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Global Chemicals and Waste Indicator Review Document

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Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
BRS Secretariat	Secretariat of the Basel, Rotterdam and Stockholm Conventions
COP	Conference of the Parties
DMC	Domestic Material Consumption
DMI	Direct Material Inputs
DNA	Designated National Authorities
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEA	European Environment Agency
EEA/EFTA	European Economic Area/European Free Trade Association
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
ERS	Electronic Reporting System
EU	European Union
EUROSTAT	European Union statistics
EW-MFA	Economy-Wide Material Flow Accounts
FLI	Food Loss Index
FLW	Food Loss and Waste
FLWP	Food Loss and Waste Protocol, multi-stakeholder partnership which developed the FLWS
FLWS	Food Loss and Waste Accounting and Reporting Standard
FWI	Food Waste Index
GDP	Gross Domestic Product
GFLI	Global Food Loss Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit – German development agency
IAEG	UN Inter-agency and Expert Group on SDG Indicators
ICCM	International Conference on Chemicals Management
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification of all Economic Activities
ISWA	International Solid Waste Association
JICA	Japan International Cooperation Agency
LAFA	Loss-Adjusted Food Availability
MBT	Mechanical-Biological Treatment
MEA	Multilateral Environment Agreement
MF	Material Footprint
MFA	Material Flow Analysis/Material Flow Accounts
MSW	Municipal Solid Waste
NACE	Statistical Classification of Economic Activities in the European Community

NFP	National Focal Point
NIP	National Implementation Plan
ODSs	Ozone Depleting Substances
OECD	Organisation for Economic Cooperation and Development
PAHO	Pan American Health Organization
PIC Procedure	Prior Informed Consent Procedure (Basel and Rotterdam Conventions)
POPs	Persistent Organic Pollutants
RWA	Resources and Waste Advisory Group
SAICM	Strategic Approach to International Chemicals Management
SDG	Sustainable Development Goal
SDI	Sustainable Development Indicator
SEEA	System of Environmental-Economic Accounting
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
UNU	United Nations University
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WACS	Waste Amounts and Composition Survey
WaCT	Waste Wise Cities Tool
WaW	What a Waste
WB	World Bank
WFA	Waste Flow Account

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Background

In September 2015, the United Nations Sustainable Development Summit adopted a new framework to guide development efforts between 2015 and 2030, entitled "Transforming our world: the 2030 Agenda for sustainable development". The 2030 Agenda contains 17 Sustainable Development Goals (SDGs), divided into 169 targets, which are informed by 247 indicators.

Sustainable Development Goal 11, Make cities and human settlements inclusive, safe, resilient and sustainable, promotes sustainable urban development through intelligent urban planning and basic service provision that creates safe, affordable, resilient, green cities with equitable access to basic services and healthy living condition. The SDG 11 targets cover different areas of basic service provision and environment impact reduction in cities and one of them is measured by indicator 11.6.1 on municipal solid waste management.

A global data collection and publication system through the UNSD/UNEP Questionnaire on Environment Statistics has collected data on municipal solid waste (MSW) collection and treatment since 1999. Data has been received from about 160 to 170 countries, covering both national and city levels. However, the response rate for the UNSD/UNEP Questionnaire is hovering around 50% and data completeness and quality remain a challenge, especially for developing countries. This indicates that it is critical to improve the availability and accessibility of waste statistics and increase training for collection of data and capacity development on the ground.

This paucity of evidence-based data hinders the development of waste management strategies and constrains investment decision-making in infrastructure and service expansion, leading in many countries to insufficient or absent MSW management services. Poor MSW collection and management trigger severe threats to public health and pollute air and water. Furthermore, uncollected, and mismanaged waste is the main source of marine plastic pollution. SDG indicator 11.6.1 quantifies parameters that will help cities and countries to better manage resources, mitigate and prevent environmental pollution, create business, employment and livelihood opportunities, and shift towards a circular economy. The methodology to monitor SDG indicator 11.6.1 provides guidelines for ladders for MSW collection services and control level of waste management facilities, and aims to bring standardized definitions, nomenclature and techniques to MSW data collection.

Waste management concerns various socioeconomic and environmental aspects by addressing a plethora of challenges linked to health, poverty, food security, resource management, climate change and equal participation. The waste sector is widely and mistakenly assumed to be gender-neutral, and impacts of exposure to hazardous waste and chemicals affect humans differently depending on their sex, age and gender role. According to UNEP´s "Gender and Waste Nexus" report (UNEP, 2019), gender inequalities are embedded in almost all aspects of waste management and overcoming the presumption of gender neutrality is the first step to mainstreaming gender in the waste sector. To do so, it is essential to collect and report data disaggregated by sex, age and gender role to ensure progress towards gender equity and equality.

Sustainable Development Goal 12, Ensure sustainable consumption and production patterns,

promotes increased human well-being while decoupling economic growth from resource use and environmental degradation. The SDG 12 targets cover a range of entry points and actors for promoting responsible consumption and production. This includes a series of indicators related to waste generation and management, including Indicators 12.4.2 on hazardous waste, 12.5.1 on recycling and 12.3.1a on food waste.

Food security is becoming an increasingly serious concern to countries across the planet as the population increases yet the capacity of the agricultural sector has not been able to keep up. One of the lowest hanging fruits to increase out food capacity to by limiting food waste. Furthermore, food production is particularly resource intensive. In order to create a sustainable production as stated in goal 12, we must look beyond the specific process and understand whether they are effectively being consumed. In all, food waste is important to prevent, because these wasted resources could have been used purposefully, i.e. for feeding further wanting persons.

By incorporating studies concerning food waste through the steps described in this document, member states can make strides in understanding how they compare to their peers in terms of food waste and potentially find significant gains in their own capacity to feed their populations and reduce waste throughout the food value chain.

Another vital indicator is the management of hazardous materials (12.4.2). While the Basel Convention exists to create rules related to the transportation of hazardous waste, it is vital for states to be informed on the state and developments within their own borders. It is particularly important to have robust statistics for hazardous waste compared to other forms of waste because of its potential impact on human and environmental health. Available adequate and reliable records for hazardous waste allow states to identify potential challenges earlier, and in turn, to coordinate a more timely and thorough response.

The entire surrounding world and our way of life are founded on daily used chemicals . While these chemicals enable substantial achievements, many are harmful to people and planet; and the impacts from exposure dependon one's age, sex, and gender role. It is of vital importance for human health in the long-term that there is a system in place to record and understand how these chemicals move through our economies, so we can properly regulate and control them to our greatest advantage before more drastic actions are needed, which in turn would affect the quality of life.

Another indicator that is addressed in this document is recycling (12.5.1). Recycling is a central pillar in the transition which countries, as well as companies in the private sector, must go through in order to create long term and sustainable economies. In many ways, recycling is seen as a final effort to effectively utilize finite resources after reducing their consumption and finding more efficient processes in production. Recycling is a vital solution towards reducing environmental impacts, since mining is responsible for a dramatic impact on the environment, be it through destructing natural landscapes or discharging hazardous chemicals used in the process. By investing in recycling and transforming already extracted resources, economies can make significant progress towards decoupling economic growth from the resources they need.

Generally, waste is by definition "any 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" (UNSD/UNEP Questionnaire 2020 on Environment Statistics). This has traditionally meant that waste was left in a landfill without further consideration. As humanity reaches permanently closer to the limits of the planet's capacity for the former's own consumption, we must re-think and understand that what was once considered trash, presents now valuable resources which could be used more effectivelyand efficiently. Additionally, as the planet's limited resources are being further consumed, fewer places remain for storing waste for an indefinite period. In order to ensure that the planet is habitable for the next generations, we must look at the waste we produce, maintain knowledge of how much exists and and use it, as far as possible, as a source of valuable raw materials instead of consuming further primary resources.

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Introduction

1

Introduction

The *"Global chemicals and waste indicator review document"* aims to strengthen the knowledge base of chemicals and hazardous waste and enhance the capacity of selected countries to track progress towards related SDGs indicators across sectors in order to strengthen the evidence base for policy making and stakeholder action.

By strengthening the evidence base as well as the science policy interface, the project responds to the need for better information to empower decision makers and stakeholders to act and support policy making aimed at sound management of waste to minimize risks to public health and the environment associated with chemicals and hazardous waste.

This document aims to provide a coherent methodology for measuring the SDG indicators related to municipal and food waste, hazardous waste and recycling rate.

SDG 11.6.1 Municipal solid waste collected and managed in controlled facilities, out of total municipal solid waste generated, by the city

SDG 12.3.1 (a) Food loss index[1] and (b) food waste index

SDG 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

SDG 12.5.1 National recycling rate, tons of material recycled

1 Note that this document only covers Food Waste as Food Loss has an existing methodology and is under the custodianship of FAO.

Closely related indicators and targets include:

	GOAL 12: SUSTAINABLE CONSUMPTION AND PRODUCTION
Target 12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
Indicator 12.4.1	*Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement*
	GOAL 14: CONSERVE AND SUSTAINABILY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT
Target 14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
Indicator 14.1.1	*Index of coastal eutrophication and floating plastic debris density*

The objective of this document is to provide guidance and training on how to measure and use national chemicals and waste indicators, including data disaggregation (including by sex and age), statistical standards and methodologies, in order to improve the level and quality of reporting.

It includes a literature review and current reporting status on related data (Annex I), as well as a first methodology on how to measure these indicators. In addition, UN-Habitat developed a complementary document *Waste Wise Cities Tool - Step by Step Guide to Assess a City's MSWM Performance through SDG indicator 11.6.1 Monitoring (WaCT)* which provides detailed methodology for on the ground data collection.

Annex III also provides a data assessment tool which can be used by countries interested in conducting a self-assessment of the priorities and gaps in developing a system for national monitoring of waste. For all the indicators in this document, a progressive monitoring approach is proposed. The progressive monitoring approach will use three levels of indicators:

- **Level I:** accessible to all countries, based on global modelling of existing data which can be used in order to estimate data for all countries.
- **Level II:** core indicators which are recommended for all countries to compile nationally, this will be globally collected for SDG reporting.
- **Level III:** includes proposed supplementary indicators and disaggregation which are useful for informing national policy and decision-making; however, will not be part of the core data reporting at the global level.

Note that in the context of the SDGs, level I global monitoring approach is introduced to fill in the data gap for some of the SDG indicators[2]. All data for level I estimated indicators will be shared with countries to (i) request national data that will replace the estimation; and (ii) if national data is not available, request countries to verify and approve the dissemination of the estimated data until nationally produced data becomes available. In the event where countries do not wish to disseminate the data for level I estimated indicators, indicators will not be published.

2 In this document, SDG indicators that use level I global estimated indicators are 11.6.1, 12.3.1b and 12.5.1 for e-waste recycling rate.

2

Links with existing initiatives

2

Links with existing initiatives

A significant number of international Conventions, complemented by existing metadata and statistical standards and other initiatives from international organizations, are presented in this section to provide input on the impact of chemicals and waste on the environment and human health.

BOX 1: Existing international Conventions and statistical standards

Indicator for the impact of chemicals and waste on the Environment

Multilateral Environmental Agreements

- Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Minamata Convention on Mercury Strategic Approach to International Chemicals Management (SAICM)

Existing metadata and statistical standards

- EUROSTAT
- UNSD
- UNECE
- OECD
- Material Flow Accounts (MFA)

Other Initiatives

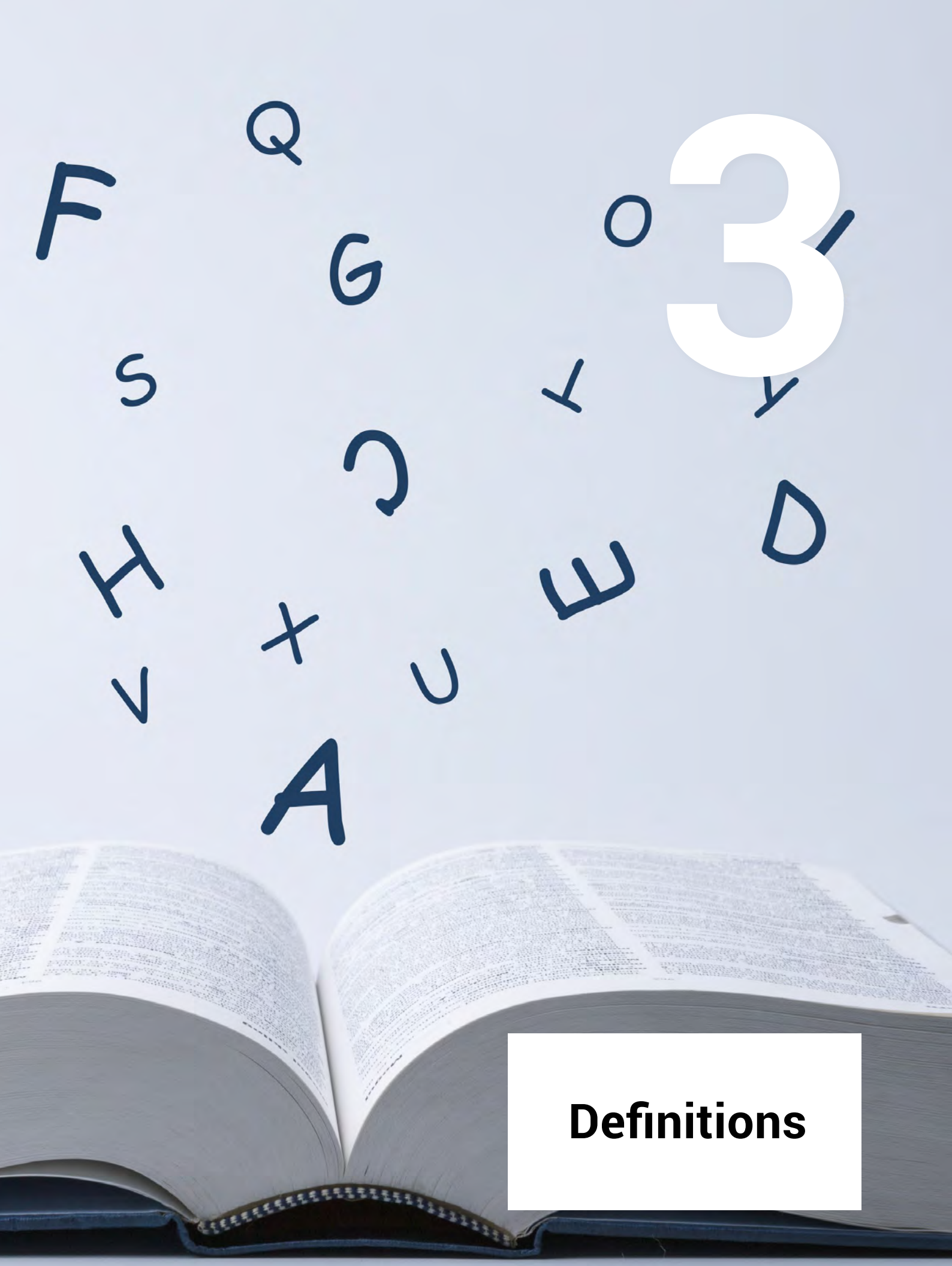
- World Bank – What a Waste (WaW) publication
- Waste Atlas

Information on the main provisions of the above-mentioned initiatives and current status of reporting on international level indicators on chemicals and waste, which are relevant for developing the SDG indicators, can be found in Annex I.

Almost all United Nations Member States are party to at least one of these Conventions. Under the current MEAs' obligations, countries are requested to regularly report data and information related to hazardous waste, persistent organic pollutants (POPs) and ozone depleting substances (ODS). The frequency of reporting differs between Conventions and national reports are usually submitted through an electronic reporting system. Reporting to the Conventions and relevant international initiatives are a major source of data and information relevant to the follow-up and review of the environmental section of the 2030 Agenda on Sustainable Development.

Unfortunately, many countries still fail to fully meet their reporting commitments under the key global MEAs on chemical and hazardous waste. Between 2010 and 2014, only 51% of Parties to the Stockholm Conventions, 57% of Parties to the Basel Convention and 71% of Parties to the Rotterdam Convention provided the requested data and information. While all Parties reported to the Montreal Protocol, the majority had difficulties in providing complete national reports and/or provided data that was clearly erroneous or inconsistent.

The reduced number of reports submitted by countries and inconsistent data provided can be partly explained by the difficulties in accessing and using the electronic reporting tool; reporting format; national circumstances; lack of data availability (including sex-disaggregated data) or scattered among different institutions; shortage of skilled personnel; financial constraints and lack of perceived benefits of reporting or consequences of lack of reporting. Currently, a framework for ensuring collaboration between relevant institutions (Ministries of Environment, National Statistical Offices, Ministries of Finance and Planning, Ministries of Industry, Agriculture or Health, and others) is not present in many countries.



3

Definitions

3

Definitions

Definitions presented in this manual are included below in alphabetical order.

Apex traders "receive materials from intermediate traders or directly from both formal and informal recyclable collection systems (including waste pickers), store and prepare these materials for onward trading to end-of-chain recyclers/recoverers" (UN-Habitat, 2021).

Composting is a "biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered and can be used to increase soil fertility" (UNSD/UNEP Questionnaire 2020 on Environment Statistics).

Disposal means "any operation whose 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" (UN-Habitat, 2021).

Disposal facilities refer to "sites which are regularly used by the public authorities and private collectors, regardless of their level of control and legality, for the disposal of waste. Such sites may or may not have an official recognition, a permit or a license. Disposal sites may be managed in either a controlled or uncontrolled manner. The definition excludes unrecognized places where waste is deposited occasionally in small amounts which public authorities may clean up from time to time" (UN-Habitat, 2021).

Domestic Material Consumption (DMC) is a "standard material flow accounting (MFA) indicator and reports the apparent consumption of materials in a national economy" (UN Metadata 2020).

Environmentally sound management (ESM) of hazardous waste is described within the Basel Convention as "taking all practicable steps to ensure that hazardous waste or other waste are managed in a manner which will protect human health and the environment against the adverse effects which may result from such waste". The Conference of the Parties (COP) to the Basel Convention develops and adopts technical guidelines[3] for the environmentally sound management of various types of waste as grouped into 'disposal' and 'recovery' operations. Although not legally-binding, those technical guidelines provide the foundation upon which countries can operate at a standard

3 Technical Guidelines on the sound management of hazardous waste, Basel Convention website: http://www.basel.int/Implementation/Publications/LatestTechnicalGuidelines/tabid/5875/Default.aspx#, last accessed February 18th 2018.

that is not less environmentally sound than that required by the Basel Convention. The concept of ESM encompasses all the management steps from inventorying, sampling, analysing and monitoring to handling, collecting, packaging, labelling, transporting, storing and environmentally sound disposal. The technical guidelines adopted by the COP provide guidance on all mentioned steps. As per the Basel Convention, countries may define their own standards for sound treatment of hazardous waste, based on their national context.

End-of-chain recycler/recoverer "receives materials from apex traders or direct from both formal and informal MSW collection systems and processes them into materials and products that have value in the economy either through recycling, incineration with energy recovery, or other recovery process" (UN-Habitat, 2021).

Extended Producer Responsibility (EPR) is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (OECD, 2001).

Food: according to the UN SDG Global Metadata repository, food is defined as "any substance—whether processed, semi-processed, or raw—that is intended for human consumption. "Food" includes drink, and any substance that has been used in the manufacturing, preparation, or treatment of food. "Food" also includes material that has spoiled and is therefore no longer fit for human consumption. It does not include cosmetics, tobacco, or substances used only as drugs. It does not include processing agents used along the food supply chain, for example, water to clean or cook raw materials in factories or at home" (UN Metadata, 2019a).

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" (UN-Habitat, 2021).

Hazardous waste is waste with properties capable of having a harmful effect on human health or the environment and is regulated and controlled by law. Hazardous waste is generated from many sources, ranging from industrial manufacturing processes waste to domestic items such as batteries. It may come in many forms, including liquids, solids, gases and sludge. It can be discarded as commercial products, like cleaning fluids or pesticides or the by-products of manufacturing processes.

In developing Indicator 12.4.2, the definition of Hazardous waste will be based on the one defined in the Basel Convention[4] (Article 1, paragraph 1(a)). Waste listed in Annex VIII of the Basel Convention are presumed to be hazardous, while waste listed in Annex IX are presumed not to be hazardous. For the purpose of this indicator, due to comparability reasons, we exclude additional waste considered hazardous as per national definitions, as provided by the Basel Convention under Article 1, paragraph 1 (b) (UN Metadata, 2019b).

4 UNEP, Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, texts and Annexes, available online at http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx, accessed January 2018

Hazardous waste generated "refers to the quantity of hazardous waste generated within the country during the reported year, prior to any activity such as collection, preparation for reuse, treatment, recovery, including recycling, or export, no matter the destination of this waste" (UN Metadata, 2019b). In case hazardous waste identified as such in national context is not part of the definition of hazardous waste used in this manual, the amounts is also included with noting the type of hazardous waste and specific amounts. Hazardous waste generated should be aggregated by households; and per the following breakdowns of the International Standard Industrial Classification of all Economic Activities (ISIC rev. 4)[5]: agriculture, forestry and fishing (ISIC 01-03); mining and quarrying (ISIC 05-09); manufacturing (ISIC 10-33); electricity, gas, steam and air conditioning supply (ISIC 35); construction (ISIC 41-43), and other economic activities excluding ISIC 38.

Since not all hazardous waste generated is immediately treated or disposed of under other economic activities excluding ISIC 38[6], the **stock of hazardous waste** should also be reported, as per the categories and indications in Table R2 of the UNSD/UNEP Questionnaire on Environment Statistics[7] (waste section) (UN Metadata, 2019b).

Incineration is defined as the controlled combustion of waste, with or without energy recovery. During incineration, the chemically fixed energy of combusted matter is transformed into thermal energy. Incineration results in combustion gases leaving the system as flue gases, while incombustible material remains in the form of slag and fly ash.

Provided it is carried out under the conditions of the legally approved standards and respectively controlled, incineration is often employed as a form of treatment for hazardous waste, for example the incineration of medical waste in cement kilns, which can be considered environmentally sound, according to the Basel Convention's Technical Guidelines on the Environmentally Sound Co-processing of Hazardous Wastes in Cement Kilns.

For the purpose of Indicator 12.4.2, operations defined in Annex IV of Basel Convention as R1 (use as fuel (other than direct incineration) or other means to generate energy) will be considered incineration with energy recovery, while Incineration without energy recovery will be considered as operations under D10 and D11 in the Basel Convention Annex IV.

Inedible (or non-edible) parts: "Components associated with a food that, in a particular food supply chain, are not intended to be consumed by humans. Examples of inedible parts associated with food could include bones, rinds, and pits/stones. "Inedible parts" do not include packaging. What is considered inedible varies among users (e.g., chicken feet are consumed in some food supply chains but not others), changes over time, and is influenced by a range of variables including culture, socio-economic factors, availability, price, technological advances, international trade, and geography" (UN Metadata, 2019a).

