596)[238], with reference to EU WFD, concerning the recycling of polyester of footwear waste into new textile products using glycolysis technology. The project took place in 2015 with a total budget of 1 246 048 euro, the EU contribution to it being 735 827 euro.
- Project LIFE CYCLE OF PET (LIFE20 ENV/FR/000596)[239], with reference to EU PPWD, regarding the way towards a true circular economy of PET plastics and textiles thanks to enzymatic recycling of waste. The project was launched in 2020, with a total budget of 10 316 239 euro, the EU contribution to it being 3 300 000 euro.
- Project LIFE RE: NEWTEXTILE (LIFE18 ENV/SE/000489)[240], with reference to EU legislative text on Landfill of waste, concerning an innovative process for sustainable recycling and reuse of cellulosic textile waste. The project was held on 2018, with a total budget of 4 242 210 euro, the EU contribution to it being 1 719 943 euro.

As regards the **Horizon Programme**, a few projects have already been funded by Horizon 2020, while other projects will now be funded under Horizon Europe through both the Work Programme 2021/2022 and Work Programme 2023/2024.

On **Horizon 2020**, the following projects have already been funded by the EU.

- Project RESYNTEX[241] (2014-2015) relating to a new circular economy concept: from textile waste towards chemical and textile industries feedstock. Its specific topic is: "WASTE-1-2014 – Moving towards a circular economy through industrial symbiosis" and its total budget 11 478 761.97 euro the EU contribution to it being 8 787 749.25 €.
- Project Trash-2-Cash[242] (2014-2015) concerning the designed high-value products from zero-value waste textiles and fibres via design driven technologies. Its specific topic is: "NMP-18-2014 – Materials solutions for use in the creative industry sector", while its total budget is 8 890 559.80 euro the EU contribution to it being 7 933 461 euro.

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[238] LIFE 3.0 - LIFE Project Public Page (europa.eu)
[239] LIFE 3.0 - LIFE Project Public Page (europa.eu)
[240] LIFE 3.0 - LIFE Project Public Page (europa.eu)
[241] RESYNTEX - Quantis
[242] Trash-2-Cash-Trash-2-Cash HOME page (trash2cashproject.eu)

- Project REACT REcycling of waste ACrylicTextiles[243] (2018-2019-2020) with the following topic: "CE-SC5-01-2018 – Methods to remove hazardous substances and contaminants from secondary raw materials". The project's total budget is 3 267 696.25 euro and the EU contribution is 3 267 696.25 euro.
- Project ECWRTI ECOLORO[244] (2014-2015) concerning the reuse of wastewater from the Textile Industry with the following topic: "WATER-1a-2014 – First application and market replication". The project's total budget is 4 822 849.63 euro and the EU contribution to it is 3 748 967.50 euro.
- Project New Cotton[245] (2020) regarding the demonstration and launch of high performance, biodegradable, regenerated textiles to consumer markets through an innovative, circular supply chain using Infinited Fiber technology. This project's topic is: "CE-FNR-14-2020 – Innovative textiles – reinventing fashion" and its total budget: 8 886 912.50 euro, while the EU contribution to it: 6 745 801.25 euro.

Regarding **Horizon Europe**, under the Work Programme 2021/2022 there was a 2021 topic dedicated to "Increasing the circularity on textiles, plastics and/or electronic value chains for proposals". In this context, one of the proposed projects, under the name T-REX : Textile Recycling Excellence[246], focuses on the recycling of household textile waste. It will also highlight feasible business models and will be including players such as Adidas, BASF and Veolia. Total budget of the project will be 8 422 410 euro, while the EU Contribution to it will be 6 390 674 euro. Another relevant project that has recently been funded by the Horizon Europe Work Programme 2021/2022 is extended: Knowledge based framework for extended textile circulation. The project will aim at reducing textile waste by 80% by within industrial-urbal symbiosis developing and demonstrating effective textile recovery, waste valorisation and recycling processes combined with digital tools, sensing systems and data-driven solutions to support sustainable circularity of textiles. The total budget for this project is 14 860 675.25 euro, with an EU contribution of 12 345 596 euro.

Finally, there will be very promising opportunities for funding under the Horizon Europe Work Programme 2023/2024, particularly through a topic on "Circular solutions for textile value chains through innovative sorting, recycling, and design for recycling". The total indicative budget for this topic is 15 million euro.

The Work Programme was published on 6 December 2022 and, since this is a call for 2024, applicants will be able to submit their proposals by October 2023. More details on the topic are expected once the WP has been published.

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[243] REcycling of waste ACrylic Textiles | REACT Project | Fact Sheet | H2020 | CORDIS | European Commission (europa.eu)
[244] HORIZON2020 - European Consortium to Demonstrate EColoRO Concept for Wastewater Reuse in the Textile Industry (europa.eu)
[245] Demonstration and launch of high performance, biodegradable, regenerated New Cotton textiles to consumer markets through an innovative, circular supply chain using Infinited Fiber technology | New Cotton Project | Fact Sheet | H2020 | CORDIS | European Commission (europa.eu)
[246] Driving textile recycling excellence - T-REX Project (trexproject.eu)

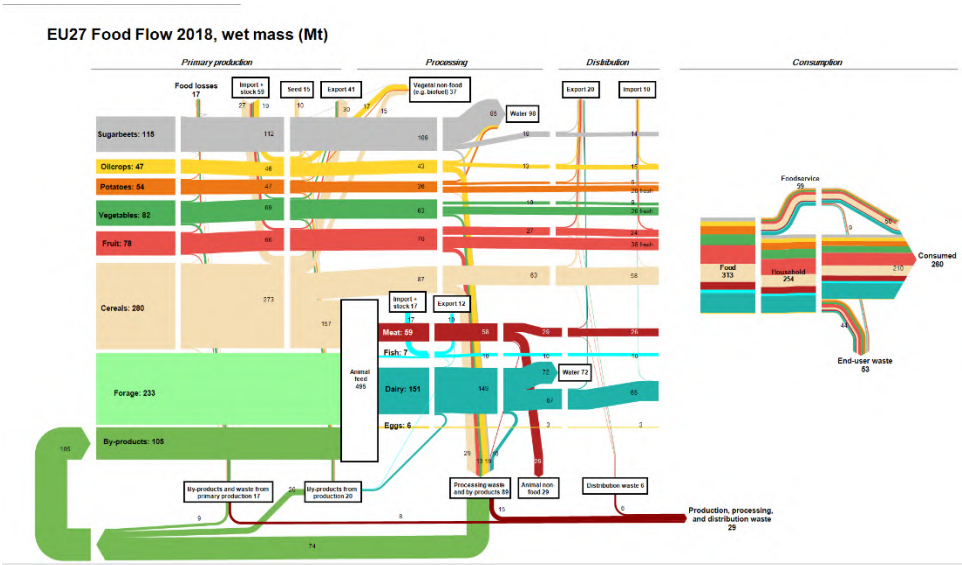
2- Food Waste

Food waste is one of the largest sources of inefficiency in the agri-food chain and depletes limited natural resources, such as land, water and biodiversity, on which the food system depends. FAO's Food Loss Index (FLI) estimates that globally, around **14 percent of all food produced** is lost from post-harvest up to, but not including the retail level[247].

Around 931 million tonnes of food waste were generated in 2019 – 61% of which came from households, 26% from food service and 13% from retail – suggesting **that 17% of global food production may be wasted** at these stages of the food supply chain[248].

Tackling food loss and waste is key to achieving sustainability of the food system. However, food waste itself is just one aspect of a very complex system. In order to better understand how the food system functions, the figure below shows mass flows in the food system[249,250]. It illustrates amounts of food produced, processed, distributed and consumed and shows the complexity of the system. This impact assessment analyses impacts of the food waste reduction targets on that whole system.

Figure 24 – Sankey diagram of the product flows and food waste generated along the Food Supply Chain in the EU27 in 2018



[247] FAO, 2019
[248] UNEP Food Waste Index 2021
[249] Caldeira, C., De Laurentiis, V., Corrado, S., van Holsteijn, F. and Sala, S., *Quantification of food waste per product group along the food supply chain in the European Union: A mass flow analysis. Resources, Conservation and Recycling,* 2019.
[250] De Laurentiis, V., Caldeira, C., Biganzoli, F. and Sala, S., 2021. Building a balancing system for food waste accounting at National Level. Publications Office of the European Union.

The diagram contains feed and food flows, excluding soft drinks, mineral waters and some non-perishable foodstuffs (salt, coffee, etc.).

