

# Conference of European Statisticians Framework on Waste Statistics





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# **Conference of European Statisticians Framework on Waste Statistics**



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## Acronyms / Abbreviations

CES	Conference of European Statisticians
EEA	European Environment Agency
ELV	End-of-life vehicles
EU	European Union
EWC-Stat	European Waste Classification for Statistics
FDES	Framework for the Development of Environment Statistics
HS	Harmonized Commodity Description and Coding System
ICT	Information and communications technology
ILO	International Labour Organization
ISIC	International Standard Industrial Classification of All Economic Activities
NACE	Statistical Classification of Economic Activities in the European Community (nomenclature statistique des activités économiques dans la Communauté européenne)
NSO	National Statistical Office
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
SEEA-CF	System of Environmental Economic Accounting – Central Framework
SNA	System of National Accounts
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
UNU	United Nations University
WEEE	Waste electronic and electrical equipment

## Executive summary

Every household, enterprise and institution produces waste. The management of waste is an issue of growing seriousness and increasing policy interest. When properly organized, waste management creates employment, income and materials that can be re-used in production processes, as well as protecting human health and the environment. When poorly organized, waste is largely a drag on the economy and can pose a real threat to humans and the environment.

Official waste statistics have been produced for more than 40 years. They were initially developed to monitor and manage threats to human health and the environment. More recently, information needs have shifted toward realising the economic value of waste, particularly in the context of the “circular economy”. This change has created demand for information on waste types that have not traditionally been measured, for example, electronic, food and textile wastes. Greater insight is also sought into the economic value of waste and wastes that are difficult to measure, including those processed by workers in the informal sector. This growing interest is reflected in the fact that several of the United Nations’ Sustainable Development Goal indicators refer directly to waste and its management.

Given these evolving information demands, high-quality, internationally comparable waste statistics are important. Therefore, international organisations have harmonised their waste statistics data collections to a large extent, including the terminology and definitions. However, differences remain. In some cases, there are comparability problems even between different organisations of the same country. Those can stem from differences in concepts, scope, classifications and definitions, or from differences in the practical measurement. Some of those issues are almost unavoidable, as they are consequences of the differing legal, regulatory and policy frameworks related to waste within and among countries. Furthermore, the data according to different breakdowns of waste statistics are sometimes presented side-by-side leaving the impression that the different components can be added up (for example, hazardous waste, municipal and industrial waste) while in fact they are partially overlapping.

The current scope of waste statistics does not usually cover informal or illegal waste-related activities. In many countries these uncontrolled and often unmeasured activities contribute significantly to the handling of waste, but also pose a risk for human health and the environment.

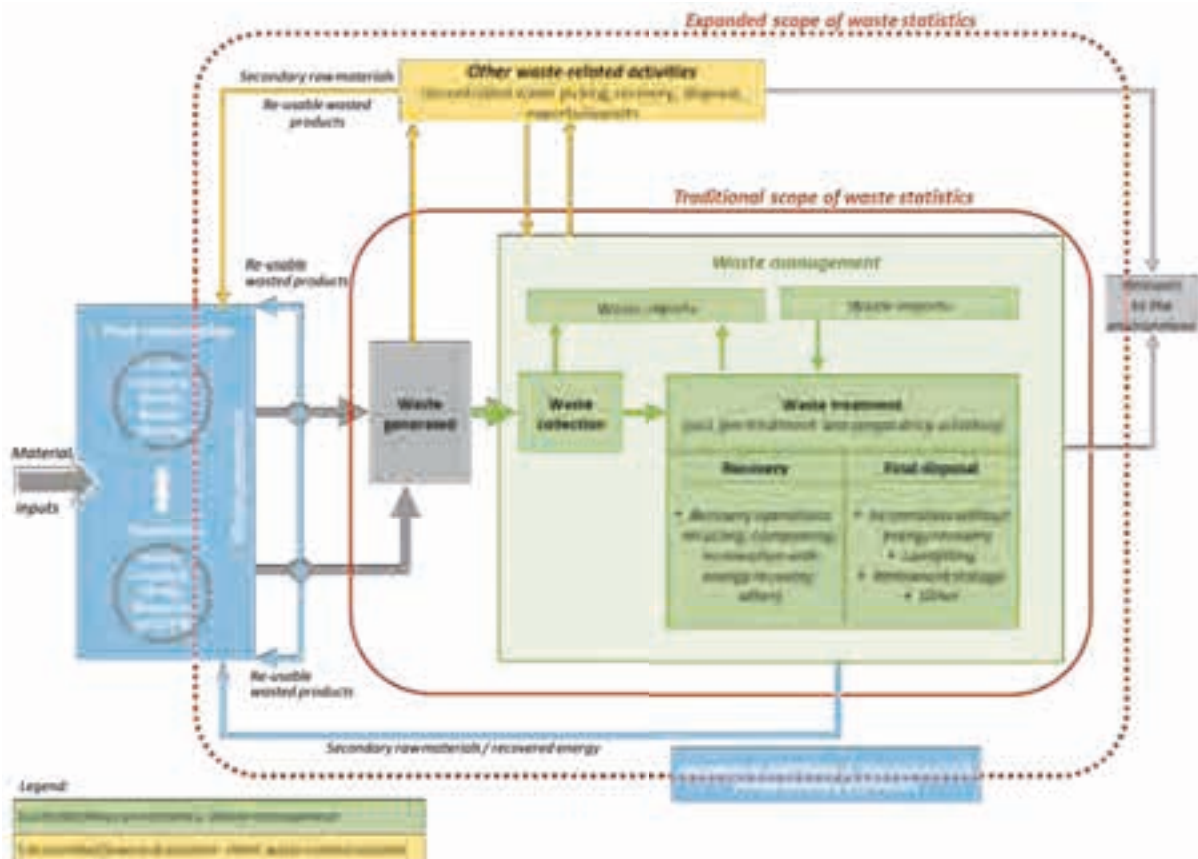
The Bureau of the Conference of European Statisticians established a Task Force on Waste Statistics in 2017. The aim was to develop a *waste statistics framework* that would be coherent to the fullest extent possible with existing national and international frameworks but also support the development of future data collections, e.g. on specific waste streams (food waste, electronic waste, etc.) and for measuring the circular economy. The Task Force was also asked to draft a *glossary of the most important terms and definitions in waste statistics*.

This document presents the results of the Task Force’s work, of which the main ones are:

- Conceptual framework for waste statistics
- Definition of key terms
- Recommendations for improving waste statistics
- Recommendations for further work.

The *conceptual framework for waste statistics* developed by the Task Force is shown in the figure below. The recommended expanded scope of waste statistics (the red dotted box in the figure) includes the waste management activities carried out by formal economic units (that is, the “traditional” scope of waste statistics) and the (usually uncontrolled) waste handling by informal economic units and illegal handling of wastes. The framework also considers the linkages between waste prevention and flows of secondary raw materials as well as waste-related emissions to the environment.

Recognizing that waste statistics gain relevance if they are comparable with other material-related statistics, the Task Force included broader material flows (for example, inputs from the environment to the economy) in the Figure below to show waste statistics within a broader context.



Based on a review of terminology used in international waste statistics questionnaires and taking into consideration an expanded scope of waste statistics, the Task Force agreed on the following definitions for the key terms “waste” and “waste management”:

**Waste:** Any material which the holder discards or intends or is required to discard.

**Waste management:** Set of lawful activities carried out by economic units of the formal sector, both public and private for the purpose of the collection, transportation and treatment of waste, including final disposal and after-care of disposal sites.

Definitions used in international questionnaires are often formulated slightly differently but are conceptually identical. The definitions used by the Task Force to describe the waste statistics framework embed all definitions used in the most important international waste statistics questionnaires. Any differences are further explained.

The waste statistics framework and its glossary will support countries in developing or reviewing national work plans on waste statistics. It also serves as a reference for National Statistical Offices (NSOs) and international organisations when reviewing existing waste statistics data collections and related concepts, terms and definitions. Relevant recommendations to national data producers and international organisations are formulated in chapter 5 of the document.

While conducting its work, the Task Force identified a number of issues that require further research to fully implement the proposed waste statistics framework. These are presented in chapter 6. The research agenda includes:

- Development of new methods and tools for data collection
- Filling data gaps
- Development of a waste classification for possible global use
- Responding to emerging needs (e.g. measuring the circular economy, measuring food waste, wood waste, textile waste, etc.)

- Further clarification of key terms (e.g. waste and generation of waste in the context of SEEA, illegal waste-related activities, informal waste handling, secondary raw materials, re-use, organic waste, biodegradable waste, etc.)
- Drafting of guidelines for the practical distinction of wastes, resources and products
- Drafting of guidelines for distinguishing between waste management, informal and illegal activities
- Measures to improve the international comparability of statistics on municipal waste
- Clarification of conceptual issues related to disposal in waterbodies
- Better alignment of Harmonized Commodity Description and Coding System (HS) for monitoring of transboundary movements of waste.

The Conference of European Statisticians, consisting of heads of statistical offices of UNECE and OECD Member States endorsed the document, including the waste statistics framework at its plenary session in 2021.



## 1 Introduction

1. Every household, enterprise and institution produces waste. Waste poses a threat to human health and the environment if not properly dealt with. Driven by growing consumption levels and low levels of re-use and recycling, waste is an issue of growing seriousness. Inadequate waste management is costly to the economy. For example, when municipal waste management systems are absent or improperly funded, household solid waste may be dumped in the street or inappropriately handled by the informal sector.

2. On the other hand, when managed in a sound manner, waste represents an opportunity. Its management creates employment and secondary raw materials that can be used in production processes.

3. Official waste statistics have a long history. For example, in the Netherlands they have been produced for more than 40 years. These statistics were initially developed to better monitor and manage threats to human health and the environment from municipal and industrial wastes.

4. More recently, policies have shifted from viewing waste as a problem toward seeing it as a potential resource and an integral element of a circular economy. This change in perspective has created demands for better information on specific waste streams (for example, electronic wastes, food wastes and textile wastes), as well as on the economic value of waste as a resource. Greater insight is also sought into waste flows that are difficult to measure but important for effective waste management (for example, waste processed by workers in the informal sector).

5. The importance of waste and its management is reflected in several of the United Nations' Sustainable Development Goal (SDG) indicators, such as:

- **Indicator 11.6.1** – Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities
- **Indicator 12.3.1** – Food loss index and food waste index
- **Indicator 12.4.2** – Hazardous waste generated per capita; and proportion of hazardous waste treated, by type of treatment
- **Indicator 12.5.1** – National recycling rate, tons of material recycled.

6. Waste management is an essential public service in the 21<sup>st</sup> century, particularly in densely populated areas. Despite this, the public and political profile of waste management is low and policies and related statistics are underdeveloped in many countries. To establish and measure the effectiveness of local, national and international policies, high-quality official waste statistics are crucial.

7. Despite the big progress made by international organisations to harmonise definitions and classifications, it still happens that waste statistics are not comparable internationally or even between institutions of the same country. Differences in the used concepts, scope, classifications and definitions lead to inconsistent data. For example, there is no globally agreed classification of non-hazardous wastes. Measuring waste flows associated with informal and illegal activities remains a challenge.

8. In October 2016, these issues were summarised in a paper drafted by Statistics Netherlands and the United Nations Economic Commission for Europe (UNECE) that was presented to the Bureau of the Conference of European Statisticians (see issue paper *Problems with waste statistics and a proposal for action* by Statistics Netherlands and UNECE, 2016). Based on the recommendations in that paper, CES Bureau in February 2017 established a Task Force on Waste Statistics with the mandate to develop a waste statistics framework and to draft a glossary of the most important terms and definitions used in waste statistics.

9. The present report, which has been prepared by the Task Force, responds to this mandate by:
  - Describing the challenges faced by existing official waste statistics and the emerging policy needs (chapter 2).
  - Trying to define and harmonise the key terms related to waste statistics, based on existing definitions (chapter 3).
  - Proposing a waste statistics framework (chapter 4).
  - Providing suggestions to producers of statistics for improving waste statistics (chapter 5).
  - Issues for further research (chapter 6).
10. The waste statistics framework presented here is intended primarily as a guide for statisticians compiling national waste statistics. At the same time, it will also contribute to further international harmonisation of waste statistics, for example when existing questionnaires and guidance documents are being reviewed. The identified research agenda will help to improve the quality of waste statistics and make it more useful for emerging policy areas such as the circular economy.
11. The framework builds upon the considerable work done by both national and international statisticians to develop coherent waste statistics. Much effort has been devoted in recent years to harmonizing the concepts, scope, classifications and definitions used in waste statistics, particularly by the Statistical Office of the European Union (Eurostat), the Organisation for Economic Co-operation and Development (OECD), the Secretariat of the Basel Convention, the United Nations Environment Programme (UNEP) and the United Nations Statistics Division (UNSD).
12. In spite of these efforts, there remain differences in waste statistics across countries and international organisations. Some of these are consequences of the differing legal, regulatory and policy frameworks related to waste within and among countries. These frameworks determine the ways in which countries and international organisations collect and present waste statistics.
13. The European Union has established one of the most comprehensive regulatory frameworks on waste, resulting in waste statistics of the highest level of detail and quality worldwide. The European *Waste Framework Directive (2008/98/EC)* and *Regulation on Waste Statistics (2150/2002/EC)* provide legally binding guidance on the concepts, scope, classifications and definitions to be used in the collection of official waste statistics. Thus waste statistics produced by countries of the European Union are harmonised to a certain extent, though improvements have still to be achieved, for example through the implementation of the new rules on the calculation of the attainment of European waste management targets.
14. However, these frameworks are binding only for EU countries and not always applicable to other countries. In addition, in many countries outside the EU the production of waste statistics lacks resources and is of low priority.
15. The Task Force set out to create a statistical framework that, while coherent to the fullest extent possible with existing concepts and regulations, would help producers and users of waste statistics to understand the scope and main concepts of waste statistics. It furthermore would highlight differences in existing concepts and regulations, which need to be taken into account when producing waste statistics from primary data originating from different sources.
16. As a result, the concepts, scope, classifications and definitions in the framework deviate in some instances from those currently used by countries and international organisations; for example, the framework includes high-level radioactive wastes within the scope of waste, whereas internationally these data are not collected as part of waste statistics but separately by the International Atomic Energy Agency.
17. These changes were felt necessary to improve the clarity and coherence of the concepts, scope, classifications and definitions used in official waste statistics and to increase their comparability with other relevant statistics, such as material flow accounts. These improvements allow to better meet the information needs of emerging policy domains, such as the circular economy.

18. Countries and international organisations are encouraged to apply the framework to the extent possible, taking account of their individual needs and constraints. The framework and its glossary will support countries in their efforts to develop and review national waste statistics strategies. It also serves as a useful reference for NSOs and international organisations when reviewing existing waste statistics data collections and related concepts, terms and definitions.

19. Some issues could not be clarified within the mandate of the Task Force, such as the development of a waste classification that could be used at global level or the consideration of the SEEA-term “waste product” in the framework. These issues are discussed in detail in chapter 6 - Issues for further research.

## 2 Waste statistics – current status and emerging needs

20. This chapter explains the needs for sound waste statistics to support current and emerging waste-related policies. It discusses how the demand for high-quality waste statistics is changing in light of emerging policy objectives around, for example, the circular economy. Various examples are used to illustrate the challenges statisticians face in compiling waste statistics, and some of the discrepancies caused by inconsistencies in concepts and terminology across countries. More examples can be found in the issue paper *Problems with waste statistics and a proposal for action* (Statistics Netherlands and UNECE, 2016), which the CES Bureau considered in October 2016.

### 2.1 Challenges with existing waste statistics

21. Providing high quality statistics on waste requires clear, widely accepted definitions and a good understanding of waste flows and their management all along the materials cycle. It further requires a good knowledge of waste-related policies and of the information needed to support them. These policies are increasingly oriented towards waste prevention, and circular strategies that place greater emphasis on aspects such as dematerialization, the reduction of primary mined materials by using waste as an input in manufacturing. This shift in orientation increases demand for reliable statistics on waste generation, treatment and disposal and on the life-cycle of materials and products.

22. Although many countries produce waste statistics, the quality and availability of statistics vary greatly depending on the priority given to waste management and on the financial and human resources available for statistics. Some countries monitor waste only in major cities, leaving smaller cities and rural areas uncovered. Other countries have difficulties producing any waste statistics due to scattered data sources.

23. At international level, the quality and comparability of waste statistics are hampered by differences between countries in terms of the scope, definitions, classifications and methods used in their collection. Frequent changes in these attributes reduce the length and coherence of time series and the usefulness of waste statistics for international policy analysis.

24. In the paper of Statistics Netherlands and UNECE (2016) the following challenges have been identified with waste statistics:

- Collection of primary data from various sources and compilation of statistics at national and international level
- Harmonization of concepts and terminology
- Changing policy needs.

25. Each of these requires different – but coherent – solutions, as discussed in the sections that follow.

#### 2.1.1 Problems in data collection and compilation

26. Traditionally, the main driver for the production of national waste information, including official waste statistics, has been the planning of national waste management infrastructure. However, in many countries, governments lack sufficient resources to establish and fully implement national waste management plans. These plans are, therefore, often poorly monitored and evaluated.

27. One specific challenge is the conversion between different units of measure. Usually, waste statistics is expressed in terms of mass. However, for waste management purposes also other units of measurement may be in use, for example volume for bulky wastes. Another issue is related to the water content of waste. This is particularly relevant for the reporting of liquid waste and certain biomaterials. For waste management purposes waste is usually reported in wet weight, however for several policy questions and for comparability reasons information about the dry matter might be more relevant. Also,

the state of dryness for specific wastes can differ between waste generators, and it can change during waste collection, transport and treatment.

28. In addition, the coverage of waste statistics differs significantly across countries. Often good data are available for larger cities, but there may be lack of data for smaller cities and rural areas, leading to difficulties in compiling national figures.

29. Some countries have also difficulty responding to international questionnaires with existing national statistics. Basic waste data may be not available in appropriate units of measure (for example, in volume rather than mass), the classifications and definitions used may be different from those used internationally and there may be insufficient guidance on conversion factors.

30. Consequently, waste statistics collected through international questionnaires also face problems of gaps and comparability. For example, even if the response rate of countries covered by the waste section of the *OECD/Eurostat Questionnaire on the State of the Environment* is nearly 100%, data quality has been an issue and many data gaps remain. Box 1 presents some of the data quality issues identified by OECD related to their questionnaire on the state of the environment, section waste.

31. The majority of countries in the world have difficulties to respond to the simpler *UNSD/UNEP Questionnaire on Environment Statistics* (section waste statistics) for which the response rates are below 50%. Box 2 provides more details on the response rates and development over time.

Box 1

**Data quality issues related to the section on waste of the OECD questionnaire on the state of the environment (source: OECD, 2018)**

Although all OECD countries and many other countries in the world produce data on waste, data quality has been an issue and many gaps remain. Information gaps exist in particular as regards (i) non-hazardous industrial waste, (ii) amounts of particular waste streams and related recovery and recycling efforts, (iii) categories of hazardous waste. Gaps are also notable as regards metadata and the documentation of the data (e.g. information on definitions and surveying methods, breaks in time series, waste collection methods, waste prevention measures, national laws and regulations).

- Some countries have difficulties harmonising their waste statistics due to scattered data sources and a lack of methodological guidance. Other countries only monitor waste in major cities.
- In many countries official data on waste and materials management in the business sector remain scarce, and little information exists on waste prevention measures.
- Not all countries have established material flow accounts. In countries where such accounts are produced, the data on material flows cannot easily be combined with data on waste.
- In most countries data quality is affected by frequent changes in definitions and methodologies that reduce the length and the coherence of the time series available and make it difficult to monitor the effects of earlier policy measures.