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5 United Nations, International Standard Industrial Classification of all Economic Activities (ISIC rev. 4), available online at https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf, accessed 17 March 2021

6 ISIC 38 is waste management activities, and therefore including ISIC 38 would represent double counting, as waste is first counted when entering management or treatment facilities.

7 https://unstats.un.org/unsd/envstats/questionnaire

Intermediate traders "receive materials from both formal and informal recyclable collection systems (including waste pickers), store and prepare these materials for onward trading to apex traders" (UN-Habitat, 2021).

Landfill is the "deposit of waste into or onto land. It includes specially engineered landfill sites and temporary storage of over one year on permanent sites. The definition covers both landfills at internal sites, i.e. where a generator of waste is carrying out its own waste disposal at the place of generation, and at external sites" (UN-Habitat, 2021).

For the purpose of this indicator, additional details related to the type of landfills should be provided. Separate categories should include:

Amounts going to Landfills:

- Out of which amounts going to controlled landfills/cells for hazardous waste
- Out of which amounts going to controlled landfills for Industrial waste
- Out of which amounts going to controlled landfills, for Municipal Solid Waste
- Out of which amounts going to uncontrolled landfills.

A waste disposal site that is authorized and operates under applicable national or international legal requirements is considered to be a "controlled" landfill.[8] For MSW, a specific assessment ladder for the level of control (Table 1) has been developed under SDG 11.6.1.

For ease of use, the above mentioned linkages between operations included in the UNSD/UNEP Questionnaire 2020 on Environment Statistics and Basel Convention Annex IV are included in the table below.

TABLE 1: Matching the UNSD/UNEP Questionnaire 2020 on Environment Statistics and Basel Convention

OPERATIONS IN THE UNSD/UNEP QUESTIONNAIRE 2020 ON ENVIRONMENT STATISTICS	OPERATIONS UNDER BASEL CONVENTION ANNEX IV
Recycling	R2 – R12
Incineration with energy recovery	R1
Incineration without energy recovery	D10, D11
Amounts going to controlled landfills/cells for hazardous waste	D5

8 Basel Convention's technical guidelines on specially engineered landfilling (D5) provide general guidance on this waste disposal method and safe landfill management practices.

Mass balance: A calculation involving subtracting the output from the input to find the material lost in the process. In practice, the amount of material in the calculation may be expressed in units other than mass.

Material exported intended for recycling: Expressed in tonnes, reported based on customs data, during the course of the year; the materials exported destined for recycling are considered to be recycled and checking final destination of these materials is not part of the reporting exercise (UN Metadata, 2019c).

Material Flow Accounting (MFA) is "a monitoring system for national economies based on methodically organised accounts and denoting the total amounts of materials used in the economy" (Eurostat, 2001,p.73). MFA enables the monitoring of total consumption of natural resources and the associated indirect flows as well as calculation of indicators.

Material Footprint (MF) "is the attribution of global material extraction to domestic final demand of a country. The total MF is the sum of material footprint for biomass, fossil fuels, metal ores and non-metal ores" (UN Metadata, 2020).

Material imported intended for recycling: Expressed in tonnes, reported based on customs data, during the course of the year (UN Metadata, 2019c).

Material recycled: Expressed in tonnes, reported at the last entity in the recycling chain, preferably when tonnes of material is bought as secondary resource to be used in production facilities during the course of the reporting year; Secondary mineral materials used in the construction sector are excluded; composting is considered recycling for the purposes of this indicator (UN Metadata, 2019c).

Materials Recovery Facility "(MRF; or materials reclamation facility, materials recycling facility, multi re-use facility) is a specialized recovery facility that receives, separates and prepares recyclable materials for marketing to further processors or end-user manufacturers" (UN-Habitat, 2021).

Mechanical Biological Treatment (MBT) system is "a type of recovery facility that combines an MRF with a form of biological treatment such as composting or anaerobic digestion" (UN-Habitat, 2021).

Municipal Solid Waste (MSW) "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., old furniture, mattresses) and waste from selected municipal services, e.g. waste from parks and gardens maintenance, waste from street cleaning services (street sweepings, litter containers content, market cleansing waste), if managed as waste" (UN Metadata, 2019c).

MSW managed in controlled facilities "refers to MSW collected and transported to recovery and disposal facilities that are operated under basic, improved or full control according to the Ladder of waste management facilities' control level (Table 2). The Ladder can be used as a checklist for assessing the level of control of a particular recovery or disposal facility. The facility should be classified by going through the decision-making tree, available in the Waste Wise Cities Tool (UN-Habitat, 2021). Note that the emphasis is on operational control rather than engineering/design. A facility that is constructed to a high standard, but not operated in compliance with Level III (or above) standard is not regarded as a controlled facility" (UN-Habitat, 2021).

TABLE 2: Ladder of control level for landfill sites[9]

CONTROL LEVEL	LANDFILL SITE
Full Control	• Waste daily covered • Waste compacted • Site fenced and full 24-hour control of access • Properly sited, designed and functional sanitary landfill • Leachate containment and treatment (naturally consolidated clay on the site or constructed liner) • Landfill gas collection and flaring and/or utilization • Site staffed • Post closure plan • Weighing and recording conducted • Protection of workers' health and safety
Improved Control	• Waste periodically covered • Waste compacted • Site fenced and control of access • Leachate containment and treatment • Landfill gas collection (depending on landfill technology) • Site staffed • Weighing and recording conducted • Protection of workers' health and safety
Basic Control	• Some use of cover • Waste compacted • Sufficient equipment for compaction • Site fenced and control of access • No fire/smoke existence • Site staffed • Weighing and recording conducted • The slope of the landfill is stable, landslides not possible • Protection of workers' health and safety
Limited Control	• No cover • Some compaction • Some equipment for compaction • Some level of access control/fencing • No leachate control • Some fire/smoke existence • Site staffed • Weighing and recording conducted • The slope of the landfill is unstable with high possibility of a landslide
No Control	• No cover • No compaction • No/ limited equipment • No fencing • No leachate control • Fire/smoke existence • No staff • The slope of the landfill is unstable with high possibility of a landslide

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TABLE 3: Ladder of control level for incineration[10]

CONTROL LEVEL	INCINERATION (WITH OR WITHOUT ENERGY RECOVERY)
Full Control	• Built to and operating in compliance with current national laws and standards including stringent stack and GHG emission criteria • Emission controls are conducted compliant to environmental standards and results of tests are accessible and transparent to citizens/users • Fly ash managed as a hazardous waste using the best appropriate technology • Weighing and recording conducted • A strong and robust environmental regulator inspects and monitors emissions • Protection of workers' health and safety
Improved Control	N/A
Basic Control	• Emission controls to capture particulates • Trained staff follow set operating procedures • Equipment maintained • Ash management carried out • Weighing and recording conducted
Limited Control	N/A
No Control	• Uncontrolled burning • No air/water pollution control

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TABLE 4: Ladder of control level for other recovery facilities [11]

CONTROL LEVEL	OTHER RECOVERY FACILITIES
Full Control	• Built to and operating in compliance with current national laws and standards • Pollution control compliant to environmental standards • Protection of workers' health and safety • The nutrient value of biologically treated materials utilized for separate organic waste (e.g. in agriculture/horticulture) • Materials are extracted, processed according to market specifications, and sold to recycling markets • Weighing and recording of incoming loads conducted • All outgoing loads registered by weight and type of destination
Improved Control	• Engineered facilities with effective process control • Pollution control compliant to environmental standards • Protection of workers' health and safety • Evidence of materials extracted being delivered into recycling or recovery markets. • Weighing and recording of incoming and outgoing loads conducted
Basic Control	• Registered facilities with marked boundaries • Some environmental pollution control • Provisions made for workers' health and safety • Weighing and recording of incoming and outgoing loads conducted
Limited Control	• Unregistered facilities with distinguishable boundaries • No environmental pollution control • No provisions made for workers' health and safety • Weighing and recording conducted
No Control	• Unregistered locations with no distinguishable boundaries • No provisions made for workers' health and safety • No environmental pollution control

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National Recycling Rate is defined as the quantity of material recycled in the country plus quantities exported for recycling minus material imported intended for recycling out of total waste generated in the country.

Non-metallic minerals (industrial and construction minerals) "comprise two subgroups, *industrial minerals* and *construction minerals*. They are clearly differentiated from minerals for production of metals (metal ores) and from minerals for the generation of energy (fossil fuels). However, the distinction between industrial minerals and construction minerals is not always clear, especially because one type of mineral may be used in an industrial process (e.g. limestone for the production of fertiliser by the chemical industry) or for construction purposes (e.g. limestone used as an aggregate directly for construction or used for the production of cement). A pragmatic approach is to consider *industrial minerals* as those, which are not bulk materials for construction purposes. It is worth noting that minerals grouped under industrial minerals are not double counted under construction minerals (e.g. basaltic lava under natural stones, clay for pottery under clay for bricks, and limestone for fertiliser under limestone for construction). *Construction minerals* are bulk materials, used directly or indirectly for structural and civil engineering. For pragmatic reasons, only the bulk material flows for construction are counted in this group. These are mainly natural stones (including limestone for cement making), sand and gravel, and clay for bricks. Information on the use of sand and gravel, crushed stone, dimension stone or clay for construction purposes versus other uses is often not available" (Eurostat, 2001, p.48).

The proportion of population with access to basic MSW collection services is "the proportion of population who receive waste collection services that are either basic, improved or full, defined by the service ladder of MSW collection service. It considers aspects of frequency, regularity and proximity of the collection points (Table 5). This aspect is measured under the SDG indicator 11.6.1 assessment but it is reported through a different indicator, SDG 1.4.1. on access to basic services" (UN-Habitat, 2021).

TABLE 5: Ladder of MSW collection service that household receives[12]

SERVICE LEVEL	DEFINITION
Full	• Receiving door-to-door MSW collection service with basic frequency and consistency and MSW is collected in three or more separate fractions; or • Having a designated collection point within 200m distance served with basic frequency and consistency and without major littering and MSW is collected in three or more separate fractions
Improved	• Receiving door-to-door MSW collection service with basic frequency and consistency and MSW is collected in a minimum of two, separate fractions (e.g. wet and dry fractions) • Having a designated collection point within 200m distance served with basic frequency and consistency without major littering and MSW is collected in a minimum of two, separate fractions (e.g. wet and dry fractions)
Basic	• Receiving door-to-door MSW collection service with basic frequency and consistency or • Having designated collection point within 200m distance served with basic frequency and consistency
Limited	• Receiving door-to-door MSW collection service without basic frequency and consistency; • Having a designated collection point within 200m distance but not served with basic frequency and consistency; or • Having designated collection point in further than 200m distance.
No	• Receiving no waste collection service

Note | "Basic frequency and consistency": refers to services received at least once per week for at least one year

Recovery "means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the facilityor in the wider economy" (UN-Habitat, 2021).

Recovery facilities include "any facilities with recovery activities defined above including recycling, composting, incineration with energy recovery, materials recovery facility (MRF), mechanical biological treatment (MBT), etc." (UN-Habitat, 2021).

Recycling is defined under the UNSD/UNEP Questionnaire 2020 on Environment Statistics and further for the purpose of these indicators as "Any reprocessing of waste material [...] 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. Recycling within industrial plants i.e., at the place of generation should be excluded." (UNSD, n.d.). For the purpose of consistency with the Basel Convention reporting and correspondence with EUROSTAT reporting system, Recovery operations R2 to R12 listed in Basel Convention Annex IV, are to

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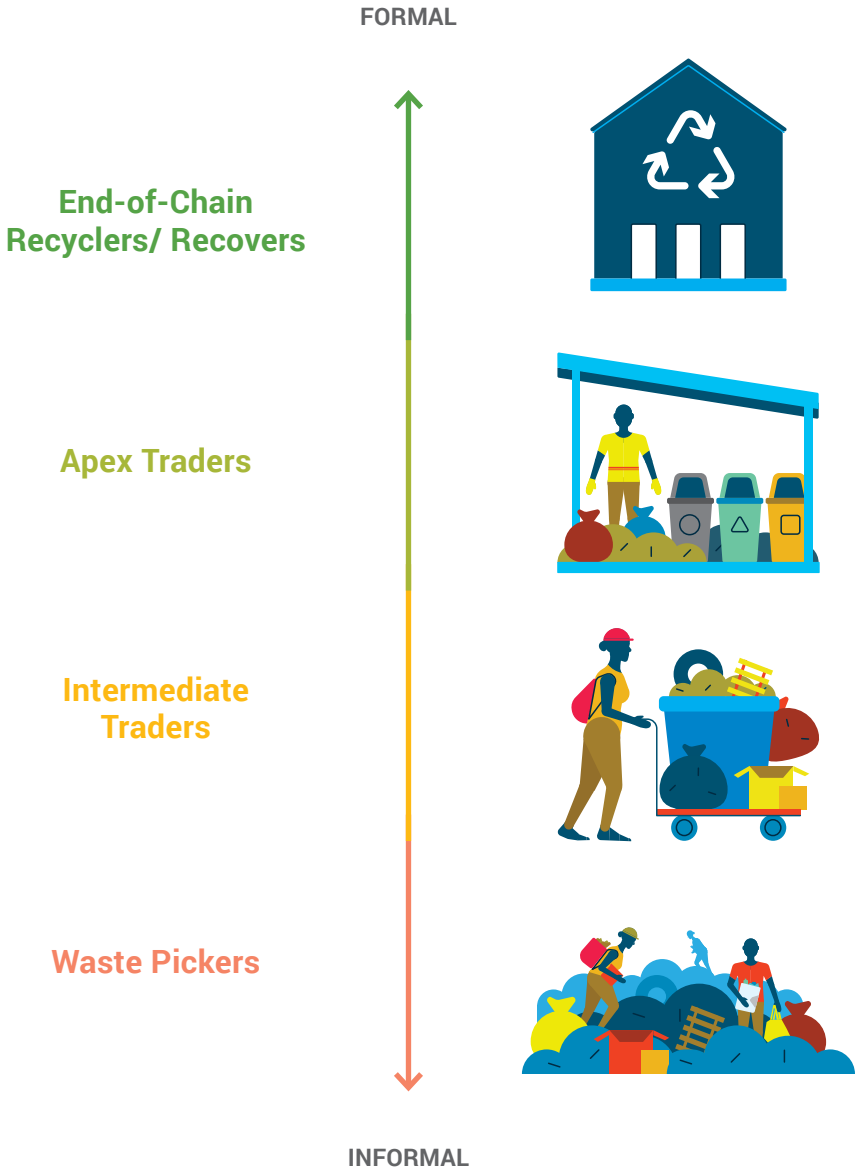
be considered as 'Recycling' under the UNSD/UNEP Questionnaire reporting for hazardous waste.

Recovery chain "usually involves several steps of the recycling industry which purchase, process and trade materials from the point a recyclable material is extracted from the waste stream until it will be reprocessed into products, materials or substances that have market value. In many low and low-to-middle income countries, this involves waste pickers, intermediate traders, apex traders and end-of-chain recyclers/recoverers" (UN-Habitat, 2021).



▲ **FIGURE 1:** Complexity in the recovery chain (plastic example)[13]

13 Adopted from Waste Wise Cities Tool. 2021, figure 2, page 13

Total waste generated is "the total amount of waste (both hazardous and non-hazardous) generated in the country during the year" (UN Metadata, 2019c)

Total waste generated (excluding construction, demolition and agriculture) is "the total amount of waste (both hazardous and non-hazardous) generated in the country during the year. For the purpose of this indicator, total waste generated will include municipal solid waste, non-hazardous industrial waste, hazardous waste and exclude non-metallic minerals (industrial and construction minerals), construction and demolition waste and agricultural waste. Expressed in tonnes, reported as the sum of waste generated during the course of the reporting year in sectors following the UNSD/UNEP Questionnaire table R1: Generation of Waste by Source with certain modifications, excluding Construction waste (ISIC 41- 43), Agricultural waste (ISIC 01-03) and quarrying and mining waste (ISIC 05-09)" (UN Metadata, 2019c).

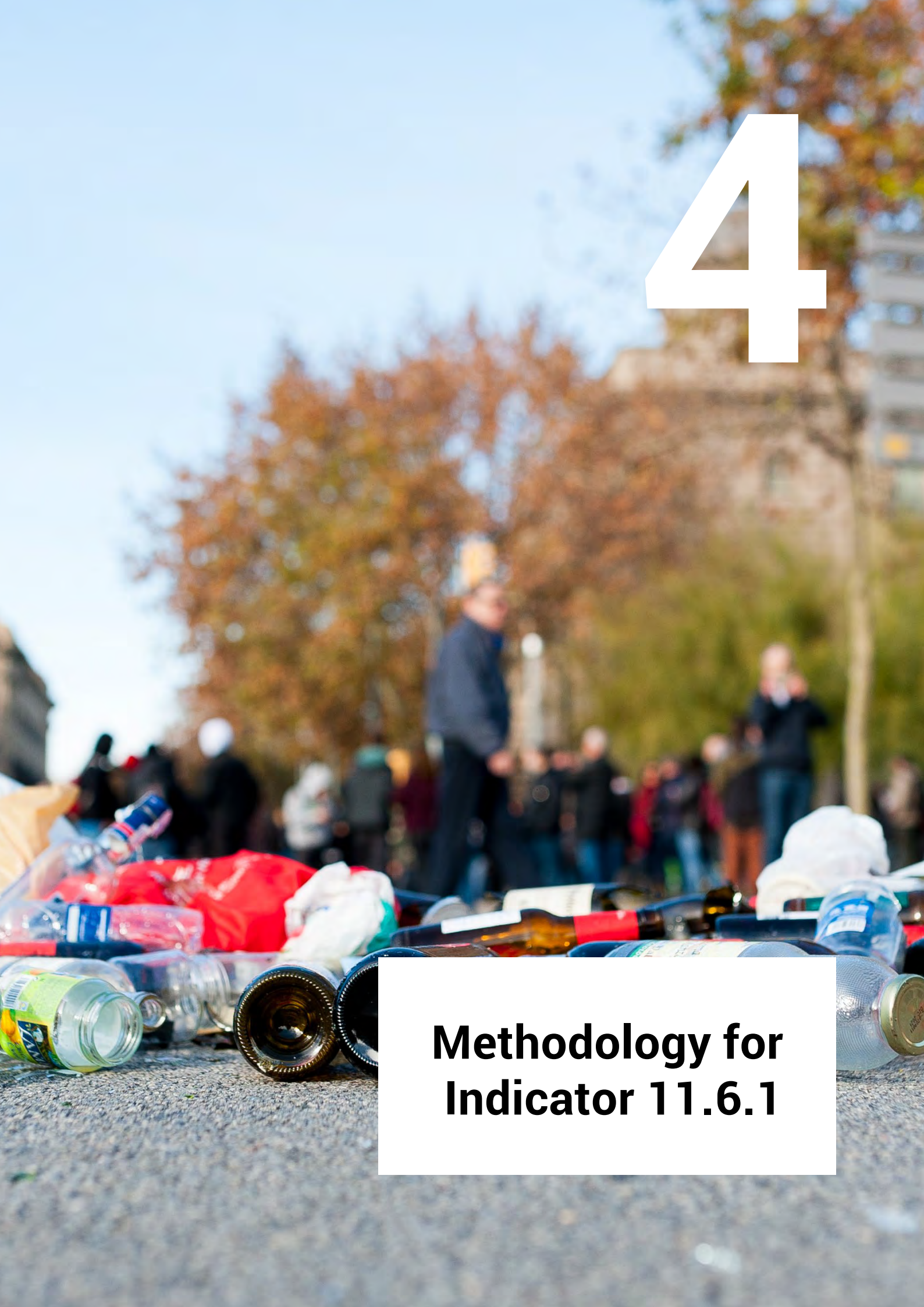
Total MSW generated "by the City is the total MSW generated by the population and their economic activities within the defined system boundary" (UN-Habitat, 2021).

Total MSW collected "refers to the amount of MSW generated that is moved from the point of generation, such as specific addresses or designated collection points, to facilities where the waste is recovered or disposed, regardless of collection modality (e.g., by municipal governments, non-state actors or informal sectors). The remaining share of MSW generated is considered "uncollected"" (UN-Habitat, 2021).

Treatment of hazardous waste: "Waste treated" and "type of treatment" are not defined in the Basel Convention. In this context, "treatment" will include all operations included under Annex IV of the Basel Convention, namely "Disposal" operations D1 to D15 and "Recovery" operations R1 to R13. This is also linked to the definitions of "Recycling, Incineration, Incineration with energy recovery, Landfilling and other types of treatment or disposal"[14]

Waste pickers "extract recyclable materials from the waste stream to support their livelihood, selling materials into the recovery system" (UN-Habitat, 2021).

14 Other types of treatment could be: physical-chemical treatment, biological treatment, thermal treatment other than incineration such as autoclave, and stabilization and solidification, interim storage, etc. (UNSD/UNEP Questionnaire 2020 on Environment Statistics)



4

Methodology for Indicator 11.6.1

4

Methodology for Indicator 11.6.1[15]

Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management.