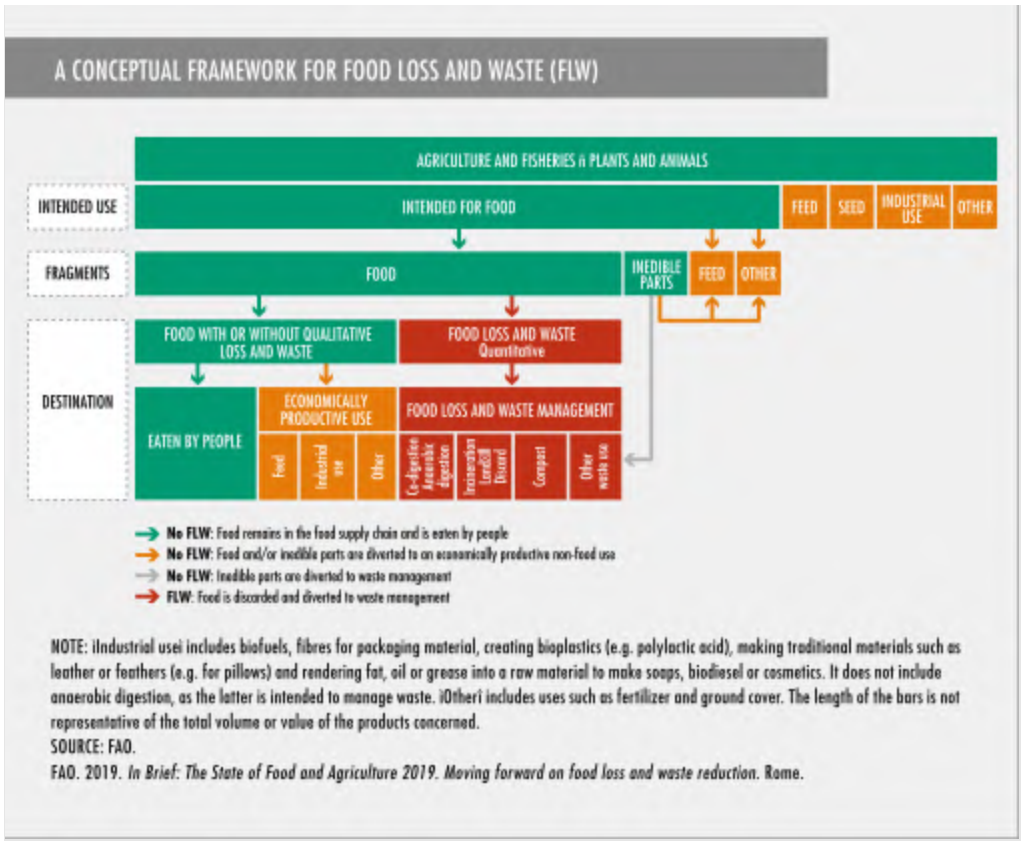
What exactly is food waste? There are several definitions of food waste (or food loss and waste) in the literature. Usually, these definitions are used to focus on specific challenges linked to food.

EU policy started from a focus on environmental aspects of management of food waste, by gradually limiting the landfilling of biodegradable municipal waste. Further studies on the environmental footprint of different materials, identified food as one of the priority streams for waste prevention due to very high environmental impacts linked to its production and consumption. In their assessment of the environmental impacts of production and consumption, the UNEP International Resource Panel concluded that agriculture and food consumption are among the most important drivers of environmental pressures comparable in magnitude only to fossil fuels.[251]

On the other hand, preventing food waste was also assessed as a key priority from the point of view of nutrition and food security, especially in developing countries. This approach led to defining food waste not by tons of food waste produced but rather that of nutrition lost (not necessarily limited to that food ending up as waste), such as crops which have not been harvested. Some definitions and measurement include economic value of lost food (e.g., Food Loss Index). Finally, even overconsumption, beyond actual dietary requirements, could be considered as a form of food loss and waste. (source: SOFA 2019).
The FAO SOFA report includes the following conceptual framework for food loss and waste. This concept is also used in EU legislation, although it is subject to further clarification.

Figure 25 – Conceptual framework for food loss and food waste

[251] assessing_scp_summary_report_english.pdf (resourcepanel.org)



Source: SOFA, 2019

In the WFD, food waste is defined as food (in the meaning of General Food Law[252] which has been disposed of as a waste (as defined in the WFD). This approach is largely based on the result of the FUSIONS research project, fits the existing regulatory framework on food and on waste and uses, to the extent possible, existing reporting and policy frameworks (e.g., Waste Statistics or Waste Prevention Programmes) in order to allow both stakeholders as well as Member States to quickly adopt the new definition and measurement of the problem.

It is important to remember that the definition of 'food' encompasses food as a whole, along the entire food supply chain from production until consumption. Food also includes inedible parts, where those were not separated from the edible parts when the food was produced, such as bones attached to meat destined for human consumption. Hence, food waste can comprise items which include parts of food intended to be ingested and parts of food not intended to be ingested.

Food waste includes:

- Whole foods or parts of food that people could eat but are thrown away. This could be, for example, milk spilled in a dairy factory; unsold vegetables in a supermarket; food

[252] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety *(OJ L 031 1.2.2002, p. 1),* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02002R0178-20210526#:~:text=REGULATION%20%28EC%29%20No%20178%2F2002%20OF%20THE%20EUROPEAN%20PARLIAMENT,laying%20down%20procedures%20in%20matters%20of%20food%20safety.

prepared at home and not eaten; or leftovers discarded after a restaurant meal. (This is a fraction of food waste that could be reduced or, ideally, avoided almost completely.)

- Elements associated with food – such as fish bones, eggshells, or fruit pits – that are not intended to be eaten. The notion of "inedible parts" varies from one place to another, or from one group to another. For example, some people peel apples while others will eat the whole fruit, including the core and seeds. In some countries, people consider chicken feet as food, and in other places, they'll typically throw them away. (This inedible fraction could be reduced, for instance by avoiding excessive peeling of vegetables, but cannot be entirely avoided. However, the way that such food waste is handled and recycled can be improved)

Due to variability in what part of food is considered "edible" and what is "inedible" and the complexity of measuring such fractions, the EU reporting framework requires only reporting of total food waste. Therefore, it is more practical to set a food waste reduction target on both edible and inedible food waste – i.e. on total food waste.

Reference to the EU definition of food excludes materials which are lost before they become food. Food losses occurring in primary production before crops and/or animals become "food"– that is, at the stage prior to crops being harvested or during the rearing of farmed animals – are not accounted for as food under EU legislation. These can include pre-harvest losses (whether these are due for instance to unfavourable climate or destruction by pests or not harvested for economical or technical reasons), food which was not allowed to enter the market due to contamination, animals affected with diseases etc.

Neither does food waste include material which is not waste; for example, surplus food that is recovered from the food supply chain and redistributed to those in need through – food donation or by-products that are used for animal feed or non-food products (e.g., cosmetics or glue).
In summary: food waste is any food that has become waste under these conditions:

1. it has entered the food supply chain,
2. it then has been removed or discarded from the food supply chain or at the final consumption stage,
3. it is finally destined to be processed as waste.

It is worth noting that this approach excludes agricultural material and animal by-products (which are not considered waste under the Waste Framework Directive (Art 2).

For practical reasons, food waste measurement further excludes some types of food waste which are technically too complex to measure:

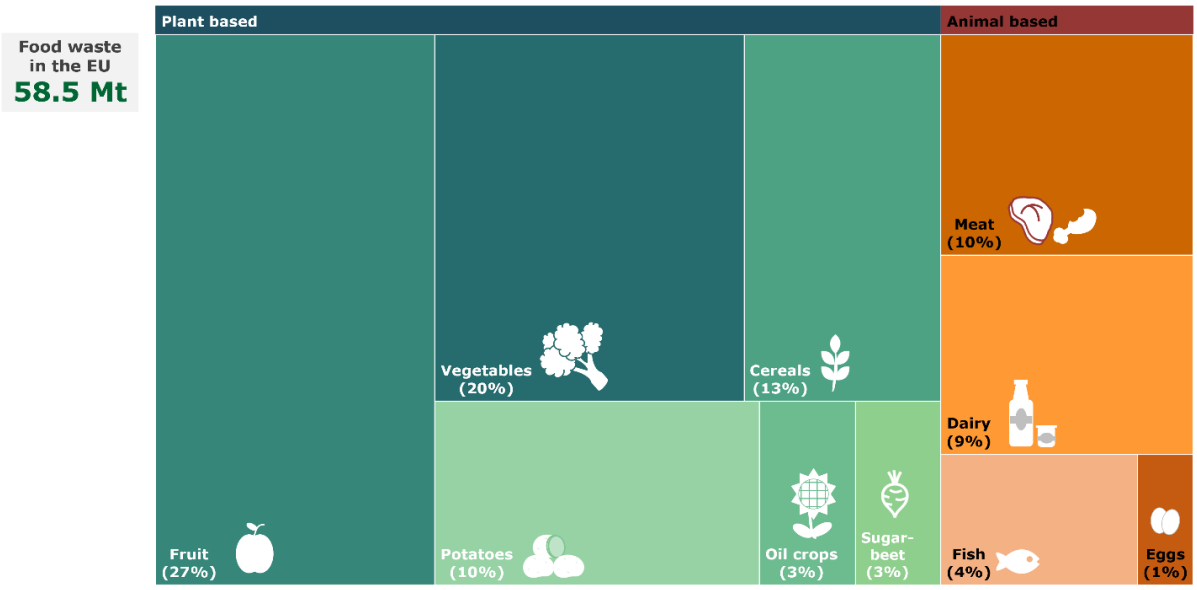
- food waste residues collected within packaging (code '15 01 — Packaging including separately collected municipal packaging waste);
- food waste residues classified under waste code: '20 03 03 — Street cleaning residues';
- food waste drained as or with wastewater.

How much food waste is generated by different food groups in the EU?

Fruits (27%) and vegetables (20%) are the food groups that produce the largest amounts of food waste, followed by cereals (13%), potatoes (10%), meat (10%), diary (9%), and oil crops and

sugar beets (each of 3%)[253]. The fish and eggs food groups, which make up a small share of food consumed, also generate low quantities of food waste in absolute terms.

Figure 26 – Food waste generated in the EU27 by food group (2020 data). Mt in fresh weight.



On the other hand, the food groups that make the largest contribution to food consumption do not produce the largest amounts of food waste. The ratio of food waste to food supplied varies between groups, mainly due to the varying amounts of inedible content and the extent to which each group can be stored before consumption, e.g., cereals (pasta, rice) vs fruit and vegetables. Other factors affecting this ratio include the use of residues in primary production and processing and manufacturing for animal feed and other by-products, and water evaporation at the processing stage (for instance when converting milk into cheese) - (see Figure 27)[254].