Overview on data quality issues of selected tables of the questionnaire section on waste:

Table	Data quality issues
1 - Generation of waste by sector (core table, data collected every two years)	<ul style="list-style-type: none"> <li>• Incomplete coverage of sectors</li> <li>• Little information on secondary waste (requested for total amounts only)</li> <li>• Insufficient information on hazardous waste (requested for most recent year only)</li> </ul>
2a - Generation, recovery and recycling of selected waste streams 2b - Generation of selected waste streams (core tables, data collected every two years)	<ul style="list-style-type: none"> <li>• Incomplete coverage of variables (tab. 2a)</li> <li>• Little information on the apparent consumption of materials (tab. 2a)</li> <li>• Incomplete coverage of materials and waste streams</li> </ul>
3 - Generation, treatment and disposal of non-hazardous industrial waste (supporting table, data collected every four years or reported on demand)	<ul style="list-style-type: none"> <li>• Incomplete coverage</li> <li>• Low response rates</li> </ul>
4a - Generation, treatment and disposal of hazardous waste (core table, data collected every two years)	<ul style="list-style-type: none"> <li>• Incomplete coverage</li> <li>• Insufficient coherence over time</li> </ul>
4b - Generation of hazardous waste by category (supporting table, data collected every four years or reported on demand)	<ul style="list-style-type: none"> <li>• Incomplete coverage</li> <li>• Almost no trends</li> </ul>
5a - Generation and collection of municipal waste (reference table, data collected every year)	<ul style="list-style-type: none"> <li>• Coherence with data provided in tables 5b and 5c not always ensured</li> <li>• Coherence in definitions across countries</li> <li>• Differences in data completeness across countries</li> </ul>
5b - Composition of municipal waste (supporting table, data collected every four years or reported on demand)	<ul style="list-style-type: none"> <li>• Coherence with data provided in tables 5a and 5c not always ensured</li> <li>• Low response rates (data are generally available from ad-hoc surveys only; often limited to selected cities)</li> </ul>
5c - Treatment and disposal of municipal waste (reference table, data collected every year)	<ul style="list-style-type: none"> <li>• Coherence with tables 5a and 5b not always ensured</li> <li>• Insufficient information on exports and imports and residues from other operations</li> </ul>

Box 2

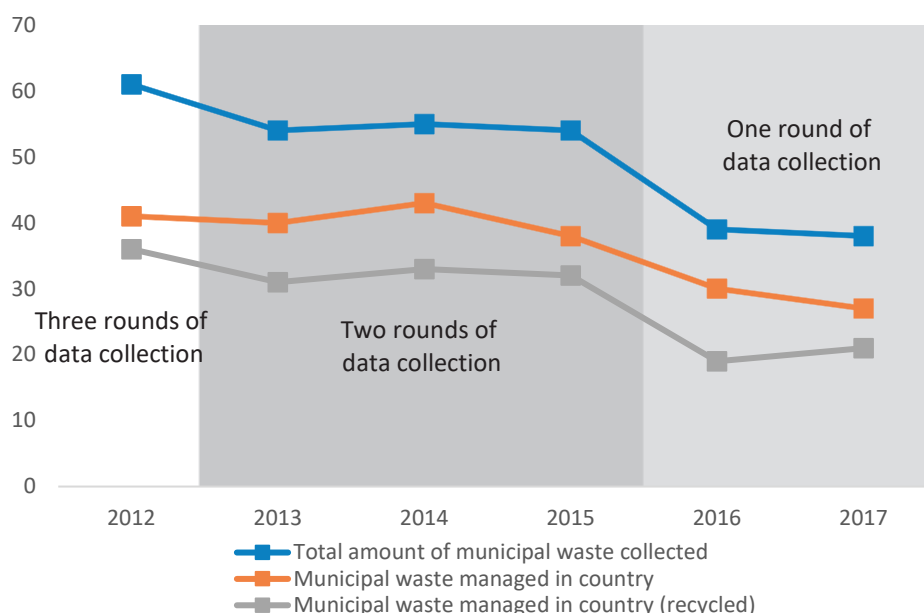
**Response rate of the UNSD/UNEP Questionnaire on Environment Statistics (see UNSD (2020a, part C) and UNSD (2020b, part 1))**

UNSD has been collecting waste statistics through the biennial *UNSD/UNEP Questionnaire on Environment Statistics* since 1999 from over 160 countries and areas not covered by OECD and Eurostat in their data collection. Both data collection processes are well coordinated, and questionnaires are fully compatible with identical definitions and classifications. Over the years, some countries have become OECD or European Union member states or candidate member states, therefore exiting the UNSD/UNEP data collection scheme. Nonetheless, the UNSD/UNEP questionnaires have consistently received strong responses and feedbacks from the recipients. In the 2018 data collection round, 70 countries and areas responded to the waste section of the questionnaire, out of 165 which have received it (response rate 42.4%). Data completeness and data quality also remain a challenge, especially for developing countries, and national capacity constraints (financial, human, technical) continue to be a concern.

Given the importance to provide waste statistics for international reporting, including for the SDG indicators (12.3.1 on food waste, 12.4.2 on hazardous waste, and 12.5.1 on recycling), several modifications have taken place in, and additional variables have been added to the UNSD/UNEP Questionnaire in the most recent data collection rounds. For example, variables on municipal waste generated and electronic waste have been incorporated into the questionnaire.

For most of the indicators collected by the questionnaire, one noticeable trend is the lag of data reporting. For instance, for SDG indicator 12.5.1 component “total amount of municipal waste collected”, 61 countries and areas have provided data for 2012, while 38 have provided data for 2017 (Figure 1). This data lag can be explained by the fact that the 2012 data have been collected for three rounds (in 2014, 2016 and 2018), while 2017 data have only been collected once (in 2018). For the 2020 round it is anticipated that more data for the years 2016 and 2017 will be provided.

Figure 1  
**Count of responses (out of 165 countries and areas), SDG indicator 12.5.1: National recycling rate, tonnes of material recycled**



32. Box 3 illustrates some of the problems related to production of waste statistics in different countries.

### Challenges in waste statistics – Examples from Armenia, Bosnia and Herzegovina, Canada, Mexico and the Netherlands

**Armenia** – According to the 2004 Armenian *Law on Waste* and related by-laws and regulations, all enterprises that generate waste in Armenia must provide annual data on the permitted quantity, type and source of waste to the regional State Environmental Inspectorate. In spite of this, Armenia has no inventory of landfill sites, poor data on recycling and re-use of waste, and underdeveloped quality control processes for waste statistics.

**Bosnia and Herzegovina** – In Bosnia and Herzegovina, response rates to waste surveys are low; for example, some firms that are known to produce waste do not submit completed questionnaires. As a result, waste statistics do not accurately reflect the amount of wastes generated by production processes. The issue of volume-to-mass conversion is one of the main obstacles to the quality of the statistics. Recently, the Agency for Statistics of Bosnia and Herzegovina developed a document to assist respondents in estimating the mass of waste materials in cases where only the volume is known.

**Canada** – In Canada, the collection and dissemination of waste statistics is the responsibility of the national statistics agency, Statistics Canada. The agency has developed clear definitions and guidelines for data reporting by respondents to its *Waste Management Industry Survey*. However, responsibility for waste policies and programs lies with provincial/territorial and local levels of government, rather than with the national government. These governments often use different definitions and guidelines from those used by Statistics Canada, leading to inconsistencies between statistics published at the national and sub-national levels. Statistics Canada is working with the Canadian Council of Ministers of the Environment to move toward better comparability of waste statistics, both within Canada and with other nations. An internationally agreed waste statistics framework with references to main internationally used concepts and definitions (e.g. questionnaires of Eurostat, OECD, UNEP and UNSD) would help Canada reach this goal.

**Mexico** – Until recently, Mexico relied on an estimation methodology to produce statistics on waste. The methodology provided statistics only at the national and state levels. Now, Mexico has developed basic statistics on waste at the national, state and municipal levels based on data from a survey of urban waste. Four iterations of the survey have been undertaken to date. The survey, which covers many aspects of the waste management, presents a number of challenges. Mexico is a highly diverse country, with 2,463 municipalities and delegations of varying population size and density, governance and economic capacities, social customs and practices, and interest in environmental policies, to mention just the most significant challenges to collecting high-quality data.

**The Netherlands** – The Netherlands have agreed definitions, protocols and funding to measure waste generation and waste treatment statistics for the entire economy annually, which is used for monitoring national waste and circular economy policies, as well as international waste statistics reporting obligations. Despite having nation-wide waste statistics, there are still challenges in the quality for some part of the statistics, such as the imports and exports of green listed wastes. Next to that, data constraints exist for emerging issues such as measuring food waste. There are new demands for waste statistics in the context of a circular economy, such as more information all secondary wastes that arise during waste treatment, the material content of the waste, the use of waste in manufacturing, and tracing of materials in products along the entire supply chain. For those new demands, data sources are currently scarce to produce high quality statistics.

**Sources:** National Statistical Service of the Republic of Armenia; Agency for Statistics of Bosnia and Herzegovina; Statistics Canada; INEGI, Mexico; Statistics Netherlands.

33. While the role of international organisations is to provide technical guidance and platforms for exchange of knowledge and experience, problems related to data collection and production of official waste statistics require solutions at the national level; such as, giving the production of waste statistics higher priority, increasing capacity, strengthening coordination and cooperation between relevant institutions, reviewing existing legislation and/or application of standardized classifications and conversion factors.

### **2.1.2 Need for harmonization of concepts and terminology**

34. The international statistical community, in particular Eurostat, OECD, UNECE and UNSD, in close cooperation with UNEP, the Basel Convention Secretariat and others, have initiated several activities to harmonise terms, definitions and classifications used in waste statistics. The waste statistics questionnaires of the mentioned organisations are harmonised to a large extent, however certain conceptual and terminological problems remain (for example, different definitions of some key terms, see chapter 3).

35. Conceptual and terminological problems partly result from fragmented policies that look at specific aspects of waste management but not at the whole picture. Such fragmentation means that different expert communities or national institutions (e.g. NSOs, ministries, inspectorates) have developed their own technical terms, definitions and classifications.

36. Another problem is the scope of official waste statistics, which typically does not include waste-related activities outside the formal waste management.

### **2.1.3 Existing waste statistics focus on the formal waste management sector, and therefore do not tell the full story**

37. Existing official waste statistics and indicators focus on waste management as a linear process from “cradle-to-grave”; that is, from waste generation to final disposal. Existing statistics therefore consist mainly of physical measures of the amounts of waste generated, collected, treated and disposed. They are used to evaluate national and international waste-related policies and to assess trends over time. In many countries, there is a focus on municipal wastes, hazardous wastes and recycling. Typical indicators include municipal waste generation per capita and national recycling rates.

38. Existing statistics and indicators usually focus only on wastes processed through formal waste management activities using survey and administrative data. Such statistics leave important parts of the “waste story” uncovered. For example, not taking into account the amounts of waste recycled by informal waste pickers may lead to waste recycling rates which significantly underestimate the actual situation (see examples in Box 4).

39. The scope of the “waste story” is wider than the scope of traditional waste statistics, even if waste statistics provide fundamental input for it. For example, the amounts of products repaired or materials re-used before entering the waste stream are usually not part of waste statistics, but are important for measuring the circular economy. Conceptual links between waste statistics and statistics on product and material flows are important.

40. Important elements that are generally not captured in existing official waste statistics include:

- The role of informal players (such as itinerant waste pickers) in the management of wastes, which may be of greater relevance in low-income countries
- Uncontrolled disposal of wastes (such as open burning of wastes, dumping of wastes in the environment)
- Illegal waste-related activities (such as illegal export<sup>1</sup> or dumping of toxic wastes)
- Re-use or re-manufacture of materials before entering the waste stream
- Theft of materials with significant market value from the waste stream (e.g. from landfills, municipal collection sites, recycling sites, etc.).

41. None of the above is measured systematically in existing waste statistics, even if the related environmental, social and economic consequences can be significant. Not all these elements are equally important for the further development of waste statistics.

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<sup>1</sup> Illegal traffic of hazardous and other wastes is defined by Article 9 of the Basel Convention.

**The significance of unmeasured waste**

Informal waste picking can be observed in almost all countries of the world and there are registered waste-picking organisations for example in the following countries: Brazil, Colombia, Canada, Chile, France, Mexico, South Africa and the United States (Global Alliance of Waste Pickers, 2016). In Albania, Bosnia and Herzegovina, North Macedonia, Montenegro and Serbia, waste pickers supply at least 40% of the materials that are recycled (Medina, 2008).

Illegal waste trade and dumping is a serious problem in many countries. According to a report of the European Environment Agency (EEA, 2009), known cases of illegal waste shipments in the EU amount to between 6,000 and 47,000 tonnes of illegal trade annually, with an average of about 22,000 tonnes. EEA believes that the number of illegal shipments is rising. In the United Kingdom, 1,175 illegal sites for waste dumping were found in 2012.

42. Statistics on specific waste streams and/or waste characteristics that are of interest for emerging policies, or that require special management approaches include those on:

- Food waste
- Electronic waste (or e-waste, or waste electronic and electrical equipment (WEEE))
- End-of-life vehicles (ELV), including used tires
- Illegally traded waste
- Infectious waste
- Construction and demolition waste, in particular those containing hazardous materials such as asbestos
- The economic value of waste as a source of raw materials or energy.

**2.1.4 Lack of harmonised definitions**

43. Key terms and definitions used in international waste statistics generally build on a tacit consensus although the texts used to describe them are not always fully harmonised (see chapter 3 for more details).

44. National definitions vary among countries and sometimes even among institutions of the same country, and are often difficult to harmonise. These include, among others, the terms *municipal solid waste*, *recycling*, *re-use*, *recovery* and *waste management*.

45. All this together contributes to some confusion on both the producer and user sides of waste statistics, who are often not subject matter experts. For example, the dialogues with data producers and users (e.g. the experts from NSOs and Ministries of Environment represented in the UNECE Joint Task Force on Environmental Statistics and Indicators) have shown that the following can happen in practice:

- *Waste generation* can be wrongly interpreted as equivalent to *waste management* (for example it happens that a country reports the same value for “waste collected” and “waste generated”).
- *Recycling* can be confused with *recovery* or *re-use*.
- *Municipal waste* can be confused with *household waste*<sup>2</sup>, *residential waste* and *urban waste*.
- *Hazardous waste* (as defined by the Basel Convention) can be taken erroneously to be mutually exclusive with *municipal waste* or *household waste*, while both can contain hazardous waste.

<sup>2</sup> Adding to this potential confusion is the fact that the first version of SDG indicator 11.6.1 used the term *urban solid waste*, which is not used anywhere in official waste statistics. To harmonise it with international waste statistics, it was later changed to *municipal waste*.

46. Furthermore, the data according to different breakdowns of waste statistics are sometimes presented side-by-side leaving the impression that the different components can be added up (for example, hazardous waste, municipal and industrial waste) while in fact they are partially overlapping.

47. This negatively affects time series consistency and comparability across countries, between institutions of the same country, and over time. Box 5 provides some examples of the kinds of inconsistencies that exist in waste statistics due to differing definitions and methods across countries.

Box 5

#### **Examples of incomparable waste figures due to different interpretations of key terms**

The following two examples presented in the issue paper by Statistics Netherlands and UNECE (2016) are from Europe and slightly outdated, but similar inconsistencies may be found around the world.

- According to [Eurostat](#), municipal waste generation in Denmark was 758 kg/person in 2014, whereas in Sweden it was 438 kg/person. This raises the question why two countries with similar economic and demographic characteristics would be so different in terms of per capita waste generation. Looking at the definitions used in Sweden and Denmark, it turns out that Denmark's definition of municipal waste is wider than Sweden's (CIWM/SOENECS, 2015).
- In Czechia both the statistical office and Ministry of Environment publish time series (2003-2014) on municipal waste generated. The difference in data is about 65 percent, showing also different dynamics.

The following two examples relate to electronic waste and also show how different national interpretations can result in incomparable statistics:

- The interpretation of waste electrical and electronic equipment (WEEE) data often depends on the product scope that is covered by the WEEE legislation and the product scopes are different across the globe. The broadest, and internationally used, definition covers a wide range of products with circuitry or electrical components with a power or battery supply. The EU, and a few other countries have full data sets on all products. However, other countries such as Japan focus on the most environmentally relevant products and have no data for some products. In USA, the product scope and available data differs per State. See Forti et.al. (2020).
- The United Kingdom uses an estimation method to report additional data regarding large household appliances (e.g. cookers, washing machines, etc.), excluding cooling equipment, which is treated as metal scrap within the light iron stream. The recycling process used on most of the light iron flow in the United Kingdom observes the standards set by the WEEE Directive. This increases the amount of WEEE collected by 28%, whereas other countries within EU do not use such estimation methods, and those flows remain unreported in WEEE Statistics. See Baldé et.al. (2020).

48. Significant progress has been made in the European Union by revising the *Directive on Waste* (Waste Framework Directive, 2008/98/EC) in 2018. The new waste legislation includes a definition of "municipal waste", a revision of municipal waste recycling targets and a number of new measures and rules related to the monitoring process, thus solving most comparability problems related to monitoring waste generation or calculation of recycling rates. To enable effective monitoring of progress based on reliable and comparable data these measures are laid down in legally binding implementing acts.

#### **2.1.5 The scope of waste statistics is not always well defined or harmonised**

49. The scope of official waste statistics in terms of the types of materials and waste-related activities covered is not always well defined and harmonised worldwide. Some countries have difficulties to adjust national definitions to international ones and consequently include or exclude materials and activities in their statistics in different ways. This is often due to differences in national waste management plans and laws that steer data collection, and the difficulty to estimate some types of materials, waste streams and waste-related activities.

50. Typical examples for types of materials of activities often covered differently by countries in waste statistics are liquid waste and certain biomaterials (e.g. sewage sludge or waste from primary industries), incineration sludge, rubble from land clearing, mining waste and radioactive waste.

51. Similarly, the system boundaries associated with waste statistics are not always clear. For example, an unclear boundary between what is a waste and what is a product is a problem given the high level of interest in re-use and recycling. Responding well to this interest requires clarity with respect to the point when wastes become raw materials and when products discarded by their owners become wastes.

52. Questions that producers of waste statistics have to deal with are for example:

- a) When does waste become a raw material?
- b) How are imports and exports of waste defined?
- c) Is a product that is discarded by the owner but collected and reused by someone else, seen as waste?

53. Waste material which is imported or exported is often not classified as waste. Customs officers look at the 'objective characteristics' of the wastes, which is sometimes inconsistent with the general waste definition in environmental policies and statistics. For a customs officer, a discarded fridge can still function, and he or she cannot judge whether it is different from a new fridge, a second-hand fridge or a wasted fridge. It might even be the case that the same good is categorized differently by the importer and the exporter. The same problem is typical for vegetal and industrial wastes. The *Harmonized Commodity Description and Coding System* (HS) is designed to deal with goods, and wastes are not reflected consistently throughout the nomenclature. Solutions need to be found to better adapt the HS for monitoring of transboundary movements of waste.

54. In addition, the scope of official waste statistics usually covers only regulated activities and does not capture or partially captures informal waste handling. This is discussed in detail in previous section 2.1.3.

### **2.1.6 Lack of an internationally agreed classification of (non-hazardous) wastes**

55. Currently, there is no globally agreed classification of non-hazardous wastes. However, most international waste and waste statistics frameworks, environment statistics frameworks (such as FDES) and accounting frameworks (such as SEEA), as well as many national frameworks make reference or are compatible with the *European Waste Classification for Statistics, Revision 4* (EWC-Stat, European Commission, 2010). EWC-Stat is an official classification of waste used by Eurostat based on an aggregation of the very detailed classification found in the *European List of Wastes* that is used in the EU waste legislation and licensing, and describes hazardous and non-hazardous waste<sup>3</sup>.

56. There is also lack of a classification for secondary raw materials which should be linked with a corresponding waste classification.

57. The *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* (Basel Convention, Basel Convention Secretariat, 2019) provides an internationally agreed classification for hazardous wastes and is used for monitoring and controlling the transboundary movement of waste. However, this is not harmonized with the EWC-Stat classifications. The

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<sup>3</sup> The *List of Wastes* is a non-statistical waste classification used in the EU for administrative purposes, forming part of the European Waste Framework Directive 2008/98/EC. See European Commission (2014) *Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council (2014/955/EU)* Official Journal of the European Union 2014: L 370/44. Available at <https://eur-lex.europa.eu/homepage.html> (accessed June 18, 2018).

consequence is that in many countries two parallel datasets exist, one for reporting under the Basel Convention, and the other one using the EWC-Stat classification.

58. The lack of a global waste classification has a negative impact on the quality and comparability of waste-related statistics. Thus, an important point of discussion is whether the EWC-Stat could be considered and further developed as a classification for potential global use.

## 2.2 Emerging policy needs

59. Waste-related policies were first adopted in countries with developed economies<sup>4</sup> but are now being implemented in other countries as well. Their initial focus was on the protection of the environment and human health, resulting in municipal, sectoral and national waste management plans.

60. In recent decades, waste-related policies have undergone a shift. Today, they aim not only to mitigate the environmental and human health impacts of waste, but also to improve resource efficiency and dematerialisation, with the long-term aim of reducing generation of waste.

61. Waste is now seen as a resource, particularly in the circular economy strategies that are becoming increasingly important. In the traditional view of the economy, waste is seen as the inevitable result of a linear chain of production and consumption activities. In contrast, the circular economy approach aims to prevent and reduce waste generation and circulates wasted materials back into the economic system into high-value applications (in contrast to downcycling).

62. In a circular economy, waste is first and foremost to be prevented; for example, by extending product lifetimes through repair and re-use. When waste generation is unavoidable, waste should be “upcycled” by re-using or remanufacturing components or by turning it into high quality secondary raw materials, rather than “downcycled”. Sound waste management presents an opportunity to recover resources, realise environmental, economic and social benefits and take a step towards a sustainable future (UNEP, 2013).

63. An important goal for official waste statistics is, then, to define the scope and system boundaries in line with the circular economy approach.

64. Box 6 discusses the circular economy approach and its implications for waste statistics in more detail.

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<sup>4</sup> Terminology of the Statistical Annex of the United Nations “World Economic Situation and Prospects 2019” ([https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019\\_BOOK-ANNEX-en.pdf](https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019_BOOK-ANNEX-en.pdf)) used.