Indicator 11.6.1: Proportion of MSW collected and manged in controlled facilities out of total MSW generated, by the city

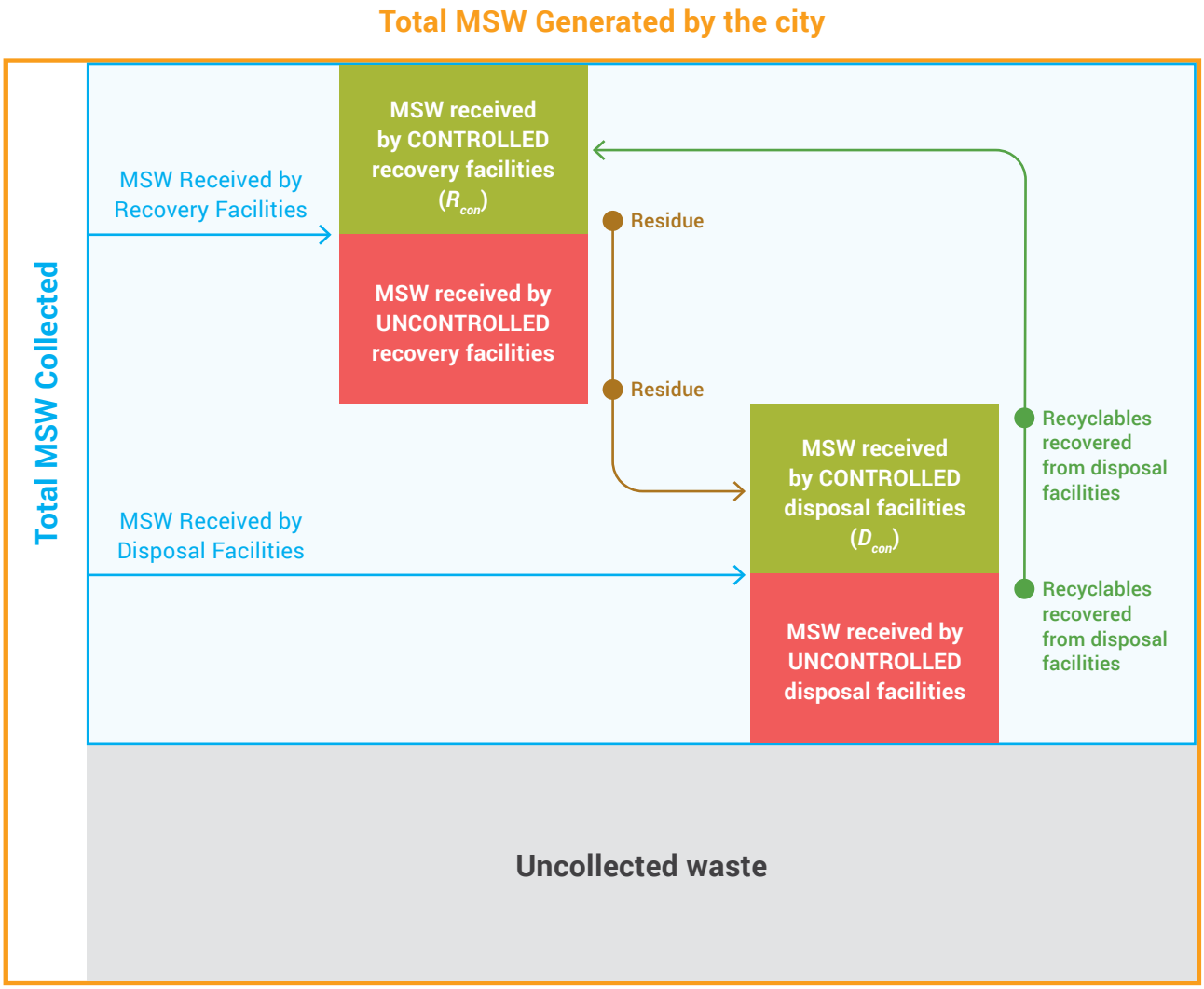
Assessing and monitoring SDG indicator 11.6.1 *"Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal solid waste generated, by the city"*, provides critical information for cities and countries to establish better waste and resource management strategies and transition towards a circular economy.

The methodology to monitor SDG indicator 11.6.1 provides a ladder system for MSW collection services and control level of waste management facilities, and aims to bring standardized definitions, nomenclature and techniques to MSW data collection.

Figure 2 summarizes the elements measured by SDG indicator 11.6.1. The MSW generated by the city is either collected or uncollected, and the collected MSW is delivered to recovery or disposal facilities. Recovery facilities generate residue that are sent to disposal facilities. In many cities, recyclables are also recovered from disposal facilities and brought back into the recycling value chain.

Recovery or disposal facilities can be categorized as either 'controlled' or 'uncontrolled' depending on the operational measures put in place to minimize the environmental, health and safety impacts from the facilities. When both recovery and disposal occur within the same facility, it is necessary to evaluate the control level of the recovery and disposal operations independently of each other.

15 The methodology follows the published metadata for SDG indicator 11.6.1, obtained from: https://unstats.un.org/sdgs/metadata/files/Metadata-11-06-01.pdf



▲ **FIGURE 2:** Concept figure of SDG indicator 11.6.1[16]

16 Adopted from Waste Wise Cities Tool. 2021, figure 3, page 18

I. Proposed Approach

SDG indicator 11.6.1 is a multi-level indicator. Depending on the status of data availability and collection nationally, countries can develop the 3 levels of this indicator as per the below table.

LEVEL I INDICATORS	
Proportion of MSW collected and managed in controlled facilities out of total MSW generated, by the city	Modelled data based on global available data (e.g. What a Waste 2.0, UNSD/UNEP Questionnaire on Environment Statistics , Wasteaware benchmark indicators, etc.).
LEVEL II INDICATORS	
Proportion of MSW collected and managed in controlled facilities out of total MSW generated, by the city	Reported data in line with the concepts and definitions provided by UN-Habitat's *Waste Wise Cities Tool – Step by Step Guide to Assess a City's MSWM Performance through SDG indicator 11.6.1 Monitoring*
LEVEL III INDICATORS	
Proportion of MSW collected out of total MSW generated, by the city	Proportion of MSW collected out of total MSW generated by the city is disaggregated from the level II indicator
City Plastic Leakage	City Plastic Leakage can be obtained through the application of Waste Flow Diagram (GIZ, 2020), a rapid and observation-based assessment tool which visualizes the MSW flows and quantifies plastic leakage to the water system.

Level I indicator can be calculated as follows:

$$SDG\ 11.6.1 = \frac{\text{Total MSW collected and managed in controlled facilities (t/day)}}{\textit{Total MSW generated (t/day)}} \times 100\ (\%)$$

For the Level I indicator, global modeling based on the available data (e.g. World Bank's What a Waste 2.0, UNSD/UNEP Questionnaire 2020 on Environment Statistics, Wasteaware Benchmark Indicators, etc.) can be conducted and made available for countries and cities who have neither reliable data nor resources to conduct the survey on the ground as guided by the Waste Wise Cities Tool (UN-Habitat, 2021).

For Level II indicator, it is recommended to report the data according to the SDG 11.6.1 definitions if reliable data is available. When reliable data is unavailable, cities and countries are recommended to conduct a survey to measure this indicator, along with the steps provided by the Waste Wise Cities Tool.

Two sub-indicators can be used for level III indicator:

$$SDG\ 11.6.1.a = \frac{\text{Total MSW collected (t/day)}}{\textit{Total MSW generated (t/day)}} \times 100\ (\%)$$

$$SDG\ 11.6.1.b = \frac{\text{Total MSW collected and managed in controlled facilities (t/day)}}{\textit{Total MSW generated (t/day)}} \times 100\ (\%)$$

Data collected for SDG indicator 11.6.1 can also be used to estimate a city's plastic leakage when combined with additional field observations, guided by the Waste Flow Diagram (WFD) (GIZ, 2020). These advanced calculations are considered to be a Level III indicator as per the following formula:

$$\textit{City's Plastic Leakage} = \frac{\text{Total plastic leakage to water systems (kg/year)}}{\textit{Total population}}$$

Data collected for the assessment of SDG indicator 11.6.1 can contribute to estimate SDG indicator 12.3.1b Food Waste Index, by providing household food waste generation per capita through the below formula.

$$\textit{Per capita household food waste generation} = \textit{per capita MSW generation rate (kg/cap/d)} \times \text{proportion of food waste}$$

Step 4 of Waste Wise Cities Tool, which collects data on the quantity of materials entering the recovery system through interviews with recovery facilities, can provide data necessary for SDG indicator 12.5.1 *National Recycling Rate*. For the purpose of consistency with the Basel Convention reporting

and correspondence with EUROSTAT reporting system, Recovery operations R2 to R12 listed in Basel Convention Annex IV, are to be considered as 'Recycling'. The questionnaire for recovery facilities in the Annex 6 can be integrated into national recycling monitoring system by national government, which can in turn to be used to report on SDG 12.5.1, by providing city recovery rate.

$$\textit{City Recovery Rate} = \frac{\text{Total recovered materials (t/day)}}{\textit{Total MSW generated (t/day)}} \; x \; 100\ (\%)$$

$$\text{Quantity of material recycled from MSW stream} = \sum \textit{Amount of recycled products sold by each of the recovery facilities}$$

II. Step-by-step guide

II.1 Waste Wise Cities Tool's 7 Steps

The Waste Wise Cities Tool consists of seven steps to guide cities on how to collect data on MSW generated, collected, and managed in controlled facilities. The tool provides a household survey guide for estimating total MSW generation, a questionnaire to investigate the MSW recovery chain and criteria to check the environmental control level of waste management facilities in the city. In the last step, the link to other waste related SDGs and the Waste Flow Diagram methodology to estimate potential plastic leakage from a city's MSWM system is highlighted.

The steps a city needs to implement can be determined depending on the data available. UN-Habitat recommends that cities go through all the steps, if the city has large amounts of uncollected waste or illegal dumping and has never done a Waste Amounts and Composition Survey (WACS) from households to estimate waste generation per capita, or if such a survey is more than 5 years old. In this context, it is important to understand that the waste received at recovery and disposal facilities sometimes does not represent the total MSW generated, especially in cities with large amount of uncollected waste.

Cities that are confident about the accuracy of their total MSW generation data, are recommended to go through Steps **4** and **5** to identify the environmental and operational control level of their waste management facilities. Detailed methodological steps and sub-steps are represented in the Waste Wise Cities Tool.

▲ **FIGURE 3:** Waste Wise Cities Tool's 7 Steps[17]

II.2 Data points

The data points required to calculate SDG indicator 11.6.1 include:

A. Total MSW generated by the city
B. Total MSW collected
C. Total MSW managed in controlled facilities

These data also help cities to identify the proportion of MSW that remains uncollected.

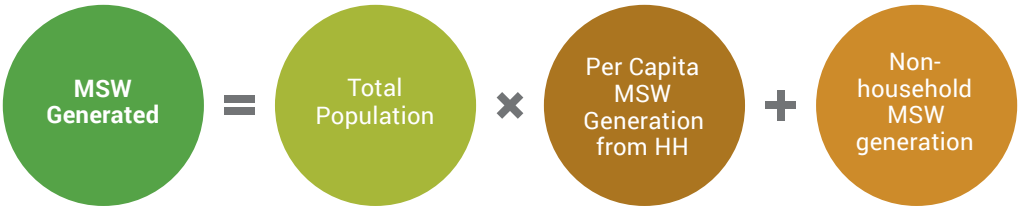
A. Total MSW generated by the city

As previously defined in the Definitions section, MSW data for this indicator covers city level data pertaining to the same entities identified in the above definition. MSW does not include waste from municipal sewage networks and treatment facilities, as well as construction and demolition waste from commercial building contractors.

For cities that do not have reliable data yet on MSW generation from households, data can be estimated

17 Adopted from Waste Wise Cities Tool. 2021, figure 4, page 23

through the multiplication of the total population by per capita MSW generation from households. Non-household MSW generation also needs to be estimated. The detailed methodology for doing estimation is provided in Steps **1**, **2** and **3**.



EQUATION 1: Total MSW Generated

B. Total MSW collected

Total MSW collected is the amount of MSW generated that is moved from the point of generation, such as specific addresses or designated collection points, to facilities where the waste is recovered or disposed.

When measuring total MSW collected there is a risk of double counting concerning the residue or rejects from recovery facilities, and the amount of waste recovered from disposal facilities going to recovery. Therefore, these amounts need to be deducted from the sum of waste received by both recovery and disposal facilities. The residue from recovery facilities is assumed to either go to disposal facilities or other recovery facilities. Steps **4** and **5** provide detailed methodology on the collection of this data.

EQUATION 2: Total MSW[18] collected

C. Total MSW managed in controlled facilities

MSW managed in controlled facilities refers to MSW collected and transported to recovery and disposal facilities with basic, improved or full control according to the Ladder of waste management facilities' control level presented in the definition section. The Ladder can be used as a checklist for assessing the level of control of a particular recovery or disposal facility. The facility's control

18 Note that MSW collected for recovery includes mixed MSW, commingled recyclables or recoverable fractions extracted from MSW

level is the category where it checks the most boxes (full, improved, basic, limited and none). Note that the emphasis is on operational controls rather than engineering/design control. A facility that is engineered and constructed to a high standard, but not operated in compliance with Level III (or above) standard is not regarded as a controlled facility. Steps **4** and **5** provide detailed methodology on the collection of this data.

EQUATION 3: Total MSW managed in controlled facilities

II.3 Additional data points

The SDG 11.6.1 indicator assessment provides three further MSWM data points:

D. Per capita MSW generation rate
E. MSW composition
F. Uncollected waste

Although they are not necessary for the calculation of the SDG indicator values, these figures are of particular importance for the identification of service/infrastructure gaps, and formulation of strategies.

D. Per capita MSW generation rate

A very relevant parameter that can be derived from the previous formula is the "total per capita MSW generation rate". Steps **2** and **3** explain how to calculate this through waste sampling from households for cities, if no reliable or updated data is available.

This is especially recommended for cities where a large amount of MSW remains uncollected. Data on per capita waste generation also enables optimization of collection system performance, an exercise that can potentially generate significant budgetary savings for the city.

E. MSW Composition

The WaCT assessment characterizes waste composition at the point of generation (i.e. households) and at the point of disposal. Understanding MSW composition at the beginning and end of the MSW service chain is a useful exercise for several reasons: understanding composition helps identify how the existing recovery/recycling sector is functioning, it enables further recovery facilities to be identified and planned, and overall helps to triangulate (i.e. test validity and reliability) of the collected data.

Note that MSW also includes waste from non-household sources. In **Step 3**, the quantities of MSW generated from commercial and institutional sources, as well as from public spaces, is estimated. However, specific composition analysis on MSW from non-household sources is beyond the scope of this tool as it is complex and resource intensive.

F. Total uncollected waste

Total uncollected MSW can be calculated by subtracting the total MSW regularly collected from the total MSW generated.

EQUATION 4: Total uncollected MSW

III. Disaggregation

Data for this indicator can be disaggregated at various levels in accordance with the country's policy information needs. For instance:

- MSW generation rate of different income level (high, middle, low)
- Amount of different MSW material received by recovery facilities
- MSW generation rate in different cities

IV. Data Sources, availability and production

MSW data is available through What a Waste 2.0 by the World Bank and the UNSD/UNEP Questionnaire on Environment Statistics. The UNSD/UNEP Questionnaire on Environment Statistics has collected data on municipal waste collection and treatment since 1999. Data has been received from about 160 to 170 countries, covering both national and city levels. However, the response rate for the questionnaire is hovering around 50% and data completeness and quality remain a challenge, especially for developing countries.

Both data sources have key MSW data such as MSW generation, MSW generation rate, MSW collection rate, etc., but lack the aspect of 'controlled management', except for the case of controlled landfilling. It is recommended that the UNSD/UNEP Questionnaire on Environment Statistics establish a data outlet for countries and cities can report on parameters of SDG indicator 11.6.1.

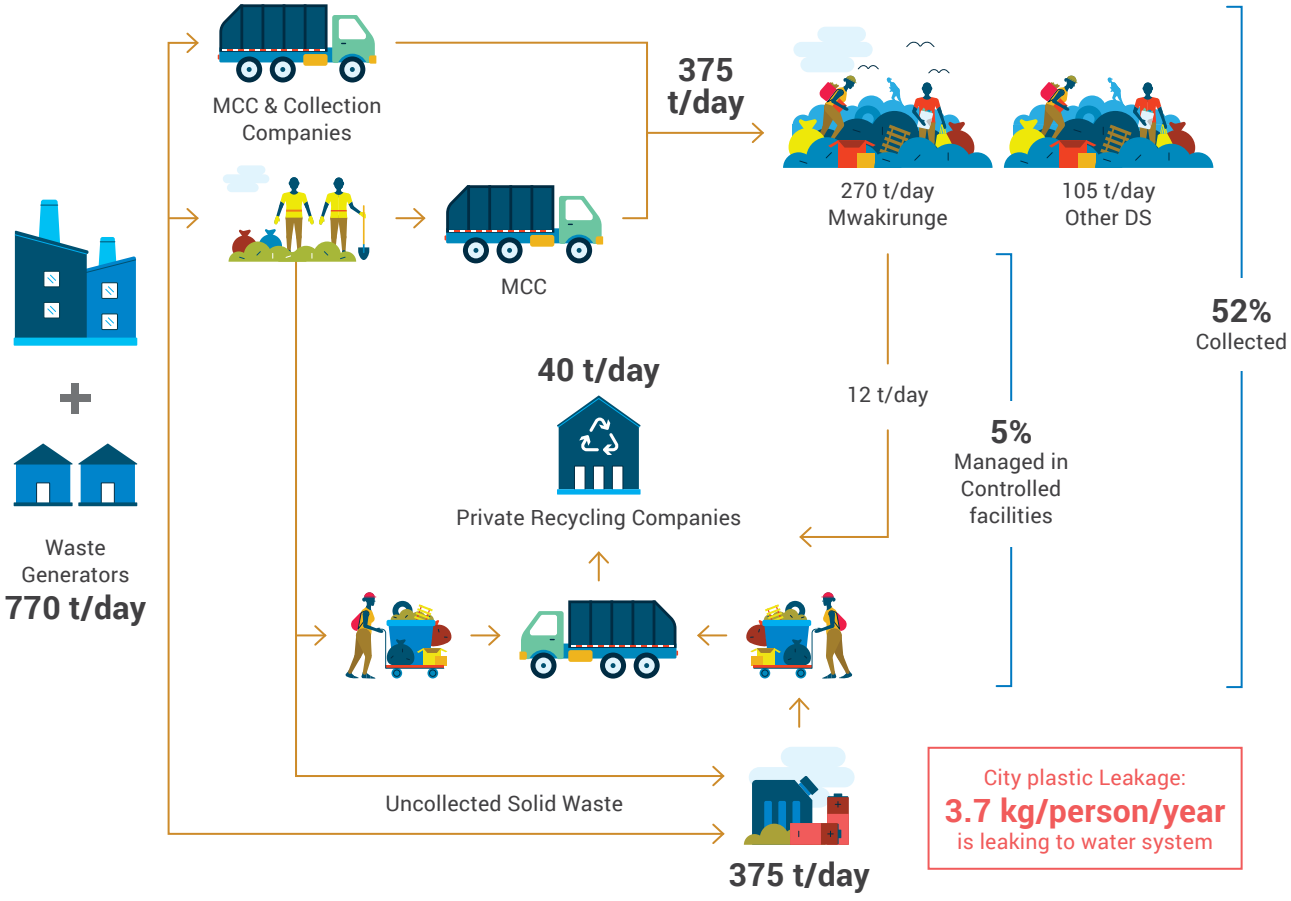
In parallel with the effort to establish a global data reporting according to the SDG indicator 11.6.1, training and capacity development on data production and data quality improvement for national and local government is essential to accelerate the progress towards the achievement of this SDG goal. UN-Habitat offers capacity development and trainings both offline and online for cities to apply the Waste Wise Cities Tool, generate the SDG indicator 11.6.1 and associated data, as well as use this data to identify the policy, infrastructure and service provision gaps to improve MSWM systems.

V. Discussion: opportunities and limitations

The case studies of the Waste Wise Cities Tool's application and pilot data collection shows the opportunities provided by the monitoring of SDG indicator 11.6.1. The Waste Wise Cities Tool has been field-tested in Nairobi (Kenya), Mombasa (Kenya) and Mahé Island (Seychelles).

These assessments were followed by local stakeholders' workshops, helping the cities to identify key intervention areas and service/infrastructure investment gaps. Workshop attendees included stakeholders from the waste management chain as well as civil society: local government officials, private recycling and collection companies, informal waste pickers, representatives of manufacturers and residents, and many more.

The following figure depicts the results from the SDG 11.6.1 assessment in Mombasa, a Kenyan coastal city of 1.2 million inhabitants. Results show that about 708 t/day of MSW is generated, of which 56% is collected and 5% is managed in controlled facilities. Around 308 t/day remain uncollected.

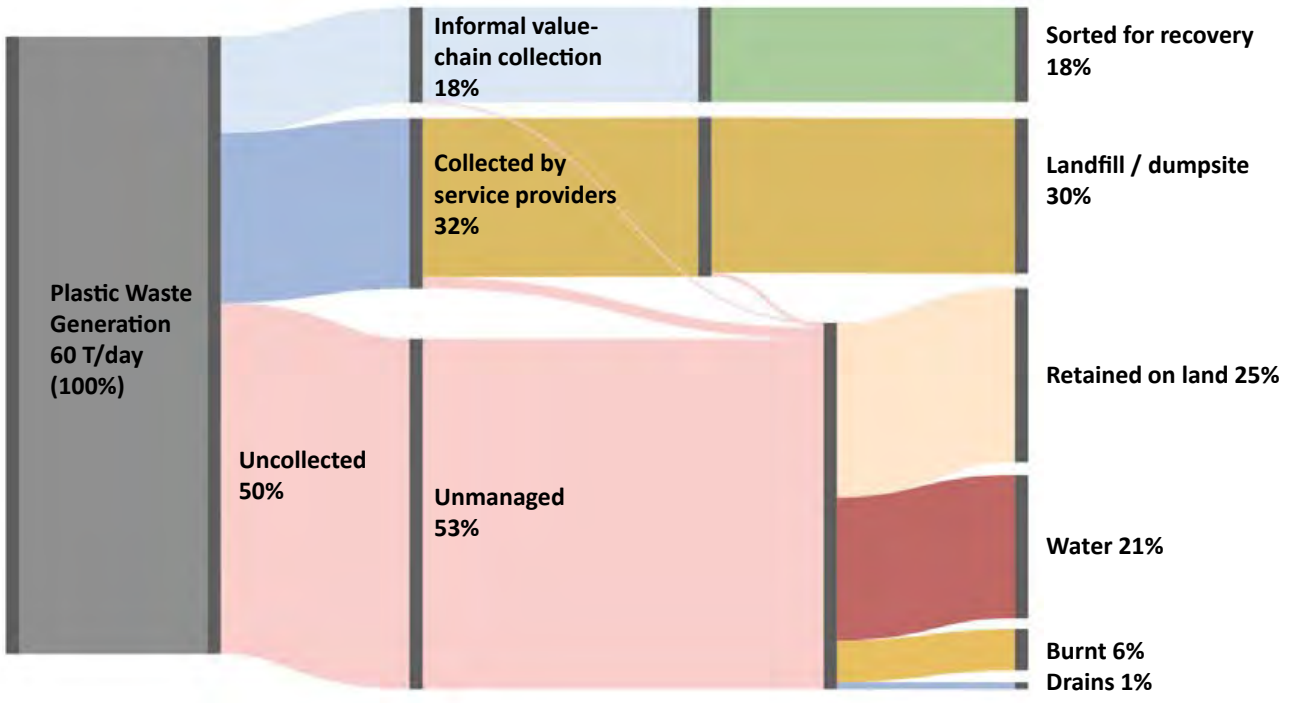


▲ **FIGURE 4:** WaCT Flow Chart, Mombasa, Kenya[19]

19 Adopted from Waste Wise Cities Tool. 2021, page 7

From this data an estimate can be made using the Waste Flow Diagram (GIZ, 2020) of the City's Plastic Leakage. In the case of Mombasa (2019), estimated plastic leakage is 3.7 kg per person/year.