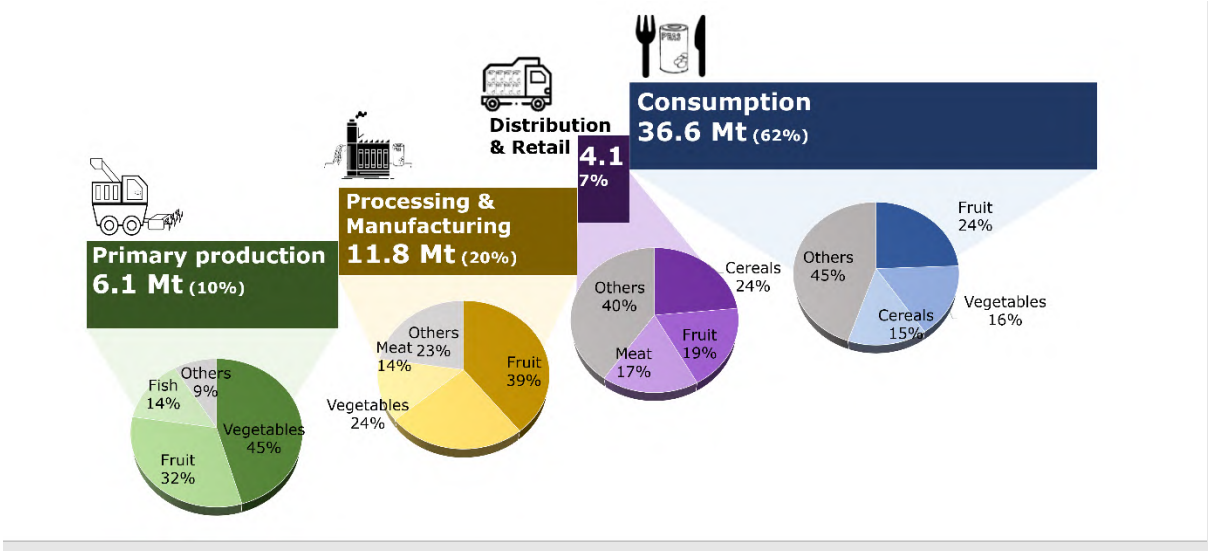
Figure 27 – Relationship between food available at the beginning of the food supply chain (based on 2019 data) and food waste along the entire food supply chain, by food group in the EU. Each dot represents 1 Mt of food; red dots represent the amount wasted. The ratio of Food waste/Food available is given in brackets for each food group. (Please note, that due to rounding, the number of dots may slightly differ from percentages).

[253] Adapted from: Sanchez Lopez, J., Caldeira, C., De Laurentiis, V., Sala, S., *Brief on food waste in the European Union,* Avraamides, M. editor. European Commission, JRC121196, 2020.
[254] See footnote 253, p. 149.

How much food waste is generated in each stage of the food supply chain?

The largest amount of food waste is generated during the consumption stage, both in- and out of home (62%), followed by processing and manufacturing (20%) and primary production (11%). The distribution and retail stages only account for 7% of the food waste generated in the supply chain (see Figure 28)[255].

Figure 28 – Amount of food waste (in fresh weight) generated in the EU27 during the different stages of the food supply chain (bars) and breakdown by main food groups (pie charts).



[255] See footnote 253, p. 149.

While fruit and vegetables only represent 20% of available food, they account for as much as 77%, 63% and 40% of the food waste generated during primary production, processing and manufacturing and consumption, respectively. The significant shares that these food groups have in the food waste generated at the consumption stage is related to their high inedible fraction at the point of purchase and their high perishability compared to other food groups.

Significant share of the inedible parts produced during the processing of different food groups is valorised in other industries and is therefore not counted as food waste. For example, bones, blood, inedible organs, and skin from the processing of meat are used as fertiliser, feedstuffs, binders, clothing, pharmaceuticals, etc., while milling residues from cereals processing, brewer's spent grain from beer production, oilcake from vegetable oil production and residues from the potato processing industry are often used as animal feed.

Previous estimations of food waste amounts in EU (FUSIONS project)

The Commission has conducted various studies on the topic. In 2010, it published a report, Preparatory Study on Food Waste across EU 27[256] and, on this basis, the Impact Assessment on measures addressing food waste to complete SWD (2014) 207 final regarding the review of EU waste management targets. [257]

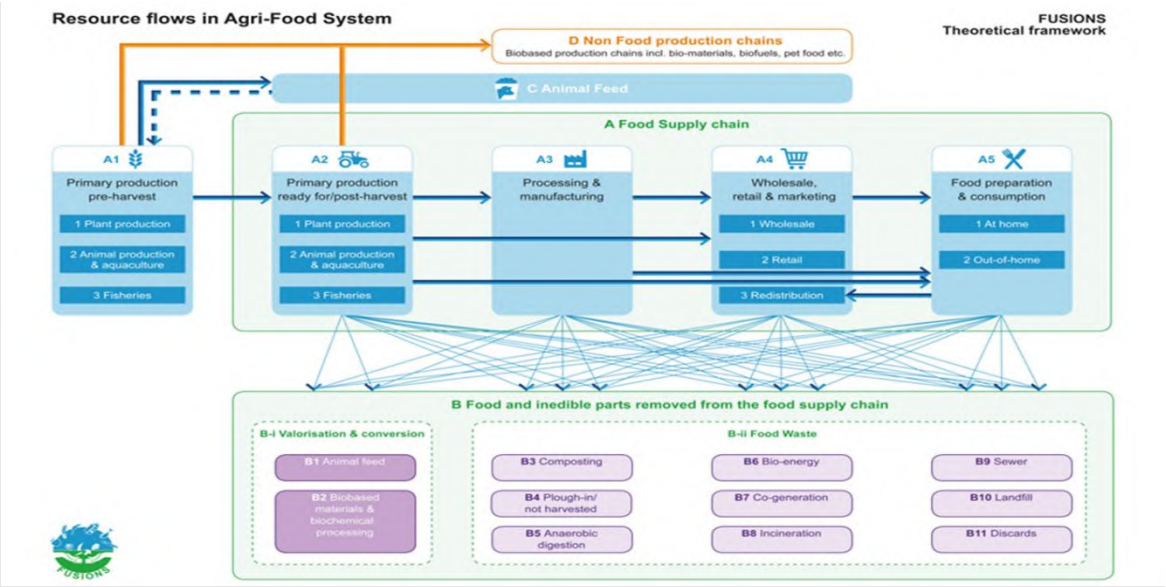
The study was based on 2006 data. The amount of food waste according to this study for EU 27 (with UK, but without HR) was then assessed at around 90 mln tonnes in 2010, and projected to grow to over 120 M tonnes in 2020. This assessment was not linked to actual measurement of food waste but was based on the analysis of other data reported in Waste Statistics.

The FUSIONS project (Food Use for Social Innovation by Optimising Waste Prevention Strategies, 2012-2016) provided useful input on food waste. In particular, it established a common definition of food waste, prepared harmonised quantification methods and, on this basis, provided estimations of food waste amounts in the EU.

In 2016, as a part of the FUSIONS project, the first comprehensive assessment of food waste in the EU was published. This EU research project calculated food waste amounts according to a slightly different methodology than that adopted subsequently in the EU. While the definition of food waste was very similar, the scope used by FUSIONS was extended to include food lost at farm level (including food not harvested). It also tried to estimate amounts of food discarded with wastewater. See the figure below.

Figure 29 –Amount of food waste (in fresh weight) generated in the EU27 during the different stages of the food supply chain (bars) and breakdown by main food groups (pie charts).

[256] European Commission, *Preparatory Study on Food Waste across EU27,* 2010, https://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf
[257] SWD(2014) 289 final



Source: FUSIONS 2016

The results were as presented in the table below.

Table 32 – Estimates of food waste in EU-28 in 2012 from this quantification study; includes food and inedible parts associated with food

Stage of the food supply chain	Food waste (M tonnes) with 95% CI*	Food waste (kg per person) with 95% CI*
Primary production	9.1 ± 1.5	18 ± 3
Processing	16.9± 12.7	33 ± 25
Wholesale and retail	4.6 ± 1.2	9 ± 2
Food service	10.5 ± 1.5	21 ± 3
Households	46.5 ±4.4	92 ± 9
Total food waste	87.6 ± 13.7	173 ± 27

*Confidence interval

According to FUSIONS, the sectors contributing the most to food waste are households (47 million tonnes ± 4 million tonnes) and processing (17 million tonnes ± 13 million tonnes). These two sectors account for 72 percent of EU food waste, although there is considerable uncertainty around the estimate for the processing sector compared to all the other sectors.

First reporting of food waste amounts in EU (for 2020)

In October 2022, Eurostat published the results of the first EU-wide monitoring of food waste levels, based on a harmonised methodology. Total food waste measured in 2020 nearly reached 58.5 million tonnes (131 kg per person per year).

Over half of food waste (53%) is generated at the level of households, representing more than 31 million tonnes. The second biggest share (20 %) is generated by the processing and manufacturing sector, where the amount of measured food waste is almost 12 million tonnes. The remaining shares – representing altogether a quarter of the total food waste – originate from

the primary production sector (6 million tonnes, 11% share of the total amount of food waste), restaurants and food services (more than 5 million tonnes, 9% of the total) and retail and other distribution of food sectors (more than 4 million tonnes, 7% of the total).

Table 33– Food waste amounts by Member State and by stage of the food supply chain for the reference year 2020.