### The circular economy approach

There is an on-going paradigm shift today from traditional waste policies based on the view that waste is an end-of-production/consumption issue towards an approach in which waste is seen as an integral part of the production and consumption cycle. The latter is known as the circular economy approach (Figure 2).

In the circular economy approach, production and consumption processes are seen as restorative and regenerative by design and the distinction is made between technical and biological cycles. The overall aim is to:

- Keep products, components and materials in their highest use at all times
- Preserve and enhance natural capital
- Optimize resource yields
- Minimize system risks by managing finite stocks and renewable flows.

The circular economy approach can be applied effectively at any scale.

Figure 2

#### Linear versus circular economy



**Linear economy:** waste is generated at the end of a linear production and consumption chain

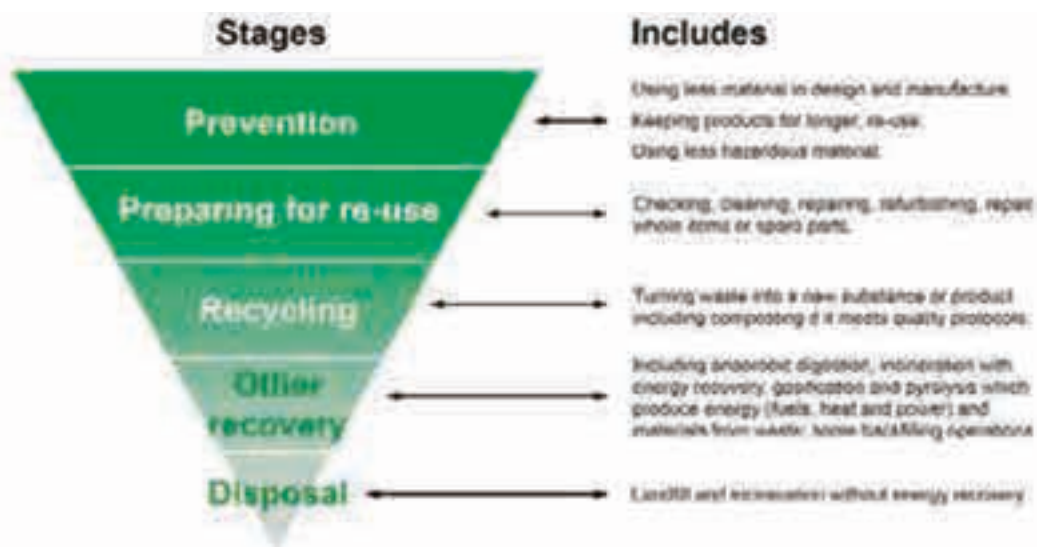


**Circular economy:** waste is seen as an integral part of a production and consumption cycle

**Source:** EU Directorate General for Environment (<https://www.oecd.org/env/outreach/EC-Circular-economy.pdf>).

The circular economy approach is reflected in the five-step waste hierarchy of the *European Waste Framework Directive* (2008/98/EC), in which waste prevention is the best option, followed by re-use, recycling and other forms of material and energy recovery, with waste disposal seen only as a last resort (Figure 3). Waste prevention refers to reduction of the amounts of waste generated and of the hazardous components embodied in waste through eco-design, re-use, repair, refurbishment, re-manufacturing and extended producer responsibility schemes.

Figure 3  
The waste hierarchy



Source: OECD based on various other sources.

The waste hierarchy considers the potential of the various options to reduce environmental impact and to foster an efficient use of resources. It relates closely to the concept of the 3Rs (reduce, re-use and recycle), is widely applied across OECD and non-OECD countries and is used in EU waste legislation.

Informing circular economy policies with waste statistics requires clarity as to where products and wastes begin and end. From the waste hierarchy perspective, the border between waste and products occurs at the stage of re-use.

65. In addition to the circular economy approach, emerging policy objectives with implications for waste statistics include:

- Extending the life-cycle of products
- Green purchasing policies
- Sustainable materials management
- Sustainable construction
- Managing waste as a resource
- Waste management as an opportunity for economic growth
- Strengthening marginalised groups involved in informal waste management.

66. As a result of these emerging objectives, there is greater focus on the management of specific waste streams rather than on general waste management policies intended to fit all types of waste. Waste policies are also increasingly addressing all three dimensions of sustainable development simultaneously, integrating environmental, social and economic goals. These changes are clearly reflected in global initiatives such as:

- *United Nations Sustainable Development Goals*, several of which include waste-related targets and indicators (SDGs 11.6.1, 12.3.1, 12.4.2 and 12.5.1).
- *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, with its strengthened commitment to promoting and implementing more efficient waste prevention and minimization strategies (Basel Convention Secretariat, 2019).
- *7th Environment Action Programme* of the European Union (European Commission, 2014), with its focus on a resource-efficient Europe and a circular economy<sup>5</sup>.

<sup>5</sup> <http://ec.europa.eu/eurostat/web/circular-economy>

- European Union *Waste Framework Directive 2008/98/EC* (European Commission, 2008) and *Regulation 2150/2002/EC on waste statistics* (European Commission, 2002).
- Recommendation of the *OECD Council on the Environmentally Sound Management of Waste*<sup>6</sup>.
- *Green economy /growth initiatives* of the OECD<sup>7</sup> and UNEP<sup>8</sup>, among others.
- *UN 10-year Framework of Programmes on Sustainable Consumption and Production Patterns* (United Nations, 2014).
- *United Nations Framework Convention on Climate Change reporting*<sup>9</sup>.
- *European Sustainable Consumption and Production Action Plan* (European Commission, 2008a).
- *European Agreement concerning the International Carriage of Dangerous Goods by Road* (UNECE, 2019).

67. In this more complex policy environment, better and more detailed waste statistics than those currently available are required. Waste statistics can no longer stand alone. Rather, they must be integrated with social and economic statistics, not to mention the need for greater coherence with other environmental statistics (for example, climate change-related statistics) and with other statistics e.g. materials, products, trade, to meet the new demands policy makers are creating.

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<sup>6</sup> <http://www.oecd.org/env/waste/environmentallysoundmanagementofwaste.htm>

<sup>7</sup> <http://www.oecd.org/greengrowth/>

<sup>8</sup> <https://www.unenvironment.org/explore-topics/green-economy>

<sup>9</sup> <https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-kyoto-protocol/overview/background-and-resources>

### 3 Main terms and definitions

68. In this chapter, the main terms associated with official waste statistics are defined. These terms provide the basis for the waste statistics framework that is spelled out in the following chapter.

69. Waste is defined differently in policy frameworks, laws and regulations of different countries, or sometimes even inconsistently defined in policies within the same country. This is one of the reasons why it has been difficult to harmonise waste statistics.

70. Huge efforts have been made to harmonise key terms and definitions used in international waste-related questionnaires and guidelines, in particular those used by Eurostat, OECD, UNSD and UNEP. These questionnaires also refer to the terminology and definitions used by the Basel Convention.

71. For the purposes of developing a framework for waste statistics, this chapter starts with a conceptual definition of waste, and links it with existing operational definitions used in statistical and legal frameworks.

72. The terms “economic unit” and “household” in this chapter refer to institutional units as defined in national accounts<sup>10</sup>. They include households, private and public (government) entities, etc.

#### 3.1 Definition of waste

##### 3.1.1 Conceptual definition of “waste”

73. As a basis for the conceptual waste framework, a simple conceptual definition of waste is proposed. This is then complemented by the considerations that have to be taken into account for a definition for measurement purposes.

74. From the existing definitions in waste statistics, two international definitions are broad enough to be the basis of a conceptual definition of waste:

- (a) Basel Convention: *“Wastes are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law.”*
- (b) EU Waste Framework Directive 2008/98/EC: *“Waste means any substance or object which the holder discards or intends or is required to discard.”* It is mentioned that the scope of the EU Waste Framework Directive excludes wastewater.

75. These two definitions are very close. Basel Convention is a global convention with currently 188 countries as Parties to the Convention and is therefore a good basis for a globally valid definition.

76. Even if not spelled out directly, both definitions can be interpreted to exclude emissions to air, the residuals of substances released into ambient environment for a purpose other than final disposal (e.g. residuals of fertilizers and biocides) and wastewater.

77. Both definitions use the terminology “substances or objects” where other waste definitions use the term “material” (e.g. FDES, UNSD/UNEP and Eurostat/OECD questionnaires). For the purpose of this framework the term “material” will be used as this allows alignment with the terminology used in related frameworks, such as material flow accounts. For the purpose of the framework the terms “material” and “substances or objects” are considered to be synonyms.

78. The definition used in the Basel Convention (Basel Convention Secretariat, 2019) uses the term “disposed of” where the EU Waste Framework Directive (European Commission, 2008) uses both terms “discard” and “dispose of”. For the purpose of this framework the two terms are understood as synonyms and the term “discard” will be used, because this term is also used in international questionnaires of UNSD/UNEP and Eurostat/OECD.

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<sup>10</sup> See para. 2.16 in SNA (United Nations et.al., 2009)

79. Therefore, it is proposed to use the following **conceptual definition of waste**:

***Waste is any material which the holder discards or intends or is required to discard.***

80. To develop an operational statistical definition, a number of issues have to be considered which are described below. The decision what is included and excluded for measurement purposes can depend on policy, legal, administrative, practical or other considerations and may have a different answer in different countries, or even in different parts of a country. This can result in many different definitions of “waste”.

81. Such different definitions pose a problem for international comparability. However, the measurement is linked to how waste is defined in legal and administrative documents, and statisticians have a very limited possibility to influence that. The first step towards ensuring comparability is to list the aspects that have to be taken into account and provide explanation what is excluded or included in specific cases.

82. The following aspects have to be taken into account in defining waste for measurement purposes:

**a) State of matter**

Often waste definitions refer only to solid, semi-solid or liquid material. Common examples include waste generated by a household, sludge from a sewage treatment plant and debris from building construction.

For official statistics, waste excludes emissions of materials that are released into ambient environment for a purpose other than final disposal (e.g. residuals of fertilizers and biocides) and wastewater. For such materials, a broader term “**residuals**” is used in official statistics (in FDES) referring to all materials that flow from the economy to the environment. Flows of any residual can have important environmental consequences and in principle all residuals should be traced in official statistics. Doing so, however, requires reference to domains beyond waste statistics; for example, air emission inventories or statistics on wastewater. The domains related to residuals are fully covered in FDES (see Component 3) and SEEA-CF (see, among others, Section 3.2.4), both of which have broader conceptual coverage than official waste statistics.

Wastewater is considered as a separate category and not included in international definitions of waste because it has different characteristics, requires specific treatment and is covered by special regulations. However, sewage sludge resulting from wastewater treatment (can be liquid or solid) is considered to be waste in most frameworks.

**b) Radioactivity**

Radioactive waste, even if conceptually being “waste”, is excluded from many international and national waste definitions, including the Basel Convention. Radioactive waste requires specific treatment which is covered by special regulations and procedures, and is therefore out of the scope of waste statistics. In some cases, difference is made between low and highly radioactive waste.

**c) Source**

Source here means the economic activity (according to ISIC classification) or households that generate the waste. Some waste definitions, without further specifying that, exclude material from certain economic activities. For example, some waste definitions exclude material from mining, quarrying or construction, others exclude organic material originating from agricultural production that are left on the field. The Basel Convention for example excludes wastes originating from the normal operation of ships (article 1, paragraph 4).

#### d) Recycling or re-use at the place of generation

Definitions used in international waste statistics exclude material directly recycled or reused at the place of generation which can be both an establishment or a household. For example, paper “cutting” wastes produced during paper making and collected within the mill for re-use within its own operations are not considered waste, as they are part of the integral functioning of the paper mill.

However, there is growing interest in measuring some of these activities, as they are relevant for the circular economy (e.g. recycling within an economic unit) or waste management policies (e.g. the EU Waste Framework Directive in its Article 22 encourages home composting, but currently there is no obligation to measure it).

#### e) Value

Value of the material is sometimes used for determining whether it is waste. In this case, the waste is defined as having no value for the holder who disposes or has to dispose the material, regardless of whether it has value for someone else.

#### f) The moment when something becomes waste

Most definitions use the intention or requirement to dispose of the material as the moment in time when it becomes waste.

Minor conceptual differences remain, for example the definitions used in UNSD/UNEP and OECD/Eurostat questionnaires refer to material which the user **has already discarded or intends to discard**, whereas the FDES definition only refers to material which **is already discarded**. The SEEA definition of waste only refers to material which the user **wants to dispose of**.

The different moments in time when material becomes waste can lead to differences in waste statistics, e.g. when measuring “waste generation”.

#### g) The moment when waste ceases to be waste

As waste can become a product or raw material, it is also needed to define when it ceases to be waste. The EU Waste Framework Directive defines “end-of-waste” when waste has undergone a recovery operation (including recycling) and has been converted into a product or raw material subject to the following criteria

- 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.

From a conceptual perspective, for the purpose of this framework, the end of waste status is achieved when the material is removed from the waste stream for recovery purposes.

### 3.1.2 Operational “waste” definitions used in international questionnaires, guidelines and frameworks

83. Several definitions of the term *waste* exist in international statistics (Table 1), which are harmonised to a large extent. The common element among them is their reference to waste as an *end-of-life* object or material when the holder no longer has use for it, regardless of whether this material still has a value for another economic unit (for example as raw material for another production process). All definitions exclude emissions to air, the release of substances into ambient environment (e.g. residuals of fertilizers and biocides) and wastewater.

Table 1  
**“Waste” definitions used by international organisations**

<i>Source</i>	<i>Operational definition</i>	<i>Comments</i>
UNSD/UNEP (Questionnaire 2020 on Environment Statistics)  Eurostat/OECD	Materials that are not prime products (i.e., products produced for the market) for which the generator has no further use for his own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard.  It excludes material directly recycled or reused at the place of generation (i.e., establishment) and waste materials that are directly discharged into ambient water or air as wastewater or air pollution.	<ul style="list-style-type: none"> <li>• Used in biennial data collections for UNSD since 2004, for OECD since 1981 and since 1988 for joint collection with Eurostat</li> <li>• Based on national accounts viewpoint</li> <li>• Uses the term “generator”</li> <li>• Excludes material recycled or re-used at the place of generation.</li> <li>• Uses the term “material”</li> <li>• Uses the term “discard”</li> </ul>
OECD supplement (see <a href="https://stats.oecd.org/glossary/detail.asp?D=2896">https://stats.oecd.org/glossary/detail.asp?D=2896</a> )	Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.	<ul style="list-style-type: none"> <li>• In addition to the above: provides clarification that at all stages of production and consumption processes can generate waste</li> </ul>
FDES	Waste is discarded material for which the owner or user has no further use, generated by human activities in the course of production and consumption processes.	<ul style="list-style-type: none"> <li>• Moment of something becoming waste: when it is discarded</li> <li>• Uses the term “owner or user”</li> <li>• Uses the term “material”</li> <li>• Uses the term “discard”</li> </ul>
Basel Convention	“Wastes” are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law.	<ul style="list-style-type: none"> <li>• Uses the terms “substances or objects” instead of “material”</li> <li>• Does not refer to any holder, user or generator</li> <li>• Uses the term “dispose of”</li> <li>• The moment of something becoming waste is “disposed of”, “intended to be disposed of” or “required to be disposed of”</li> </ul>
SEEA-CF	Materials that are not prime products (that is, products made for the market) for which the generator has no further use for own purposes of production, transformation or consumption, and which he wants to dispose of. Wastes may be generated during the extraction of raw materials, during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Residuals recycled or reused at the place of generation are excluded. Also excluded are waste materials that are directly discharged into ambient water or air.	<ul style="list-style-type: none"> <li>• Similar with the UNSD/UNEP and OECD/Eurostat definitions</li> <li>• Uses the term “generator”</li> <li>• Uses the term “dispose of” instead of “discard”</li> <li>• Moment of material becoming waste is when the user wants to dispose it</li> </ul>
EU Waste Framework Directive	Waste means any substance or object which the holder discards or intends or is required to discard	<ul style="list-style-type: none"> <li>• Similar with the Basel Convention definition</li> <li>• Uses the term “holder”</li> <li>• Uses the terms “substances or objects” instead of “material” (same as Basel Convention)</li> <li>• Uses the term “discard” instead of “dispose of” (different from Basel Convention)</li> </ul>

Source	Operational definition	Comments
		<ul style="list-style-type: none"> <li>The moment of something becoming waste: when it is discarded, intended to be discarded or required to be discarded</li> </ul>

84. Table 1 reveals a few differences between the internationally used definitions:

- Use of the term “material” versus “substances or objects”, but the terms are used as synonyms.
- It remains unclear whether the terms “generator”, “owner or user” and “holder” should be seen as synonyms. The Basel Convention does not refer to a holder in its waste definition (or generator, user, owner).
- Use of the term “discard” versus “dispose of” – the terms are used as synonyms.
- In most definitions, the moment when something becomes waste is defined as the moment when a material (substance or object) is discarded (disposed of), intended to be discarded (disposed of) or required to be discarded (disposed of). However, in SEEA-CF it is the moment when the user “wants to dispose it” and in FDES it is defined as the moment when the material is being discarded. The moment in time when something is definitely considered to be waste in all definitions is “the moment when material is disposed of”.

85. The differences between international definitions can be explained with the specific purposes and the wording used in the policy contexts for which they have been developed.

86. All the above international definitions can be embedded into the broad conceptual definition which is presented in section 3.1.1: “Waste is any material which the holder discards or intends or is required to discard.” The correspondence between the conceptual definition and the definitions used by international organisations is presented in Annex II.

### 3.1.3 Municipal waste

87. The term “municipal waste” is used in several indicator frameworks and international questionnaires. The following Table 2 gives an overview on important existing definitions.

Table 2  
“Municipal waste” definitions used by international organisations

Source	Operational definition	Comments
UNSD/UNEP (Questionnaire 2020 on Environment Statistics)	Municipal waste, collected by or on behalf of municipalities, by public or private enterprises, includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g., white goods, old furniture, mattresses) and waste from selected municipal services, e.g., waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.	<ul style="list-style-type: none"> <li>Collected by or behalf of municipalities</li> <li>Waste from households, commerce and trade, small businesses, office buildings and institutions, bulky waste and waste from selected municipal services</li> <li>Excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.</li> </ul>

Source	Operational definition	Comments
OECD	Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities.	Conceptually identical with UNSD/UNEP Questionnaire definition
SDG Indicator 11.6.1 (Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated)	Municipal Solid Waste includes waste generated from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g. white goods, old furniture, mattresses) and waste from selected municipal services, e.g. waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.	Conceptually identical with UNSD/UNEP Questionnaire definition
Eurostat	Municipal waste consists of waste collected by or on behalf of municipal authorities and disposed of through waste management systems. Municipal waste consists mainly of waste generated by households, although it also includes similar waste from sources such as shops, offices and public institutions.	Understood as conceptually identical with UNSD/UNEP Questionnaire definition.
EU Waste Framework Directive	<p>'municipal waste' means:</p> <ul style="list-style-type: none"> <li>(a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture;</li> <li>(b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households; Municipal waste does not include waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste.</li> </ul>	Conceptually identical with UNSD/UNEP Questionnaire definition

88. Definitions used by international organisations are different in wording, but conceptually identical. For the purposes of this framework the wording used in the UNSD/UNEP Questionnaire 2020 on Environment Statistics will be used: ***Municipal waste, collected by or on behalf of municipalities, by public or private enterprises, includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g., white goods, old furniture, mattresses) and waste from selected municipal services, e.g., waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.***

89. Countries often use slightly different definitions and sometimes it is not clear what to include or to exclude (e.g. what if the industrial sector is also municipally managed?). Therefore, metadata on the nationally used definition of “municipal waste” is key.

90. Practical guidance for the compilation of statistics on municipal waste can be found in the *EU Guidance for the compilation and reporting of data on municipal waste* (European Commission, 2021).

## 3.2 Definition of key terms of waste-related activities

91. The terms related to dealing with waste can cover a broad range of areas and the decision what to include in statistics depends on the purposes of measurement. Waste-related activities in a broader, conceptual sense can include all activities related to dealing with waste, starting before the waste is generated (prevention of waste) and ending after it has been finally disposed (after-care or recovery of disposal sites). This wider view can cover the related policies, laws and regulations, public education, awareness raising, prevention, etc. The waste-related activities in a narrower sense can focus on activities that directly handle waste, such as collection, transport, disposal, recovery, etc.

92. The importance of activities related to circular economy strategies, such as prevention, reuse, remanufacturing, refurbishing, and recycling of waste in the economy is increasing and the regulatory framework is still developing. In this dynamic environment, the users’ interest in what should be measured could change over time and might vary per region.

### 3.2.1 Conceptual definition of “waste management”

93. A key term for policies and measurement frameworks on materials and waste is “**waste management**”.

94. In international policy frameworks and waste statistics questionnaires “waste management” is usually defined to cover the different activities related to handling waste, which include the following main categories:

- a) Collection
- b) Transportation
- c) Treatment including disposal and after-care of disposal sites.