In addition, the assessment helped to break down and categorise the sources and pathways of plastic waste in Mombasa identified with the two tools.

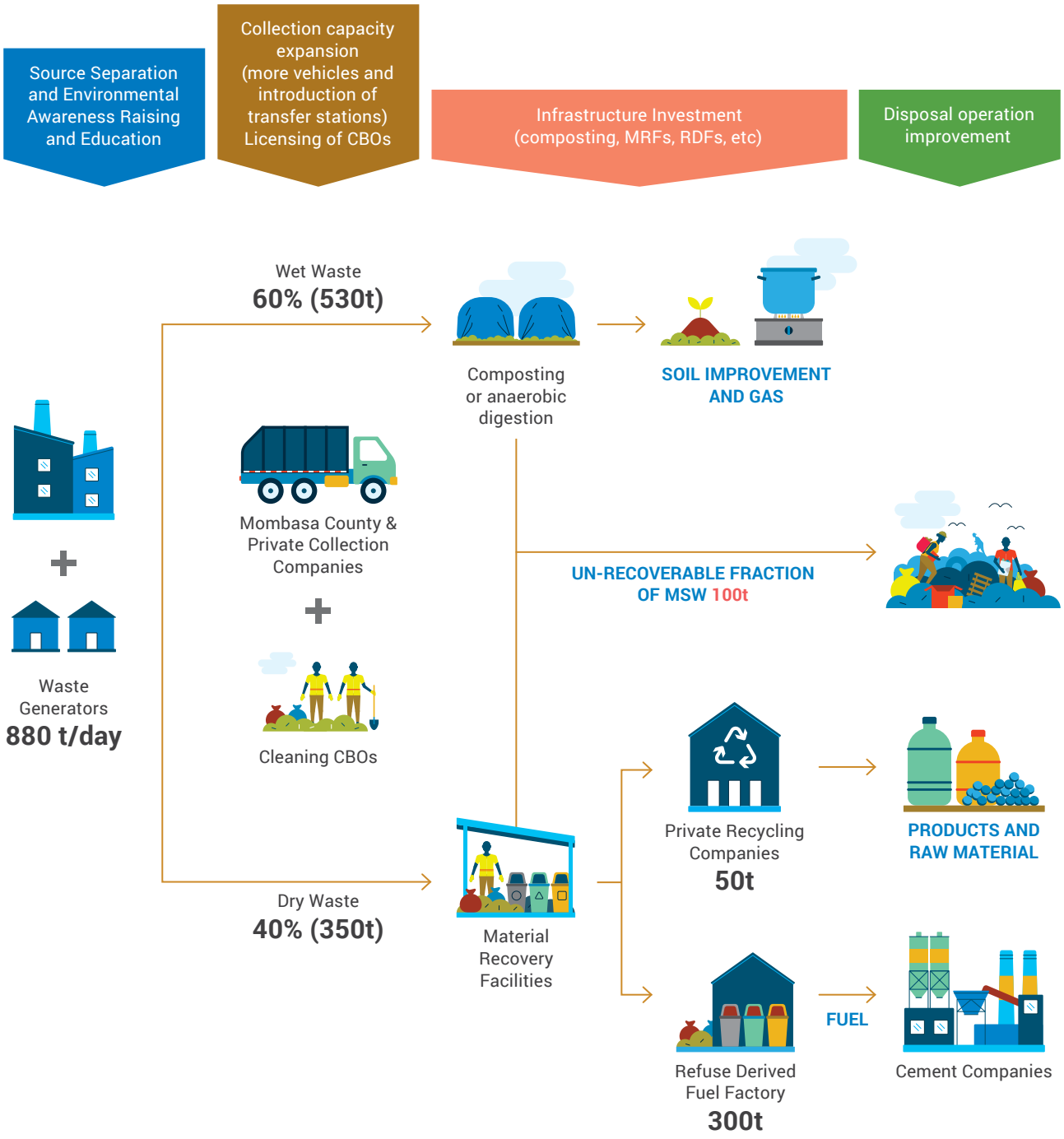


All %'s are in reference to the total Plastic Waste generated

▲ **FIGURE 5:** Plastic Waste Flow Diagram for Mombasa, Kenya[20]

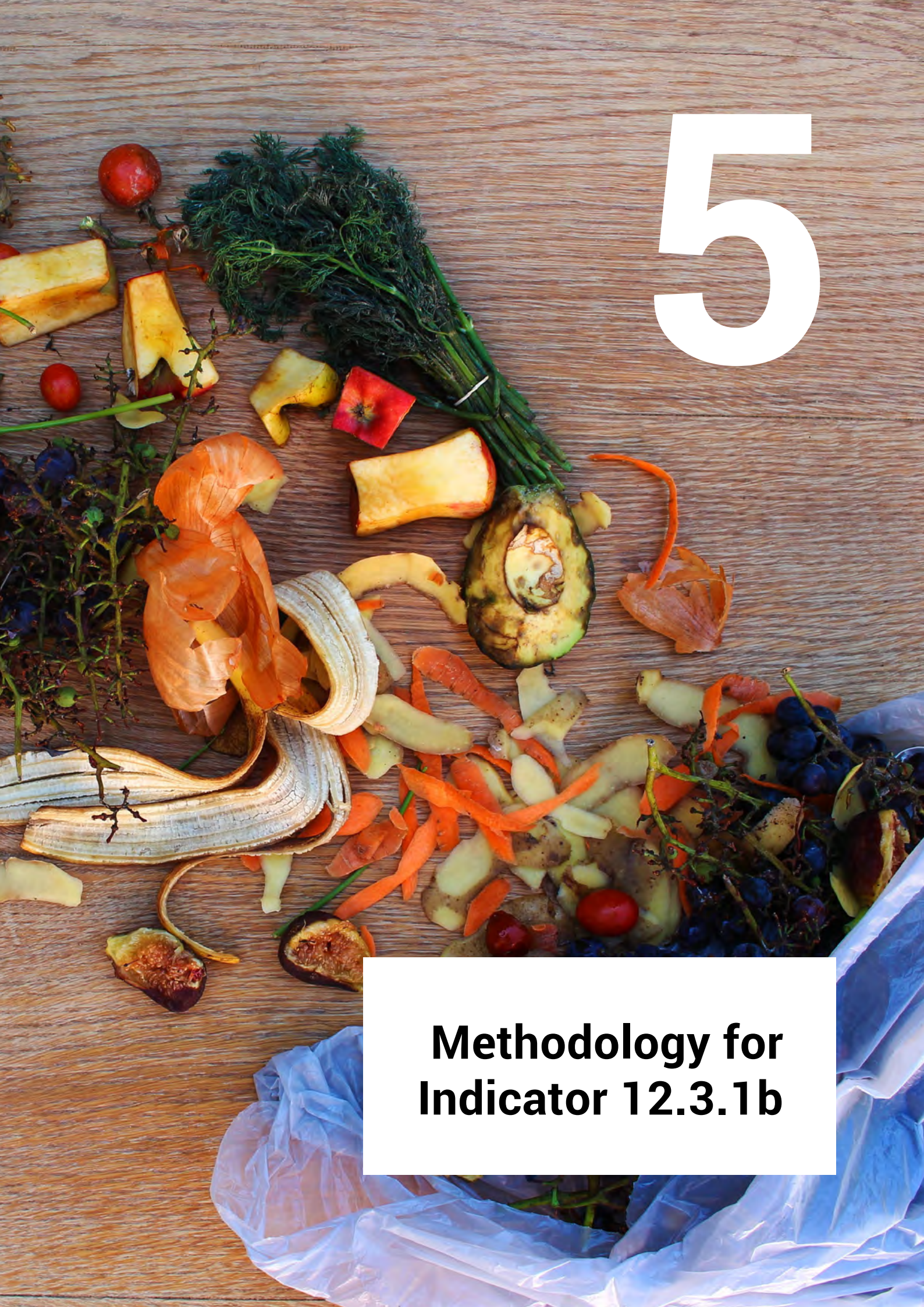
Following a city assessment using the Waste Wise Cities Tool and Waste Flow Diagram, a local stakeholder workshop identified key intervention areas and service/infrasructure investment gaps. Workshop attendees included stakeholders from the waste management chain such as local government officials, environmental regulators, collection service operators, disposal facility managers, formal and informal recyclers, representatives of manufacturers and residents, and many more. The following figure 6 shows the future waste flow envisioned by participants during the workshop in Mombasa.

20 Waste Wise Cities Tool. 2021, page 8



▲ **FIGURE 6:** Proposed waste flow by Mombasa workshop participants, Kenya[21]

21 Adopted from Waste Wise Cities Tool. 2021, page 8



5

Methodology for Indicator 12.3.1b

5

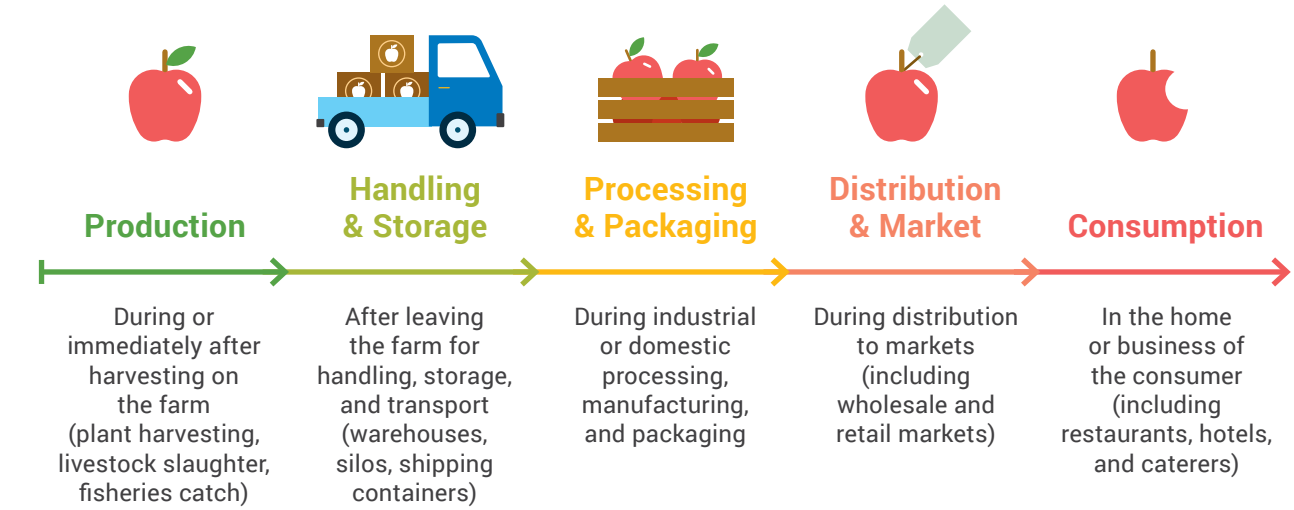
Methodology for Indicator 12.3.1b[22]

Target 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

Indicator 12.3.1b: Food waste

SDG indicator 12.3.1 comprises two sub-indicators: 12.3.1a Food loss index and 12.3.1b food waste index. Food Loss is under the custodianship of FAO and will not be discussed in detail in this document. It is however important to discuss the potential overlaps between the methodologies of these two sub-indicators. The two sub-indicators cover discrete food value chain stages, but some overlap is possible at the interface of the manufacturing and retail stages, as outlined in the below graphic.

22 The methodology follows the published metadata for SDG indicator 12.3.1b, adopted in the Food Waste Index Report 2021, obtained from: https://www.unep.org/resources/report/unep-food-waste-index-report-2021



▲ **FIGURE 7:** Theoretical best-case interaction between SDG 12.3.1a and 12.3.1b[23]

23 Adapted from UNEP, 2019, slide 12

I. Proposed approach

SDG 12.3 calls for a halving of food waste at retail and consumer level. The proposed approach endeavours to balance fitness for purpose, in tracking progress at retail and consumer level, with feasibility of implementation in as many UN member countries as possible. Three levels of measurement are envisaged, to enable flexibility in respect for different policy priorities and capacities for data collection among countries, summarised below:

LEVEL I INDICATORS	
Food waste estimates for each sector	Existing data and extrapolation to other countries
LEVEL II INDICATORS	
Food waste generation tracked at a national level	Direct measurement of food waste in retail, food service and households. Sufficiently accurate for tracking.
LEVEL III INDICATORS	
Additional information and disaggregation of food waste data	Additional information to inform policy and other interventions. This includes disaggregated data by destination, edible/inedible parts, and also captures manufacturing food loss not covered by the Food Loss Index (e.g. where more than one commodity is combined to produce complex food products).

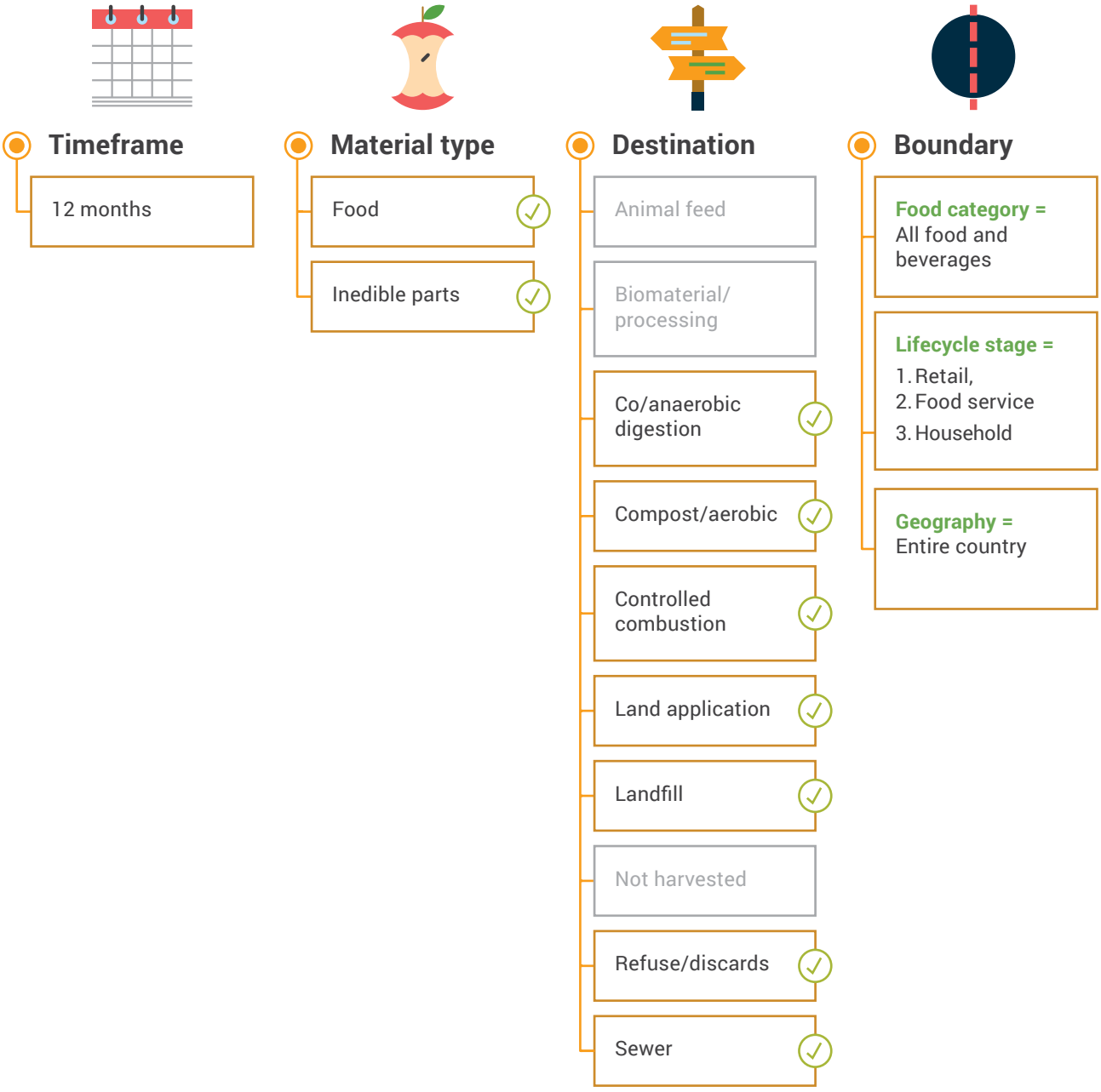
II. Step-by-step guide

This section outlines the three levels of the proposed approach. Level I proposes a method to estimate food waste for member states not able to undertake their own measurement in the short term, using existing data and modelled data through extrapolation. Country-level food waste estimates provide a case for action, while governments work towards putting in place the necessary arrangements to begin their own quantification. The method involves a model and some other basic calculations. This modelled data is useful in providing a snapshot of food waste generation at country level for the first time. It is not adequate for tracking changes at time intervals towards 2030. UNEP calculates estimates for Level I on behalf of countries.

Level II fulfils the requirement for tracking national data at retail and consumer level, in line with the SDG 12.3 methodology. It generates primary data on actual food waste generation that will show progress (or lack thereof) over time. For European countries, the reporting under level II will include

data submissions on food waste required under the act of food waste (2019/1597).

Level III provides additional information to inform policy and other behaviour change interventions.



*** Sewage is within the scope of food waste; however, due to greater difficulty in measuring food waste going to sewage it is a level III monitoring methodology.**

Note that animal feed and bioprocessed materials are not considered food waste as they do not enter the waste stream. The definitions of these destinations are found below.

▲ **FIGURE 8:** Food waste scope and boundaries[24]

24 Adopted from Food Waste Index Report 2021, Figure 1, page 14

TABLE 6: Definitions of food-waste destinations[25]

DESTINATION	DEFINITION
Animal feed	Diverting material from the food supply chain* (directly or after processing) to animals
Bio-based materials/ biochemical processing	Converting material into industrial products for food and non-food purposes. Examples include creating fibers for packaging material; creating bioplastics (e.g., polyactic acid); making "traditional" materials such as leather or feathers (e.g., for pillows); and rendering fat, oil, or grease into raw material to make products such as soaps, biodiesel, or cosmetics. "Biochemical processing" does not refer to anaerobic digestion or production of bioethanol through fermentation
Codigestion/ anaerobic digestion	Breaking down material via bacteria in the absence of oxygen. This process generates biogas and nutrient-rich matter. Codigestion refers to the simultaneous anaerobic digestion of FLW and other organic material in one digester. This destination includes fermentation (converting carbohydrates—such as glucose, fructose, and sucrose—via microbes into alcohols in the absence of oxygen to create products such as biofuels)
Composting/ aerobic processes	Breaking down material via bacteria in oxygen-rich environments. Composting refers to the production of organic material (via aerobic processes) that can be used as a soil amendment
Controlled combustion	Sending material to a facility that is specifically designed for combustion in a controlled manner, which may include some form of energy recovery (this may also be referred to as incineration or thermal treatment)
Land application	Spreading, spraying, injecting, or incorporating organic material onto or below the surface of the land to enhance soil quality
Landfill	Sending material to an area of land or an excavated site that is specifically designed and built to receive wastes
Not harvested/ plowed-in	Leaving crops that were ready for harvest in the field or tilling them into the soil
Refuse/discards/ litter	Abandoning material on land or disposing of it in the sea. This includes open dumps (i.e., uncovered, unlined), open burn (i.e., not in a controlled facility), the portion of harvested crops eaten by pests, and fish discards (the portion of total catch that is thrown away or slipped)
Sewer/wastewater treatment	Sending material down the sewer (with or without prior treatment), including that which may go to a facility designed to treat wastewater
Other	Sending material to a destination that is different from the 10 listed above. This destination should be described

*** |** Excludes crops intentionally grown for bioenergy, animal feed, seed, or industrial use

25 Food Waste Index Report 2021- Appendix 6, Table 19

II.1 Level I - Estimates of food waste for each sector

Initial Level I food waste estimates

Estimates are made for countries not yet publishing their own food waste data. The approach uses existing country data, studies carried out by member states and extrapolations based upon the estimates observed in other countries for countries where no estimates are available. Lastly, confidence ratings are assigned to the estimates. This work builds on existing efforts to compile information for SDG 11.6.1 on MSWM and will utilize existing data on global waste, including data from UN-Habitat on SDG 11.6.1 and from other available sources (such as the UNSD/UNEP Questionnaire on Environment Statistics). Most of the Level I estimates are approximate and not sufficiently accurate for observing and tracking changes over time. However, they are sufficient to provide insight into the scale of the problem and make a case for action. They are intended as a short-term support while governments develop capacity for national measurement (consistent with Level II).

II.2 Level II – Food waste generation by supply chain stage

Level II provides a framework for countries to measure and report food waste, enabling the tracking of progress in line with the SDG 12.3 objective. It covers studies on food waste generation at the retail, household and food service stages of the food supply chain and provides guidance on accepted methodologies. If food waste is not yet measured or the information is not shared, conducting new measurement studies for all three sectors can be challenging and require a higher level of resources. Countries can therefore begin with one nationally relevant stage and complete all sectors over time. However, household food waste is recommended to be measured as a first step, as household food waste is suggested to be the largest source of food waste in most countries. The manufacturing sector as a possible fourth supply chain stage is included in the level III framework (see II.3).

Methodology for food waste measurement

The amount of food waste within a stage of the food supply chain shall be established by measuring food waste generated by a sample of food business operators or households using any of the following methods or a combination of those methods or any other method equivalent in terms of relevance, representativeness, and reliability.

TABLE 7: Appropriate methods of measurement at different stages of the food supply chain[26]

<table>
<tr><th>STAGES OF THE FOOD SUPPLY CHAIN</th><th colspan="5">METHODS OF MEASUREMENT</th></tr>
<tr><td>Manufacturing / processing (if included)</td><td rowspan="4">Direct measurement (for food-only waste streams)</td><td rowspan="4">Waste composition analysis (for waste streams in which food is mixed with non-food)</td><td rowspan="4">Volumetric assessment</td><td rowspan="2">Mass Balance</td><td rowspan="3"></td></tr>
<tr><td>Retail and other distribution of food</td></tr>
<tr><td>Food service (out-of-home consumption in restaurants, schools, hospitals, other canteens, etc.)</td><td rowspan="2"></td><td rowspan="3">Counting/ scanning</td><td rowspan="3">Diaries (for material going down sewer, home composted or fed to animals</td></tr>
<tr><td>Households</td><td></td></tr>
</table>

In addition, questionnaires, interviews, diaries and forms can be used to collate existing information. However, to obtain primary data in the above-mentioned sectors, these methods are not sufficiently accurate.

The Level II approach calls for studies on food waste at retail and consumer level, and anticipates separate studies on households and food service. Household consumption studies shall ensure women's participation, as they play a central role in food management at the household level.