Table 1: Food waste by sector of activities, 2020
(tonnes of fresh mass)

	Total food waste	Primary production	Processing and manufacturing	Retail and other distribution of food	Restaurants and food services	Households
EU (¹)	*58 512 559*	*6 067 377*	*11 806 452*	*4 079 709*	*5 275 265*	*31 283 755*
Belgium	2 881 897	38 699	1 862 177	73 591	88 333	819 097
Bulgaria	596 844	228 472	156 435	15 708	14 375	181 854
Czechia	*972 445*	27 022	100 339	*64 394*	*37 941*	*742 749*
Denmark	1 286 488	66 452	596 599	99 500	62 544	461 392
Germany	10 922 321	190 203	1 612 505	762 352	1 860 980	6 496 282
Estonia	166 513	23 612	31 622	19 976	10 739	80 564
Ireland	770 316	70 413	219 453	60 894	178 507	241 048
Greece (¹)	2 048 189	*372 204*	375 158	*150 472*	*220 032*	930 323
Spain (¹)	4 260 845	*845 620*	1 419 257	*348 219*	*213 023*	*1 434 726*
France	*9 000 000*	*1 059 000*	*1 926 000*	*800 000*	*1 096 000*	*4 119 000*
Croatia (¹)	286 379	*40 916*	9 866	4 180	15 072	216 345
Italy (¹)	8 650 456	*1 270 638*	510 018	343 535	*193 915*	*6 332 349*
Cyprus (¹)	*354 021*	*43 564*	*169 706*	*50 268*	*27 145*	*63 338*
Latvia (¹)	275 304	*32 487*	*36 107*	14 765	35 436	156 509
Lithuania	*382 665*	*81 202*	*28 057*	*27 342*	*4 495*	*241 570*
Luxembourg	92 580	7 384	10 692	8 525	8 739	57 240
Hungary	905 068	16 587	187 391	41 952	19 331	639 806
Malta	79 589	759	4 668	3 910	23 016	47 235
Netherlands	2 811 000	*463 045*	*1 031 407*	*209 805*	*83 035*	*1 023 708*
Austria	1 211 534	13 879	173 734	84 326	201 956	737 639
Poland	4 002 099	670 547	544 942	320 396	190 293	2 275 921
Portugal	*1 890 712*	*101 384*	*61 719*	*214 233*	*237 486*	*1 275 891*
Romania	:	:	:	:	:	:
Slovenia	143 570	93	10 757	15 290	42 666	74 764
Slovakia	455 587	71 889	4 113	15 825	7 110	*356 650*
Finland	641 258	48 011	162 278	57 555	77 914	295 500
Sweden	*905 000*	*22 000*	*53 000*	*97 000*	*98 000*	*635 000*
Norway	769 967	162 158	29 088	61 281	97 547	419 893

(:) not available
Figures in italic are estimates
(¹) Definition differs in some figures
Source: Eurostat (online data code: env_wasfw)

eurostat

Comparison of data reported (EUROSTAT 2022) with estimations of FUSIONS (2016)

Eurostat data of 2020, published in October 2022 may be perceived, on first sight, as showing a significant decrease (35%) in food waste amounts in comparison with the previously available dataset (FUSIONS project, published in 2016 on 2012 data).
However, the actual decrease should be much smaller given that the scope of FUSIONS' quantification was broader (number of countries, type of waste considered, coverage of the food supply chain, estimations used) than that of ESTAT.

- The FUSIONS figures included data from the UK, which was then responsible for more than 10% of food waste generated in the EU. Moreover, UK data were also used as a proxy for other countries (where data were missing), which likely inflated the FUSIONS findings given the high level of food waste generation at the time in the UK.
- The FUSIONS figures included estimations of food waste sent to sewer (which is excluded from the EU's quantification of food waste levels). This represents 8 million tonnes or approximately 10% of FUSIONS total.
- On primary production, the scope of FUSIONS estimation (food ready-to-harvest which was lost or wasted) was wider than that of ESTAT (food discarded as waste).
- It seems that the amount of household food waste sent for home composting could have been overestimated by FUSIONS (while underestimated in reporting to ESTAT), but lack precise data are not available to verify this claim.

Overall, a rough assessment (details are provided in the table below) would indicate an actual decrease at consumer level (household and food services) between 2012 and 2020 of about 12%. It is not clear whether this could be attributed to COVID, as according to ESTAT, countries informed that they did not observe a general reduction in the amount of collected waste but only a reduction at food services level. The reduction of food waste throughout the whole food supply chain could be estimated at around 8%, but with a high level of uncertainty, so this was not taken into account when developing the baseline for this Impact Assessment.

Table 34 – Comparison of data reported by Member States with FUSION estimations with and without impact of UK data.

	ESTAT (2022)		FUSIONS (2016)		FUSIONS 2016 (without UK and food to sewer)
Total food waste	Ca 57 million tonnes (56.981.209)		Ca 88 million tonnes (87.6 ± 13.7)		ca 62 mln tonnes
Kg/inhabitant	127		173		
	share FSC [%]	mln tonnes	share FSC [%]	mln tonnes	mln tonnes
Primary production *	11%	6.2	11%	9.1	8
Processing/manufacturing	18%	10.1	19%	16.9	9
Retail/other distribution	7%	4.1	5%	4.6	4
Restaurants/food services	9%	5.3	12%	10.5	10

Households**	55%	31.2	53%	46.5	31
Scope	*Excludes any pre-harvest losses ** Excludes food waste to sewer		*Includes food ready-to-harvest and discarded from FSC **Includes estimation of FW to sewer		*Includes food ready-to-harvest and discarded from FSC **Excludes estimation of FW to sewer
Source of data	Collected in 2020 according to harmonised EU methodology		National estimations for several MS (ca 2012). The average from these was used to estimate food waste amounts for the rest of EU.		Own calculations based on FUSIONS
Countries concerned	EU-27 – based on 23 responses. (without BE, LV, MT and RO)		EU-28 (including UK and HR)		EU-27 (without UK)

When modifying the FUSIONS data by removal of the input (and impact) of the UK as well as removal of food-to-sewer, the main difference was found in household food waste (decrease from 46,5 to 31 M tons, i.e. by 1/3) as well as in food processing (decrease from 17 to 9 M tons, i.e. almost by half, however FUSIONS data waste from food processing had high uncertainty). Removing the UK from estimates has no impacts on data from retail and from food services.

Finally, comparing the national studies for household waste (Denmark, Estonia, Finland, Germany, Ireland, Luxembourg, Netherlands, Sweden) from 2012 which wereused in FUSIONS estimations, with the country values reported to ESTAT (2020) – the results vary from -15% (Finland) and -9% (Netherlands) to +28% (Germany) and +35% (Luxembourg). However, a possible link between these findings and the presence (or absence) of food waste prevention policy cannot be established.

Estimations of trends on food waste amounts before 2020

There is no data series available on food waste so far. 2020 is the first year for which data on food waste have been collected across the EU and according to a harmonised methodology. The FUSIONS project provided a one-off estimate of food waste levels.

Between 2010 and 2018, Eurostat has been working with Member States to see if data collected within the framework of the Waste Statistics Regulation (WstatR) could be used for the purpose of monitoring of food waste. Data collected through the Waste Statistics Regulation, according to the EWC-Stat and NACE waste categories which are considered relevant for food waste data collection, are shown in below.

Table 35 – Relevant waste categories and economic activities in WstatR for calculating Food waste estimates

Item	NACE ACTIVITIES / EWC-STAT		A01-A03 Agriculture, forestry and fishing	C10 - C12 Manufacture of food products, beverages, tobacco	G - U excl. G46.77 Service activities	Households	Total
31	09.1	Animal and mixed food waste	Data reported for the Waste Statistics Regulation (WStatR) – waste generation				
32	09.2	Vegetal wastes					
34	10.1	Household and similar wastes					
51	TT	Total					

As can be seen in the table above (blue cells), the WstatR breakdown of the EWC-Stat allows the distinction of the following waste types containing food waste:

- 09.1 “animal and mixed food waste”,
- 09.2 “vegetable waste”,
- 10.1 “household and similar waste”.

As these waste categories include more waste than just food waste, Eurostat developed relevant methodology and requested Member States for voluntary reporting of disaggregated data, in order to better assess the actual amount of food waste. Eurostat published these estimates covering the period between 2012 and 2018, as part of the Monitoring Framework on Circular Economy, specifically the indicator on amounts of food waste generated. The values have been stable over that period and ranged between 66 and 69 million tonnes.[258] The main challenge was due to the limited information on the share of food waste within household waste, especially mixed household waste, hence the decision to develop a monitoring framework dedicated to food waste.

Three graphs below show trends in the amounts of waste coming from 3 sectors of the economy, classified in the following NACE categories:

[258] Monitoring framework - Circular economy - Eurostat (europa.eu)

- NACE A: Agriculture, forestry and fishing – expected to include food waste from primary production;
- NACE C10-C12: Manufacture of food products; beverages and tobacco products – expected to include food waste from processing and manufacturing;
- NACE G-U_X_G4677: Services (except wholesale of waste and scrap) – expected to include food waste from retail and food services.