95. The existing international definitions are well aligned with each other. The term “management” implies that the definitions refer to activities carried out by economic units of the formal sector within a legal framework. As there also might be waste-handling carried out by informal economic units (e.g. informal waste picking) or illegal waste-handling (e.g. illegal waste disposal, illegal imports and exports) it is important to make a conceptual distinction between

- a) Management of waste (carried out by formal economic units and legal)
- b) Informal and illegal waste handling.

96. The definition of “waste management” in ISIC rev. 4.0 is broader, thus slightly disconnected from other international definitions. It includes Groups 381 (waste collection), 382 (waste treatment and disposal) and 383 (materials recovery). Additionally, it includes Division 39 (remediation activities and other waste management services) which refers to the provision of remediation activities, i.e. the clean up of contaminated buildings and sites, soil, surface or groundwater. Also the definition used in SEEA-CF is broader, as it additionally includes prevention measures, monitoring and regulation activities as well as administration, management, training, information and education activities.

97. Waste prevention is an important factor in waste management strategies <sup>11</sup> and for the circular economy strategies, such as eco-design, reuse, repair, refurbishment, re-manufacturing, etc. However, waste prevention is excluded from the definition of “waste management” in this framework, as the materials are not discarded yet, thus they are not waste.

98. For the purposes of this framework *waste management is defined as the set of lawful activities carried out by economic units of the formal sector, both public and private for the purpose of the collection, transportation, and treatment of waste, including final disposal and after-care of disposal sites.*

99. The set of activities included in this definition is discussed in the following sections.

#### 3.2.1.1 Waste collection

100. International statistical questionnaires do not directly define the term “**waste collection**”. A definition can be found in the *EU Waste Framework Directive*. It means “*the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility.*”

101. The EU Waste Framework Directive furthermore defines the sub-category “**separate collection**” as “*the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment.*”

102. As this statistical framework also recognizes informal and illegal waste handling activities which may result in disposal of collected waste without treatment, it is suggested to use, for conceptual purposes, the definition of the EU Waste Framework Directive without mentioning the destination: *Waste collection means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport.*

103. Waste statistics measures only the part of collected waste which is handed over from an economic unit to another unit. What is temporarily stored at the place of generation, even if conceptually “collected”, is usually not measured. However, storage of waste may be important for understanding stocks and flows of waste, for example electronic waste.

#### 3.2.1.2 Transportation of waste

104. “**Transportation of waste**” is not directly defined in international questionnaires, Basel Convention or EU Waste Framework Directive. Transport or transportation is generally defined as “the movement of people and/or goods from one place to another for a purpose. This may be done by various powered vehicles (such as trains, buses, passenger cars, lorries, boats and aircraft) or by human-powered means such as walking and cycling”.<sup>12</sup>

105. For the purpose of this statistical framework the conceptual definition of *transportation of waste is “the movement of waste from one place to another for a purpose. This may be done by various powered vehicles (such as trains, buses, passenger cars, lorries, boats and aircraft), by human-powered means such as walking and cycling or by pipelines”*. For measurement purposes this usually only refers to movements of waste between two different economic units (i.e. establishments or households).

106. Transportation of waste by households to a waste collection facility is not included in the definition of transport of waste for measurement purposes. This is considered part of “waste collection”.

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<sup>11</sup> See e.g. <https://ec.europa.eu/environment/waste/prevention/index.htm> and <http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/ESMFramework/tabid/3616/Default.aspx>

<sup>12</sup> Suggestion of UNECE Transport Division.

107. A sub-category of transportation of waste are transboundary movements, i.e. **export** and **import** of waste.

### 3.2.1.3 Waste treatment

108. **“Waste treatment”** is generally defined as activities intended to change the nature of wastes once collected to either 1) render them more suitable for further treatment or for final disposal (for example, less hazardous to human or environmental health); or 2) to recover materials from them. In both cases, energy can be also recovered. Waste treatment is not directly defined in international waste questionnaires of Eurostat, OECD, UNEP and UNSD. The *EU Waste Framework Directive* defines it as **recovery or disposal operations, including preparation prior to recovery or disposal**, and for the purposes of this statistical framework the same definition is used.

109. According to the definition of the *EU Waste Framework Directive* waste treatment operations are divided into **disposal** and **recovery** operations. However, it should be noted that in the case of the *UNSD/UNEP Questionnaire on Environment Statistics* and the waste section of the *OECD/Eurostat Questionnaire on the State of the Environment*, “waste management” refers to the collection, transport, treatment and disposal of waste, including after-care of disposal sites, thus considering “waste treatment” a category which excludes “final disposal of waste”. In the case of the *OECD/Eurostat Questionnaire*, the term “disposal” refers to “final treatment” and “final disposal”; the term “recovery” is also used, and is inclusive of material recovery, energy recovery, biological recovery and re-use. Even if the questionnaire includes re-use in its definition of “recovery” it needs to be noted that according to the *European Waste Framework Directive* “re-use” refers to operations with products or components that are not waste. Therefore “re-use” is not a recovery or recycling operation. The part of the *OECD questionnaire*, which is joint with EUROSTAT only contains “preparation for reuse”. The questionnaires use the International Standard Industrial Classification of All Economic Activities (ISIC) rev. 4 and the Statistical classification of economic activities in the European Community (NACE Rev. 2) respectively and Division 381 Waste collection, 382 to treatment and disposal activities; and 383 to materials recovery.

110. **“Disposal”**, according to the *EU Waste Framework Directive*, means **any operation which main purpose is not the recovery of materials or energy even if the operation has as a secondary consequence the reclamation of substances or energy**. According to *Annex II of the EU Waste Framework Directive*, disposal operations include deposit into or on to land (e.g. landfill), biological and physico-chemical treatment, incineration, permanent storage etc.

111. SEEA-CF has a narrower definition for “disposal of waste”, as it only refers to the “final deposition of waste on the ground or underground in controlled or uncontrolled fashion, in accordance with the sanitary, environmental or security requirements.”

112. For the purposes of this framework the *EU Waste Framework* definition for “disposal of waste” will be used. The final deposition of waste as described in SEEA-CF is a sub-category of waste disposal.

113. **Recovery**, according to the *EU Waste Framework Directive*, means **any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy**. According to *Annex II of the EU Waste Framework Directive* recovery operations include, amongst other issues, use as fuel or other means to generate energy, solvent reclamation, recycling/reclamation of organic substances, metals, other inorganic materials, etc.

114. For the purpose of this framework the definition of the *EU Waste Framework* will be used. It excludes “re-use” as this term refers to materials which have not entered the waste stream.

115. An important sub-category of waste recovery is **“recycling”**. Recycling is defined slightly differently in different contexts, which requires the formulation of a broader conceptual definition for

the purpose of this framework. The following Table 3 presents the different definitions used by international organisations.

Table 3  
**“Waste recycling” definitions used by international organisations**

<i>Source</i>	<i>Operational definition</i>	<i>Comments</i>
UNSD/UNEP (Questionnaire 2020 on Environment Statistics)	Any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included.	<ul style="list-style-type: none"> <li>• Uses the term “waste material”</li> <li>• Refers to material diverted from the waste stream in a production process</li> </ul>
Eurostat/OECD	Recycling within industrial plants i.e., at the place of generation should be excluded.	<ul style="list-style-type: none"> <li>• Includes reprocessing as the same type of product and for different purposes</li> <li>• Excludes reuse as fuel</li> <li>• Excludes recycling at the place of generation</li> <li>• Questionnaire measures only material recovered by formal units</li> </ul>
FDES	No definition provided	
Basel Convention	No definition provided	
SEEA-CF	Division 37 of ISIC/NACE defines recycling as the processing of waste, scraps whether or not used, into a form feasible to be transformed in new raw materials. Typical is that, in terms of commodities, both input and output consist of waste and scrap, the input being sorted or unsorted but always unfit for further direct use in an industrial process whereas the output is made fit for further processing and is to be considered then as an intermediate good. A process is required, either mechanical or chemical. The main purpose of activities classified in division 37 of ISIC/NACE rev 1 is the manufacture of secondary raw materials but there may be important secondary waste management activities.	<ul style="list-style-type: none"> <li>• The term “recycling” is not directly defined, but it is interpreted that in SEEA-CF recycling are the activities by formal units classified in division 37 of ISIC, rev 1 and division 38 (E38 - Waste collection, treatment and disposal activities; materials recovery) in NACE rev2.</li> </ul>
EU Waste Framework Directive	‘Recycling’ means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations;	<ul style="list-style-type: none"> <li>• Uses the term “waste material”</li> <li>• The results of the process are “products, materials or substances”</li> <li>• Excludes energy recovery and reprocessing into materials used as fuels</li> <li>• Excludes reprocessing into materials for backfilling<sup>13</sup>.</li> <li>• Does not exclude recycling at the place of generation (which is the case in international questionnaires)</li> </ul>

116. Methodologies for SDG indicators 12.5.1 (National recycling rate, tons of material recycled) and 12.4.2 (Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment) use the definition for “recycling” that is provided in the UNSD/UNEP Questionnaire on

<sup>13</sup> Backfilling means a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials. See <https://ec.europa.eu/eurostat/documents/342366/4953052/Guidance-on-Backfilling.pdf/c18d330c-97f2-4f8c-badd-ba446491b47e>

Environment Statistics. The SDG indicator metadata<sup>14</sup> recognize the significance of informal sector activities and the difficulties to measure them.

117. The definitions have in common that they refer to recovery operations by which waste materials cease to be waste, by becoming products, materials or substances for the original or other purposes. They also exclude the reuse as fuel.

118. The definition in the EU Waste Framework Directive excludes materials for backfilling (which is not explicitly mentioned in the UNSD/UNEP and Eurostat/OECD definitions).

119. Some definitions exclude reuse or recycling at the place of generation of waste.

120. The interpretation of SEEA-CF is that recycling are the activities by formal units classified in division 37 of ISIC, rev 1 and division 38 (E38 - Waste collection, treatment and disposal activities; materials recovery) in NACE rev2. However, this might be too narrow, as waste recycling also happens in other sectors of the economy.

121. For the purposes of this framework *recycling is defined as any activity by which materials are recovered from a waste stream for the purpose of providing material inputs for use in another production process (other than processes designed for energy recovery, the reprocessing into fuels or material for backfilling).*

### **3.2.2 Operational “waste management” definitions used in international questionnaires, guidelines and frameworks**

122. The UNSD/UNEP, FDES, Eurostat and Eurostat/OECD definitions on “waste management” are harmonized and give a breakdown of the stages in the waste flow. Waste management is generally defined as “collection, transport, treatment and disposal of waste, including after-care of disposal sites.” See Table 4 below.

123. The definition used in the SEEA-CF makes a link to the prevention of waste, and to recovery operations, but does not set out the full stages of the waste management process.

124. The term “waste management” by default refers to lawful activities carried out by economic units of the formal sector. These activities may also be carried out by informal employees<sup>15</sup>.

125. Table 4 presents the definitions of “waste management” used by different international organisations. The definitions differ slightly from each other, but can be embedded in the broader conceptual definition presented in section 3.2.1: *Waste management is the set of lawful activities carried out by economic units of the formal sector, both public and private, for the purpose of the collection, transportation, treatment and disposal of waste, including after-care of disposal sites.* The main difference between the conceptual definition and the existing operational definitions is that the conceptual definition also includes waste prevention.

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<sup>14</sup> Metadata of SDG indicator 12.5.1 (version of September 2020): <https://unstats.un.org/sdgs/metadata/files/Metadata-12-05-01.pdf>; metadata of SDG indicator 12.4.2 (version of September 2020): <https://unstats.un.org/sdgs/metadata/files/Metadata-12-04-02.pdf>

<sup>15</sup> ILO definition of informal employment: All remunerative work (i.e. both self-employment and wage employment) that is not registered, regulated or protected by existing legal or regulatory frameworks, as well as non-remunerative work undertaken in an income-producing enterprise. Informal workers do not have secure employment contracts, workers' benefits, social protection or workers' representation. See [https://www.ilo.org/global/topics/wages/minimum-wages/beneficiaries/WCMS\\_436492/lang-en/index.htm](https://www.ilo.org/global/topics/wages/minimum-wages/beneficiaries/WCMS_436492/lang-en/index.htm)

Table 4

**“Management of waste” definitions used by international organisations**

<i>Source</i>	<i>Operational definition</i>	<i>Comments</i>
UNSD/UNEP (Questionnaire 2020 on Environment Statistics)  Eurostat/OECD	Collection, transport, treatment and disposal of waste, including after-care of disposal sites.	The definition used in regular collection of waste statistics by UNSD, UNEP, OECD and Eurostat
FDES	This topic includes statistics on: (i) the amount of waste collected and transported to treatment facilities or to their final disposal; (ii) the amount treated by type of treatment or disposal (e.g., recycling, composting, incineration, landfilling); (iii) the physical infrastructure for waste treatment, including the number and capacity of treatment plants; and (iv) other relevant information. (Topic 3.3.2)	Includes the <u>physical infrastructure</u> for waste treatment.
Basel convention	“Management” means the collection, transport and disposal of hazardous wastes or other wastes, including after-care of disposal sites.	The convention applies to <u>hazardous waste</u> .
SEEA-CF	Waste management refers to activities and measures aimed at the prevention of the generation of waste and the reduction of its harmful effect on the environment. Includes the collection and treatment of waste, including monitoring and regulation activities. It also includes recycling and composting, the collection and treatment of low-level radioactive waste, street cleaning and the collection of public litter.	Wider than the UNSD/UNEP/OECD/Eurostat definition: includes also <u>prevention of waste, reduction of its harmful effect, monitoring and regulation, and low-level radioactive waste</u> .
EU Waste Framework Directive	‘Waste management’ means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker	Includes <u>recovery</u> , and <u>supervision</u> of the operations.
SDG indicator 11.6.1 (Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities) <sup>16</sup>	The indicator methodology now distinguishes between formal and informal waste management:  Formal waste management relates to waste management activities undertaken by units working within the context of the formal governmental or non-state actors regulating and operating waste management; that is, organisations or individuals registered as economic units with government authorities and assumed to generally abide by local laws and regulations related to wastes and their management.  Informal waste management, recycling and recovery refers to waste management and recovery activities undertaken by individuals, economic units, or enterprises which are not sponsored, financed, recognised, supported, organised or acknowledged by the formal solid waste authorities, or which operate in violation of or in competition with formal authorities (Scheinberg et al., 2010). Informal units are assumed to abide by local waste-related laws and regulations when it is in their interests to do so.	Distinguishes between formal and informal waste management  “Management” in the SDG metadata refers to <u>recovery</u> and <u>disposal</u> of <u>solid waste</u> (the indicator name distinguishes between “collected” and “managed”, thus “waste collected” is excluded from “waste managed”)

**3.2.3 Conceptual definition of the “informal and illegal waste handling”**

126. It is important to identify the informal and illegal activities related to waste handling. These activities are difficult to measure but they cover a significant portion of waste handling in some countries.

<sup>16</sup> Metadata of SDG indicator 11.6.1 (version of September 2020): <https://unstats.un.org/sdgs/metadata/files/Metadata-11-06-01.pdf>

127. For the purpose of this framework *informal waste handling is defined as collection, transportation, treatment and disposal of waste by the informal sector*<sup>17</sup>. When informal workers are involved in waste management (a legal activity carried out by an economic unit of the formal sector), then this falls in the category of “management of waste” (see section 3.2.1).

128. Reflecting the informal activities in waste statistics is important because in some countries they can play a significant role in the collection, disposal and recycling of wastes. But their contribution is difficult to measure as it is difficult to reach them for any statistical data collection and they have no obligation to keep records.

129. The term “**informal**” is defined differently in different contexts. Furthermore, distinguishing between the “informal economy”, “informal sector” or “informal employment” is important when describing waste management. For example, when someone with an informal job (as defined by ILO) is working for the municipal waste collection, his work contributes to the formal sector according to national accounts. However, due to the lack of a formal working agreement, no income taxation etc., he may be considered as part of the informal economy as defined by ILO (see Box 7).

130. The informal sector can operate at all stages of waste flows from collection, transport, disposal and recycling. Its activities include:

- Waste collection: includes itinerant waste buyers, street waste picking from bins or collection containers, people picking certain kinds of waste that may have some value (metal, electronics) from vehicles transporting to landfills etc.
- Waste treatment: includes sorting and recycling operations by informal sector.
- Waste disposal: disposal of collected waste at landfill or uncontrolled disposal or disposal of residues from recycling.

131. More work is needed to agree on a definition of formal versus informal for the purpose of waste statistics (see also Box 7).

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<sup>17</sup> ILO definition of informal sector: A group of production units comprised of unincorporated enterprises owned by households, including informal own-account enterprises and enterprises of informal employers (typically small and non-registered enterprises). See ILO (2017) section 4.5 on informal economy workers

**Informal sector and waste related activities**

Several definitions of the informal sector exist, and they are not fully aligned with each other.

**ILO** distinguishes the concepts “informal sector”, “informal employment” and the “informal economy” (see ILO, 2015):

- The **informal economy** refers to all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements. The informal economy does not cover illicit activities.
- The **informal sector** consists of units engaged in the production of goods or services with the primary objective of generating employment and incomes to the persons concerned. The informal sector is a subset of unincorporated enterprises not constituted as separate legal entities independently of their owners. They are owned by individual household members or several members of the same or different households. Typically, they are operating at a low level of organization, on a small scale and with little or no division between labour and capital as factors of production.
- **Employees** are considered to have informal jobs if their employment relationship is, in law or in practice, not subject to national labour legislation, income taxation, social protection or entitlement to certain employment benefits (advance notice of dismissal, severance pay, paid annual or sick leave, etc.). The underpinning reasons may be the non-declaration of the jobs or the employees; casual jobs or jobs of a short duration; jobs with hours of work or wages below a specified threshold (e.g. for social security contributions); or lack of application of law and regulation in practice. In the case of own-account workers and employers, the informal employment status of the job is determined by the informal sector nature of the enterprise. Employers (with hired workers) and own-account worker (without hired workers) are considered to be informal when their economic units belong to the informal sector. All contributing family workers are classified as having informal employment, irrespective of whether they work in formal or informal sector enterprises.

**SNA 2008** discusses informal aspects of the economy in chapter 25. It makes a distinction between the two concepts “non-observed economy” and the “informal sector” which largely overlap:



- The **non-observed economy** comprises production activities that are illegal, underground, informal, or otherwise missed by the statistical system. Unless efforts are made to deal with such activities, economic indicators are underestimated. This can be a serious issue, particularly in transition and emerging economies.
- The concept of the **informal sector** recognizes the analytical importance, especially in developing countries, of being able to measure that part of the economy that reflects the efforts of people without formal jobs to engage in some form of monetary economic activity.

For example, street traders or taxi drivers may be both not observed and informal. A vehicle repair shop with 5-10 employees may be formal but too small to be covered by statistical enquiries and therefore not observed. Teaching assistants may be informal but observed.

For the purpose of monitoring informal waste-related activities **Scheinberg et.al.** (2010) refer to the **informal solid waste sector** as “individuals or enterprises who are involved in private sector recycling and waste management activities which are not sponsored, financed, recognised, supported, organised or acknowledged by the formal solid waste authorities, or which operate in violation of or in competition with formal authorities”.

132. “**Illegal activities**”, according to SNA 2008, are defined as activities carried out by unauthorised persons (e.g. unlicensed practitioners) and activities that are against national law regardless of who carries them out (e.g. illegal transportation in the form of smuggling of goods). For the purpose of this framework “**illegal waste handling**” includes both illegal transactions and illegal dumping of waste.

133. Common examples of illegal activities can include dumping, incineration and export of wastes. Such activities may be relatively minor in terms of environmental consequences (for example, littering in a city park) or quite significant (for example, open burning of toxic wastes). Illegal activities may be undertaken by organisations/individuals registered as formal economic units and by those operating informally, including by households.

134. “**Lawful activities**”, in the context of this framework, are understood as activities carried out by authorised persons operating fully within the law.

135. From the perspective of material and waste streams, flows between formal units and informal units as well as between lawful and illegal activities can occur at any stage of the waste value chain.

136. Often also the terms “controlled facilities”, “uncontrolled waste” or “uncontrolled dumping or burning of waste” are used in various policy frameworks and publications, for example in the metadata of SDG indicator 11.6.1 (Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated), UNEPs “Global Waste Management Outlook” (UNEP, 2015) or the World Bank’s “What a Waste 2.0” report (The World Bank, 2018). The term “**controlled**” (opposite: uncontrolled) usually means that the waste or waste handling is subject to legislative control and following the regulations in force. While “illegal activities” clearly fall in the category “uncontrolled”, “informal waste handling” may or may not be controlled. When the term “**uncontrolled**” is used in this report, it refers to activities for which no legislative control is in place, including illegal activities and informal waste handling outside the scope of regulated waste management.

## 4 Waste statistics framework

137. Having defined the main waste-related terms in the previous chapter, this chapter focuses on laying out the proposed **waste statistics framework**. The framework covers waste statistics from both the conceptual and measurement perspectives; that is, it deals with both conceptual considerations of *what* should be measured and practical considerations of *how* it should be measured.