Consistent with the overall intent of the indicator, the approaches described below for levels II and III are designed to enable a country to measure food waste, take actions to reduce food waste, and assess the impact of such actions. Ideally this would coincide with a national strategy on food waste reduction. Where countries do not have a national strategy, prioritization may be conducted using economic, environmental or social factors such as importance of the different food supply chain stages or impact of certain destinations (e.g., GHG emissions from landfills) on the economy. The flexibility is not intended for member countries to 'game' the system by focusing on an area where there is less waste. By focusing on areas of national environmental, social or economic importance, a country can align investment in this area with national priorities.

26 Adapted from UNEP, 2021, page 15, table 4

Comparability between countries would depend on the scope selected.

The Level II approach requires a reporting member country to:

1. Define a scope – i.e., select the sector(s) they are going to report;
2. Pick suitable method(s) to measure and report food waste within the sector(s);
3. Conduct a study(ies) using the chosen method(s);
4. Report food waste for the Food Waste Index;
5. Repeat studies regularly using a consistent methodology.

Choosing a scope

The process for defining a scope for Level II reporting against SDG 12.3.1b is similarly important to the method used to quantify food waste within that scope. In addition, once a broad scope is chosen (e.g. household waste only), specific techniques for data collection may be employed (these are included in Annex II).

Relevant measures for other purposes might already exist in a reporting country, such as for SDG indicator 11.6.1. Under this indicator, the proportion of municipal solid waste (MSW) collected and managed in controlled facilities out of the total municipal waste generated, by cities, is tracked. Data for this indicator can be provided by tracking the amount and composition of urban solid waste by compositional analysis of a range of sectors, including households, food retail and food service. The amount of food waste included in this data can be repurposed for the Food Waste Index.

It needs to be noted that the two indicators differ in geographic bounds: 12.3.1b (the Food Waste Index) covers the entirety of a country, while 11.6.1 solely covers cities. Introducing additional studies for rural areas or extending city-based studies to surrounding areas could be methods to overcome this difference.

In certain situations, it might be possible to report both SDG indicators with one set of fieldwork. Nevertheless, additional measurement is required if a considerable amount of food waste is not collected as part of the MSW collection system.

Boundaries

A member country will need to specify which of the following stages are included within their Level II estimate:

- Retail
- Households
- Food service

The inclusion of more than one stage within the scope's boundaries may necessitate multiple studies and different methods for each stage chosen.

The UN Statistics Division-UNEP Questionnaire on Environment Statistics: Waste Section will be used to collect food waste data under SDG 12.3 and is sent out every two years to National Statistical Offices and Ministries of Environment. For each country, these will nominate a single food waste focal point to coordinate data collection and reporting. The SDG Global Database, UNSD Environmental Indicators and UNEP's Food Waste Index, which will be published at regular intervals up to 2030, will function as media to make the data publicly available. In September 2022, the next questionnaire will be forwarded to member states. By February 2023, the results will be reported to the SDG Global Database. It is recommended for countries to measure each sector at least once every four years. It is not necessary to conduct new

measurements every two years or measure every sector simultaneously.

Choosing a method

As shown in Table 6 above, appropriate measurement methods vary between sectors. The advantages and disadvantages of different methods are well documented in the Food Loss and Waste Accounting and Reporting Standard (Hanson et al., 2016). Up-to-date data that are accurate enough to allow tracking of food waste over time should be generated by the chosen measurement method(s). Obtaining other information at the same time can also help to reduce food waste in a country (e.g., on the types of food that are most frequently thrown away and the principal causes). More details on the most appropriate methods for each food supply chain stage is found in Annex II.

It may be necessary to conduct multiple studies applying different methods if more than one sector is included within the scope's boundaries. The methods presented in Table 6 are not only appropriate for government-funded studies, but also for individual businesses. In some situations, it might be necessary to apply more than one method in the same sector, for example if a business has food waste in two solid waste streams (one food waste only and one mixed residual).

To estimate the amount of food waste within a sector in a country, measurements shall be generated by a sample of businesses or households, which needs to be adequate in size and representativeness. Moreover, scaling will be required to obtain the estimate. Food waste agreements (or legislations) that require businesses to share data on the amount of generated food waste exist in some countries. These data can then be used for tracking purposes if the respective agreement allows. .

II.3 Level III – Food waste and reuse by destination

Information for Level III includes supplementary indicators which are useful for informing national policy and decision-making. These will not be part of the core data reporting at the global level, but may provide useful information for national decision making.

Measuring both food waste and reuse by destination is important for understanding the best way to optimize food waste or food used for composting. The preferred scope would be the below and it would be useful to disaggregate the total food waste by these categories:

- Codigestion/anaerobic digestion,
- Composting/aerobic process,
- Controlled combustion,
- Land application,
- Landfill,
- Refuse/discards/litter,
- Sewer*[27],
- Home composted,
- Animal feed,
- Bio-material/biochemical processing.

Sewer/wastewater provides useful information for understanding food destinations. Countries may wish to include food discarded to sewer if this is an important destination in the country. As an example, the amount discarded to sewer (down the sink) can

27 For more detail, please refer to page 40 of the FLWS (Hanson et al. 2016). Ploughed in/not harvested is a destination not applicable to food waste as it is only relevant at the production stage of the food chain.

vary depending on disposal culture. In the UK, 23% of household food and drink waste in 2015 was discarded to sink or sewer (WRAP 2018).

Additionally, the food "surplus" destinations animal feed and biochemical processing are out of the scope of waste, but would capture food reuse and provide information which would be useful to understand the food system. The total amount of food waste and reuse will be greater than food waste measured under level II.

A reporting member country should include in its scope both material types that leave the food supply chain (i.e., food and its associated inedible parts). It is recommended where possible that food waste is disaggregated by edible parts (intended for human consumption) and inedible parts. Note that assumptions on what constitutes inedible parts varies across and within countries (sometimes even within households). Nicholes et al. provides a methodology that could be applied in different countries taking into account cultural differences[28]. The disaggregation by edible and inedible parts associated with food (e.g. animal bones, egg shells, fruit stones or pips) helps understand the amount of food waste which is unavoidable (e.g. if fresh eggs are purchased, then egg shells will need to be discarded), and how much is avoidable, in that it could have been prevented if better managed in the supply chain or the home. Definitions for wasted food and inedible parts are given in the *Food Loss and Waste Accounting and Reporting Standard*.

Finally, the level III framework also captures food waste in the manufacturing sector that is not covered by the Food Loss Index, e.g., where more than one commodity is combined to produce processed/complex food products.

The choice of destinations may be influenced by the data available. For example, a hypothetical country wishes to report food waste comprising both food and inedible parts for the retail sector and has determined that the formal retail sector can provide records from stock and sales data. Using 'inventory' records however are unlikely to provide insight to determine where the material is sent. If information (whether through records or other means) does not exist about where material is sent by the retail sector, it may need to be removed from the two excluded destinations from the scope before reporting. Another factor to consider is that some destinations may not exist in the reporting member country e.g. codigestion/anaerobic digestion.

III. Additional Disaggregation

In global reporting, the disaggregation will include the supply chain stages: households, food service, and retail. Additionally, for level III, disaggregation by destination, by edible and inedible food waste and by manufacturing as a fourth sector is proposed.

28 Nicholes et al. Surely you don't eat parsnip skins? Categorising the edibility of food waste Resources, Conservation & Recycling 147 (2019) 179–188

The following disaggregation will not be included in the global reporting but are proposed for national consideration.

The types of food thrown away provides useful insight for focusing effort and developing solutions to prevent waste. This can be performed at a high-level using categories such as fruit, vegetables, bakery. More detailed information can be obtained by studying e.g., the type of fruit wasted. Either level of details can be achieved via waste compositional analysis. In retail and food service settings, the use of scanning systems and / or smart bins can also provide this level of detail. Disaggregation may also be useful based on **geography**, e.g., obtaining data for individual states, provinces, cities, or other areas within a country. This will help understand where efforts to reduce food waste need to be focused. For similar purposes, countries may wish to undertake studies to understand the **groups of businesses or people** that waste disproportionately high or low levels of food waste or particular types of food. Taking household food waste as an example, this disaggregation may include understanding the variation by age, gender, income, levels, region, household composition, employment status, etc. Qualitative research, including interviews and observation, can be a useful measurement method. This additional disaggregation creates a more complete picture of the food waste and food surplus status within a country, and the data can contribute to a national food waste prevention strategy.

IV. Data sources, availability and production

The following data collection tools, measurement techniques and leveraging of existing data sources applies to both level II and level III. As described above, level II covers food waste generation at retail and consumer level, whereas level III allows countries to report additionally at the manufacturing level and to gather disaggregated data on causes, types of foods wasted and destinations, to better inform policymaking.

Data collection tools

The following methods request data from others in varying forms and will require collation at least and potentially scaling to represent the total population/ food chain stage. If it is of appropriate quality and coverage, using existing data is generally more cost-effective for a country than to undertake new measurements.

- Diaries – a type of log where quantities of food discarded are recorded on a case by case basis daily. This can involve weighing or estimation/ approximation by the person filling in the log. For example, in a household setting, a respondent in a Mexican study may log discarding 3 tortillas on the first day or a respondent in Tanzania may log 'a handful' of ugali (staple foods in each country). The average mass of items for such reported measures would need to be used to convert the measure into grams.

- Surveys – a structured questionnaire to gather information from a large number of individuals or entities. A survey is most appropriate when the commissioner of such a method is confident in the ability of the respondent to accurately provide the data requested. This means that the respondent has already recorded the data

and the survey is gathering it, rather than asking for a recollection or opinion. Practically, this invalidates surveying as a useful method for household food waste quantification as respondents are unlikely to have measured their waste and remember it accurately at time of asking. It is more appropriate for formal retailers, food service companies (restaurants etc.) and food manufacturing who may collect waste data as part of record-keeping activities (see below).

- Records – a collection of data that have been recorded and saved physically or virtually. These are often collected for reasons other than quantifying food waste (e.g. warehouse record books). For specific food chain stages, these may provide a relatively accurate picture of an organisation's food waste. A non-perishable food wholesaler may keep records of any unsold stock that is discarded, representing its food waste if the stock records can be matched to weight of food for each item in question.

Existing Data sources

It is possible that some of the data required to produce estimates of quantities of food waste already exist and are collected for other reasons. These will likely be related and useful data but often do not include information about the quantities of food waste. For example, registration of companies with the government can give an indication of number, size and type of business (e.g. restaurant vs. street vendor) to scale other data with.

- Manufacturing/processing: company registration data, factory records, stock keeping, purchase and sales ledgers, and waste management records/receipts (where charged by volume).
- Retail: (formal) company registration data, company records, stock keeping, purchase and sales records, waste contractor data; (informal) government surveys, academic surveys and studies.
- Food service: (formal) company registration data of restaurants, hospitals, schools etc., company records, purchase and sales records, waste contractor data; (informal) government surveys, academic surveys and studies.
- Households: household income and expenditure surveys on purchases, census data for population, number and type of household, waste collection company data, academic studies on generation and composition.
- Municipal Solid Waste: covering waste originating from households, commerce, and trade, food service, small businesses, office buildings and institutions (schools, hospitals, government buildings), as well as waste from park and garden maintenance and street cleaning services. This is consistent with the definition used in SDG 11.6.1.

Direct measurement and scaling

These methods are most useful for a reporting country which has decided to conduct a study into food waste within the set scope, usually for a representative sample, that can then be scaled to estimate the total quantity for that scope.

- Direct weighing - using a measuring device to determine the mass of food wasted. This could involve weighbridges for collection vehicles or simple scales in a household setting.
- Counting - assessing the number of discrete food items that have been discarded and using the result to determine the mass. This could include scanner data or simply counting bags of waste.
- Assessing volume - assessing the physical space occupied by the food waste and using the result to determine the mass. In a situation where the entire quantity of food waste is likely to have the same composition, for example a waste stream from commodity processing, the density of that

waste is likely to be consistent. Therefore, a value for mass can be determined by applying the density of the waste to the volume it occupies, potentially something like a residue collection vat.

- Waste composition analysis - physically separating food waste from other material to determine its mass and composition. This can be the most accurate way to gain deeper understanding into the differences in material type (wasted food against inedible parts) and types or categories of food wasted. Thus, even in a separate food waste stream, this method has some utility to achieve a narrower scope or provide greater detail.

At the subnational level, these methods could be used by the subjects of interest to quantify their own waste, ready for collating using methods above. For example, a member country may work with a few formal retailers and a research partner to conduct a month-long study of recording retail waste using scanner data which is then scaled to the whole sector (direct measurement and scaling). Conversely, a country legislates a requirement for all formal retailers to start collecting the data (potentially through scanners) and report in an annual survey.

A combination of methods may be suitable for certain scopes. For example, if household waste collection is very close to generation, direct weighing of waste and applying a weighted average of the composition can arrive at percentage that is food and/or inedible parts. However, this scope would exclude food composted at home and discarded via the sink or to a sewer system.

A full elaboration of data sources for each stage of the supply chain is described in Annex II.

V. Discussion: opportunities and limitations

Accurate food waste measurement takes time and resources, but adequate data collection is possible with sufficient commitment, and tailored and targeted communication. For example, countries with confidence in their household waste collection infrastructure and statistics, such as the UK and Denmark, have commissioned specific food waste studies for that food chain stage. Retail food waste may require a trusted confidential reporting system for formal retailers to feel comfortable sharing information. However, many companies are already publicly sharing data on food waste[29]. Informal sectors (in the food supply chain but also in the waste management industry) are more difficult to quantify and food waste estimates would require some idea of their size (e.g. number of informal food retailers and the quantity of food sold by them) alongside estimates of the proportion of food handled that is wasted, potentially a separate piece of work.

Food waste data is often based on calculations using existing related data. It could involve deducing the amount of food waste from quantities of related data (e.g. calculating the difference between food

29 A number of large international food retailers have recently published data publicly on The Food Waste Atlas (https://www.thefoodwasteatlas.org).

inputs and food outputs in a process such as food manufacturing) or using models (e.g. applying percentages to quantities of purchased food or by applying a series of coefficients to sociodemographic variables). The related data may have been sourced from a measurement activity to help form assumptions. Modelled data can provide high-level insight for tracking SDG 12.3.1b; however, this will be less useful for informing specific interventions or actions. As a rule, food waste models based on indirectly correlated data are not a replacement for measurement/tracking progress against a target; they can provide valuable information in a first instance about indicative amounts and areas of interest to help prioritise action.

The causes of food waste could also be collected to help develop solutions to tackle food waste. At home, kitchen diaries that allow people to record why they threw away an item can be undertaken. This can be supplemented with in-home observation and interviews (ethnography) to help understand the root causes. In business settings, quantitative information can be recorded with smart-bin technology or by scanning systems. Diaries can also be used. These can also be supplemented by observation, interviews, and on-site assessments / audits.

It would be useful to understand the food that enters a chain element (i.e. households) compared to the food waste from that supply chain element. For example, this would enable the analysis of the amount of food brought into the home (purchase data) and the percentage of food purchases that are wasted in the home. Similarly, for businesses, the amount of food waste could be compared to the amount of food entering the business. Adjustments may need to be made if the mass of items changes within the business (e.g. if chickpeas are dried, or pasta is cooked and absorbs water).

V.1 Limitations

The challenge resulting from the flexible three-level approach to presenting a methodology is one of consistency and comparability. Level I cannot be compared directly with Levels II and III without caveats, as the methodologies differ substantially. Level I data is not designed to track food waste over time in a country and should not be used to compare countries, as the data often originates from a few years ago or from other countries. Level II and III data however should enable comparison over time for a specific country, as well as comparison between countries with care, as the measurement of food waste becomes more established. Moreover, when good country coverage exists, levels II and III data can be aggregated to regional level.

Naturally, food waste data reported by countries entails uncertainties. These can come from random errors and systematic errors. Random errors can for example be sampling errors and are relatively easy to estimate, whereas systematic errors are harder to estimate and can arise by e.g. using a measurement method that systematically over-or under-estimate food waste. Countries should report the total estimated uncertainty related to their levels II and III food waste data, as a good practice and to ensure that comparisons between countries are only made when the degree of uncertainty is sufficiently small.

Additionally, there are a number of challenges related to the following:

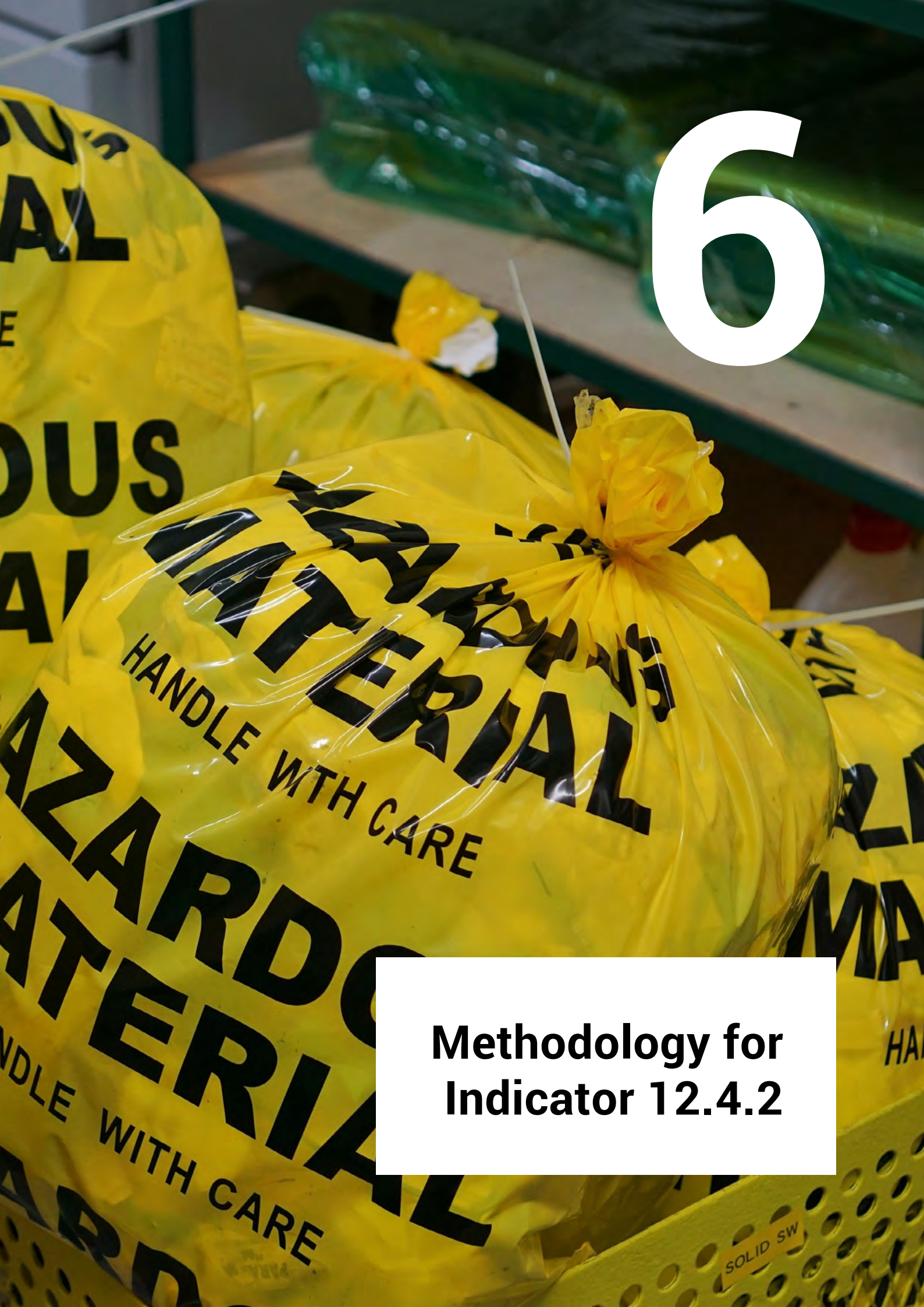
- Variations in waste over time can have a significant impact on estimated quantities of waste when short studies (e.g. a week) are used to represent a longer time period (a year), either due to:
  - The specific time of year when a study takes place which may affect the waste produced

and contributes to a systematic error (it is useful to collect data during two different seasons e.g. rainy and dry seasons during one year, or to adjust to account for known variations if a study has been conducted at one time of the year);

- Natural variation over time in amounts of waste generated by single entities (e.g. households or restaurants), which contributes to random sampling error (it is useful to include a sufficient number of entities and measure over a sufficient length of time) .

- Different methods of quantification can also be used for other relevant and related purposes (for example, "where are the greatest opportunities within the waste that is produced to reduce it?"). Taking households consumption as an example, it is difficult to obtain reasons for discarding food (and therefore the opportunities for influencing citizen behaviour) without the use of diaries or ethnography. However, direct weighing of waste volumes could give a significantly more accurate quantity.

- At a national level, countries may have to rely on other entities (e.g. waste management companies, municipalities, businesses generating food waste) to measure their own waste and report to the government, which would then be collated and analysed to estimate the total amount. How the data is collected would vary by food chain stage as the way food waste is generated in each stage varies. For example, a large formal retailer (supermarket chain) may keep records of stock unsold and discarded which could be reported. This effort can be supported by establishing clear guidance for these entities. On the other hand, a government requesting reporting from households may have to issue guidance to local municipalities and prescribe a quantification method, e.g. a food waste diary. The reported quantities may require scaling if a government cannot obtain reports from the entire population of the food chain stage, i.e. it is unlikely that every household in the country would report.



Methodology for Indicator 12.4.2

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Methodology for Indicator 12.4.2[30]

Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

Indicator 12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

SDG target 12.4 calls for achieving the environmentally sound management of chemicals and waste through their life cycle and significantly reduce their release to air, water and soil with the purpose of minimizing their adverse effects on human health and the environment. The proposed approach relies on country specific data since hazardous waste generated is highly dependent on national factors. Hence, indicator 12.4.2 entails only levels II and III indicators.

I. Proposed approach

The indicators' calculation using gap fillers and country specific data are based on the definition of the indicator and constitute the minimum level of reporting which the countries should achieve. In case of lack of robust country-specific data based on measurements, gap fillers should be used (such as sector-based estimations of quantities based on industry standards, data extrapolation, use of values from internationally accepted publications or databases, etc.). Whenever using gap fillers, the

30 The methodology follows the published metadata for SDG indicator 12.4.2, obtained from: https://unstats.un.org/sdgs/metadata/files/Metadata-12-04-02.pdf

employed method for calculating/estimating should be indicated. It is important to note that there is no possibility to report data on hazardous waste using only gap fillers, as hazardous waste generation is extremely country-specific and depends on several factors, such as the type of economic activities performed in the country, level of industry development, and others. There are no known international benchmarks for general hazardous waste generation rate. Therefore, the employed method for indicators calculation/estimation should always strive towards using country specific data or a combination of gap fillers and country specific data. Therefore, there are no Level I indicators for this indicator.