It should however be noted that, for all waste streams presented in the graphs hereunder, it is not possible to disaggregate the food waste component; therefore the evolution of food waste over time cannot be determined. ,

Figure 30 – Generation of selected streams of waste (expected to including food waste) from primary production, in M tonnes

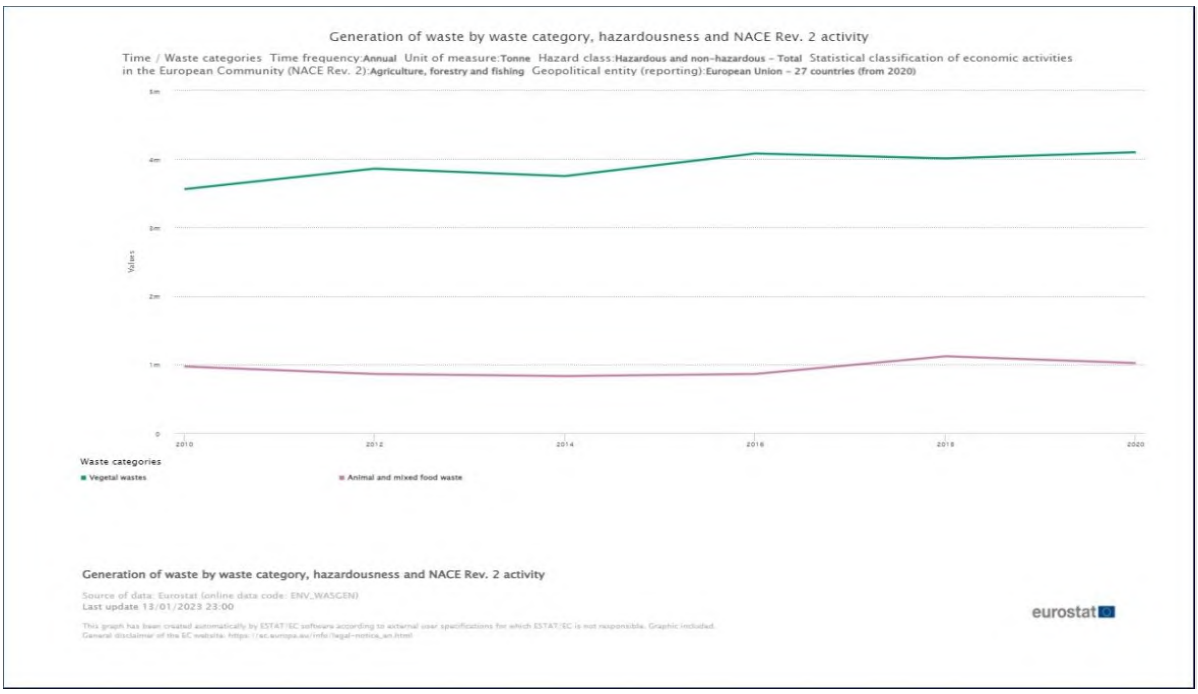


Figure 31 – Generation of selected streams of waste (expected to including food waste) from processing and manufacturing sector, in M tonnes.

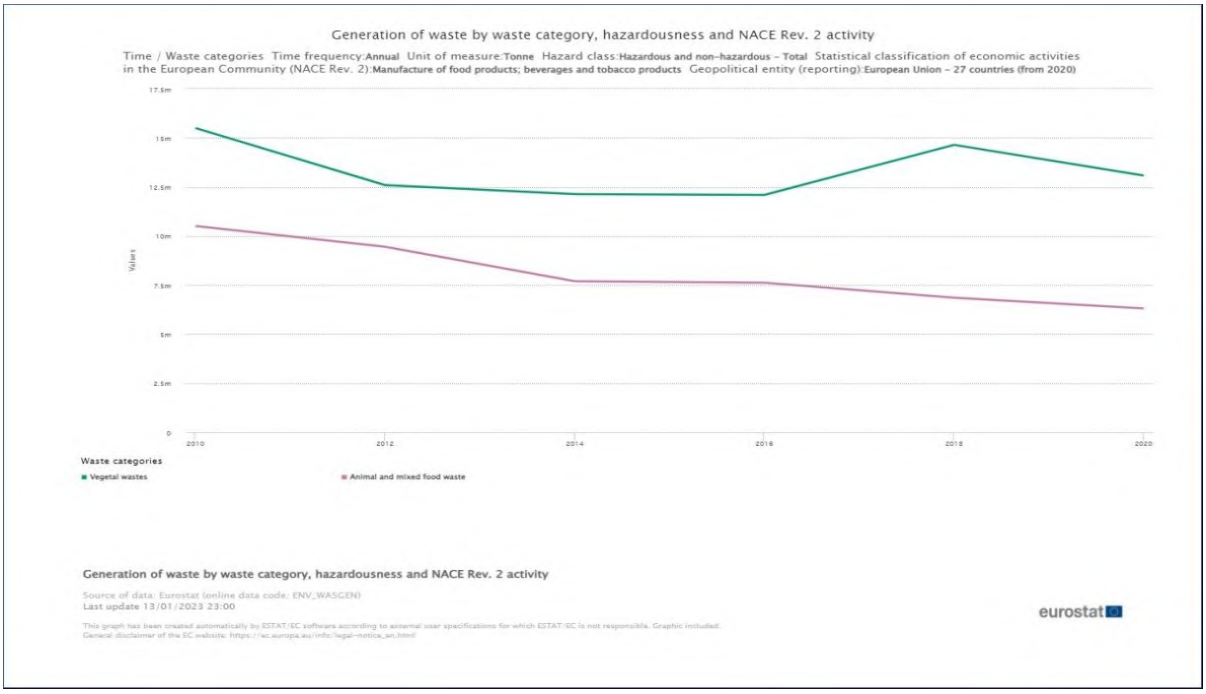
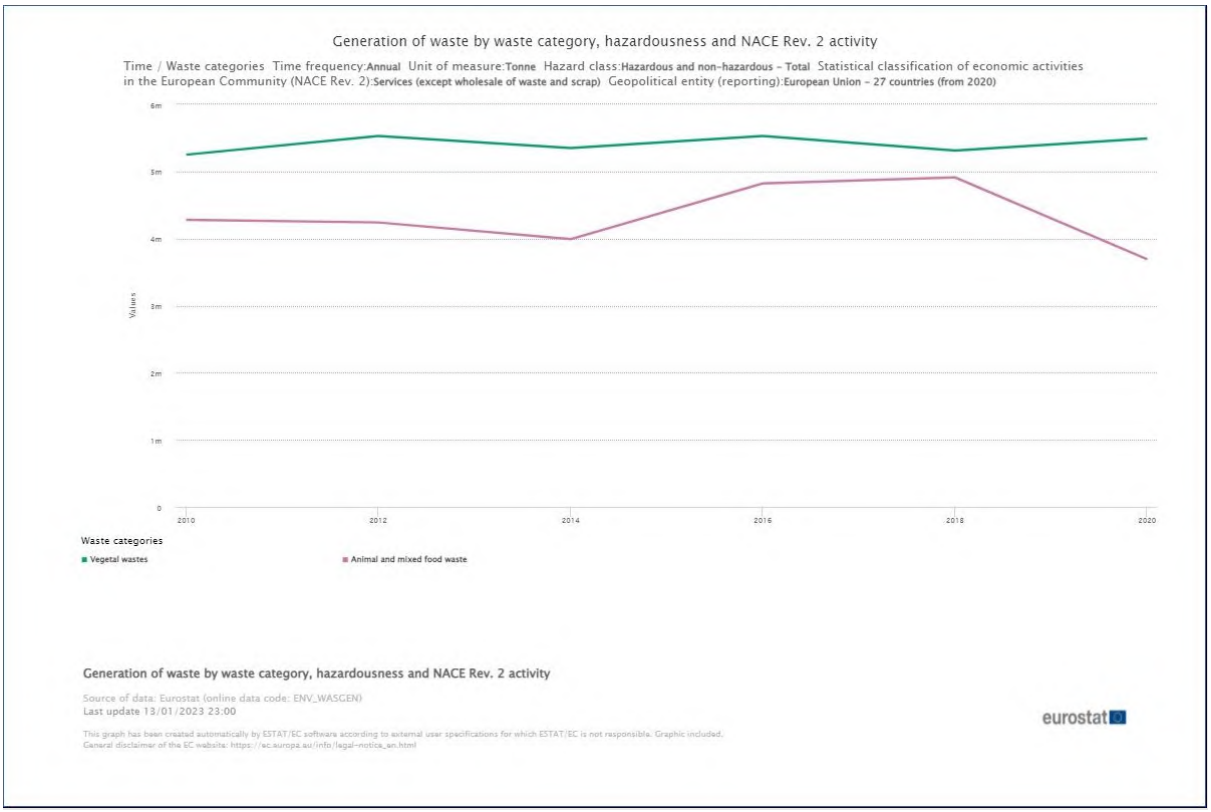
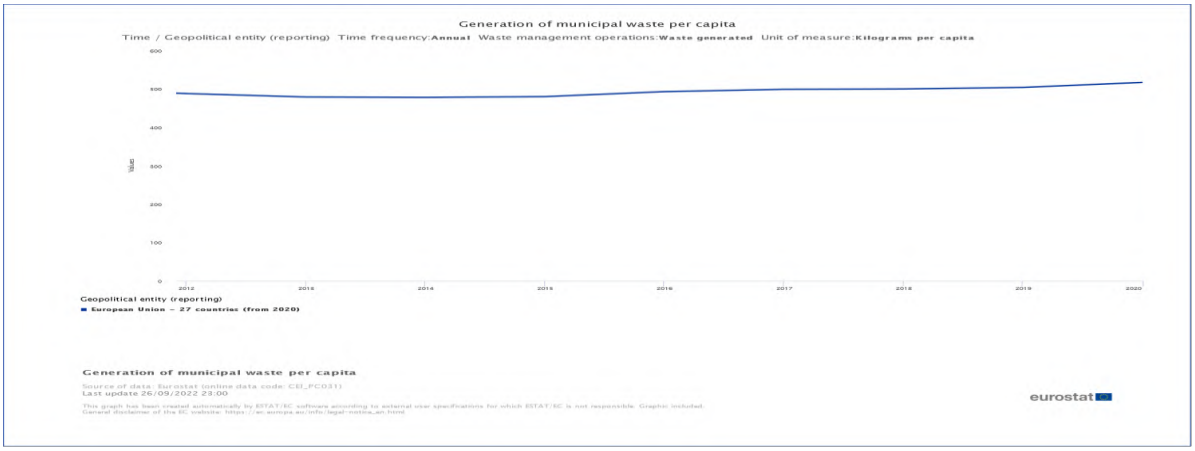


Figure 32 – Generation of selected streams of waste (expected to including food waste) from services sector, in M tonnes.