138. The terms in this chapter are used as defined in the preceding chapter.

### 4.1 Conceptual framework and the scope of official waste statistics

139. The **conceptual framework** was designed to apply to the national level but can equally be used to characterise waste statistics at sub-national level. It gives a simplified overview of the main waste-related activities (boxes) and flows (arrows), and their connection with production and consumption activities.

140. Waste statistics can be seen as a statistical domain by itself, or a sub-component of environment statistics (sub-component 3.3 of FDES). However, it is conceptually closely linked with other statistical areas such as flows of materials and products. Therefore, the conceptual framework of waste statistics is embedded in the broader context of production and consumption of materials and products, and also linked with waste-related emissions to the environment.

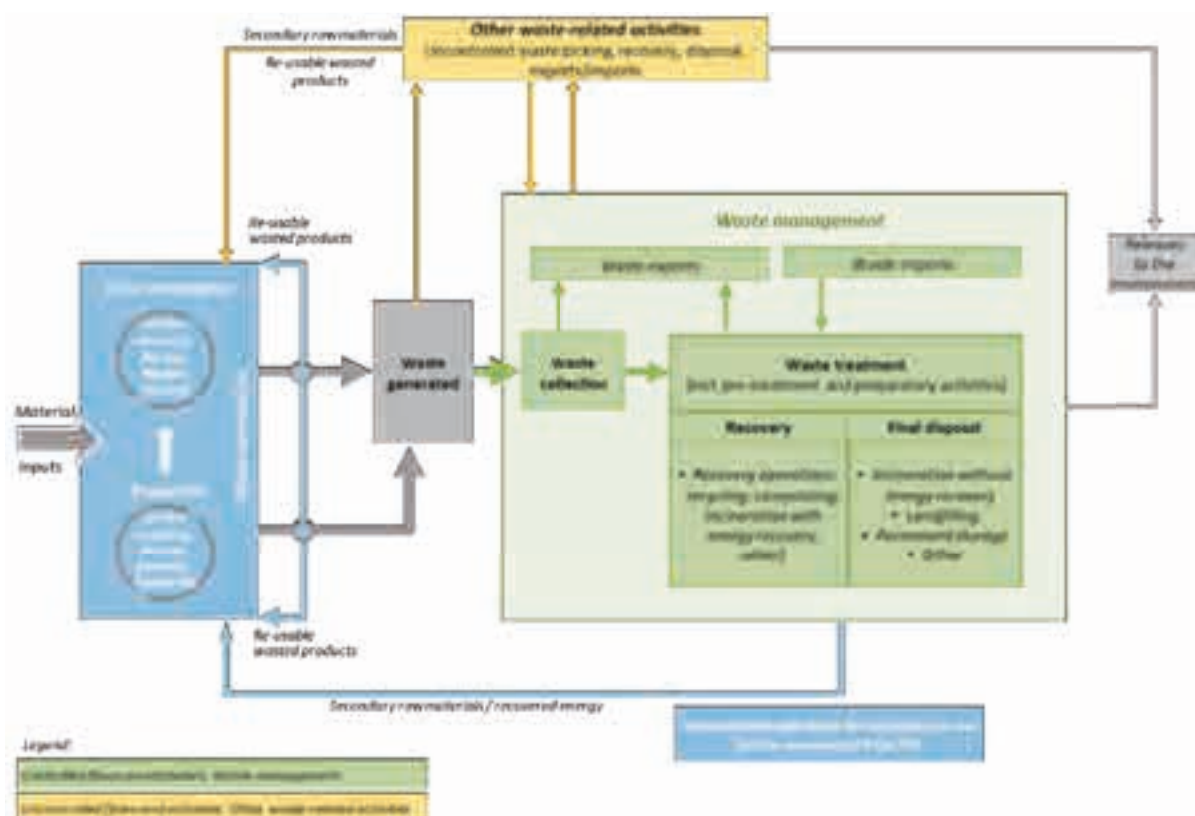
141. The waste-related terms used to describe the framework are defined in chapter 3. Some additional terms, such as those related to product flows, are discussed in this section.

142. The following Figure 4 presents the main conceptual understanding of waste flows, starting with material inputs for production and consumption, continuing with waste generation, waste collection and waste management. This traditional linear economy-based approach is complemented with important elements of a circular economy, such as waste prevention, re-use of products, and waste recovery. It is furthermore complemented by other waste-related activities which are usually not monitored but may contribute significantly to waste handling in many countries, such as uncontrolled waste picking or illegal waste disposal.

143. The framework also considers releases to the environment (such as emissions to air, soil and water) and is in alignment with the concepts used in SEEA-CF and the United Nations Framework for Development of Environment Statistics, which describe stocks and flows within the environment, within the economy and between the economy and the environment.

144. The framework as presented in Figure 4 is accompanied by additional figures explaining its main components (distinguished by colours) in more detail.

Figure 4  
Conceptual framework for waste statistics, embedded in a broader context



Blue box and arrows	Production and consumption activities, and related trade; the flows of used and end-of-life products diverted from the waste stream for re-use, remanufacturing, repair or trade; and the flows of secondary raw materials and energy recovered from waste and that are used as inputs into the economy or traded
Grey box and arrows	Flows of materials to the economy, i.e. material inputs (inputs of raw materials and of derived products), their use in production and consumption and related flows of waste generated. Flows of residuals (releases) from the economy to the environment (pollutant emissions from waste management and related activities, waste dumped, etc.).
Green box and arrows	Waste management activities and related flows, i.e. controlled activities, including waste collection, transport, treatment (including recovery and final disposal), and related transboundary movements
Yellow box and arrows	Other waste-related activities, i.e. uncontrolled (informal and illegal) activities, and related flows.

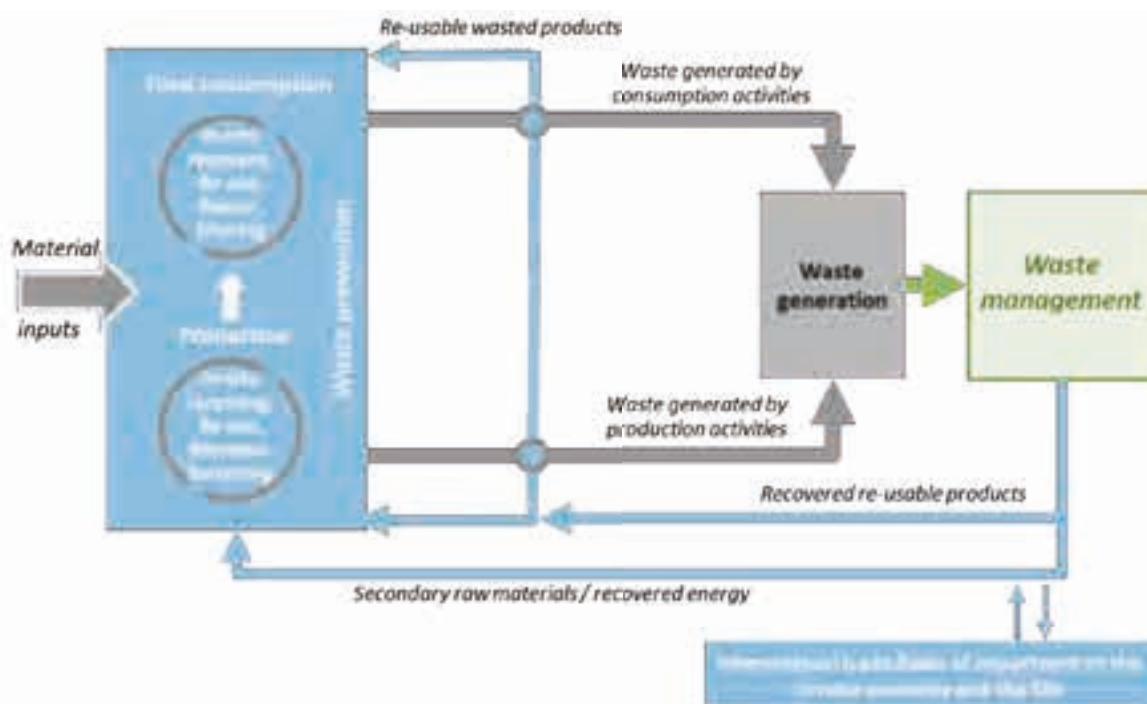
#### 4.1.1 Component “production and consumption activities”

145. Data on production and consumption and on related material and product flows are not part of official waste statistics, but are important “waste-related statistics”, which can be useful to measure aspects of the circular economy. Therefore, the conceptual waste statistics framework has to take into account production and consumption activities, as they provide the link with accounting of materials and products.

146. The following Figure 5 presents in more detail the activities related to production and consumption:

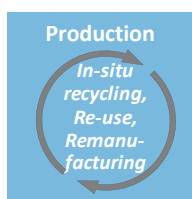
- The blue box represents consumption and production activities and the related material and product flows in the economy.
- The blue arrows represent “products” that are diverted from the waste stream for re-use, and materials or energy recovered from waste that return to production and consumption or are traded.
- The grey arrows represent flows of material inputs into production and consumption, and flows of waste generated by production and consumption.

Figure 5  
**Production and consumption activities (blue box and arrows; grey box and arrows)**



147. Terms and definitions used (see also chapter 3 on key terminology used in waste statistics):

- **Material inputs:** For the purpose of this framework material inputs are defined as raw materials and the derived semi-processed and processed products that enter the economy for use in production and consumption processes. Material inputs stem from domestic activities or from imports.
- **Production and final consumption**



**Production** The use of materials and other products in production processes, including their internal circular use through in-situ (i.e. at the place of generation) recycling, re-use and remanufacturing of residuals, by-products and used goods (e.g. repair and remanufacturing of used electric equipment, of used motor vehicle engines).



**Final consumption** The use of materials and other products in final consumption, including their internal circular use through in-situ recovery (e.g. home composting, donations to charity), re-use and repair, and the sharing of goods and services by final consumers (e.g. through sharing economy approaches like car-sharing).

Note: Materials and “by-products” recycled and re-used of at the place of generation are not considered “waste” for the purpose of waste statistics. The *EU Communication from the Commission to the Council and the European Parliament on the Interpretative Communication on waste and by-products* (European Commission, 2007) provides useful guidance for distinguishing non-waste by-products from waste.

- **Re-usable products:** Used and end-of-life goods (including second-hand goods) diverted from the waste stream for re-use, remanufacturing, repair or trade (e.g. electrical and electronic equipment or its components that can be used for the same purpose for which they were conceived). Re-usable products can be diverted from the waste stream after waste collection (thus ceasing to be waste), or before the products become waste.

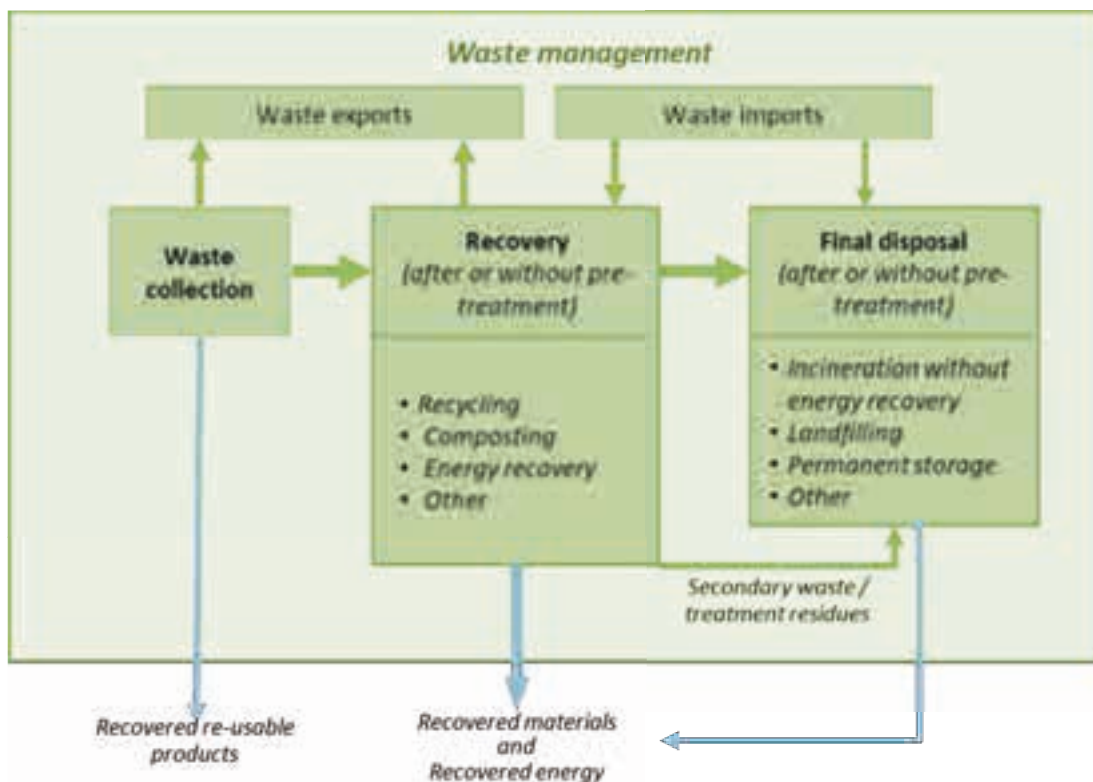
- **International trade flows of importance to the circular economy and the 3Rs (reduce, re-use, recycle):** Exports and imports of second-hand goods, goods for repair and remanufacturing (e.g. used electronic equipment, vehicles), secondary raw materials recovered after sorting or treatment. Such trade should not get mixed up with transboundary movements of waste for treatment and disposal.

#### 4.1.2 Component “waste management activities”

148. The green box (Figure 6) represents the waste management system (collection, recovery and disposal of waste) and related movements or flows, i.e. transport and transboundary movements (green arrows).

149. These activities and flows presented are typically carried out by formal units, sometimes also involving employees with informal jobs. These activities and flows are usually covered by waste statistics. The activities generate flows of recovered materials and products that can be used again in production and consumption (blue arrows).

Figure 6  
Waste management activities (green box and arrows)



- **Waste collection:** Waste collection is generally defined as the gathering of waste, including the preliminary sorting and storage of waste for the purposes of transport. Thus, waste collection is an activity carried out by both the generating unit of waste (when it stores waste for the purpose of transport) and the transporting unit of waste (usually another economic unit, such as a municipal waste management company). It includes infrastructure and flows of waste that are collected (and transported) for further processing.
- **Sorting operations:** Sorting operations can take place at any stage of the waste management process, e.g. sorting by households for separate collection of their waste; sorting of recoverable materials before recycling, sorting of bulky waste collected before refurbishing.
- **Pre-treatment and preparatory activities:** Physical, thermal, chemical or biological processes applied prior to any recovery or disposal operation, and that change the characteristics of the

waste to reduce its volume or hazardous nature, enhance recovery, and facilitate its handling or further treatment or disposal. It may also include temporary storage.

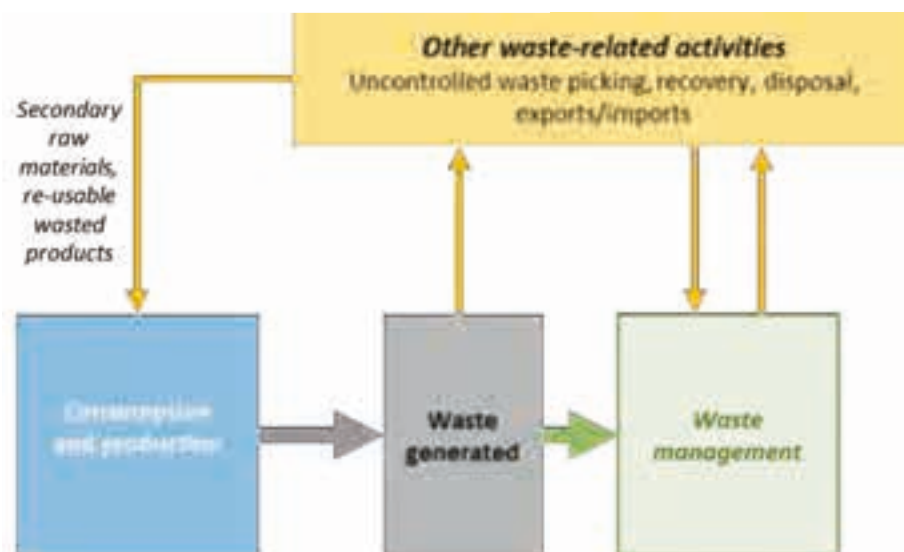
- **Exports and imports of waste** (transboundary movements): Movements of waste from a country to or through another country (the “rest of the world” in SNA terms). Waste can be exported or imported before or after treatment at their place of origin; they can be exported or imported for further treatment, for recovery or for disposal. N.B. Within a country, movements also occur between sub-national units (such as a province), or between a sub-national unit and another country.
- **Recovery operations:** Recovery is defined as any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. It includes recovery infrastructure and flows of waste sent to recycling, energy recovery, composting (after or without pre-treatment). These operations divert waste materials from final disposal and result in the **recovery of materials and energy** (e.g. secondary raw materials, other materials, energy) that are used again in production and consumption, or traded. N.B. Biogas and heat can also be recovered from landfills (not shown on the diagram).
- **Recovered re-usable products:** End-of-life products and equipment (e.g. electrical and electronic equipment) or its components that can be used for the same purpose for which they were conceived. Re-usable products can be diverted from the waste stream after waste collection through sorting, or before the products become waste. See section 4.1.1 on production and consumption activities.
- **Waste disposal:** Waste disposal is defined as any operation which main purpose is not the recovery of materials or energy even if the operation has as a secondary consequence the reclamation of substances or energy. It includes incineration without energy recovery, deposit into or onto land (e.g. landfilling), deep injection, surface impoundment, release into water bodies and permanent storage.
- **Secondary waste:** Secondary waste consists of residual materials left over after treatment. It includes residual materials originating from recovery and disposal operations, such as incineration and composting residues. For the sake of simplicity, the diagram only shows the flows of residuals from waste treatment that go to final disposal; residuals from disposal operations such as incineration that are sent to landfills or material recovery are not shown, but need to be considered in waste statistics.

#### **4.1.3 Component “other waste-related activities”**

150. Other waste-related activities as presented in Figure 7 refer to uncontrolled informal or illegal activities that handle waste arising from production and consumption. They include informal waste picking (collection), transport, recovery and disposal, as well as informal exports and imports. These activities are often carried out by the informal sector and they can be illegal. It needs to be noted that the term “uncontrolled” is used in different contexts in various waste and waste policy frameworks and no harmonised definition exists. When the term “uncontrolled” is used in this report, it refers to activities for which no legislative control is in place, including illegal activities and informal waste handling outside the scope of regulated waste management (see also section 3.2.3).

151. Data on these activities and related waste and material flows are usually not captured in waste statistics. However, as discussed in section 2.1.3 in some countries they contribute significantly to waste recycling. These activities may also be important from a social viewpoint (generating family income), but since they are often not following environmental and safety regulations also pose a potential risk for health and the environment.

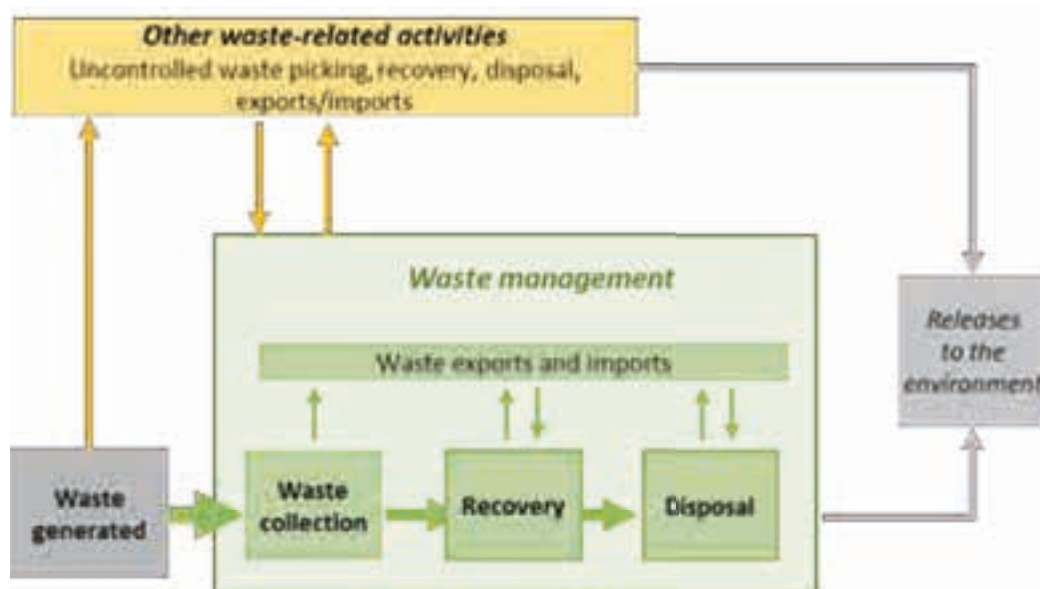
Figure 7  
Other waste-related activities” (yellow box and arrows)



#### 4.1.4 Component “releases to the environment”

152. The grey box on the right side of the diagram (see Figure 8) represents releases to the environment originating from waste generation and management activities.