LEVEL II INDICATORS	
Hazardous waste generated (in tonnes, per km sq. of land area and per capita)	Hazardous waste collected + Hazardous waste given by generator to treatment or disposal facilities + Estimation of Unaccounted for hazardous waste
Hazardous waste generated by type, including e-waste	A breakdown of hazardous waste generated by key type of waste, including e-waste
Proportion of hazardous waste treated	Quantity of hazardous waste treated during reporting year / quantity of hazardous waste generated x 100
LEVEL III INDICATORS	
Environmentally sound treatment of own generated hazardous waste	Related to the country capacity for sound treatment of own hazardous waste within the country and the capacity for treatment of hazardous waste from other countries
Hazardous waste intensity of production	Quantity of hazardous waste generated during the reporting year / DMC in the reporting year

II. Step-by-step guide

II.1 Level II - Hazardous waste generated

Hazardous waste generated should include collected hazardous waste (either by specialized companies or by municipal services), hazardous waste which is given by the generator directly to the treatment or disposal facility, as well as an estimation of hazardous waste which is unaccounted for. **Generated hazardous waste includes exported hazardous waste and excludes imports of hazardous waste.**

The most recently reported hazardous waste generation rates come from the "What a Waste 2.0" publication (2018). These are available as global waste generation rates as data was insufficient and situation across regions and income levels is heterogeneous, which did not allow a more specific breakdown. Nevertheless, these can be used as a start for establishing specific gap-fillers for a country. The industrial waste generation rates per income level is presented as an aid for thinking about adjusting hazardous waste generation based on the income level in your country.

TABLE 8: Global hazardous, medical, and industrial waste generation rates[31]

	HAZARDOUS WASTE [kg/capita/day]	MEDICAL WASTE [kg/capita/day]	INDUSTRIAL WASTE [kg/capita/day]
Global generation rate	0.32	0.25	
High income			42.62
Upper middle income			5.72
Lower middle income			0.36
Low income			No data

31 What a Waste 2.0, Figure 2.14, Table 2.2, page 36

The generic global generation rate should be adjusted to better fit the specificities of the country. One tool to aid this is a dataset associated with the "What a Waste" publication that contains country-specific data on hazardous waste[32] as well as population data for selected countries. A country of similar income level and macro-economic profile from the same region could be chosen from the database for establishing a proxy that may be comparable to the situation of your country. In the table below, the calculation has been done for selected countries. High-income countries are not included here, since they are expected to report country-specific data. A combination of available gap-fillers and clearly presented expert judgement should be used to establish hazardous waste generation.

At the global level, UNSD collects data from all countries (except those covered by the OECD/Eurostat Joint Questionnaire on Environment Statistics) through the UNSD/UNEP Questionnaire on Environment Statistics (waste section). UNSD carries out extensive data validation procedures that include built-in automated procedures, manual checks and cross-references to national sources of data. Communication is carried out with countries for clarification and validation of data. Only data that are considered accurate or those confirmed by countries during the validation process are included in UNSD's environment statistics database and disseminated on UNSD's website.[33]

32 What a Waste 2.0, A Global Snapshot of Solid Waste Management to 2050, The World Bank, http://datatopics.worldbank.org/what-a-waste/

33 UNSD/UNEP Questionnaire on Environment Statistics, https://unstats.un.org/unsd/envstats/qindicators and https://unstats.un.org/unsd/envstats/country_files

TABLE 9: Hazardous waste generation rate in selected countries[34]

COUNTRY	HAZARDOUS WASTE GENERATION RATE [kg/capita/day]	COUNTRY	HAZARDOUS WASTE GENERATION RATE [kg/capita/day]
Albania	0.01	**Malaysia**	0.26
Barbados	0.09	**West Bank and Gaza**	0.04
Chile	0.04	**Thailand**	0.14
Dominica	0.02	**Tunisia**	0.04
Hungary	0.17	**Turkey**	0.12
Indonesia	0.24	**Vietnam**	0.09
India	0.02	**South Africa**	0.07
Kuwait	0.19	**Zambia**	0.02
Madagascar	0.01		

Estimation of unaccounted for hazardous waste

Hazardous waste which is unaccounted for may come from, *inter alia*, households, small businesses and farms. Due to the small quantities of hazardous waste generated per entity, and a lack of or difficulty to access hazardous waste collection services, weak or weakly enforced environmental protection regulations, hazardous waste may be mixed with municipal waste and/or disposed of in an uncontrolled manner (e.g. illegal dumping, open burning). In the case of some lower-income countries, due to insufficient environmental protection regulations or monitoring of implementation, hazardous waste dumping or open burning instead of treatment can occur even in the case of producers of significant quantities, further increasing the amount of hazardous waste which is unaccounted for. A significant amount of unaccounted hazardous waste may also be diverted into the informal sector, prior or after it enters the collection system.

Although there is no agreed methodology on the estimation of unaccounted hazardous waste, countries should employ the often-used methodology of following the mass balance principle, using the Material Flow Analysis (MFA). Input-output analysis is increasingly applied to estimate and represent material flows, MFA is a general system approach

34 What a Waste 2.0, own calculation based on downloadable database

that can be used to explore various interfaces between flows and stocks. For a comprehensive picture of the material flows, it is vital to have data on the accumulation and stock of materials in the economy. There is a direct relationship between the use of certain products and the amount of hazardous waste that is created as a result of their production (e.g. fluorescent lamps, batteries, e-waste, etc.). Looking at production processes, sampling different industry sectors to determine the hazardous waste generation rate over the amount of input materials and then using the ratio to estimate the total across all industry sectors is one of the methods that can be employed for estimating the country specific hazardous waste generation. Significant information and guidance on various methods of data collection, including surveys and sampling, as well as their shortcomings, are available in the Eurostat Manual on waste statistics, Chapter 3[35].

II.2 Level II - Hazardous waste generated by type, including e-waste

In terms of estimating hazardous waste generation from households, small businesses, offices and institutions, direct sampling of waste generation is one of the methods which can be employed. For the household target group, it is necessary to determine characterization of a consumption system, which should include the following: products consumed, frequency of consumption, levels of consumption, consumption patterns (social context closely linked to household location and income class), consumption preferences (highlight production and marketing opportunities). Different consumption patterns of households of various socio-economic status are needed for sampling to be able to create a representative average. Additionally, consumption patterns typically change across seasons, therefore it is also necessary to sample waste generation amount across the year.

It is more challenging to estimate the hazardous fraction in the total waste generation from households using the previously-mentioned methodology (i.e. sampling from households) because the pattern of the generation of household hazardous waste is much more irregular than in the case of industry. Some hazardous waste is generated infrequently, such as paint, lamps and electric and electronic waste, other waste such as household appliances have a long useful life which mean they take many years until they are no longer productive and become waste. As a result, other methods of estimation for hazardous fraction in household waste can result in more accurate figures than sampling.

Statistical data on imports and exports, combined with data on local production allows estimates to be made on the sale of certain products and an estimation of the waste generated, after its use or lifespan. This can be performed following the steps below:

- Identification of the types of household hazardous waste: paint, nail polish, cleaning products, electric and electronic wastes, batteries, car engine oil, fluorescent lamps, etc.
- Obtain sales data from retailers of those goods and data on their expected life-time. If this data is not available, statistical data on imports and exports, combined with data on domestic production allows for estimates to be made on

35 European Commission, Eurostat Manual on Waste Statistics, 2013, available online at http://ec.europa.eu/eurostat/documents/3859598/5926045/KS-RA-13-015-EN.PDF/055ad62c-347b-4315-9faa-0a1ebcb1313e, last accessed April 2018

the sale of certain products. Ideally, this would also comprise historical sales data (the longest life-time of the goods containing hazardous substances) to be able to estimate the generation of hazardous waste amount for the current year. Paints are a particular case, as presented in Box 2 below, in that they are applied to objects which are usually not regarded as hazardous waste when they reach end of life. Only the residual unused paint is regarded as hazardous waste. Assuming that people buy paint to use it, a consumption pattern needs to be surveyed or sampled to determine how much percent of paint is usually discarded. This rate can then be used to estimate future waste generation in this category.

These data collection exercises can be laborious, but once a generation pattern is established, the rate can be used to estimate waste generation for many years to come, or until there is a dramatic change in consumption behaviours and/or production processes of any product or sector. It is recommended that a designated research institution is tasked with this work in a country to gradually obtain data on waste generation pattern using the previously mentioned methods.

Specific methodologies for developing inventories on different types of hazardous waste are included in The Methodological guide for the development of inventories of hazardous waste and other waste under the Basel Convention[36]. The document aims to provide guidance to the Basel Convention compliant authorities and other stakeholders on the methods of developing national inventories for the development of annual reports.

Hazardous waste generation rates for selected waste streams and waste types, selected from the Guidance document mentioned above, are provided in the table below. In case of lack of more accurate country specific data sources based on measurements or calculations/estimations based on the above mentioned methodologies, values such as the ones below and/or values from international databases can be used as gap fillers, until more accurate data is produced.

36 UNEP, Basel Convention, Methodological Guide for the Development of Inventories of Hazardous Wastes and Other Wastes under the Basel Convention, available online at http://www.basel.int/Implementation/Publications/GuidanceManuals/tabid/2364/Default.aspx, accessed April 2018.

TABLE 10: Selected waste streams and waste types

NO.	HAZARDOUS WASTE STREAM/TYPE	WASTE GENERATION RATE	COMMENTS
1	E-waste generated[37]	20 Kg/capita/year, out of which: • 3.1 kg – temperature exchange equipment • 2.3 kg – screens and laptops • 0.2 kg – lamps • 6.5 kg – large household equipment • 6.1 kg – small household equipment • 1.6 kg – small IT equipment	Data valid for EU countries, year 2016.[38]
1	E-WASTE generated from households[39]	15 Kg/capita/year, out of which: • 7.5 kg – large household appliances • 1.5 kg – small household appliances • 3 kg – ICT devices • 3 kg – Other consumer electronic waste	Data valid for EU countries, year 2009
1	E-waste generation rate	• 0.05 kg/capita/day in high income countries • 0.02 kg/capita/day in upper middle-income countries • 0.01 kg/capita/day in lower middle-income countries • <0.01 in low income countries	What a waste 2.0, generation rates per income level
2	Waste engine oils	Data in litres/year/vehicle • 4.25 for automobile • 31.5 for minibus • 425 for bus • 92.5 for truck or pickup truck • 31 for tractor	Inventory from Turkey, year 2006

37 *Although e-waste can be either hazardous or non-hazardous, depending on the content of hazardous substances within the specific EEE, based on the precautionary principle we decided to include e-waste in the 12.4.2 indicator on hazardous waste. In the case of reliable data on separately collected/treated/disposed of e-waste without hazardous substances content, these quantities can be excepted from the calculation of the indicator.*

38 Baldé, C.P., Forti V., Gray, V., Kuehr, R., Stegmann, P. : The Global E-waste Monitor – 2017, United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Vienna.

39 *Although e-waste can be either hazardous or non-hazardous, depending on the content of hazardous substances within the specific EEE, based on the precautionary principle we decided to include e-waste in the 12.4.2 indicator on hazardous waste. In the case of reliable data on separately collected/treated/disposed of e-waste without hazardous substances content, these quantities can be excepted from the calculation of the indicator.*

TABLE 10: Selected waste streams and waste types (cont.)

NO.	HAZARDOUS WASTE STREAM/TYPE	WASTE GENERATION RATE	COMMENTS
3	Hazardous household waste	• 3 – 5 kg/capita/year	Usually estimated based on the quantities of waste collected at designated collection points.
4	Healthcare waste	• 10-25% of generated healthcare waste is hazardous High income countries[40] • Total waste generated 0.9 – 10.7 kg/ occupied bed/day • Out of which infectious waste 0.038 – 2.79 kg/occupied bed/day	Estimation of World Health Organization Depends on type of healthcare facility WHO reference includes additional estimates for low-income countries

40 WHO, Safe management of wastes from health-care activities, 2nd edition, 2014, Available online at http://apps.who.int/iris/bitstream/handle/10665/85349/9789241548564_eng.pdf;jsessionid=2743A11E1925DBB6A180C868456B1D01?sequence=1

As previously mentioned, the global level data is collected by UNSD through the UNSD/UNEP Questionnaire on Environment Statistics that contains data from all countries (except those covered by the OECD/Eurostat Joint Questionnaire on Environment Statistics). Data on e-waste generated and collected, hazardous waste generated per capita are also disseminated on UNSD's website[41].

BOX 2. Tool for estimating E-waste generation

The E-waste calculation tool[42] made available by the European Commission, calculates the quantity of E-waste generated in each EU Member State based on the quantity of electrical and electronic equipment (EEE) placed on the market. The average lifespan of each type of EEE is taken into consideration in the calculation of E-waste quantities. This tool is based on an elaborate research study that was established for 54 homogeneous electric or electronic equipment product types and linking the over 600 products to these keys. The keys were developed by the United Nations University (UNU) and are called UNU keys.[43] The EU commissioned a study to establish typical life-span of E-waste and collection rates across the EU building on the 54 UNU key categories.[44] The two studies together generated sufficient information to develop the E-waste estimation tool. In practice, there are 28 E-waste calculation tools, which are developed on the basis of the same methodology but are filled in with the data of each Member State. This tool comes with a user manual[45] and can be used to generate better estimated E-waste quantities based on quantities put on the market, life span estimations based on the UNU key categories and estimations regarding collection rates. (Also relevant for level II recycling indicators per material type).

42 E-WASTE calculation tool, available online http://ec.europa.eu/environment/waste/weee/data_en.htm

43 Baldé, C.P. et al.,The global E-waste monitor 2017, Quantities Flows and Resources, United Nations University

44 Magalini, F. Study on collection rates on Waste Electrical and Electronic Equipment (WEEE), European Commission, 2015

45 Manual for the use of the WEEE calculation tool. European Commission 2017. Available online http://ec.europa.eu/environment/waste/weee/pdf/WEEE%20calculation%20tools/WEEE_calculation_tool__manual.pdf

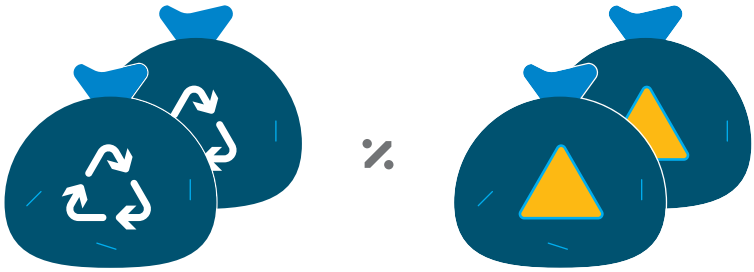
Based on the above, the ***Hazardous waste generated per capita*** indicator is calculated by dividing the quantity of hazardous waste generated during the reporting year to the population of the generating country.

41 WHO, Safe management of wastes from health-care activities, 2nd edition, 2014, Available online at http://apps.who.int/iris/bitstream/handle/10665/85349/9789241548564_eng.pdf;jsessionid=2743A11E1925DBB6A180C868456B1D01?sequence=1

II.3. Level II - Proportion of hazardous waste treated, by type of treatment

In order to calculate the proportion of hazardous waste treated by each type of treatment considered in the section above, the **total quantity of hazardous waste treated during the reported year in the reporting country** is calculated by **adding quantities of hazardous waste treated, per each type of treatment** (recycling, incineration with/without energy recovery, landfilling or other), **including exports and excluding imports.**

The proportion is calculated by dividing the treated quantity of hazardous waste to the generated quantity of hazardous waste.



$$\textit{Proportion of hazardous waste treated (\%)} = \frac{\textit{Quantity of hazardous waste treated during the reporting year} \times 100}{\textit{Total quantity of hazardous waste generated during the reporting year}}$$

Data on proportion of hazardous waste treated by each type of treatment are disseminated on UNSD's website[46].

II.4 Level III - Environmentally sound treatment of own generated hazardous waste

An indicator which would give insight into countries' capacity in terms of hazardous waste treatment is the calculation of their performance in terms of **environmentally sound treatment of own generated hazardous waste.** Generated hazardous waste is calculated as above, including exports and excluding imports. The indicator described can be further developed and disaggregated per sub-indicators, further detailing countries' capacity and performance on more specific environmentally sound waste treatment practices. As such, the **environmentally sound treatment of hazardous waste** will be calculated from the values of the following sub-indicators:

A. Country capacity for sound treatment of own hazardous waste within the country

This sub-indicator takes into consideration the quantity of waste which is treated in an environmentally sound manner within a country,

46 UNSD/UNEP Questionnaire on Environment Statistics, https://unstats.un.org/unsd/envstats/qindicators

out of the total hazardous waste which is generated within the country.

Granted that hazardous waste might be stored for a period of time prior to being treated, this sub-indicator will be increasingly useful over long periods of time, to allow for waste which is generated during a year but treated in the following year(s) to be reflected in the data. It should be noted that treated quantities should only be reported when actual treatment takes place. In order to avoid double counting situations or reductions in weight following treatment operations, waste quantities should be counted when **first** entering the waste treatment process/cycle.

This is consistent with the reporting process on the UNSD/UNEP Questionnaire 2020 on Environment Statistics (waste section), in which, after entering the waste treatment process, waste is considered as being generated by the waste management sector (ISIC 38) and hence, as per Table R1 of the questionnaire, should be excluded.

B. Country capacity for treatment of hazardous waste from other countries

This sub-indicator aims at highlighting better performance of countries that have developed their capacity for treatment of hazardous waste and are able to treat hazardous waste in an environmentally sound manner for other countries, beside their own waste.

This sub-indicator only considers imported waste. For own waste treated in an environmentally sound manner within the country, quantities would fall under sub-indicator A.

C. Hazardous waste exported in order to be treated in an environmentally sound manner

The reason for calculating this sub-indicator is that a high number of developing countries do not have in-country capacity for treating hazardous waste. However, they may make efforts to export this waste for treatment in an environmentally sound manner in another country. In some countries, such as small island states, it might also be impractical to have hazardous waste treatment facilities within the country, as economies of scale might be difficult to achieve.

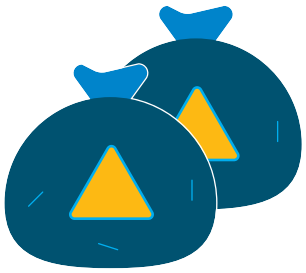
It is our general assumption that all hazardous waste exported for treatment is treated in an environmentally sound manner, as transfer of hazardous waste is governed by the Basel Convention, which a considerable number of countries are parties to.

Considering that the alternative is simple landfilling, or possibly open dumping/burning, efforts of countries which take these measures are, as such, acknowledged.

II.5 Level III – Hazardous waste intensity of production

Information on hazardous waste generation can be used for the characterization of countries' clean production practices, when linking it with the DMC, as an increase in the generation of waste is one of the environmental implications related to increased material consumption[47]. The **hazardous intensity of production** indicator would be calculated as follows:

47 Stefan Giljum, Monika Dittrich, Mirko Lieber and Stephan Lutter, Global Patterns of Material Flows and their Socio-Economic and Environmental Implications: A MFA Study on All Countries World-Wide from 1980 to 2009, Resources 2014, 3, 319-339; doi:10.3390/resources3010319



DMC Includes solid, gaseous and liquid materials

$$\textit{Hazardous waste intensity of production} = \frac{\textit{Quantity of hazardous waste generated in the reporting year}}{\textit{DMC in the reporting year}}$$

Thus, countries which have lower quantities of hazardous waste generated but the same amount of resources in consumption will have a lower hazardous intensity of production and hence rank higher according to this indicator. However, this indicator has its limitations; as often there is a significant gap in time between the use of materials in production and the moment the materials become waste.

III. Disaggregation

Indicators described above can be further disaggregated depending on the country's policy information needs. For instance:

- Disaggregation at sector level, by ISIC codes. Information on the generation and treatment of hazardous waste could be collected from industry or municipal level and treatment/ disposal facilities.
- Disaggregation by type of landfilling. As there is significant difference between landfilling in specialized, controlled and uncontrolled landfills, further disaggregation on this type of treatment could be analysed.
- Disaggregation by type of treatment per each generating sector;
- Disaggregation by type of recycling operation (R2 to R12 from Basel Convention Annex IV).
- Disaggregation by territorial division. Information on the hazardous waste generated can significantly vary throughout the territory of a country as there might be hotspots of hazardous waste generation, concentrated around industry intensive areas.

IV. Data Sources, availability and production

On a national level, data and information regarding hazardous waste can be derived from hazardous waste generators, hazardous waste collection operators, as well as treatment facilities, local/ regional and national environmental protection agencies. Depending on national obligations for record keeping and reporting, the extent of the data available might vary at country level as well as at sector level.

Data on the generation of hazardous waste should ultimately be reported by generators to environmental authorities. The actual form and frequency of which depends on legal requirements and the maturity and/or complexity of the environmental regulation system within the country, which can differ significantly across the world.

At a minimum, information on possible generators of hazardous waste can be derived from environmental authorities based on the environmental permits issued for industrial activities. Industrial activities are likely to fall under environmental permitting requirements, as they are likely to generate hazardous waste. In case reporting on hazardous waste generation is not a legal requirement, industry specific hazardous waste generation rates could be applied as a gap filler to production data, in order to estimate the quantity of hazardous waste generated by the specific industry.

Depending on the extent and quality of the waste collection system, data on collected hazardous waste may be used as a proxy for hazardous waste generation, acknowledging also the invariable existence of a fraction of unaccounted for hazardous waste. Collection data may be available from public and/or private waste collection operators and subsequently cross-referenced with data from hazardous waste treatment facilities, landfills, as well as data on exported hazardous waste, for consistency.

Data collection on hazardous waste generation and treatment is usually done by the competent authorities designated under Basel Convention (submission of annual reports in fulfilment of the Convention's obligations) or by national statistics offices in terms of data aggregation, as an overarching organism which links to national/regional authorities, be it environmental agencies, environmental ministry, commerce and trade authorities, etc.

Information on exported/imported hazardous waste is generally available through the customs office. As compelled by the Basel Convention, this type of information is generated through the designated authorities , as they are responsible for receiving notifications of transboundary movements and any related information and for responding to such notifications (Article 2).

V. Discussion: opportunities and limitations

A general challenge in hazardous waste statistics is the sensitive public opinion on the hazardous properties of chemicals and hazardous waste. These concerns may disincentivize private operators from disclosing data on their hazardous waste generation unless compelled to do so by a robust environmental regulator with proven legislative and institutional backing, which in many countries is lacking.