Finally, data on municipal waste (which include a large fraction of food waste) show stable trend.

Figure 33 – Generation of municipal waste in per capita (kg per capita, 2012-2020)



BIBLIOGRAPHY FOR TEXTILES WASTE

Alcin-Enis I., Kucukali-Ozturk M., Sezgin H., "Risks and Management of Textile Waste". In: Gothandam K., Ranjan S., Dasgupta N., Lichtfouse E. (eds) *Nanoscience and Biotechnology for Environmental Applications. Environmental Chemistry for a Sustainable World*, vol 22. Springer, Cham., 2019, https://doi.org/10.1007/978-3-319-97922-9_2.

Atkar, A., Pabba, M., Sekhar, S.C., Sridhar, S., *Current limitations and challenges in the global textile sector,* Fundam Nat Fibres Text, 2021, pp. 741-764.

Bel J.-B. and ACR+ D4.5. *Guidelines for successful implementation. Guidelines for improving local waste collection systems*, 2020, https://www.collectors2020.eu/wp-content/uploads/2020/12/COLLECTORS_D4.5Guidelines-final.pdf.

Bel, J.-B., ACR+ & Flanagan, B., Eurocities *D4.6. Policy recommendations & development needs related to the waste framework conditions. Policy recommendations*, 2020, https://www.collectors2020.eu/wp-content/uploads/2020/12/COLLECTORS-D4.6_Policy-recommendations-final.pdf.

CESME, "3.1.5 HUMANITA textile recycling", *The CESME White Book*, https://www.cesme-book.eu/book/level-1-d/3.1-best-practices/3.1.2-humanita-textile-recycling.

Changing Markets Foundation, *Trashion: The stealth export of waste plastic clothes to Kenya,* 2023. (due for publication Feb 2023, http://changingmarkets.org/wp-content/uploads/2023/02/Trashion-Report-Web-Final.pdf.

COWI, Eunomia, *Study on investment needs in the waste sector and on the financing of municipal waste management in Member States*, 2019

Cura Kirsti Rintala, N., Kamppuri, T., Saarimäki, E., and Heikkilä, P., *"Textile Recognition and Sorting for Recycling at an Automated Line Using Near Infrared Spectroscopy"*, 2021.

ECAP, *Used textile collection in European cities,* 2018, http://www.ecap.eu.com/wp-content/uploads/2018/07/ECAP-Textile-collection-in-European-cities_full-report_with-summary.pdf.

ECAP, *ECAP and used textiles,* 2019, http://www.ecap.eu.com/wp-content/uploads/2019/07/Guidance-for-Textiles-Collections.pdf.

Elander, M., *Automated feeding equipment for textile waste: experiences from the FITS-project,* Mistra Future Fashion, 2019.

Ellen Mac Arthur Foundation, *A New Textiles Economy: Redesigning fashion's future*, 2017, https://ellenmacarthurfoundation.org/a-new-textiles-economy.

Ellen MacArthur Foundation and Boston Consulting Group, *Circular business models – Redefining growth for a thriving fashion industry*, 2021.

EMF, *A New Textiles Economy: Redesigning fashion's future*, 2017, https://ec.europa.eu/commission/presscorner/api/files/attachment/872168/Textiles%20Factsheet.pdf.pdf.

ETP, *Towards a 4th Industrial Revolution of Textiles and Clothing,* Brussels, 2016, 6.

EURATEX, *ReHubs: A joint initiative for industrial upcycling of textile waste streams & circular materials,* 2020. ReHubs - EURATEX.

European Commission, Climate Action, 2030 Climate Target Plan, https://climate.ec.europa.eu/eu-action/european-green-deal/2030-climate-target-plan_en.

European Commission, Directorate-General for Environment, Stahl, H., Merz, C., *Study to support the Commission in gathering structured information and defining of reporting obligations on waste oils and other hazardous waste: final report,* Publications Office, 2020, https://data.europa.eu/doi/10.2779/14834

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Duhoux, T., Maes, E., Hirschnitz-Garbers, M., et al., *Study on the technical, regulatory, economic and environmental effectiveness of textile fibres recycling: final report* Publications Office, 2021, https://op.europa.eu/en/publication-detail/-/publication/739a1cca-6145-11ec-9c6c-01aa75ed71a1.

European Commission, Industry, European industrial strategy, Ecosystems, *Internal Market, Industry, Entrepreneurship and SMEs*, https://single-market-economy.ec.europa.eu/industry/strategy/ecosystems_en

European Commission, *Best Environmental Management Practice for the Waste Management Sector,* JRC Publications Repository, 2018, https://publications.jrc.ec.europa.eu/repository/handle/JRC111059.

European Commission, *Circular Economy Perspectives in the EU Textile sector,* JRC Publications Repository, 2021, https://publications.jrc.ec.europa.eu/repository/handle/JRC125110.

European Commission, *EU green public procurement criteria for textiles products and services,* SWD (2017) 231 final, 2017.

European Commission, Directorate-General for Environment, Dubois, M., Sims, E., Moerman, T., et al. *Guidance for separate collection of municipal waste*, Publications Office, 2020.

European Commission, Directorate-General for Environment, Weißenbacher, J., Dollhofer, M., Herczeg, M., et al., *Assessment of separate collection schemes in the 28 capitals of the EU: final report*.

European Commission, Directorate-General for Environment, Karigl, B., Neubauer, C., Kral, U., et al., *Scoping study to assess the feasibility of further EU measures on waste prevention: final report*, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2779/21588

European Commission, Directorate-General for Research and Innovation, *A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment: updated bioeconomy strategy,* Publications Office, 2018, A sustainable bioeconomy for Europe - Publications Office of the EU (europa.eu).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, *Data on the EU textile ecosystem and its competitiveness: final report*, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2873/23948.

European Commission, Joint Research Centre, Donatello, S., Danneck, J., Löw, C., et al. *Circular economy perspectives in the EU textile sector: final report*, Publications Office, 2021, https://data.europa.eu/doi/10.2760/858144.

European Commission, JRC Publications Repository, *Best Environmental Management Practice for the Waste Management Sector,* 2018, https://publications.jrc.ec.europa.eu/repository/handle/JRC111059.

European Environment Agency, *Progress towards preventing waste in Europe - the case of textile waste prevention,* EEA report No.15, 2021, https://www.eea.europa.eu/publications/progressing-towards-waste-prevention-in/at_download/file.

European Environment Agency, *Textiles and the Environment – The role of design in Europe's circular economy,* Textiles and the environment: the role of design in Europe's circular economy — European Environment Agency (europa.eu), 2022.

European Environment Agency, *Textiles in Europe's circular economy,* 2019, Textiles in Europe's circular economy — European Environment Agency.

European Environment Agency, *The use of primary raw materials in the upstream supply chain of EU-27 household consumption domains million tonnes* 2020 https://www.eea.europa.eu/data-and-maps/figures/the-use-of-primary-raw.

European Environment Agency, *Textiles and the environment in a circular economy*, 2019, https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-wmge-reports/textiles-and-the-environment-in-a-circular-economy.

European Environment Agency, *Plastic in textiles: potentials for circularity and reduced environmental and climate impacts,* 2021, https://www.eea.europa.eu/themes/waste/resource-efficiency/plastic-in-textiles-towards-a.

European Environment Agency, *Waste prevention in Europe,* 2021, Waste prevention in Europe — European Environment Agency (europa.eu).

European Environmental Bureau, *Advancing resource efficiency in Europe*, 2014.

European Parliament, *Environmental impact of the textile and clothing industry: What consumers need to know,* 2019, https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2019)633143.

European Parliament, *The impact of textile production and waste on the environment,* 2020, https://www.europarl.europa.eu/news/en/headlines/society/20201208STO93327/the-impact-of-textile-production-and-waste-on-the-environment-infographic.

EUROSTAT, *Guidance for the compilation and reporting of data on municipal waste according to Commission Implementing Decisions 2019/1004/EC and 2019/1885/EC and the Joint Questionnaire of Eurostat and OECD, 2021*, https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+municipal+waste+data+collection/.

EUROSTAT, *Guidance on classification of waste according to EWC-Stat categories,* 2010, https://ec.europa.eu/eurostat/documents/342366/351806/Guidance-on-EWCStat-categories-2010.pdf/0e7cd3fc-c05c-47a7-818f-1c2421e55604.

EUROSTAT, *E-commerce statistics for individuals,* 2022, E-commerce statistics for individuals - Statistics Explained (europa.eu).

EUROSTAT, *Prodcom - Statistics by products – Overview*, Overview - Prodcom - statistics by product - Eurostat (europa.eu).

Farrant, L., Olsen, S.I. & Wangel, A., *Environmental benefits from reusing clothes,* The International Journal of Life Cycle Assessment 15, 726–736 2010 https://doi.org/10.1007/s11367-010-0197-y.

Fashion for Good, *Sorting for Circularity Europe. An evaluation and commercial assessment of textile waste across Europe*, 2022.

Fortuna and Diyamandoglu, 2017 in Gustav Sandin and Greg M., Peters, "Environmental impact of textile reuse and recycling – A review", *Journal of Cleaner Production,* Vol. 184, 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

Global Fashion Agenda & The Boston Consulting Group, *Pulse of the fashion industry*, 2017.

Greenpeace, *Poisoned Gifts. From donations to the dumpsite: textiles waste disguised as second-hand clothes exported to East Africa*, 2022, https://www.greenpeace.org/static/planet4-international-stateless/2022/04/9f50d3de-greenpeace-germany-poisoned-fast-fashion-briefing-factsheet-april-2022.pdf.