Figure 8  
Releases to the environment (grey box and arrows, right side of the diagram)



153. Waste management and other waste related activities, even under regulated conditions, result in releases to the environment in form of gas (e.g. methane from decomposition processes or carbon dioxide from incineration), liquids (e.g. leachate infiltration into the soil) or solids (e.g. from illegal disposal or movement of waste by wind and water).

154. Parts of solid waste released to the environment may be eventually collected. Double counting of this waste should be avoided.

#### **4.1.5 Waste stocks**

155. It is important to note that some waste-related activities increase the quantity of waste accumulated within the borders of the nation (waste stocks), either in controlled storage facilities that form part of the economy (such as managed landfills) or in the domestic environment. The main waste stocks of importance are:

- Waste temporarily held by units carrying out waste treatment activities
- Waste permanently stored in controlled waste disposal facilities such as managed landfill sites (these stocks are considered to remain within the economy)
- Waste from informal or illegal dumping in the environment.

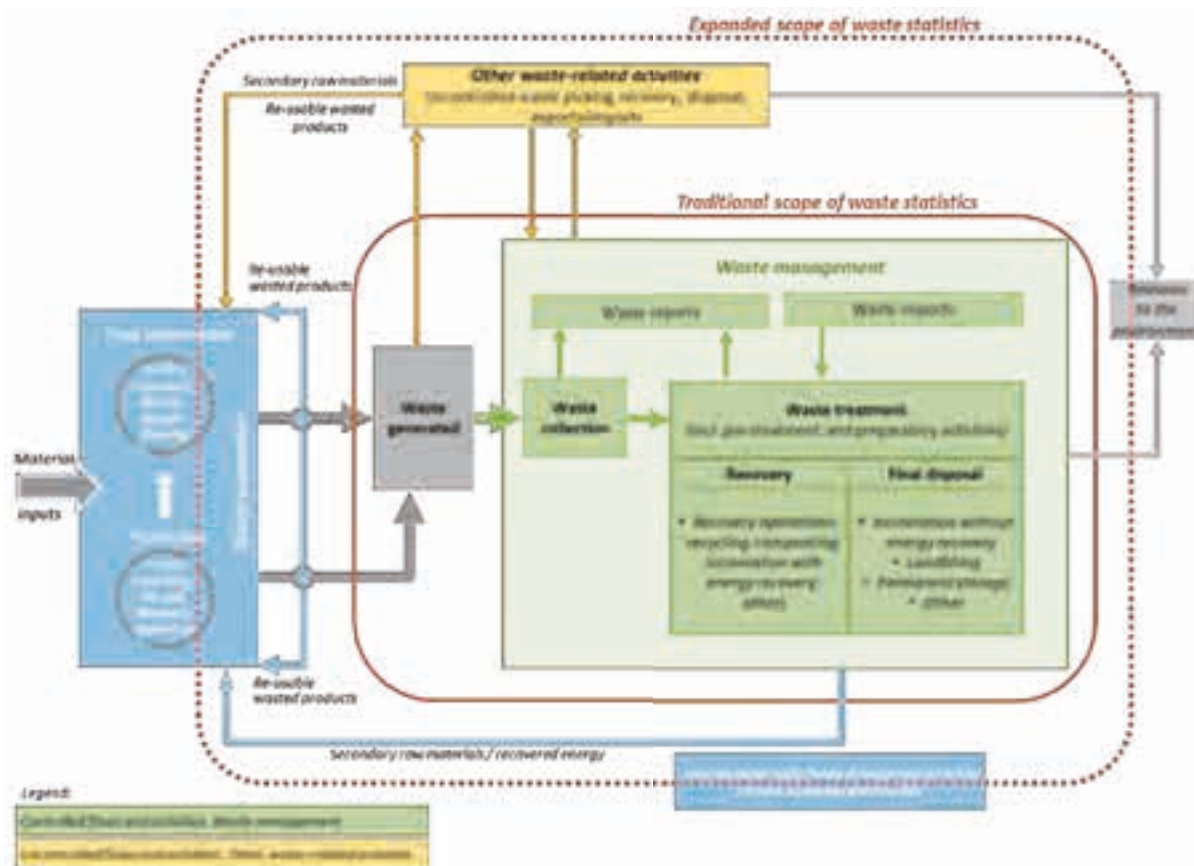
#### **4.1.6 Scope of waste statistics**

156. A conceptual framework aims to define the scope of measurement, helping statisticians to understand what variables should be measured and how these relate to each other.

157. The scope of waste statistics depends on the purpose for which the data are to be used, and on the data availability and quality. It should be conceptually embedded in circular economy statistics. Moreover, it should also cover uncontrolled waste generation and treatment activities, and provide links to waste-related emissions to the environment.

158. Traditional waste statistics usually provide data on generation and management of waste. As uncontrolled waste collection and waste treatment activities can contribute significantly to waste handling, an expanded scope of waste statistics has to conceptually include them, even if they may be difficult to measure. In addition, the expanded scope is also needed for measuring the dependency of waste generation from production and consumption of goods, and circular economy aspects. For example, if the average lifespan of a good is known, waste generation can be calculated. This does not mean that waste statistics cover the production of goods, but that the production data and data on circular strategies (refuse, rethink, reduce, re-use, repair, refurbish, remanufacture, repurpose) may be needed for waste statistics. On the other end, the extended scope also has to consider waste-related emissions to the environment. Both the traditional scope and the expanded scope are presented in Figure 9 and explained further in the following paragraphs.

Figure 9  
**Scope of waste statistics embedded in a broader context**



**Scope of traditional waste statistics (plain red border, Figure 9)**

159. In the case of official waste statistics, the tradition has been to define the scope of measurement more-or-less in line with the scope of national and international policy and legal frameworks, thus covering waste management activities carried out by registered units in the business and government sectors (also called waste management, see section 3.2). This choice of scope has also been driven by the consideration of data availability. In practical terms, the activities of informal units engaged in waste management (even if legal and following regulations) have generally not been measured in most countries.

160. Other activities, such as waste prevention activities, informal or illegal activities and waste-related product flows were excluded from waste statistics under this traditional scope.

161. Excluded in the traditional scope of waste statistics are:

- Lawful waste-related activities undertaken by informal units
- Illegal activities
- Activities related to the use of secondary raw materials in production processes
- Other waste prevention activities such as eco-design, eco-innovation and “sustainable production and consumption” processes.

**Expanded scope of waste statistics (dotted red border, Figure 9)**

162. It is desirable in many instances to define the scope of waste statistics more broadly than has been the tradition. When defined in **this expanded sense**, the scope of waste statistics covers, in addition to the activities and flows covered in the traditional scope:

- Other waste-related activities (informal and illegal) and the related flows

- flows of waste-related products (secondary raw materials and energy, waste products and recycled materials) resulting from waste treatment and disposal, including international trade in such products, which is of importance in the context of the circular economy
- flows of wasted goods which went for repair and remanufacturing, including international trade in such products.

163. Most of the above activities and flows are difficult to measure. Further work is needed to develop methodologies and guidelines for addressing these data gaps with new statistics, estimations, modelling, etc.

#### **Links with other relevant (waste-related) statistics**

164. Beyond expanding the scope of official waste statistics, it is also important to acknowledge the important links between the following upstream and downstream activities and those directly related to the processing of waste:

- Material inputs to the consumption and production activities from the environment
- Waste prevention activities such as *in-situ* re-use of scrap materials in production processes
- Re-use of waste products
- Releases of wastes and related emissions to the environment
- Goods placed on the market and imported (needed for extended producer responsibility systems)
- Flows of waste-related products (secondary raw materials and energy, waste products and recycled materials) resulting from waste treatment and disposal, including international trade in such products, which is of importance in the context of the circular economy.

165. Since the above activities and the related stocks/flows already fall within the scope of other domains of official statistics (for example, flows of material inputs from the environment are part of material flow statistics and flows from waste management to the environment are part of emissions statistics), it is not necessary to define them as part of official waste statistics. It is important, however, that official waste statistics be collected and structured in such a way that they are coherent with waste-related statistics covering these other activities and flows.

#### **Expanded policy relevance**

166. An important reason for expanding the scope for official waste statistics and ensuring their coherence with related statistics is to increase their utility for understanding and studying the **circular economy**; for example, by permitting calculation of recycling ratios for selected materials or products. This would also facilitate links to extended producer responsibility schemes and help respond to information needs for integrated waste and materials management and circular economy policies. The inclusion of illegal activities within the expanded scope also increases the relevance of waste statistics to national authorities charged with the enforcement of waste management laws and regulations.

167. It is important that the development of waste statistics always considers the expanded scope, so they better respond to emerging policy needs. For this reason, countries are encouraged to adopt the broadest possible scope in their official statistics, taking into consideration their national circumstances (such as available capacity), and to identify additional waste-related statistics (such as from material flows and product statistics) which are needed for policies related to sustainable production and consumption and the circular economy.

168. In the case of international reporting (for example, for SDGs), it is not always clear today what is to be reported by countries; for example, international questionnaires do not always clarify whether the scope of waste-related activities is to be limited to formal waste management. Countries are therefore encouraged also to adopt the broadest possible scope for the purposes of international reporting and to be clear what this scope is when filling the relevant questionnaires. Since measuring informal, and/or

illegal activities is challenging, countries should be careful to provide metadata outlining the quality and compilation methods of their estimates. Good metadata are essential to understanding the comparability of data across countries. Comparability is key to producing a common set of internationally harmonised waste statistics for the maximum number of countries without adding to the existing reporting burden.

169. As contextual information, countries may also want to compile statistics describing the infrastructure used in waste management activities (such as the planned capacity, age and remaining capacity of landfill sites). Such information is important, for example, for investment planning. Information on the socio-economic dimensions of waste-related activities (such as employment in formal and informal waste management units or value added of the formal waste management sector) may also be useful contextual information.

## 4.2 Measurement considerations

170. The **conceptual framework** discussed in the preceding section described what should be measured in official waste statistics. This section presents important **measurement considerations** defining how official waste statistics should be measured. It focuses on practical matters relating to:

- The structure of waste statistics
- Units of measure
- Accounting for specific waste-related activities, sectors and materials
- Quality criteria for international waste statistics.

### 4.2.1 Main international data collections and data bases

171. Waste statistics are collected by different international organisations (main players are Basel Convention, UNSD/UNEP, Eurostat, OECD and UNECE). These data collections all together ensure a global country coverage. They follow the same conceptual understanding, thus the data sets are expected to be complementary, coherent and consistent.

172. International waste statistics usually focus on the following, in terms of mass (tonnes per year):

- a) Generation of waste (total, per waste type, per economic activity and households)
- b) Management of municipal waste (collection, recycling, incineration, disposal etc.)
- c) Management of hazardous waste
- d) Eurostat also collects statistics on packaging waste, waste electrical and electronic equipment (WEEE), portable batteries and accumulators, end-of life vehicles.

#### 4.2.1.1 United Nations

173. The **UNSD/UNEP Questionnaire on Environment Statistics** is sent biennially to National Statistical Offices and Ministries of Environment. Since 2004 the questionnaire has been conducted jointly with UNEP. The most recent data collection was carried out in 2018 requesting data from 165 countries and areas, of which 70 responded (response rate 42.4%). The 2020 questionnaire has been sent out in November 2020. These are mainly developing countries which are not covered by data collections of other international organisations (i.e. Eurostat and OECD). The questionnaire collects the following statistics on solid waste:

- Management of waste by source
- Management of hazardous waste
- Management of municipal waste (national total and city data)
- Composition of municipal waste
- The 2018 and 2020 questionnaires also included a template for collecting statistics on electronic waste generation and collection.

174. UNSD publishes data on waste at the following website: <http://unstats.un.org/unsd/ENVIRONMENT/qindicators.htm>.

175. The **UNECE Guidelines for the Application of Environmental Indicators** which are used in the development of the pan-European Shared Environmental Information System (SEIS) ask countries to produce and publish at least the following statistics on national websites:

- Waste generation
- Management of hazardous waste
- Waste reuse and recycling
- Management of municipal waste
- Management of non-hazardous industrial waste.

176. The UNECE data collection templates and the used terms and definitions are aligned with the UNSD/UNEP Questionnaire.

177. Data reported to the **Secretariat of the Basel Convention** can be accessed at: <http://basel.int/Countries/NationalReporting/DataVisualizationTool/tabid/3216/Default.aspx>

178. The United Nations University led the task group on e-waste statistics in the UN interagency group: **Partnership on Measuring ICT for development**. The task group published a framework for global statistics to evaluate the fate of electronic products and the resulting e-waste flows (Balde, 2015a). The first dataset using the framework was published in the UNU's First Global E-waste Monitor (Balde, 2015b)<sup>18</sup>.

#### 4.2.1.2 European Union

179. Eurostat collects the following statistics every second year from EU Member States following the EU Waste Statistics Regulation:

- Waste generated for each waste type (51 waste categories) per NACE activity and households
- Waste treatment by waste category and type of treatment
- Number and capacity of recovery and disposal facilities (per NUTS 2 region) and population served (national).

180. For other specific waste streams, the following statistics are available on an annual basis:

- Municipal waste
- Packaging waste
- Waste electrical and electronic equipment (WEEE)
- End-of-life vehicles
- Portable batteries and accumulators
- Shipments of waste.

181. Additionally, there are new legal obligations with annual waste reporting on

- Municipal waste (European Commission, 2019c)
- Oil and waste oils (European Commission, 2019c)
- Food waste (European Commission, 2019a)
- Packaging waste (European Commission, 2019b).

182. Eurostat statistics on waste can be accessed via <http://ec.europa.eu/eurostat/web/waste>.

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<sup>18</sup> An Excel file with the data can be found here: <https://exp.unu.edu/media/project/174/United-Nations-University-Data-E-waste-Monitor-2014.xlsx>

#### 4.2.1.3 *OECD*

183. OECD has been collecting data on waste since 1981 on a biennial basis through its *Questionnaire on the State of the Environment* (joint questionnaire with Eurostat since 1988; coordinated with the *UNSD/UNEP Questionnaire on Environment Statistics*). Data on municipal waste are updated every year since 2010 in coordination with Eurostat. The data are provided by NSOs and environment ministries and agencies of OECD member countries, accession countries and partner countries; and through reporting to Eurostat following the *Waste Statistics Regulation for European Union countries*.

184. OECD publishes time series on waste generation (waste by sector, municipal waste) and treatment on its statistical platform<sup>19</sup>. Waste related indicators are available on an interactive web platform *Environment at a Glance*<sup>20</sup>. All data and indicators are regularly used in policy work on waste and materials management and in OECD country reviews.

185. OECD also publishes time series on food waste based on several types of sources.

#### 4.2.2 *Disaggregation of waste statistics*

186. Waste statistics are usually measured by a combination of type, source and composition, depending on how they are collected and governed in the country. Waste can be categorized in multiple ways:

- **Type** (primary - generated by any activity other than waste treatment or secondary - resulting residuals from waste treatment)
- **Source** (e.g. households, businesses, governments, following the ISIC/NACE classification of economic activities)
- **Material/composition** (paper, textile, plastics, glass, metals, other inorganic material, mixed household waste, etc.)
- **Waste stream** (e.g. municipal waste, medical waste, electronic waste, etc.)
- **Hazardousness** (following the Basel Convention classification).

187. These categories are not mutually exclusive, for example industrial waste may or may not be hazardous, plastic and paper waste may originate from households or any economic activity.

188. Keeping track of both primary and secondary wastes is especially important in understanding the life-cycle of materials in a circular economy, and to understand the resulting double-counting. The total amount of waste generated by an economy could thus constitute of both primary and secondary wastes, and is then more than the sum of primary waste generated by its economic units, but also more than the waste which is managed or treated.

189. Taking into account the experience with existing international data collections and the expanded scope of waste statistics, statistics should be compiled for each stage of the value chain, from generation via collection and transport to treatment and disposal, including transboundary movements and other (e.g. informal and illegal) waste handling.

190. Statistics on “municipal waste” are relevant for many national and international policy questions and indicators (e.g. SDG indicators 11.6.1 and 12.5.1). Municipal waste consists to a large extent of waste generated by households, but may also include similar wastes generated by small businesses and public institutions and collected by the municipality. The OECD/Eurostat and UNSD/UNEP definitions of municipal waste are harmonized. Both exclude municipal sewage waste and construction and demolition waste. Countries often use slightly different definitions and sometimes it is not clear what to include or to exclude (e.g. what if the industrial sector is also municipally managed?). Therefore, metadata on the used definition of “municipal waste” is key.

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<sup>19</sup> <http://stats.oecd.org/Index.aspx?DataSetCode=MUNW>

<sup>20</sup> <http://www.oecd.org/environment/environment-at-a-glance/>

191. Statistics should be compiled at national level, as well as for selected sub-national units (for example, provinces or major cities).

192. In addition, it may be desirable to break statistics down further by waste stream, such as municipal waste, food waste, waste electric and electronic equipment, sewage sludge, used tires, bulky waste, construction and demolition waste.

193. Complementary data on, for example, waste management expenditures and employment in the waste management sector provide additional information of relevance to the design and assessment of waste-related policies.

### **4.2.3 Units of measure**

194. Official waste statistics are usually reported in units of mass (kilograms or tonnes). However, respondents to waste surveys often use other measurement units; for example, volumetric units may be used for bulky wastes (such as construction debris) and simple counts may be used for wastes made up of homogenous, discrete items (such as waste tires).

195. When the units of measure used by respondents differ from mass units, statisticians must first convert the units before reporting the statistics. This can be challenging, as the density of a given waste depends on many factors (for example, whether the waste is compacted or not, wet or dry, etc.). Statisticians will have to address this challenge on a case-by-case basis, as no general approach to unit conversion is possible.

196. In addition to mass, there may be interest in compiling official waste statistics in terms of the monetary value, energy content and useful energy (exergy) of the materials. Waste statistics reported using energy content can, for example, be used to establish a link between renewable energy statistics and waste statistics in cases where waste is incinerated with energy recovery. The typical unit of measure for energy content is the joule (J).

197. It should be noted that the mass of waste can change over time due to changes in its water content (for example, from precipitation during transport or drying of waste during storage) or decomposition processes. Conceptually, these changes in mass should be recorded as flows of materials between the environment and the economy, though tracking them is difficult. As a result, these processes can lead to inconsistencies in data when the mass of waste is measured.

198. Though most waste policies require statistics in terms of mass, for certain types of wastes (for example, electronic wastes) monetary value is of growing interest. Other approaches of interest include measurement in terms of volume, water content and organic material content. Box 8 discusses an emerging approach to the measure of wastes in terms of quality and demand.

Box 8

#### **Measuring wastes in terms of quality and demand**

Though existing mass- and energy-based waste statistics have proven to be policy relevant in a number of countries since the 1970s, they are not always suitable for identifying quantities of wastes that are recycled. For instance, if a recycled waste contains a small concentration of a precious metal, such as gold, the recycling of the gold may not be recorded in spite of the fact that the gold is likely the most valuable material found in the waste. In addition, current waste statistics do not specify the quality of or the demand for the recycled material. Within the circular economy framework, matching secondary raw materials from wastes with the demand for them is becoming increasingly important.

Though waste statistics based on quality or demand are relatively new and have not been tested in many countries, they are increasingly relevant in the context of the circular economy. There are several ways to produce such statistics.

One approach is to account for the price and value of secondary raw materials of certain quality levels. Trends in prices provide an indication of the demand for secondary raw materials of that quality, taking account of

socio-economic dimensions such as subsidies or taxes or the energy intensity of the recycling process (di Maio et.al., 2015 and 2017). A 2018 Dutch government report on the circular economy included one preliminary indicator of this kind (José Potting et.al., 2018).

Economic accounting and environmental accounting do not always match. A recurring theme is that external social and environmental costs are rarely included in economic accounting. Such external costs can, to some extent, be more readily included in environmental accounting using thermodynamic principles (see chapter 'Materials Separation and Recycling' in Bakshi et.al., 2011).

Waste statistics can also be compiled using thermodynamic principles (Cooper et.al., 2017).

For the moment, it remains most practical to measure waste in terms of mass and energy. However, new approaches to measuring waste based on, for instance, the prices of secondary raw materials will be needed in the near future.

#### **4.2.4 Accounting for illegal activities**

199. Accounting for illegal activities is not easy, as there are no internationally accepted definitions for such statistics. The data available in countries are limited, often scattered and rarely harmonised with official statistics. Data sources include national compliance and enforcement agencies, inspectorates and environment ministries. Availability is best for data on illegal transport and transboundary movements of waste that are controlled under national law and international commitments. Some countries have information systems that monitor waste movements and include information on illegal movements and on fines paid.