Data on illegal waste collection, illegal trade, and illegal dumping or deliberate leakage into the environment are difficult to capture. An effective record mechanism would require the integration of data from the environmental regulator (e.g. for illegal dumpsites) and from law enforcement (e.g. for illegal trade).

Meanwhile, the informal and semi-formal sectors, including waste picking and recycling by the informal private sector, all of which are especially relevant to the situation in developing countries, are difficult to measure because, in most countries, they are unregulated and operate without oversight. Hence, data collection disaggregated by sex and age for the informal waste sector is particularly difficult; however, essential in understanding gender-related imbalances and burdens. Gender equal employment practices in the waste management sector are incremental to achieve the 2030 Agenda (UNEP, 2019).

Another challenge is linking data on the use of chemicals and generation of hazardous waste. Efforts are underway at the EU to correlate the classification and labelling of chemical substances with hazardous waste codes, but it is an ongoing process and the EU Waste Framework Directive has not yet been revised to include this correlation[48, 49] .

The Basel Convention gives the choice to link hazardous waste either to the sector generating the waste or based on waste constituents (Annex I). By correlating specific waste to its constituent chemicals, there can be a clear connection made between the production data and its resulting waste.

However, other challenges might also be considered, such as the numerous transformations chemicals may be subjected to through their use cycle, which may change their classification to hazardous or non-hazardous, time lag from chemical production to it becoming waste, as well as mixing of several chemicals in hazardous waste generated by a single sector.

48 Waste Framework Directive and European List of Waste, information available at http://ec.europa.eu/environment/waste/framework/list.htm, accessed March 2018

49 Review of the European List of Waste, Final Report by Ökopol GmbH, November 2008, available at http://ec.europa.eu/environment/waste/pdf/low_review_oekopol.pdf, accessed March 2018

BOX 3: Linking chemicals with hazardous waste – an example

The case of solvent-based paint is particularly relevant in illustrating the difficulties in correlating data on the production of chemicals with hazardous waste data.

Solvent based paints (or "oil based" paints, also enamels, varnishes, sealants, etc.) are considered hazardous substances/products. Unused/expired paints of this kind, and also the empty cans/aerosol containers resulting from their use are considered hazardous waste and evidently should be treated/ disposed of as such.

However, once applied, they lose this classification. This means that the objects on which this type of paint is applied to, once out of use or at the end of their life cycle (such as discarded furniture which was painted with solvent-based paint) is, however, not considered hazardous.

Estimating the quantity of hazardous waste generated by this sector based on the production data is a difficult task. One could carry out surveys/studies to obtain data estimates on how much of the produced paints expire before they reach the end-users, together with how much of the purchased paint will remain unused, and as such determine a hazardous waste generation rate for this sector. Such data however would be prone to significant errors, due to a series of factors, such as: different time lags between production and expiration date which vary by product and producer, user stockpiling of products and waste products, and improper disposal of unused paint and empty packaging, such as mixing it with the municipal solid waste.

The link between hazardous waste and chemicals is not yet clearly established. Efforts are being made within the EU to correlate classification of chemicals with the classification of hazardous waste. Further research is needed on potential methods to correlate hazardous waste based composition of hazardous chemicals and the production and/or consumption of said chemicals. Further disaggregation on the above could be carried out based on the hazardous characteristics of chemicals (weather harmful to the environment or to human health) and subsequent hazardous waste. Limitations exist however when it comes to understanding and factoring in the above-mentioned correlation exercise of the transformations which chemicals may be subjected to throughout their use cycle and after disposal, the time lag between chemical production/market entry and it becoming waste, as well as treating mixtures of chemicals in certain waste streams.

Considering the above, it is yet unclear if a direct correlation between chemicals production/ consumption and hazardous waste can be made. A solution might be first correlating hazardous waste with economic sectors which generated the waste. Depending on the availability of disaggregated data, the use of chemicals in each of the sectors generating hazardous waste can be used to make correlations with hazardous waste generated. Particularities of each industry however need to be taken into consideration and factored into such correlation attempts, as often there are cases in which hazardous chemicals enter in the composition of products which will further generate waste classified as non-hazardous. An example is the use of formaldehyde in the production of particle board for furniture or solvent-based paint applied on objects which, once discarded by the user, are not considered hazardous.

V.1 Limitations

Data on hazardous waste generation and treatment may be scarce in some countries, due to a series of factors, such as: lack of, or insufficient, policies and regulations on management and/or reporting; limited human, financial and technical resources within government agencies, lack of clear disclosure and reporting rules and requirements, and unwillingness of generators and public officials in certain countries to disclose the quantities of hazardous waste generated. Some countries may have the data and monitoring systems needed to report, while for others there is a need for training and capacity development to enhance data collection, validation and reporting capacity.

Limitations in terms of usable data for calculating the indicator(s) may arise due to misunderstanding of the terminology used in the indicator or discrepancies between these definitions and the definitions included in national legislation. This can lead to inconsistencies in reported values and difficulties in cross-checking reported data. For example, through national legislation, countries may define additional types of waste to be considered as hazardous beyond the waste streams defined in the Basel Convention. By having inconsistent grouping of types of waste, creating comparable data between states becomes incredibly challenging.

As reporting data on the generation of hazardous and other waste is becoming optional under Basel Convention with the new reporting format adopted by the COP in 2013 for the year 2016, having accurate data on generated hazardous waste may become a challenge.

While hazardous waste generation per capita might be misleading when all sources of hazardous waste are taken into consideration, for some sectors of the economy it can be a suitable indicator of the level of development of the country and its waste management practices. This can be the case, for example, for the hazardous fraction of municipal solid waste, as well as for hazardous waste resulted from healthcare facilities.

Hazardous waste which is unaccounted for as well as hazardous waste which results from treatment of waste considered otherwise non-hazardous (for example hazardous waste resulting from the treatment of municipal solid waste, or through contamination of non-hazardous waste after it enters the waste treatment cycle) is likely to introduce inconsistencies in reported figures.

Inconsistencies in reporting figures may also arise from the way data is reported and then aggregated. In some cases, hazardous waste is reported by volume, with no indication on density. As a result, estimations and assumptions must be made to convert the units. These estimations and assumptions must consider a series of factors which can affect the actual weight of waste, such as moisture content variation with season, degree of pre-processing (crushing/compacting), etc.

Statistical data on imports and exports and production statistics use different classification (for international trade statistics Combined Nomenclature (CN) codes are subject to annual changes, but the Harmonized System (HS Nomenclature) is renewed every five years). Statistical code systems for material flows (CN codes, CPA) and for waste (EWC-Stat codes) are not always comparable. For improved information on the relationship between the inflow of materials and the materials reaching waste management, the method needs to be improved. When semi-manufactured and finished products are to be aggregated into material flow categories, a definition of the materials incorporated has to be done. To what extent this information can be taken from the CN codes is not always clear.

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Methodology for Indicator 12.5.1

7

Methodology for Indicator 12.5.1[50]

Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

Indicator 12.5.1: National recycling rate, tons of material recycled

SDG 12.5 aims to substantially reduce waste generation through prevention, reduction, recycling and reuse. The proposed approach relies on 3 levels indicators.

I.Proposed approach

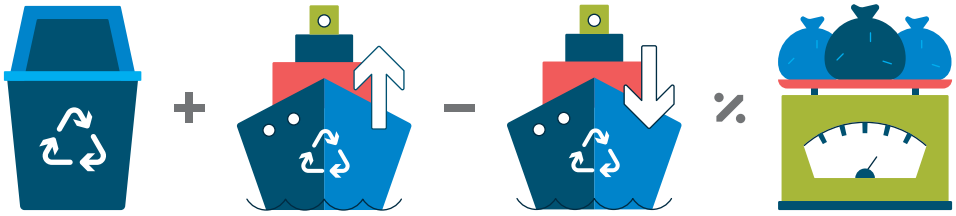
LEVEL I INDICATORS	
National recycling rate	(Material recycled + material exported for recycling – material imported for recycling) / total waste generated (with gap filling for regional and global aggregates)
LEVEL II INDICATORS	
Total Waste Generated (excluding construction, mining and agriculture) by type, including e-waste	This is the denominator for recycling and useful for understanding the target 12.5 on waste reduction.
National recycling rate by type of waste, including e-waste (other possible disaggregations include for metals and packaging waste)	Based on national data sources, including disaggregation of the recycling rate
LEVEL III INDICATORS	
Waste intensity	Waste generated divided by DMC (as an indicator of waste reduction)

50 The methodology follows the published metadata for SDG indicator 12.5.1, obtained from: https://unstats.un.org/sdgs/metadata/files/Metadata-12-05-01.pdf

II. Step-by-step guide

II.1 Level I - National Recycling Rate

For the purpose of this indicator, the National Recycling Rate will be defined as the quantity of material recycled in the country plus quantities exported for recycling minus material imported intended for recycling out of total waste generated in the country. Note that recycling includes codigestion/anaerobic digestion and composting/ aerobic process, but not controlled combustion (incineration) or land application.



$$\text{National Recycling Rate} = \frac{(\text{Material recycled} + \text{Material exported intended for recycling} - \text{Material imported intended for recycling}) \times 100}{\text{Total waste generated}}$$

Gap fillers for waste generation are more commonly used than for recycling rates, since end of the chain recycling data is typically more readily available. For the recycling rate, information on waste generation will be used with regional gap fillers which are based on existing data on the recycling rate. Note that gap fillers are available in publications such as What a Waste by the World Bank (2018)[51] or the 2006 IPCC Guidelines[52] for waste generation. The Global Waste Management Outlook (2015) is also a source of worldwide waste data and more recent regional publications are available for geographic areas and also for specific landscapes (e.g. mountains) that may have an impact on waste generation and composition. There is also Waste Atlas with waste data available online which is a common initiative of ISWA and the SWEEPnet, but the data has not been updated in recent years. What a Waste has the most comprehensive data-set and will be used as the starting point for waste generation estimation. A summary table with a rough

51 What a Waste 2.0, A Global Snapshot of Solid Waste Management to 2050, The World Bank, http://datatopics.worldbank.org/what-a-waste/

52 IPCC Guidelines, https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

breakdown is presented below and country level data is also downloadable on the World Bank website[53], so if regional or income-based data does not seem similar enough for the country for which gap filling is done, then the more detailed database could be used to choose a similar country.

A. Municipal waste generation estimation

Most recent municipal waste generation data was collected from countries and all data was extrapolated to the year 2016 based on a methodology detailed in the What a Waste publication.[54]

TABLE 11: Municipal waste generation rate per region[55]

REGION	2016 AVERAGE [kg/capita/day]
Sub-Saharan Africa	0.46
East Asia and Pacific	0.56
South Asia	0.52
Middle East and North Africa	0.81
Latin America and Caribbean	0.99
Europe and Central Asia	1.18
North America	2.21

Municipal waste generation per income level[56]

INCOME LEVEL	2016 AVERAGE [kg/capita/day]
Low income	0.40
Lower middle income	0.62
Upper middle income	0.71
High income	1.52

53 What a Waste 2.0, A Global Snapshot of Solid Waste Management to 2050, The World Bank, http://datatopics.worldbank.org/what-a-waste/

54 What a Waste 2.0, Box 2.1., page 26

55 What a Waste2.0, Table 2.1., page 22

56 What a Waste, Figure 2.2, page 21, authors' own calculation based on data from this figure and population reported in the publication's national waste database

Data is extrapolated and projected in the publication to 2030 and 2050 respectively. More accurate reporting may be done by checking the extrapolated data in the report or doing a projection based on combining GDP growth rate and population growth rate forecasts.

B. Industrial waste generation rate estimation

Industrial waste quantities are significant and are available as a proxy by income level breakdown.

TABLE 12: Industrial waste generation rate per income level[57]

INCOME LEVEL	2016 AVERAGE [kg/capita/day]
Low income	No data
Lower middle income	0.32
Upper middle income	5.72
High income	42.62

Non-metallic minerals may be counted towards industrial waste in some countries and therefore these proxies are likely to have a bias towards overestimation for the purposes of calculations under this methodology. Recent country specific data for industrial waste is available for selected countries in the What a Waste database. Similarly, as for the municipal waste generation rate, this database may be consulted to choose a country that has a more similar industrial profile or if there are other reasons to use a country as a proxy rather than the income-based generations rate.

C. Other waste stream generation rate estimation

The same publication contains data on special waste streams that may be taken into consideration as proxies. Special waste streams that are relevant for the purposes of the computation and are available in the publication are hazardous and medical waste. Agricultural, construction and mining waste, though listed below and marked in grey, are not accounted towards total waste generation when computing national recycling rate.

57 What a waste, Table 2.2, page 36

TABLE 13: Generation rate of special waste streams

SPECIAL WASTE STREAM	GLOBAL AVERAGE 2016 [kg/capita/day]
Agricultural waste	3.35
Construction waste	1.68
Hazardous waste	0.32
Medical waste	0.25

II.2 Level II - Total Waste Generated excluding construction, mining and agriculture

The sources of economic activities and households that generate waste and are included in this indicator are listed below. From the total waste generated, non-metallic minerals (including construction and mining waste from the municipal waste stream) and agriculture waste is excluded. Waste generated by ISIC 38, waste management activities, is also excluded, as counting from these activities would lead to double counting.

Total waste generated = *Waste from manufacturing (ISIC 10-33)* + *Waste from electricity, gas, steam and air conditioning supply (ISIC 35)* + *Waste from other economic activities (excluding ISIC38)* + *Municipal waste (excluding construction and demolition)*

In reality, quantities of waste generated are available from one of three data sources:

- by source of waste as reported by waste generators or measured or estimated based on surveys carried out at waste generators (level II);
- may be estimated based on data reported from waste handling and waste management entities due to unavailability of data (level I);
- by type of material for some because waste tends to be treated by material, especially for high value recyclables, such as non-ferrous metals, ferrous metals, various packaging wastes (level II).

The methodologies described below should be taken as a working document, countries should make efforts to regularly check for updates in international best practices, available benchmarks, check waste generation patterns through surveys and measurements, etc.

At the national level quantity of materials recycled and materials exported for recycling is relatively easy to collect from large facilities and customs offices. Note that municipal waste is defined differently in different countries, but it generally includes all waste handled by the municipal waste management

system and may include residential waste, waste from commercial entities and institutions, but also construction and demolition waste, some industrial waste streams, parts of medical waste, agricultural waste, etc. UN-Habitat is working to reduce discrepancies through the work on SDG 11.6.1 on municipal solid waste generation. A summary of relevant characteristics and aspects is included below.

TABLE 14: Waste types and their characteristics

WASTE TYPE	CHARACTERISTICS	ASPECTS TO CONSIDER
Municipal waste	Aligned with SDG 11.6.1 on municipal solid waste generation	Most municipal waste streams including those from households, institutions and commercial entities are counted towards the amount of waste generated. Municipal waste may or may not include E-waste, construction and demolition waste, waste from commercial and institutional entities and agricultural waste. When adding this stream to total waste generation, discount any construction and demolition waste and agriculture waste that may be included in the municipal stream as these are not considered in the calculations of this indicator.
Construction and Demolition waste	This waste stream is often separately collected and therefore may not be counted towards municipal waste quantities	This waste stream is not counted towards waste generation in the context of this indicator.
Industrial waste	Industrial waste stream is typically the largest waste stream in countries. The gap-fillers available in the breakdown per income category give an indication of the magnitude the waste stream may have. Data is likely to be available for high income countries. To make the estimation of these quantities more country-specific, expert judgement may be used, technical staff of landfill operators and collection companies are likely to be able to validate the estimated quantities and a composition and breakdown for Industrial waste.	Counted towards the waste generation rate Mind for double counting in case waste amounts are already reported under the other relevant sources, such as municipal waste.

TABLE 14: Waste types and their characteristics (cont.)

WASTE TYPE	CHARACTERISTICS	ASPECTS TO CONSIDER
Agricultural waste	This waste stream is often separately collected and therefore may not be counted towards municipal waste quantities	This waste stream is not counted towards waste generation.
Medical waste	Especially in low and lower middle-income countries this waste type ends up in limited quantities in the municipal waste management system.	Medical waste is counted towards waste generation rate Mind for double counting in case waste amounts are already reported under other economic activities or included in the municipal waste stream.

II.3 Level II – National Recycling rate by type

A common way to improve waste data is to carry out surveys or measurements for a sample of waste generators belonging to a specific category. If enough, resources to collect data for all waste generators is typically not available, it is recommended to take a sample of waste generators. This may be done for the best disaggregation:

- By type of waste, including e-waste and potentially metals and packaging waste.
- for economic activities by local unit (enterprise or part thereof such as a workshop, factory, warehouse, office, depot, etc.) situated in a geographically identified place;
- for municipal waste first by source of generation, household or non-household sources. Per capita generation waste can be disaggregated by income levels. UN-Habitat's Waste Wise Cities Tool – Step by Step Guide to Assess a City's MSMW Performance through SDG indicator 11.6.1 Monitoring provide more details on the measurement methodology.

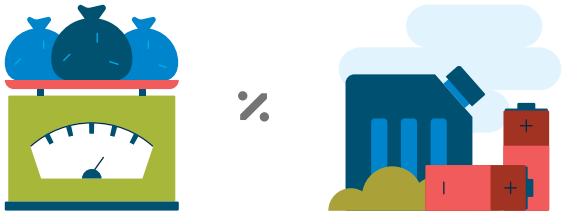
Several tools can be used to estimate the national recycling rate. These also provide information on estimating waste generation.

TABLE 15: Existing or on-going methodologies, tools or developments

Eurostat: Manual on Waste Statistics, A handbook for data collection on waste generation and treatment[58]	Chapter 3.1. on data collection on waste generation is relevant | The guidance includes use of surveys to collect information from units in the form of a questionnaire based on the business registry of the country. The guidance describes the steps for designing a representative sample for the surveys among economic units and households. Questionnaires and table formats for data collection are also suggested.
UNEP, Basel Convention, Methodological Guide for the Development of Inventories of Hazardous Waste and Other Wastes under the Basel Convention	Chapter 6 on methods for estimating waste generation is relevant. The methodology works with establishing waste generation factors for hazardous waste, but this can be done the same way for non-hazardous industrial waste.
Waste Wise Cities Tool – Step by Step Guide to Assess a City's MSMW Performance through SDG indicator 11.6.1 Monitoring	UN-Habitat developed an evidence based MSW data collection methodology for monitoring SDG 11.6.1, developing concepts and definitions to unfold complex waste recovery market at the national level. The tool consists of 7 steps. Step 4 of the tool provides questionnaire for recyclers to compile data and calculate total amount of waste recycled. The tool also provides the waste composition survey methodology both at the generation and disposal point.
Waste Characterization Methodologies	There are several methodologies available for sampling and characterizing municipal waste. A couple of sources are listed below: • ASTM D5231 - 92(2016) - Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste - Available from - http://www.astm.org/cgi-bin/resolver.cgi?D5231 • Methodology for the Analysis of Solid Waste (SWA-Tool) User Version – Available from - https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

58 Eurostat: Manual on Waste Statistics, A handbook for data collection on waste generation and treatment, Available at http://ec.europa.eu/eurostat/documents/3859598/5915865/KS-RA-10-011-EN.PDF/39cda22f-3449-4cf6-98a6-280193bf770c

II.4 Level III - Waste Intensity



$$\textit{Waste intensity of production} = \frac{\textit{Total waste generated}}{\textit{DMC}}$$

By making total waste generated relative to DMC, the indicator will be able to show how waste generation is related to waste intensity of production. Thus countries, which have the same quantities of generated waste but use fewer resources in production, will rank lower according to this indicator, by having a higher waste intensity of production.

It is also recommended that this could be based on material footprint; however, a globally agreed definition of material footprint does not yet exist for this.

E-waste generation rate, which is a level I indicator, is available but this waste type is likely to be collected with municipal waste. Therefore, it might be already reflected in the municipal waste generation rate, predominantly in low income and lower middle-income countries, but to some extent also in upper middle income and high-income countries. UNU maintains a detailed database on e-waste generation with data available per country.

III. Disaggregation

Data for this indicator can be disaggregated at various levels for this indicator in accordance with the country's policy information needs. For instance:

- In country recycling and materials exported/ imported destined for recycling will show how much capacity the country has to recycle in country.
- By type of recyclable material: i.e. e-waste, metals and packaging materials are given above. These may be reported as quantities out of total waste generated instead of materials put on the market to get a disaggregation and keep a common denominator.
- Disaggregation of Recycling Rate by material flow for metal is possible by disaggregated data for ferrous and non-ferrous recycled materials and material flows.

IV. Data sources, availability and production

Data sources within a country vary greatly, as these depend on the regulatory and institutional framework within the country. Some suggestions on possible data sources are provided above, for each level of reporting.

For quantity of waste recycled, data for output of secondary materials from permitted end of recycling chain entities should be used. Data should be collected from processing units as close as possible to the end of the recycling value chain or at the production unit using the secondary raw material as input to its processes.

Export and imports data on recyclables exported with the destination of recycling can be sourced from customs offices.

UNSD database on SDG indicators DMC and MF may be used. DMC will be used as DMC by material, specifically DMC of metal ore.

Collection process

Data collection on quantities of material recycled is usually done by national statistical offices, as an overarching organism which links to national/regional authorities, be it environmental agencies, environmental ministry, commerce and trade authorities, etc.

Depending on the type of data needed and on the regulatory system within the country, information for national/regional authorities may come directly to them, or through county/local offices (for example, environmental permitting of large industry operators may be done by national environmental authorities, while environmental reporting on generated waste may be directed towards local authorities).

Data availability

For the countries with centralised solid waste data collection system, it is considered to be easy to collect data required for the indicator. For the countries without centralised solid waste collection system, Level I methodology may be used.

V. Discussion: opportunities and limitations

Measuring prevention and reduction of waste is a challenge, but one metric can be construed by comparing waste generation rates to GDP and DMC. These metrics will indicate how successful a country is in decoupling waste generation from consumption and economic activity. Reuse and repair are also difficult to measure because often products are reused and repaired before they are discarded and avoid entering the waste stream, thus they are not counted or measured in waste statistics. However, increased reuse and repair activities should lead to less waste generated (i.e. waste prevention). Given these challenges, waste prevention via reduction, reuse, and repair are not captured within this indicator. There are several challenges in measuring and tracing recycling.

The recycling value chain

The recycling value chain regularly involves several steps from the point a recyclable material is extracted from the waste stream until it will be used as secondary raw material.

Before a material is recycled, it may be source segregated, separately collected, sorted in a facility, washed, pressed and bailed, shredded and transported. All these steps may be done at different locations by specialized businesses or organizations.