Greer, L., Keane, S., Lin, C., Zhou, A., Yiliqi Tong, T., Natural Resources Defense Council, *The Textile Industry Leaps Forward with Clean by Design: less environmental impact with bigger profits,* 2015.

H&M group, IKEA, Adidas, Bestseller, PVH, Gap Inc, Kingfisher, *Collaborative study on chemicals in recycled textiles,* 2021, https://www.naturvardsverket.se/contentassets/be04327b5a874955a5402d4f663d1632/webinar-collaborative-study-chemicals-recycled-textiles-hm-ikea.pdf.

Dumped in the Atacama desert the mountain of discarded cheap clothes from the West | Daily Mail Online.

Herjanto, H., & Scheller-Sampson, J., & Erickson, E., "the increasing phenomenon of second-hand clothes purchase: insights from the literature" *Jurnal Manajemen dan Kewirausahaan*, 18. 10.9744/jmk.18.1.1-15, 2019.

Hur, E. "Rebirth Fashion: Secondhand clothing consumption values and perceived risks" *Journal of Cleaner Production* Vol. 273 p.122951 2020 https://doi.org/10.1016/j.jclepro.2020.122951.

ISO, ISO 14040:2006, *Environmental management — Life cycle assessment — Principles and framework*, 2006, rev 2022

JRC, *Best Environmental Management Practice – Treatment of mattresses for improved recycling of materials*, 2016.

Köhler, A., Watson, D., Trzepacz, S., Löw, C., Liu, R., Danneck, J., Konstantas, A., Donatello, S., Faraca, G., *Circular Economy Perspectives in the EU Textile sector*, Publications Office of the European Union, 2021.

Les joyeux recycleurs, *Recyclage de vos tapis et moquettes mode d'emploi*, 2018, Recyclage de vos tapis et moquettes mode d'emploi - Les joyeux recycleurs.

Lai, O., *What is fast fashion*, Earth.org, 2021.

Maletic, M., *Shoe Recycling Guide: Recycle Your Footwear Responsibly* Green Citizen, 2022 Shoe Recycling Guide: Recycle Your Footwear Responsibly (greencitizen.com).

McKinsey, Global Fashion Agenda *Fashion on climate. How the fashion industry can urgently act to reduce its greenhouse gas emissions*, 2020.

McKinsey & Company, *Apparel, Fashion & Luxury Group Scaling textile recycling in Europe–turning waste into value* 2022.

McKinsey & Company, *Scaling textile recycling in Europe–turning waste into value*, 2022.

MDPI, *A Systematic Literature Review for the Recycling and Reuse of Wasted Clothing* 2021 https://www.mdpi.com/2071-1050/13/24/13732/pdf.

Migiro, G., *Top 10 Textile Importing Countries In The World*, WorldAtlas in Economics 2020. https://www.worldatlas.com/articles/top-10-textile-importing-countries-in-the-world.html.

NRDC, *Encourage Textile Manufacturers to Reduce Pollution* 2022.

OECD, *Germany supports sustainable textile production,* Development co-operation tips tools insights practices in practice 2022, Germany supports sustainable textile production - OECD.

OECD, *Understanding the Spillovers and Transboundary Impacts of Public Policies, Implementing the 2030 Agenda for More Resilient Societies,* 2021, https://www.oecd.org/gov/pcsd/understanding-the-spillovers-and-transboundary-impacts-of-public-policies-862c0db7-en.htm.

Recycling Magazine, *World's first fully automated textile sorting plant in Malmö*, 2021, World's first fully automated textile sorting plant in Malmö - RECYCLING magazine (recycling-magazine.com).

Refashion press release, *Lauch of RECYCLE by Refashion,* 2021, https://refashion.fr/pro/en/press-releases ; https://www.textile.fr/actualite/recycle-plateforme-digitale-de-mise-en-relation-des-acteurs-du-recyclage-de-refashion.

RREUSE, *Job creation in the reuse sector: data insights from social enterprises,* 2021.

RREUSE, *Vision for a new fashion season: social and circular stakeholder workshop* The Policy hub – response to interview questionnaire.

RREUSE, *Research study on developing reuse networks in Europe,* 2022

Sandin, G., and M. Peters, G., *Environmental impact of textile reuse and recycling – A review*, 2018, https://www.sciencedirect.com/science/article/pii/S0959652618305985#bib21.

Scheffer, M.R. 'Shishoo R. (ed.). The global textile and clothing industry Technological advances and future challenges *Trends in textile markets and their implications for textile products and processes* Cambridge: Woodhead Publishing Ltd 2012 pp. 8– 28.

Shaikh, M.A., *Water conservation in textile industry,* College of Textile Engineering, SFDAC, 2009.

Statista, *Fashion e-commerce revenue forecast in Europe from 2017 to 2025, by segment,* 2022 Europe: e-commerce fashion segment revenue | Statista.

STATISTA, *Household consumption of textiles and clothing in the European Union from 2009 to 2020,* 2022.

Textile & clothing EU household consumption 2009-2020 | Statista.

Swedish Environmental Protection Agency, *Response to interview questionnaire*, 2022.

The Conversation, *Do you shop for second-hand clothes? You're likely to be more stylish,* 2022. Do you shop for second-hand clothes? You're likely to be more stylish (theconversation.com).

The Exchange, *Africa is fighting a losing battle banning used apparel*, 2021, https://theexchange.africa/industry-and-trade/africa-second-hand-clothes-imports-ban/.

The Policy Hub, *Circularity for Apparel and Footwear*, Response to interview questionnaire, 2022.

Tojo, N., Kogg, B., Kiørboe, N., Kjær B. and Aalto K., *Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments*, NORDEN, http://dx.doi.org/10.6027/TN2012-545

United Nations, Kuwonu, F., Protectionist ban on imported used clothing | Africa Renewal (un.org), December 2017 - March 2018

Watson, D., Kant Hvass, K., Moora, H., Martin, K., Nausėdė, V., Gurauskiene, I., & Akule, D., *Textile circularity in the Baltic countries: current status and recommendations for the future* Nordic Council of Ministers TemaNord Report 2020b.

Watson, D., Trzepacz, S., Kiørboe, N., Elander, M., Ljungkvist Nordin, H., Lander Svendsen N., & Wittus Skottfelt, S., *Towards 2025: Separate Collection and Treatment of Used Textiles in 6 EU countries* 2020a.

Watson, D., Aare, A., K., Trzepacz, S., and Dahl Petersen, C., *Used Textile Collection in European Cities,* Study commissioned by Rijkswaterstaat under the European Clothing Action Plan (ECAP) 2018a.

BIBLIOGRAPHY FOR FOOD WASTE

Aguiar, A., Chepeliev, M., Corong, E., Mcdougal, R., Van der Mensbrugghe, D., The gtap data base: Version 10. J. Glob. Econ. Anal. 4 1–27, 2019a, https://doi.org/10.21642/JGEA.040101AF

Aguiar A Corong E.L an der Mensbrugghe D Bekkers E Koopman R Teh R 2019b. The WTO Global Trade Model: Technical documentation WTO Staff Working Papers.

Andreasi Bassi, S., Biganzoli, F., Ferrara, N., Amadei, A., Valente, A., Sala, S. and Ardente, F. (2023) Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method, EUR 31414 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-99069-7, doi:10.2760/798894, JRC130796.

Barba Navaretti G Castellani D Pieri F 2014. Age and firm growth: evidence from three European countries. Small Bus. Econ. 43 823–837. https://doi.org/10.1007/s11187-014-9564-6

Bartelings H Verma M Boysen K 2021. Waste management and circular economy in a CGE framework Heleen Bartelings. 24th Annual Conference on Global Economic Analysis p. 14.

Beck T DEMIRGÜÇ-KUNT A MAKSIMOVIC V 2005. Financial and Legal Constraints to Growth: Does Firm Size Matter? J. Finance 60 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

Boulanger P Boysen-Urban K Philippidis G 2021. European union agricultural support 'coupling' in simulation modelling: Measuring the sustainability impacts. Sustainability 13 1–17. https://doi.org/10.3390/su13063264

Boulanger P Philippidis G 2015. The EU budget battle: Assessing the trade and welfare impacts of CAP budgetary reform. Food Policy 51 119–130. https://doi.org/10.1016/j.foodpol.2015.01.004

Boysen-Urban K M'barek R Philippidis G ferrer Perez H 2022. Exploring changing food attitudes to respect planetary boundaries - A global model-based analysis. https://doi.org/10.2760/744504

Caldeira C De Laurentiis V Ghose A Corrado S Sala S 2021. Grown and thrown: Exploring approaches to estimate food waste in EU countries. Resour. Conserv. Recycl. 168 105426. https://doi.org/10.1016/j.resconrec.2021.105426

Castellani V Fusi A Sala S 2017. Consumer Footprint Basket of Products indicator on Food. https://doi.org/10.2760/668763

Champions 12.3 2017. The Business Case for Reducing Food Loss and Waste.

Christopherson S 2015. How does financialization affect manufacturing investment? Preliminary evidence from the US and UK in: J. R. Bryson J. Clark V. Vanchan (Eds Handbook of Manufacturing Industries in the World Economy. Edward Elgar Cheltenham pp. 42–57.