200. Illegal waste-related activities (including disposal and trade) are generally defined in national law. A major part of the activities is illegal waste disposal, such as dumping and burning of wastes in open areas. Other activities include illegal recycling and illegal trade. Such activities can occur at any point during the processing of wastes, whether carried out by the formal or informal sector.

201. Countries are encouraged to take into account illegal waste activities and related flows in their waste statistics to obtain the most complete picture of waste generation and processing possible. As it is difficult to measure these activities and related waste flows, estimates should be provided if relevant in a country, e.g. in form of a footnote. Methodological development is needed at both the national and international level to better capture these activities in statistics. Estimates on illegal activities should be integrated into official waste statistics only once a robust methodology and clear definitions have been developed and agreed upon at international level.

202. As long as no internationally agreed upon definitions and classifications exist for illegal waste-related activities, countries may wish to use their own definitions and classifications as the basis for measuring these activities.

#### **4.2.5 Accounting for waste-related activities by the informal sector**

203. The contribution of informal activities to waste processing is difficult to monitor, as informal waste units have no obligation – nor often the capacity – to keep records. National waste information systems and official statistics thus do usually not cover the informal sector, nor do international data collections.

204. For the purpose of monitoring informal waste-related activities refer to the **informal solid waste sector** as “individuals” or “collectives of individuals” that are not officially registered and licensed, but who are involved in private sector waste handling activities. These occur outside of formal waste management regime, which could be, but not exclusively, not sponsored, financed, supported, organised by the formal solid waste authorities, or which even operate in violation of or in competition with formal authorities.

205. Key aspects of the informal sector to be monitored include types of waste materials collected and the estimated contribution to waste treatment. Other important aspects could serve as proxies, such as size, number of people involved, income and jobs.

206. The characteristics of informal waste sector are specific to each country and no internationally agreed upon definition exists.

207. The informal sector is active in almost all aspects of waste processing. It often interacts with the formal sector and can also carry out illegal waste-related activities. The activities of the informal sector are the same as the formalized sector and include:

- **Waste collection:** for example, doorstep waste pickers; itinerant waste buyers buying or bartering for recyclable material; street waste picking from bins or collection containers; and waste picking from landfills
- **Recovery:** for example, sorting; recovery of waste-related materials; dismantling of wastes
- **Waste disposal,** whether in legal, controlled sites or in uncontrolled and/or illegal sites.

208. Overall, the informal sector plays an important role in the collection, disposal and recovery of wastes. This role is particularly important in low-and middle-income countries but also in developed countries.

209. Some countries have integrated some or all of the activities of the informal sector in their formal waste management systems.

#### **4.2.6 Accounting for transboundary movements**

210. Data on transboundary movements of waste are generally available from the national authorities that monitor these movements in accordance with national laws and international commitments. In countries that maintain related databases and electronic information systems (sometimes with real-time monitoring), data on exports and imports of waste are generally included in waste statistics.

211. Data on the imports and exports of waste are an important component of waste statistics. Beyond simply recording the transboundary movements of waste, they are needed to:

- Monitor the amounts of waste that must be managed and treated in a country, which is relevant to decision-making regarding waste infrastructure capacity needs and related investment choices.
- Monitor the treatment processes applied to waste generated within a country, including those carried out abroad, to assess the achievement of material recycling/recovery targets and understand the extent to which trade contributes to high-value recycling, basic material recovery and energy recovery.

212. Wastes that are imported or exported are often not classified as such in trade statistics. Customs officers consider the “objective characteristics” of the materials, which are sometimes inconsistent with the definition of waste in environmental policies and statistics. A customs officer cannot judge, for example, whether a used refrigerator is a second-hand refrigerator intended for continued use or a waste refrigerator intended for disposal.

213. It may be that the same good is categorized differently by the importer than by the exporter. The *Harmonized Commodity Description and Coding System (HS)* is designed to deal with products first and foremost. Wastes are not reflected consistently throughout the HS nomenclature. Solutions need to be found to better adapt HS for monitoring of transboundary movements of waste.

214. Data on trade in second-hand goods, goods for repair/remanufacturing and secondary raw materials<sup>21</sup> are important for integrated waste and materials management and the circular economy. Such data are rarely as separate statistics, because of the difficulty of distinguishing between second-hand products and other products in trade statistics. An OECD study on non-hazardous recyclable materials (OECD, 2008) identified the HS codes on metal scrap, scrap paper and plastic scrap that could be used as starting points. They could be complemented by the HS codes for waste compiled by Kellenberg (2012) and by the correspondence table made available by the Secretariat of the Basel Convention (2013). However, the nature and magnitude of such trade flows are extremely complex and their measurement merits further investigation.

#### **4.2.7 Links to statistics on raw material and product flows**

215. For waste statistics to be fit for monitoring re-use, recycling, integrated waste and materials management policies and other circular economy approaches, they should be compatible with statistics on raw material and product flows (product sales, second-hand and remanufactured products). In particular, waste statistics should be consistent with statistics on:

- Material inputs into the economy or into production processes from, for example, economy-wide and other types of material flow accounts
- Secondary raw materials
- Re-used and second-hand products.

#### **4.2.8 Criteria for high-quality international waste statistics**

216. The quality of the data (that is, their fitness for purpose) is determined by a variety of characteristics. For waste statistics, particular attention should be paid to the following:

- **Coherence over time** – This implies that data are based on common definitions and methodology over time and that any changes are documented and accounted for. Improvements in data quality often require changes in definitions, scope and survey methods, all of which can lead to breaks in time series that can hamper the assessment of trends and policy effectiveness over time.
- **Comparability and coherence across countries** – Comparability of data across countries supports the monitoring of international conventions and targets. It also supports national policy design and assessment. The adoption of internationally harmonised definitions is therefore crucial to increase the comparability and coherence of data across countries.
- **Timeliness** – Improving the timeliness of statistics increases their relevance to policy. Timely statistics are essential for investment planning, establishment of targets and assessment of policy effectiveness. As statistics can become rapidly outdated, it is important to establish efficient data collection, exchange and publication processes.
- **Metadata** - The role of metadata in explaining possible changes in concepts or methodologies over time and across countries is fundamental. Unexplained inconsistencies across datasets can reduce the interpretability and credibility of statistics. Information on definitions and survey methods, breaks in time series and relevant national laws and regulations are therefore essential for the interpretation, use and credibility of waste statistics, particularly when they are not yet internationally harmonised.

217. Applying the Generic Statistical Business Process Model (GSBPM) for the statistical production processes will support the achievement of high quality statistics, including waste statistics.

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<sup>21</sup> Eurostat publishes the secondary raw material price indicator for glass, paper and board and plastic under [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Recycling\\_%E2%80%93\\_secondary\\_material\\_price\\_indicator](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Recycling_%E2%80%93_secondary_material_price_indicator)

#### **4.2.9 Classifications – type of waste**

218. The most important statistical classifications currently used in national waste statistics and international questionnaires are the following:

- List of Waste (European Commission, 2014)
- European Waste Classification for Statistics (EWC-Stat), version 4 (waste categories)
- Waste management categories as used in international waste statistics questionnaires
- Hazardous wastes: Waste categories (Annex I and II of Basel convention), disposal operations (Annex IV of Basel convention)
- Central Product Classification (CPC) version 2.1 and the European Union’s Classification of Products by Activity (CPA), version 2.1.

219. There is no globally agreed classification of non-hazardous wastes. However, most international waste and waste statistics frameworks, environment statistics frameworks (such as FDES) and accounting frameworks (such as SEEA-CF), as well as many national frameworks refer to or are compatible with the *European Waste Classification for Statistics, Revision 4* (EWC-Stat, European Commission (2010)).

220. The *Basel Convention* provides an internationally agreed classification for hazardous wastes and is used for controlling the transboundary movement of waste. However, this is not covering all hazardous waste and is not harmonized with the EWC-Stat classifications.

221. A classification for electronic wastes has been developed recently by the Partnership for Measuring ICT for Development (Forti V. et.al., 2018). It links to multiple data sources and data formats, such as the *Harmonized Commodity Description and Coding System* (HS) and the *EU WEEE Directive* reporting.

222. The *Harmonised Commodity Description and Coding systems* (HS codes) allows participating countries to classify traded goods on a common basis for customs purposes, and thus is relevant for statistics on imports and exports of waste. However, the actual imports and exports of wastes cannot be distinguished from products through the HS classification, thus posing a problem for producing official statistics. Solutions need to be found to better adapt the HS for monitoring of transboundary movements of waste.

223. As also mentioned in chapter 3 it is recommended that a classification be developed for global use based on the European Waste Classification for Statistics for both hazardous and non-hazardous waste. This would improve international comparability and indicator development, thus improving monitoring of sustainable production and consumption. It is furthermore recommended to review other existing waste classifications for better alignment with each other, for example aligning the waste codes of the Basel Convention with those of the EU Waste Statistics Regulation. EU countries have the legal obligation to refer to the European Waste classification. It is suggested that other countries also refer to this classification in absence of a global classification.

#### **4.2.10 Classifications – treatment of waste**

224. Annex IV of the *Basel Convention* describes the recovery and disposal operations. This is also adopted in the *EU Waste Framework Directive* (European Commission, 2008), and is globally recognized and widely used for waste policies and waste statistics.

225. In the European Union the following grouping is used by Eurostat for reporting under the for the *Waste Statistics Regulation* (European Commission, 2002). The Task Force recommends using the same groupings also in countries outside the European Union:

- a) Disposal - incineration
- b) Disposal – landfill

- c) Disposal – other
- d) Recovery – energy recovery
- e) Recovery – recycling
- f) Recovery – backfilling.

## 5 Recommendations for improving waste statistics at national and international level

226. One of the main goals of this document is to provide a framework which is understood by different expert communities involved in producing and using waste statistics. The framework proposes an expanded scope of waste statistics to better inform emerging policies, including circular economy and the 2030 Agenda. It furthermore discusses issues in currently used measurement frameworks which can lead to incomparable data. Based on this analysis, chapter 5 gives some recommendations to gradually improve waste statistics and its international comparability.

### 5.1 Recommendations for national producers of waste statistics

#### **5.1.1 Review existing waste statistics and develop a national work plan on waste statistics**

227. Given the increasing importance of waste-related policies in recent decades, the main recommendation to official national statistics providers is to develop a national work plan on waste statistics.

228. As a first step, the existing official waste statistics should be reviewed to ensure that they

- a) are **consistent with the concepts, scope, definitions and classifications proposed in this framework** and already used in the international questionnaires of UNSD/UNEP and OECD/Eurostat, and
- b) are **fit-for-purpose** to respond to the needs of national and international waste-related policies.

229. Any inconsistencies and gaps in existing statistics should be documented and prioritized in a national work plan on waste statistics. This should include a plan to systematically improve official waste statistics, beginning with those of highest priority. The work plan should also address the need to adequately fund the production of official waste statistics. Data producers, data users and other national stakeholders should be involved in developing the work plan. The process may be guided by international organisations. In preparing the work plan, NSOs should consider the specific recommendations laid out below, which are relevant for countries with varying degrees of experience with waste statistics.

230. The review of existing waste statistics should take into account:

- **National user needs:** Current users of waste statistics, including those responsible for compiling SEEA waste accounts (if these exist), should be contacted to determine their satisfaction with the existing statistics. Potential new users (for example working on circular economy policies or sustainable development) need to be identified and consulted.
- **Quality of existing waste statistics** – Existing waste statistics should be reviewed to assess their adherence with the quality criteria described in section 4.2.8.
- **Data needs of national and international waste-related legislation and policies:** The national and international legislative and policy contexts for wastes and waste-related activities (for example, national and international laws and regulations pertaining to the management of waste and policies relating to hazardous wastes, materials recovery, resource efficiency, circular economy, green growth, among others) should be reviewed to identify the associated statistical needs.
- **Coherence of existing waste statistics with other statistics:** Existing waste statistics should be reviewed to assess their coherence with other relevant official statistics; for example, with statistics on industrial production from national accounts; economy-wide material flow statistics from environmental accounts; or statistics on residuals released to air from emission accounts.
- **Geographic coverage of existing waste statistics:** In cases where existing waste statistics provide estimates only at the national level, consideration should be given to developing sub-

national statistics, if there is demand. This is particularly important in countries where significant legal authority for waste management resides with sub-national authorities (for example, provincial or municipal government departments). In producing sub-national statistics, priority should be given to developing a core set of statistics at the national and sub-national levels. Every effort should be made to ensuring coherence between national and sub-national statistics; for example, by using identical definitions and methods to compile the statistics at both levels.

- **Existing waste trade statistics:** Existing statistics on trade in waste should be reviewed to determine their quality. In particular, a review of the classification of wastes using the Harmonized Commodity Description and Coding System (HS) system should be undertaken to determine whether HS codes are being appropriately applied (for example, that shipments of used clothing for donation and re-use are not incorrectly classified as shipments of waste textiles for disposal or recycling).
- **Complementary statistics:** These include, for example, data on employment in waste management; value-added of the waste management sector; and public and private expenditure on waste management. Any such statistics should be reviewed to assess their quality and coherence with existing waste statistics. If no complementary statistics exist, their development should be considered.
- **National definitions of key terms:** Countries should review the definitions of key terms used in existing waste statistics and existing laws, regulations and policies and compare them with those proposed in this framework, and already used in the international questionnaires of UNSD/UNEP and OECD/Eurostat.

231. One of the main guiding principles should be to collect the statistics once and use it for multiple purposes. This will increase work efficiency as well as coherence and consistency of the data.

### **5.1.2 Consider widening the scope of national waste statistics**

232. Existing waste statistics should be reviewed to identify their scope and document which waste-related activities, stocks and flows are included within the scope and which are not, in comparison with the expanded scope of waste statistics presented in section 4.1.6.

233. In doing so, a distinction should be made between activities, stocks and flows excluded from official waste statistics for pragmatic reasons versus those excluded for conceptual reasons. For example, if the activities of informal units engaged in lawful waste management activities are not within the scope of existing statistics, is this for pragmatic reasons (perhaps there is simply no possibility to collect data from these units) or because informal units are conceptually excluded from the national definition of waste management? In particular, the review of the scope should include the following:

- **Review the role of informal units in waste-related activities** (including their interactions with formal units). This may require, for example, speaking with experts in research institutes, NGOs and public agencies to gain insight into the role played by informal units. In the case that informal units play an important role in waste handling activities it is strongly recommended to expand the scope of official waste statistics accordingly. Leaving these activities out diminishes the value of the statistics for understanding waste and its impacts on human health, the environment and the economy.
- **Assess the extent of illegal waste-related activities** using whatever information can be found, both statistical and non-statistical. This may require, for example, speaking with experts in research institutes, NGOs and public agencies (including law-enforcement agencies) to gain insight into the extent of these activities.
- **Consider linking waste statistics with statistics on releases to the environment** (such as emissions to air, leakage of leachate from landfill sites or littering). At a minimum, attention should be paid to ensuring coherence between waste statistics and any statistics on such releases collected in other statistical programmes; for example, by using the same classifications of industries and wastes.

- **Expand the practical scope of waste statistics in line with the resources and user needs.** Widening the conceptual scope of waste statistics does not mean that all this must be measured in practice. It is not unusual that the coverage of certain phenomena in national statistics may be narrower than their conceptual ideal for pragmatic reasons (resource constraints or lack of user needs, for example). This is often the case, for example, in national accounts, as very few countries have implemented the entire conceptual scope of SNA. In the case that waste statistics in practice are narrower than their conceptual scope, gaps between what is measured and the conceptual ideal should be documented in metadata. If possible, the metadata should give an indication if and when the gaps between the practical and the ideal scope might be filled.

234. New data sources such as from remote sensing or big data could be explored when widening the scope of waste statistics. This may require collaboration with new data providers.

### **5.1.3 Measurement considerations for waste statistics**

235. To make waste statistics more suitable for multiple purposes and to increase international comparability, it is recommended to take into account the following measurement considerations:

- **Ensure the consistency and clarity of different categorisations used in waste statistics:** Different waste-related policies require different ways of categorisation of waste. For example, waste could be categorised according to its source (using ISIC/NACE classification), hazardousness, composition (e.g. mixed waste or plastic waste) or waste stream (e.g. municipal waste). It is important that producers and users of waste statistics understand the differences between these categories, and the fact that the categories are not mutually exclusive. For example, without further explanation it may not be clear that there may be overlaps between municipal waste and hazardous waste (parts of municipal waste can be hazardous), municipal waste and industrial waste (the source of part of municipal waste is small businesses), etc.
- **Report wastes in mass units:** Ensure that waste stocks and flows are reported in mass units whenever possible, making use of defensible and clearly documented (in metadata) factors to convert when necessary from other (for example, volume) units into mass. Where it is not possible to report statistics using mass units, document the reason why and the impact on data comparability. In some cases, additional reporting of the water content or in dry mass equivalents may be useful.
- **Report wastes in monetary or other units where relevant:** Beyond mass units, consider using monetary units to record waste stock and flow statistics where significant market values are observed; for example, the generator of waste materials usually perceives them to have zero value, however, after collection and sorting these materials take on a value and are no longer considered waste. Used aluminium beverage cans from recycling plants to refineries can be measured both in mass and in value. Other units (such as, thermodynamic units or volume) should also be considered for use as appropriate.
- **Use nationally appropriate definitions and classifications of informal and illegal activities:** As no internationally agreed definitions and classifications of informal and illegal activities exist at this time, nationally determined definitions and classifications should be used. International harmonization is important. Countries are encouraged to collaborate with international organisations in developing these definitions and classifications, to move toward more international harmonisation as quickly as possible.

236. Data collection and data production modes may vary in the different parts of the conceptual framework. Care has to be taken when integrating the statistics originating from different sources as in practice they may not always fit together.

#### **5.1.4 Other recommendations to national providers of official waste statistics**

- **Consider developing national indicators for measuring the circular economy:** For example, the *Eurostat Circular Economy Monitoring Framework* <sup>22</sup> provides a set of internationally comparable indicators of which several build upon waste statistics.
- **Consider compiling SEEA waste accounts if these do not exist:** An effective and relatively low-cost means of increasing the utility of existing waste statistics is to compile waste accounts following the internationally agreed SEEA standard.

## **5.2 Recommendations for international organisations**

### **5.2.1 Ensure ongoing collaboration among international organisations and with country experts**

237. A variety of international organisations are active in the development of official waste statistics. These include, among others, Eurostat; OECD; the United Nations and several of its agencies, programmes and regional commissions; and the World Bank. International organisations should continue to collaborate and to work with national official data providers, relevant experts and users.

238. This collaboration will allow to establish platforms for the community of practice, jointly address issues that require further research (see section 5.3) and develop guidelines addressing the specific needs of producers of waste statistics.

239. Both existing collaborative mechanisms (such as the Conference of European Statisticians, Eurostat expert groups, the UNSD Expert Group on Environment Statistics, the Inter-secretariat Working Group on Environment Statistics (IWG-ENV), the UN Committee of Experts on Environmental-Economic Accounting, the OECD Working Party on Environmental Information and the OECD Working Party on Resource Productivity and Waste) and new partnerships with statisticians, policy makers, industry and academia should be used. Such partnerships allow various actors to come together and facilitate implementation of the new waste statistics framework.

### **5.2.2 Make guidelines available and support capacity development**

240. Additional guidelines are needed for producers of waste statistics. The main objectives of the guidelines are to **help countries in the development and implementation of their national work plan on waste statistics** (see section 5.1.1), including widening the scope of waste statistics (see section 5.1.2). This could include, for example, guidelines on the measurement of informal waste-related activities.

241. Countries with developing statistical systems may require additional support to build capacity for the regular production of waste statistics. International organisations should both help to carry out these activities and to coordinate them. Capacity development can include, among other activities, regional and national training programs, sharing of resources, study visits and “South-South cooperation”.

### **5.2.3 Make reference to the waste statistics framework in existing data collections, frameworks and indicator methodologies**

242. As far as possible, **the expanded scope of waste statistics when defining waste-related indicators and reviewing methodologies should be taken into account.** Waste-related SDG indicators and other relevant international indicators should be defined to be consistent to the extent possible with the definitions and scope of this framework (e.g. by considering recycling of waste by informal units) as

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<sup>22</sup> <https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

well as with the contents of the joint OECD/Eurostat and UNSD/UNEP questionnaires. This will enhance international comparability of the indicators and provide an incentive for countries to broaden the scope of waste statistics.

243. Furthermore, this report identified a few minor discrepancies in terms and definitions used in international questionnaires. **Whenever existing international data collections are reviewed or updated, these issues could be solved.**

244. When formal revisions of international statistical frameworks (such as FDES or SEEA-CF), classifications (such as HS, ISIC, etc.) and related documents are undertaken, the **opportunity could be taken to align them with the concepts and definitions in the waste statistics framework.**

## 6 Issues for further research

245. While conducting its work, the Task Force identified a number of issues that require further research to fully implement the proposed waste statistics framework. Close collaboration among international organisations and with countries is key. The following research agenda is proposed to address these issues.

- **Development of new methods and tools for data collection:** The on-going revolution in information technology presents a wide range of opportunities for new data collection methods and tools; for example, GPS tracking of waste; sensor-based underground collection systems for municipal waste; remote sensing to determine the size of legal and illegal dumpsites; and development of material passports. These new methods and tools could be used, for example, to better measure the amount of waste collected, treated, traded and discarded in an uncontrolled manner. Some countries, international organisations and research institutes have tested such tools, but they are currently not systematically used for producing official statistics.
- **Development of a waste classification for global use:** There is currently no globally accepted classification of wastes. The Task Force recommends that a classification be proposed for global use based on the European Waste Classification for Statistics for both hazardous and non-hazardous waste. This would improve international comparability and indicator development, thus improving monitoring of sustainable production and consumption. Also worth discussing is the need for a classification of waste-related products (such as secondary raw materials) by type of material (paper, aluminium, etc.). This would help inform policies on manufacturing and mineral extraction in a circular economy.
- **Review all major existing waste classifications for better alignment with each other:** For example aligning the waste codes of the Basel Convention with those of the EU Waste Statistics Regulation and vice versa.
- **Better alignment of Harmonized Commodity Description and Coding System (HS) for monitoring the transboundary movements of waste:** Wastes are not reflected consistently throughout the HS nomenclature. Solutions need to be found to better adapt HS for monitoring of transboundary movements of waste.
- **Review other existing classifications** whenever a formal revision is on the way, such as ISIC.
- **Guidelines for the practical distinction of wastes, resources and products:** The boundaries between wastes, resources and products (for statistical purposes) may be interpreted differently. For example, the unit collecting or processing the waste may pay to the unit discarding the material because of its value for the collecting or processing unit. According to SEEA this would be called a “waste product”, a term which is not used in other waste statistics frameworks. The EU has defined criteria when a material ceases to be a waste, but they do not consider a payment. This issue will become more important with the development of the circular economy, and requires further clarification.
- **Guidelines for distinguishing between waste management, informal and illegal activities:** In practice, formal, informal and illegal waste-related activities are interlinked. Wastes flowing from informal and illegal activities may or may not be included in traditional official statistics, even though these activities may supply material to formal waste management activities.
- **Disposal in waterbodies:** Currently, legal disposal of wastes in waterbodies (such as dredging sludges) is considered part of formal waste management, even though such wastes are effectively uncontrolled once they have been released to the water. This raises the question whether disposal in waterbodies is more properly considered a form of uncontrolled disposal and, therefore, part of other waste-related activities rather than of waste management.

- **Further clarification of key terms:**
  - **Waste and generation of waste:** Inconsistencies exist between the definitions of waste. For example, the SEEA definition covers the intent to discard while other existing international definitions cover the intent, legal requirement and actual discarding. Furthermore, SEEA considers the “Rest of the World” in its supply table as a waste generator. Thus, imports of waste are added to the total generation of waste, which is also different from other frameworks. These require further explanation.
  - **Illegal waste-related activities:** Further discussion is needed to define illegal waste-related activities. In this regard, it would be useful to examine the laws pertaining to solid waste management in UNECE member states to develop a list of activities and waste streams that can be considered as illegal.
  - **Informal waste handling:** Further work is needed on a definition. Given the breadth of waste activities of the informal sector, a general definition may be supplemented by identification of particular activities of the sector, such as informal sector waste collectors, informal sector waste pickers, etc.
  - **Secondary raw materials:** To identify the extent of secondary raw material used in production processes, further work is needed to identify the waste streams important for providing secondary raw materials (for example, e-waste) and whether additional classifications or definitions are needed to define “end-of-waste status”.
  - **Re-use:** Further discussion is needed to define and collect statistics on the second-hand market for re-used goods. Definitions are needed for the key categories of products and economic activities for which these statistics should be collected.
  - **Food waste, organic waste, biodegradable waste, wood waste, etc:** These terms are semantically interlinked but there are no internationally agreed definitions.
  - **Waste stream:** The term is used in various policy documents and technical documents, but there is no internationally harmonised definition available.
  - **Municipal waste:** More work is needed to make data internationally comparable.
- **Filling data gaps:** Data gaps exist in particular as regards non-hazardous industrial waste; quantities of particular waste streams and related recovery and recycling efforts; and categories of hazardous waste. New data sources and methods (for example, big data, geospatial information) could improve and/or complement traditional sources and methods. The use and integration of these emerging sources and methods will require further work in the coming years. Gaps are also notable in metadata on definitions and survey methods; breaks in time series; waste collection methods; waste minimisation measures and relevant national laws and regulations.
- **Responding to emerging needs:** It may be difficult to adapt to emerging information needs quickly. Policies using integrated and life cycle-based approaches require data on specific waste streams and characteristics that are not always part of official statistics. Examples are:
  - food waste; wood waste; waste from electronic and electrical equipment; end-of-life vehicles (including used tires); illegal waste trade; infectious wastes; construction and demolition wastes (in particular those containing hazardous materials such as asbestos)
  - life-cycle economic value of waste as a resource and expenditure on waste management.

246. It is recommended that the issues for further research are addressed by international organisations in close collaboration with national waste statistics experts. As far as possible, existing expert groups and mechanisms already established by Eurostat, OECD, UNEP, UNSD or UNECE, should be used.

## 7 References

- Bakshi B.R., Gutowski T.G. & D. P. Sekulic (2011): Thermodynamics and the Destruction of Resources, Cambridge University Press, <https://www.cambridge.org/core/books/thermodynamics-and-the-destruction-of-resources/B48D7DE5AD86D3CBA0CA68F46A3E1748> (accessed on 22 December 2020)
- Baldé C.P., Wagner M., Iattoni G. & R. Kuehr (2020): In-depth Review of the WEEE Collection Rates and Targets in the EU-28, Norway, Switzerland, and Iceland, United Nations University (UNU) / United Nations Institute for Training and Research (UNITAR) – co-hosted by the SCYCLE Programme, Bonn, Germany
- Basel Convention Secretariat (2019): Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Revised in 2019. <http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx>
- CIWM (Chartered Institution of Wastes Management/SOENECS Ltd. (2015): EU Recycling rate harmonisation project - National Definitions and Accounting Methods, <https://files.datapress.com/barnet/dataset/municipal-waste---recycling-strategy---legislation-and-targets/2015-12-07T10:02:55/P4%20CIWM%20EU%20Recycling%20Rate%20Harmonisation%20Project%20Oct%202015.pdf>
- Cooper S.J.G., Giesekam J., Hammond G.P., Norman J.B., Owen A., Rogers J.G. & K. Scott (2017): Thermodynamic insights and assessment of the 'circular economy', Journal of Cleaner Production 162 (2017) 1356e1367
- di Maio F. & Rem P.C. (2015): A Robust indicator for promoting circular economy through recycling, Journal of Environmental Protection, Vol. 6 No.10 (2015), 1095-1104
- di Maio F., Rem P.C., Baldé C.P. & M. Polder (2017): Measuring Resource Efficiency and Circular economy: A Market Value Approach, Resources Conservation and Recycling 122 (2017), 163-171
- EEA (European Environment Agency, 2009): Waste without borders in the EU, <http://www.eea.europa.eu/publications/waste-without-borders-in-the-eu-transboundary-shipments-of-waste>
- European Commission (2002): Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002R2150> (accessed on 30 September 2020)
- European Commission (2007): Communication from the Commission to the Council and the European Parliament on the interpretative Communication on Waste and By-products, COM(2007) 59 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52007DC0059> (accessed on 22 December 2020)
- European Commission (2008): Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098> (accessed on 30 September 2020)
- European Commission (2008a): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan, COM(2008) 397 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0397> (accessed on 21 December 2020)

- European Commission (2010): Commission Regulation 849/2010 amending Regulation (EC) No 2150/2002 of the European Parliament and of the Council on Waste Statistics, Official Journal of the European Union L253/2 28.9.2010, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010R0849> (accessed 28 September 2020)
- European Commission (2014): General Union Environment, Action Programme to 2020, Living well, within the limits of our planet, <https://ec.europa.eu/environment/action-programme/> (accessed on 21 December 2020)
- European Commission (2014a): Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council, <https://eur-lex.europa.eu/eli/dec/2014/955/oj> (accessed on 23 August 2021)
- European Commission (2019a): Commission Delegated Decision (EU) of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. [https://eur-lex.europa.eu/eli/dec\\_del/2019/1597/oj](https://eur-lex.europa.eu/eli/dec_del/2019/1597/oj) (accessed on 23 August 2021)
- European Commission (2019b): Commission Implementing Decision (EU) 2019/665 of 17 April 2019 amending Decision 2005/270/EC establishing the formats relating to the database system pursuant to European Parliament and Council Directive 94/62/EC on packaging and packaging waste (notified under document C(2019) 2805). [https://eur-lex.europa.eu/eli/dec\\_impl/2019/665/oj](https://eur-lex.europa.eu/eli/dec_impl/2019/665/oj) (accessed on 23 August 2021)
- European Commission (2019c): Commission Implementing Decision (EU) 2019/1004 of 7 June 2019 laying down rules for the calculation, verification and reporting of data on waste in accordance with Directive 2008/98/EC of the European Parliament and of the Council and repealing Commission Implementing Decision C(2012) 2384 (notified under document C(2019) 4114). [https://eur-lex.europa.eu/eli/dec\\_impl/2019/1004/oj](https://eur-lex.europa.eu/eli/dec_impl/2019/1004/oj) (accessed on 23 August 2021)
- European Commission (2021): 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. <https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+municipal+waste+data+collection/> (accessed on 24 November 2021)
- Forti V., Baldé C.P. & R. Kuehr (2018): E-waste Statistics: Guidelines on Classifications, Reporting and Indicators, second edition, United Nations University, ViE – SCYCLE, [https://collections.unu.edu/eserv/UNU:6477/RZ\\_EWaste\\_Guidelines\\_LoRes.pdf](https://collections.unu.edu/eserv/UNU:6477/RZ_EWaste_Guidelines_LoRes.pdf) (accessed on 22 December 2020)
- Forti V., Baldé C.P., Kuehr R. & G. Bel (2020): The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential. United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR) – co-hosted SCYCLE Programme, International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), <https://www.itu.int/en/ITU-D/Environment/Pages/Spotlight/Global-Ewaste-Monitor-2020.aspx>
- Global Alliance of Waste Pickers (2016): Website <http://globalrec.org/waw/stats/> (accessed on 7 September 2016).
- ILO (International Labour Organization, 2015): R204 – Transition from the Informal to the Formal Economy Recommendation, [https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100\\_INSTRUMENT\\_ID:3243110](https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:3243110) (accessed on 22 December 2020)

- ILO (International Labour Organization, 2017): Minimum Wage Policy Guide, <https://www.ilo.org/global/topics/wages/minimum-wages/lang--en/index.htm> (accessed on 22 December 2020)
- Kellenberg D. (2012): Trading wastes, Journal of Environmental Economics and Management, Elsevier, vol. 64, No. 1, pp 68-87
- Medina, M. (2008): Gridlines Note No. 44: The informal recycling sector in developing countries. Organizing waste pickers to enhance their impact. <https://www.ppiaf.org/sites/ppiaf.org/files/publication/Gridlines-44-Informal%20Recycling%20-%20MMedina.pdf>
- OECD (2008): Reducing barriers to international trade in non-hazardous recyclable materials: exploring the environmental and economic benefits, Part 1: A synthesis report, COM/TAD/ENV/JWPTE(2008)27/FINAL, <https://www.oecd.org/env/45574471.pdf> (accessed on 22 December 2020)
- OECD (2018): Improving the quality of data on waste and material. Working Party on Environmental Information. ENV/EPOC/WPEI(2018)4. [https://one.oecd.org/document/ENV/EPOC/WPEI\(2018\)4/en](https://one.oecd.org/document/ENV/EPOC/WPEI(2018)4/en)
- Potting José en Aldert Hanemaaijer (eds.), Roel Delahaye, Jurgen Ganzevles, Rutger Hoekstra en Johannes Lijzen (2018): Circulaire economie: Wat we willen weten en kunnen meten. Systeem en nulmeting voor monitoring van de voortgang van de circulaire economie in Nederland, Den Haag: PBL, CBS, RIVM
- Statistics Netherlands and UNECE (2016): Problems with waste statistics and a proposal for action. Note approved by the CES Bureau in October 2016. ECE/CES/BUR/2016/OCT/7. [https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2016/October/07-Waste\\_statistics\\_final.pdf](https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2016/October/07-Waste_statistics_final.pdf) (accessed on 22 December 2020)
- UNECE (2019): European Agreement concerning the International Carriage of Dangerous Goods by Road, ADR as applicable as from 1 January 2019, <https://unece.org/adr-2019-files> (accessed on 21 December 2020)
- United Nations (2013): Framework for the Development of Environment Statistics, <https://unstats.un.org/unsd/environment/FDES/FDES-2015-supporting-tools/FDES.pdf> (accessed on 22 December 2020)
- United Nations (2014): The 10 Year Framework of Programmes on Sustainable Consumption and Production Patterns, <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1444&menu=35> (accessed on 21 December 2020)
- United Nations (2019): World Economic Situation and Prospects. Statistical Annex. [https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019\\_BOOK-ANNEX-en.pdf](https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019_BOOK-ANNEX-en.pdf)
- United Nations (2020a): Report of the Secretary General on Environment Statistics. 51st Session of the Statistical Commission, item 4 (e) of the provisional agenda. 3-6 March 2020. <https://unstats.un.org/unsd/statcom/51st-session/documents/2020-33-EnvironmentStats-E.pdf>
- United Nations (2020b): Background document to the Report of the Secretary General on Environment Statistics (E/CN.3/2020/33). 51st Session of the Statistical Commission, item 4 (e) of the provisional agenda. 3-6 March 2020. <https://unstats.un.org/unsd/statcom/51st-session/documents/BG-item-4e-EnvironmentStats-E.pdf>

United Nations, European Commission, IMF, OECD & The World Bank (2009): System of National Accounts 2008, <https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf> (accessed on 21 December 2020)

United Nations, European Commission, FAO, IMF, OECD & The World Bank (2012): System of Environmental-Economic Accounting 2012 – Central Framework, <https://seea.un.org/content/seea-central-framework> (accessed on 22 December 2020)

## Annex I – Glossary of terms

<i>Term</i>	<i>Definition</i>	<i>Source</i>	<i>Comments</i>
Disposal	Any operation which main purpose is not the recovery of materials or energy even if the operation has as a secondary consequence the reclamation of substances or energy	EU Waste Framework Directive	
Illegal waste handling	Illegal transactions and illegal dumping of waste	SNA 2008 and UNECE Task Force	According to SNA 2008, are defined as activities carried out by unauthorised persons (e.g. unlicensed practitioners) and activities that are against national law regardless of who carries them out (e.g. illegal transportation in the form of smuggling of goods).
Informal waste handling	Collection, transportation, treatment and disposal of waste by the informal sector	UNECE Task Force	
Municipal waste	Municipal waste, collected by or on behalf of municipalities, by public or private enterprises, includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g., white goods, old furniture, mattresses) and waste from selected municipal services, e.g., waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.	UNSD/UNEP Questionnaire 2020 on Environment Statistics	Definitions used by other international organisations are slightly different in wording, but conceptually identical.
Primary wastes	Wastes generated by any activity other than waste processing		
Recovery	Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy	EU Waste Framework Directive	A sub-category of "waste management"
Recycling	Any activity by which materials are recovered from a waste stream for the purpose of providing material inputs for use in another production process (other than processes designed for energy recovery, the reprocessing into fuels or material for backfilling)		A sub-category of "waste management" The conceptual definition uses a slightly different wording than the EU Waste Framework Directive
Re-use	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived	EU Waste Framework Directive	

<i>Term</i>	<i>Definition</i>	<i>Source</i>	<i>Comments</i>
Re-usable products	Used and end-of-life goods (including second-hand goods) diverted from the waste stream for re-use, remanufacturing, repair or trade (e.g. electrical and electronic equipment or its components that can be used for the same purpose for which they were conceived).		Re-usable products can be diverted from the waste stream after waste collection (thus ceasing to be waste), or before the products become waste.
Secondary raw materials	Materials recovered from recycling		
Secondary wastes	Residual materials left over after treatment of waste	Eurostat Glossary	Simpler wording used here
Transport of waste	The movement of waste from one place to another for a purpose. This may be done by various powered vehicles (such as trains, buses, passenger cars, lorries, boats and aircraft), by human-powered means such as walking and cycling or by pipelines	UNECE Transport Division	A sub-category of "waste collection"
Waste	Waste is any material which the holder discards or intends or is required to discard.	Basel Convention and EU Waste Framework Directive	Uses the term "material" instead of "substances and objects" Uses the term "discard" (as in EU Waste Framework Directive and international statistical questionnaires, but not as in Basel Convention) Refers to a "holder" (as in EU Waste Framework Directive, but not as in Basel Convention) Excludes emissions to air, residuals of substances that are released to the environment for a purpose other than final disposal (e.g. residuals of chemical fertilizers and biocides) and wastewater
Waste collection	Waste collection means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport	EU Waste Framework Directive	A sub-category of "waste management" To be applicable in a broader sense (e.g. in case of informal or illegal waste collection), the conceptual definition excludes the part "to a waste treatment facility".
Waste management	Set of lawful activities carried out by economic units of the formal sector, both public and private for the purpose of the collection, transportation, and treatment of waste, including final disposal and after-care of disposal sites.	Defined by the Task Force, based on UNSD/UNEP and Eurostat/OECD Questionnaires, and EU Waste Framework Directive	The conceptual definition clarifies that it refers to legal activities carried out by economic units of the formal sector

<i>Term</i>	<i>Definition</i>	<i>Source</i>	<i>Comments</i>
Waste prevention	Measures taken before a substance, material or product has become waste, that reduce (a) the quantity of waste, including through the re-use of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; or (c) the content of harmful substances in materials and products.	EU Waste Framework Directive	A very wide scope which requires more analysis for measurement purposes Currently excluded from the definition of "waste management"
Waste treatment	Recovery or disposal operations, including preparation prior to recovery or disposal	EU Waste Framework Directive	A sub-category of "waste management"

## Annex II - Correspondence between conceptual definition of waste and existing operational definitions of international organisations

Conceptual definition of waste: *Waste is any material which the holder discards or intends or is required to discard.*

Source	Operational definition	Embedding of operational definition into the conceptual definition
UNSD/UNEP and Eurostat/OECD	<p>Materials that are not prime products (i.e., products produced for the market) for which the generator has no further use for his own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard.</p> <p>It excludes material directly recycled or reused at the place of generation (i.e., establishment) and waste materials that are directly discharged into ambient water or air as wastewater or air pollution.</p>	<ul style="list-style-type: none"> <li>• “Generator” understood as a synonym for “holder”.</li> <li>• For measurement purposes materials recycled or re-used at the place of generation are excluded.</li> </ul>
FDES	<p>Waste is defined as discarded material for which the owner or user has no further use, generated by human activities in the course of production and consumption processes.</p>	<ul style="list-style-type: none"> <li>• “Owner or user” understood as a synonym for “holder”.</li> <li>• For measurement purposes it refers only to materials which have already been discarded.</li> </ul>
Basel convention	<p>“Wastes” are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law.</p>	<ul style="list-style-type: none"> <li>• “Substances or objects” understood as synonym for “material”.</li> <li>• “Dispose of” understood as synonym for “discard”.</li> <li>• Slightly different wording used.</li> </ul>
SEEA-CF	<p>Materials that are not prime products (that is, products made for the market) for which the generator has no further use for own purposes of production, transformation or consumption, and which he wants to dispose of. Wastes may be generated during the extraction of raw materials, during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Residuals recycled or reused at the place of generation are excluded. Also excluded are waste materials that are directly discharged into ambient water or air.</p>	<ul style="list-style-type: none"> <li>• “Generator” understood as synonym for “holder”.</li> <li>• For measurement purposes materials recycled or re-used at the place of generation are excluded.</li> </ul>
EU Waste Framework Directive	<p>Waste means any substance or object which the holder discards or intends or is required to discard</p>	<ul style="list-style-type: none"> <li>• “Substances or objects” understood as synonym for “material”.</li> </ul>





# Conference of European Statisticians Framework on Waste Statistics

Official waste statistics have been produced for more than 40 years. They were initially developed to monitor and manage threats to human health and the environment. More recently, information needs have shifted toward realizing the economic value of waste, particularly in the context of the “circular economy”. This change has created demand for information on waste types that have not traditionally been measured, for example, electronic, food and textile wastes. Greater insight is also sought into the economic value of waste and wastes that are difficult to measure, including those processed by workers in the informal sector. This growing interest is reflected in the fact that several of the United Nations’ Sustainable Development Goal indicators refer directly to waste and its management.

This document serves as a guide for statisticians compiling national waste statistics and contributes to the further harmonisation of international waste statistics. Its proposed expanded scope of waste statistics provides an important foundation for measuring the circular economy and other production and consumption-related policy areas.

The Waste Statistics Framework was developed by a dedicated UNECE Task Force established by the Conference of European Statisticians. The Framework was endorsed in 2021 by the Heads of national statistical offices of more than 60 countries who are members of the Conference, and major international organizations.

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