Corong E 2017. The Standard GTAP Model: Version 7. J. Glob. Econ. Anal. 2 1–118. https://doi.org/10.21642/jgea.0201xxad

Crenna E Sinkko T Sala S 2019. Biodiversity impacts due to food consumption in Europe. J. Clean. Prod. 227 378–391. https://doi.org/10.1016/J.JCLEPRO.2019.04.054

Crippa M Solazzo E Guizzardi D Monforti-Ferrario F Tubiello F.N Leip A 2021. Food systems

are responsible for a third of global anthropogenic GHG emissions. Nat. Food 2 198–209. https://doi.org/10.1038/s43016-021-00225-9

Daioglou V Stehfest E Wicke B Faaij A van Vuuren D.P 2016. Projections of the availability and cost of residues from agriculture and forestry. GCB Bioenergy 8 456–470. https://doi.org/10.1111/gcbb.12285

De Jong B, Boysen-Urban K, De Laurentiis V, Philippidis G, Bartelings H, Mancini L, Biganzoli F, Sanyé Mengual E, Sala S, Lasarte-López J, Rokicki B, M'barek R. Assessing the economic, social and environmental impacts of food waste reduction targets. A model-based analysis. Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/77251, JRC133971.De Laurentiis, V, Mancini, L, Casonato, C, Boysen-Urban, K, De Jong, B, M'Barek, R, Sanyé Mengual, E, Sala, S *Setting the scene for an EU initiative on food waste reduction targets*. Publication Office of the European Union, Luxembourg, doi: 10.2760/13859, JRC133967De Laurentiis V Caldeira C Biganzoli F Serenella S European Commission. Joint Research Centre 2021. Building a balancing system for food waste accounting at national level. Luxembourg. https://doi.org/10.2760/316306

De Laurentiis V Caldeira C Sala S 2020. No time to waste: assessing the performance of food waste prevention actions. Resour. Conserv. Recycl. 161 104946. https://doi.org/https://doi.org/10.1016/j.resconrec.2020.104946

Demirel P Danisman G.O 2019. Eco- innovation and firm growth in the circular economy: Evidence from European small- and medium- sized enterprises. Bus. Strateg. Environ. 28 1608–1618. https://doi.org/10.1002/bse.2336

EC - Joint Research Centre, 2022. European Platform on Life Cycle Assessment. Consumption Footprint Platform [WWW Document]. URL https://eplca.jrc.ec.europa.eu/ConsumptionFootprintPlatform.html

EC - European Commission 2021. Commission recommendation of 16.12.2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations. (2021) 9332 final.

EC - European Commission 2020. A Farm to Fork Strategy for a fair healthy and environmentally-friendly food system. COM/2020/381 final.

EEA 2022. Annual European Union greenhouse gas inventory 1990–2020 and inventory report 2022 Submission to the UNFCCC Secretariat.

ESTAT 2022. Food waste and food waste prevention by NACE Rev. 2 activity - tonnes of fresh mass [WWW Document]. Eur. Comm.

European Commission D.-G. for R. and I Borzęcka M Oberč B Haffner R, et al 2018. Research and innovation perspective of the mid-and long-term potential for advanced biofuels in Europe : final report. https://doi.org/10.2777/37969

Ferrari E Chatzopoulos T Perez-Dominguez I Boulanger P Boysen-Urban K Himics M Robert M 2021. Cumulative economic impact of trade agreements on EU agriculture – 2021 update. Luxembourg. https://doi.org/10.2760/501873

FAO 2013. Food wastage footprint Fao.

Ipinnaiye O Dineen D Lenihan H 2017. Drivers of SME performance: a holistic and multivariate approach. Small Bus. Econ. 48 883–911. https://doi.org/10.1007/s11187-016-9819-5

Kaza S Yao L.C Bhada-Tata P Van Woerden F 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050 Urban Development. Washington DC.

Keramidas K Fosse F Diaz-Vazquez A Schade B Tchung-Ming S Weitzel M Vandyck T Wojtowicz K 2021. Global Energy and Climate Outlook 2020: A New Normal Beyond Covid-19 Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/608429

Kuiper M Cui H.D 2021. Using food loss reduction to reach food security and environmental objectives – A search for promising leverage points. Food Policy 98 101915. https://doi.org/10.1016/j.foodpol.2020.101915

Lai Y Saridakis G Blackburn R Johnstone S 2016. Are the HR responses of small firms different from large firms in times of recession? J. Bus. Ventur. 31 113–131. https://doi.org/10.1016/j.jbusvent.2015.04.005

Lasarte-López. J Ronzon T Van Leeuwen M Rossi W M'barek R 2022. Estimating employment and value added in the bioeconomy of EU regions. https://doi.org/http://dx.doi.org/10.2760/850726

M'barek R 2012. An integrated modelling platform for agro-economic commodity and policy analysis (iMAP) : a look back and the way forward. https://doi.org/10.2791/78367

M'barek R Delincé J 2015. iMAP an integrated Modelling Platform for Agro-economic Commodity and Policy Analysis: New developments and policy support 2012-14. Joint Research Centre Institute for Prospective Technological Studies. https://doi.org/10.2791/651649

MAGNET 2022. MAGNET model description [WWW Document]. URL https://www.magnet-model.eu/model/ (accessed 11.24.22).

Mateev M Anastasov Y 2011. On the Growth of Micro Small and Medium-Sized Firms in Central and Eastern Europe: A Dynamic Panel Analysis. Bank. Financ. Rev. 3 81–104.

Mazzucato M Parris S 2015. High-growth firms in changing competitive environments: the US pharmaceutical industry (1963 to 2002). Small Bus. Econ. 44 145–170. https://doi.org/10.1007/s11187-014-9583-3

Naturvårdsverket 2022. Livsmedelsavfall i Sverige 2020.

Notarnicola B Tassielli G Renzulli P.A Castellani V Sala S 2017. Environmental impacts of food consumption in Europe. J. Clean. Prod. 140 753–765. https://doi.org/10.1016/j.jclepro.2016.06.080

OECD-FAO 2021. OECD-FAO agricultural outlook 2021-2030.

OECD 2021. OECD SME and Entrepreneurship Outlook 2021. OECD. https://doi.org/10.1787/97a5bbfe-en

Philippidis G Bartelings H Helming J M'barek R Ronzon T Smeets E van Meijl H Schutes L 2018. The MAGNET model framework for assessing policy coherence and SDGs - Application to the bioeconomy. Publications Office of the European Union Luxembourg. https://doi.org/10.2760/560977

Philippidis G Ferrer Pérez H Gracia de Rentería P M'barek R Sanjuán López A.I 2021. Eating your greens: a global sustainability assessment. Resour. Conserv. Recycl. 168. https://doi.org/10.1016/j.resconrec.2021.105460

Philippidis G Sartori M Ferrari E M'Barek R 2019. Waste not want not: A bio-economic impact assessment of household food waste reductions in the EU. Resour. Conserv. Recycl. 146 514–522. https://doi.org/10.1016/j.resconrec.2019.04.016

Philippidis G Shutes L M'barek R Ronzon T Tabeau A van Meijl H 2020. Snakes and ladders: World development pathways' synergies and trade-offs through the lens of the Sustainable Development Goals. J. Clean. Prod. 267. https://doi.org/10.1016/j.jclepro.2020.122147

Polizzi di Sorrentino E Woelbert E Sala S 2016. Consumers and their behavior: state of the art in behavioral science supporting use phase modeling in LCA and ecodesign. Int. J. Life Cycle Assess. 21 237–251. https://doi.org/10.1007/s11367-015-1016-2

Rigtering J.P.C Kraus S Eggers F Jensen S.H 2014. A comparative analysis of the entrepreneurial orientation/growth relationship in service firms and manufacturing firms. Serv. Ind. J. 34 275–294. https://doi.org/10.1080/02642069.2013.778978

Sala S Castellani V 2019. The consumer footprint: Monitoring sustainable development goal 12 with process-based life cycle assessment. J. Clean. Prod. 240 118050.

Sala S Crenna E Secchi M Sanyé-Mengual E 2020. Environmental sustainability of European production and consumption assessed against planetary boundaries. J. Environ. Manage. 269 110686. https://doi.org/10.1016/j.jenvman.2020.110686

Sala S Sanye Mengual E 2022. Consumption Footprint: assessing the environmental impacts of EU consumption, European Commission, JRC126257.

Sanye Mengual, E., and Sala, S., Consumption Footprint and Domestic Footprint: Assessing the environmental impacts of EU consumption and production, EUR 31390 EN, Publications

Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-61754-9, doi:10.2760/218540, JRC128571.

Sanyé-Mengual, E., Secchi, M., Corrado, S., Beylot, A., & Sala, S. (2019). Assessing the decoupling of economic growth from environmental impacts in the European Union: A consumption-based approach. Journal of cleaner production, 236, 117535.

Sanyé Mengual E, Foschi J, Orza V, Sinkko T, Wierzgala P, Sala S. (2023a) Consumption Footprint: methodological overview, A life cycle assessment-based model to assess environmental impacts of consumption, Publications Office of the European Union, Luxembourg, doi:10.2760/413081, JRC132734

Sanyé-Mengual, E., Biganzoli, F., Valente, A., Pfister, S., & Sala, S. (2023b). What are the main environmental impacts and products contributing to the biodiversity footprint of EU consumption? A comparison of life cycle impact assessment methods and models. The International Journal of Life Cycle Assessment, 1-17.

Sartori M Philippidis G Ferrari E Borrelli P Lugato E Montanarella L Panagos P 2019. A linkage between the biophysical and the economic: Assessing the global market impacts of soil erosion. Land use policy 86 299–312. https://doi.org/10.1016/j.landusepol.2019.05.014

The Netherlands Nutrition Centre Foundation 2019. Synthesis report on Food Waste in Dutch Households in 2019.

UN General Assembly 2015. Transforming our world: the 2030 Agenda for Sustainable Development. New York United Nations.

Woltjer G Kuiper M 2014. The MAGNET model: Module description. Wageningen UR. 144.

WRAP, 2020, Banbury, UK progress against Courtauld 2025 targets and Sustainable Development Goal 12.3, Prepared by Andrew Parry, Billy Harris, Karen Fisher and Hamish Forbes

WRAP 2022. The Food Waste Reduction Roadmap Progress Report 2022.

WUR 2022. Minder voedselverspilling in supermarkten.

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