BOX 4: The recycling value chain of hard plastics in Cairo Egypt[59]

A labour intense, largely informal recycling value chain entails that there are many steps and actors involved in separation, collection, sorting and processing. The example showcases the value chain of hard plastics in Cairo, Egypt. It is clear from here, that while the scope is always recycling, there are rejects in each step and deciding at which point of the chain the recycled quantity will be counted will make a vast difference between reported recycling rates.

59 GIZ, Recovering Resources, Creating Opportunities, https://www.giz.de/en/downloads/giz2011-en-recycling-partnerships-informal-sector-final-report.pdf (also referencing City Report by CID Egypt supplying information to the synthesis report, unpublished)

Source: CID Consulting | www.cid.com.eg

It is not clear at which step of the process the recycled waste should be measured and if it should be considered as input or output to a certain process step.

At the same time, the national waste reporting systems usually track waste amounts in each of these process steps, reporting each time a waste type and quantity is generated, transported or handled by an authorized entity. In theory, this would allow to check the mass balances along the value chain of the recyclables. In practice, this is not always possible and not common practice in developing countries. Double counting is a concern, as often when waste is processed or goes through the recycling chain, the reject or output from the treatment/ recycling facility is counted again as "new" waste.

Furthermore, recyclables trading happens on a global market, thus materials leaving the country destined to be recycled are regularly allocated to recycling rates, though verification to what happens to materials exported for recycling does not always occur.

Changes to quantity and quality along the recycling chain

In each process step described above, the material may be physically altered, and rejects will be produced. The rejects resulting from any step of the process in the material recycling cycle are not counted as generated waste, since this is considered "secondary waste".

The transformation in the process steps also means that if recyclables are measured at the entry point to the recycling value chain, rather than at the end of the value chain, the recycling rate will be higher.

It is noted in the OECD metadata on Municipal Waste that recycling is often reported as the quantities sources segregated, entering or leaving sorting stations (Spain, France).

Informal activities

Measuring recycling activities, by sex, is further complicated by the informal sector activities in the market. Informal sector activities in waste management are almost universally present in all countries, but more pronounced in emerging economies, large cities and in low-income countries. As noted in the Gender and waste nexus, women are often waste pickers, or informal sector waste workers, may collect recyclables from disposal sites or streets, limited to lower-income tasks whereas men may buy from generators and may be owners of informal or semi-formal scrap-yards, trading waste to bigger buyers or final users.

Box 5: Significance of informal sector activities[60]

Informal sector activities and their impact on recycling should not be underestimated. A comprehensive review of available case studies on informal sector activities, published in 2013 reveals that 288 working days per year, the daily amounts collected per person range from 7 to 700 kg with a median value of 43 kg (average value 111 kg). The study estimates that the contribution of informal sector activities to recycling can be quite high, up to 80% of total recycling rate from municipal waste streams. The proportion of informal waste workers can be estimated at approximately 0.6% (0.5–2%) of the total population. These benchmarks can help estimate the total recyclables that are captured by informal sector workers in a municipality. Nevertheless, much of these materials eventually enter the formal recycling chain and are reported towards the end of the value chain.

60 Ramusch, Roland, and Ulrike Lange. 2013. "Role and Size of Informal Sector in Waste Management – a Review." *Waste and Resource Management*, May. https://doi.org/10.1680/warm.12.00012

Before the recyclables enter the formal economy, they may go through several steps or informal transactions and transformation.

Materials that are extracted from disposal sites pose a double counting issue for waste, while those that never enter the formal economy are the most difficult to capture in statistical data.

The influence of market prices

Prices of recyclable materials are established on the global markets, these influence recycling rates.

Where recycling is primarily an activity of the private (informal and formal) value chains, higher prices will influence extraction and diversion from disposal, as a higher price will increase quantity demanded and more materials will be bought. Periods of lower prices may increase the materials that are found in municipal recycling programs, as there are fewer alternatives for households to sell directly. Price fluctuations may incentivise traders to stockpile materials in anticipation of higher prices. This increases potential time-lags and should be considered when deciding where in the recycling chain data should be reported.

TABLE 16: Principles applied when defining the indicator

PRINCIPLE	CONSEQUENCES TO DEFINING THE INDICATOR
Define a metadata that will ensure as much as possible the monitoring of the goal and target	Applying this principle to the way the indicator is measured leads to measuring materials that are actually recycled rather than materials extracted from the recycling chain, since the interest is to understand how much of the primary resources use is actually reduced after the recycling process and how society is progressing towards sustainable production and consumption. Whenever reporting the actual tonnes of waste recycled is not possible, the waste quantity "destined for" recycling will be considered. This also points to the direction that this indicator could be linked with production and consumption indicators, i.e. domestic material consumption (DMC).
Linking to other SDG indicators would enhance the policy information and would reduce the reporting burden	The indicator could be linked with those related to production and consumption, but also those related to waste management. ***Indicator 12.2.1.*** Material footprint (MF), MF/capita and MF/GDP ***Indicator 12.2.2.*** Domestic Material Consumption, DMC/capita, DMC/GDP ***Indicator 12.4.2.*** Hazardous waste treated in environmentally sound manner out of total hazardous waste generated ***Indicator 11.6.1.*** Proportion of municipal solid waste regularly collected and with adequate final discharge, out of total municipal solid waste generated MF covers the consumption, while DMC the production side of the economy. Both are related to resource efficiency and can provide interesting information in combination with the quantity of generated waste. The denominator needs to be total waste generated minus the construction and demolition waste, inert waste (the non-metallic mineral waste streams) and agriculture waste.
Do not leave anyone behind while also making it possible for countries to improve their reporting	Respecting this principle would imply that a phased approach or reporting levels would need to be defined. It also encourages the proposal of gap-fillers and methodologies to estimate certain data for countries that are struggling with data production and collection.

Considering the data that is already being collected, the opportunities that current datasets provide, the difficulties encountered and the principles to be taken into account, it makes sense to have two levels of precision and difficulties in reporting based on the indicator:

- The first and easiest level will be accessible to all countries based on data that is already being reported and gap-fillers from international benchmarks;
- The second level will be to gather country specific data on all the input data needed to calculate the indicator, as well as to disaggregate the indicator (by sex and other socio-economic factors) and calculate certain sub-indicators that inform policy and decision-making better than the single indicator does.

V.1 Limitations

The indicator is constructed in such a way as to make it feasible for countries that have limited data to make progress towards higher levels and calculating more indicators as they improve their collection capacity. Despite their limitations, data on formal solid waste collection and management may be available from municipal bodies and/or private contractors. Additionally, data on informal recycling activities may be available from NGOs and community organizations. It is important that all data sources are used for reporting must be validated and cross-referenced, otherwise discrepancies are likely to introduce inconsistencies in reported figures.

Most countries control large end-of-chain recycling facilities and export of recyclable materials, so data from these entities is feasible to collect. There may be recycling carried out in the informal sector that never enters the formal channels. In this case, countries can estimate the size of the informal recycling sector to properly account for all the recycling with said country.

National recycling rate is part of measuring progress towards sustainable consumption and production, but it does not capture prevention, reduction, reuse and repair. Calculating additional intensity indicators against the DMC and the MF gives proxies and helps connect this indicator to resource efficiency in consumption and production. In addition, DMC and MF cannot be disaggregated to economic sectors, which limits the opportunity to link recycling rates to both material flows and sectors.

Non-metallic minerals are very heavy material streams that, if counted towards generation of waste or recycling, may generate seriously flawed results. Construction waste is excluded from both generation and recycling amounts. However, non-metallic mineral industrial waste is included in total waste generated, data is collected based on ISIC categories and not on type of waste.

Material Flow Accounts are part of the System of Environmental-Economic Accounting. This accounting system measures all the materials used in an economy, including those extracted in the country and those imported. There is a rather high level of aggregation of the materials, typically reported in the Eurostat categories of biomass, metal ores, non-metallic minerals, fossil energy materials/carriers, other products and waste for final treatment. At this level of aggregation only metal ores are recyclables as a material flow category. The limitation in this case is related to the time lag between the time at which the metal ores are used in production and the time at which they enter the waste stream. Metal ores may be used for production of flows that stay in the economy for a short time (packaging materials) or infrastructure that are flows that may stay up to 30 years in the economy (such as automobiles) or more.

Imports and exports are linked to NACE/ISIC codes, but for much of the recyclables, for example for packaging a material, there is no reliable information in the import/export statistics, as imports/exports are recorded at customs at net weight excluding the packaging materials.

For estimating the amount of packaging materials put on the market, the methodology refers to the Extended Producer Responsibility studies of the EU to infer potentially useful statistical data and packaging waste coefficients for trading of goods. The information available for the latter two is scattered.

Alternative to total generated waste, waste generated by material could have been used as denominator for each material stream recycled. However, data on waste generated by material is limited and is mostly available for selected waste streams, mostly linked to EU Directives that set the field for implementing Extended Producer Responsibility schemes and these are largely limited to countries in the EU. There are reporting obligations for the generator and at all transaction points in the recycling chain, however data audits and surveillance reveal that these are not systematically applied.

Additional research is needed to understand typical losses (due to transformation of materials, loss of humidity, percent of rejects) along the recycling chain for various recyclable materials. The losses would need to be known as percentages from the point of entry in the recycling value chain (i.e. Collection of source segregated material, or input to sorting facility) to the point of exit (i.e. when the material leaves the last recyclable processing unit to enter a facility as secondary raw material). This would allow to connect indicator 11.6.1. which will measure among other things the municipal recycling rate, to the national recycling rate. Municipal recycling rate is likely going to be measured at the beginning of the chain, while indicator 12.5.1 will likely be measured at the point of exit from the chain. Such studies may be done using the process flow and material mass balance approach. Another approach could be to follow transactions in the waste management process and introducing so called “system of boundaries” defining points of reporting of waste quantities.

Very little information exists on how waste escapes/leaks from formal waste management system (i.e. informal sector, littering, wind) and becomes uncontrolled waste. In this regard, additional research on pathways of leakage is necessary.

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Data assessment tool

8

Data assessment tool

The developed data assessment tool is an excel model which is intended for filling in by each reporting country (Annex III). It is designed to include information on the overall country situation, as well as specific data required for calculating the indicators based on the methodology included in the present Indicator Review Document. The aim of this tool is to aid countries in collecting relevant data from national/regional level authorities, identifying data gaps and inconsistencies, sector priorities in terms of both data production/collection as well as waste management in general. Ultimately, the data assessment tool is aimed to inform waste management policy at national level. In addition, it will facilitate national reporting on SDGs, filling in the UNSD/UNEP Questionnaire 2020 on Environment Statistics (waste section), aid in BRS and other MEAs reporting.

The model includes six tabs, as follows:

- **Introduction** – stating the objectives of the data assessment tool and collecting general information on the reporting country
- **Glossary of terms** – providing definitions and explanations aimed at ensuring better understanding of the terms used in the model and ultimately improving reported data quality
- **Country information** – collecting details on national and international reporting requirements the country needs to fulfil, it's legislative, policy and institutional framework, as well as the definitions the country uses for terms such as 'waste' or 'recycling', among others.
- **Gaps and challenges** – aimed at capturing the national priorities related to waste management, as well as the existing gaps and challenges faced by countries in terms of waste management data generation, collection and reporting.
- **Reporting status** – includes a series of information which is requested for each of the bilateral, regional, multilateral or national agreements/Conventions/standards or reporting obligations the country has, as mentioned in the 'Country information' tab
- **Data collection form** – aimed at collecting actual data to be used in calculating the waste-related SDG indicators, with particular focus on data needed for the calculation of indicators detailed in the present Indicator Review Document. Categories include waste generation, waste collection, waste treatment and disposal, waste recycling and waste movement data.

Countries can customize and add tabs and questions to the tool depending on their specific needs for data collection or policy information.

References

1. UNEP. n.d. "Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Texts and Annexes." Accessed 17 December 2020. http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx.

2. UNEP. n.d. "Basel Convention, Glossary of Terms." Accessed 17 December 2020. http://www.basel.int/Implementation/Publications/GuidanceManuals/tabid/2364/Default.aspx.

3. UNEP. n.d. "Basel Convention, Methodological Guide for the Development of Inventories of Hazardous Wastes and Other Wastes under the Basel Convention." Accessed 17 December 2020. http://www.basel.int/Implementation/Publications/GuidanceManuals/tabid/2364/Default.aspx.

4. Statistical Office of the European Union. n.d. "Domestic Material Consumption by Material." Accessed 17 December 2020. http://data.europa.eu/88u/dataset/cOwcsyDQeZZt5dKhiCmqrg.

5. Giljum, Stefan, Monika Dittrich, Mirko Lieber, and Stephan Lutter. 2014. "Global Patterns of Material Flows and Their Socio-Economic and Environmental Implications: A MFA Study on All Countries World-Wide from 1980 to 2009." *Resources* 3 (1): 319–39. https://doi.org/10.3390/resources3010319.

6. Baldé, Kees, Harrie Meeuwissen, Federico Magalini, and Feng Wang. 2017. "Manual for the Use of the WEEE Calculation Tool," no. June: 39.

7. OECD. n.d. "Municipal Waste, Countries' Metadata." Accessed 17 December 2020. https://stats.oecd.org/Index.aspx?DataSetCode=MUNW.

8. Statistical Office of the European Union (Eurostat). n.d. "Recycling Rates for Packaging Waste (Ten00063), Indicator Profile (ESMS)." Accessed 17 December 2020. https://ec.europa.eu/eurostat/databrowser/view/ten00063/default/table?lang=en.

9. United Nations Department of Economic and Social Affairs. n.d. "Statistics Division, SDG Indicator Metadata Repository, Different Indicator's Metadata, 8.4.2. Domestic Material Consumption (DMC), DMC per Capita, DMC per GDP." Accessed 15 January 2021. https://unstats.un.org/sdgs/metadata/.

10. United Nations Department of Economic and Social Affairs. 2019a. n.d. "Statistics Division, SDG Indicator Metadata Repository, Different Indicator's Metadata, 12.3.1 (a) Food loss index and (b) food waste index." Accessed 20 January 2021 https://unstats.un.org/sdgs/metadata/.

11. United Nations Department of Economic and Social Affairs. 2019b. n.d. "Statistics Division, SDG Indicator Metadata Repository, Different Indicator's Metadata, Indicator 12.4.2: (a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment." Accessed 20 January 2021. https://unstats.un.org/sdgs/metadata/.

12. United Nations Department of Economic and Social Affairs. 2019c. n.d. "Statistics Division, SDG Indicator Metadata Repository, Different Indicator's Metadata, 12.5.1: National recycling rate, tons of material recycled." Accessed 20 January 2021. https://unstats.un.org/sdgs/metadata/.

13. United Nations Department of Economic and Social Affairs. 2020. n.d. "Statistics Division, SDG Indicator Metadata Repository, Different Indicator's Metadata, Indicator 11.6.1: Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal solid waste generated by cities." Accessed 20 January 2021. https://unstats.un.org/sdgs/metadata/.

14. Basel Convention. n.d. "Technical Guidelines on the Sound Management of Hazardous Waste." Accessed 17 December 2020. http://www.basel.int/Implementation/Publications/LatestTechnicalGuidelines/tabid/5875/Default.aspx#.

15. United Nations Statistics Division. n.d. "UNSD/UNEP Questionnaire on Environment Statistics (Waste and Water Sections)." Accessed 20 January 2021. https://unstats.un.org/unsd/envstats/questionnaire .

16. "Waste Atlas Online Platform." n.d. Accessed 17 December 2020. http://www.atlas.d-waste.com/ .

17. European Commission. n.d. "WEEE Calculation Tool, European Commission." Accessed 5 August 2019. https://ec.europa.eu/environment/waste/weee/data_en.htm.

18. Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. The World Bank. https://doi.org/10.1596/978-1-4648-1329-0.

19. "Indicator 12.2.2. Domestic Material Consumption, DMC/Capita, DMS/GDP." n.d. Accessed 20 January 2021. https://unstats.un.org/sdgs/metadata/files/Metadata-08-04-02.pdf.

20. Eurostat. 2001. "Economy-Wide Material Flow Accounts (EW-MFA) and Derived Indicators. A Methodological Guide." 2001. https://seea.un.org/sites/seea.un.org/files/economy-wide-material-flow-accounts-methodological-guide-2001-edition.pdf .

21. European Commission, and DG Environment. 2014. "Development of Guidance on Extended Producer Responsibility (EPR), Final Report." http://epr.eu-smr.eu/documents/BIO by Deloitte - Guidance on EPR - Final Report.pdf?attredirects=0&d=1%5Cnhttp://ec.europa.eu/environment/waste/pdf/target_review/Guidance on EPR - Final Report.pdf.

22. UNEP. 2021. Food Waste Index Report 2021. Nairobi.

23. UN-Habitat. 2010. Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2010. Solid Waste Management In the World's Cities: Water and Sanitation in the World's Cities. Nairobi: United Nations Human Settlements Programme.

24. EC, FAO, IMF, OECD, UN, and WB. 2012. "System of Environmental-Economic Accounting Central Framework."

25. Ramusch, Roland, and Ulrike Lange. 2013. "Role and Size of Informal Sector in Waste Management – a Review." *Waste and Resource Management*, May. https://doi.org/10.1680/warm.12.00012.

26. Commission, European. 2013. "Manual on Waste Statistics: A Handbook for Data Collection on Waste Generation and Treatment." *Eurostat Methodologies and Working Papers*. https://doi.org/10.2785/51516.

27. Gentil, Emmanuel C, Leonidas Milios, and Christian Fischer. 2015. "Hazardous Waste Review in the EU-28 , Iceland , Norway , Switzerland and Turkey Generation and Treatment." https://doi.org/10.13140/RG.2.1.1485.7363.

28. Balde, C.P., V. Forti, V. Gray, R. Kuehr, and P. Stegmann. 2017. The Global E-Waste Monitor 2017. United Nations University International Telecommunication Union International Solid Waste Association. https://doi.org/10.1016/j.proci.2014.05.148.

29. Federico, Magalini, Wang Feng, Huisman Jaco, Ruediger Kueher, Baldé Kees, van Straalen Vincent, Hestin Mathieu, Lecerf Luis, Sayman Unal, and Onur Akpulat. 2015. "Study on Collection Rates of Waste Electrical Equipment (WEEE)."

30. OECD. 2001. "Extended Producer Responsibility: A Guidance Manual for Governments." http://www.voluntaryprinciples.org/for-governments/

31. Pipatti, Riitta, Chhemendra Sharma, Masato Yamada, Joao Wagner Silva Alves, Qingxian Gao, Sabin Guendehou, G, H, Koch Mattias, et al. 2006. "Waste Generation, Composition, and Management Data." In *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Waste*, edited by Simon Eggleston, Leandro Buendia, Kyoko Miwa, Todd Ngara, and Tanaka Kiyoto. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

32. WHO. 2014. *Safe Management of Wastes from Health Care Activities.* 2nd ed. https://doi.org/10.1590/S0042-96862001000200013.

33. GIZ. 2011. "Recovering Resources, Creating Opportunities. Integrating the Informal Sector into Solid Waste Management." *Deutsche Gesellschaft Für …*. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Recovering+resources+Creating+opportunities.+Integrating+the+informal+sector+into+Solid+Waste+Ma nagment#0%5Cnhttp://scholar.google.com/ scholar?hl=en&btnG=Search&q=intitle:Recovering+Resources+Cre.

34. UN-Habitat. 2021. *Waste Wise Cities Tool - Step by Step Guide to Assess a City's MSWM Performance through SDG indicator 11.6.1 Monitoring*. https://unhabitat.org/waste-wise-data

35. GIZ, University of Leeds, Eawag-Sandec, Wasteaware. 2020. User Manual: Waste Flow Diagram (WFD): A rapid assessment tool for mapping waste flows and quantifying plastic leakage. Version 1.0. Principal Investigator: Velis C.A. Research team: Cottom J., Zabaleta I., Zurbruegg C., Stretz J. and Blume S. Eschborn, Germany. http://plasticpollution.leeds.ac.uk

36. UNEP-IETC and GRID-Arendal (2019). Gender and waste nexus: experiences from Bhutan, Mongolia and Nepal

A1

Annex I: Linkages with Multilateral Environment agreements and existing reporting

A. Initiatives

I. Stockholm Convention on Persistent Organic Pollutants (POPs)

DATE OF ADOPTION:	22 MAY 2001 IN STOCKHOLM, SWEDEN
Date of entry into force:	17 May 2004
Number of signatories:	152
Number of parties:	182
Scope:	POPs

The Stockholm Convention is a global treaty designed to protect human health and the environment, leading to gradual decrease of the presence of **Persistent Organic Pollutants (POPs)** in the environment. Each Party to this Convention is required to adopt and implement measures aimed at reducing or eliminating the release of POPs into environment.[61] One of the most important obligation is to develop a plan for the implementation of a Party's obligations and reporting it under the Convention.

61 Stockholm Convention on POPs, as amended in 2009; also BRS Secretariat website: http://chm.pops.int/TheConvention/Overview/tabid/3351/Default.aspx , accessed on January 17, 2018

The main provisions of the Stockholm Convention are:

- *To prohibit* and/or *eliminate* the production and use; as well as the import and export of the intentionally produced POPs listed in **Annex A**[62], in accordance with the provisions of this Annex (i.e. restrictive conditions);
- *To restrict production* and *use*, as well as the import and export, of the intentionally produced POPs listed in **Annex B**, in accordance with the provisions of this Annex;
- *To reduce* or *eliminate* releases from unintentionally produced POPs listed in **Annex C**,
- *To ensure* that stockpiles and waste consisting of, containing or contaminated by POPs are managed in an environmentally sound manner.

II. Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal

DATE OF ADOPTION:	22 MARCH 1989 IN BASEL, SWITZERLAND
Date of entry into force:	05 May 1992
Number of signatories:	53
Number of parties:	186
Scope:	Hazardous waste and other waste

The main objective of the Basel Convention is to protect, by strict control, human health and the environment against the adverse effects which may result from the generation and management of hazardous waste. The Basel Convention recognizes the impacts of poor hazardous chemicals and waste management, particularly on vulnerable groups such as women and young children (UNEP, 2015).

Its scope of application covers a wide range of waste defined as "hazardous waste" based on their origin and/or composition and their characteristics, as well as two types of waste defined as "other waste" - household waste and incinerator ash.[63]

62 Annex A allows for the registration of specific exemptions for the production or use of listed POPs, in accordance with that Annex and Article 4, bearing in mind that special rules apply to PCBs.

63 Basel Convention website (BRS Secretariat): http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx, accessed on January 18, 2018

The three pillars of the Basel Convention:

- Minimize the generation of hazardous waste in terms of quantity and degree of hazard;
- Control/restrictions of transboundary movements of hazardous waste and other waste (conditions and the PIC procedure);
- Promote the environmentally sound management of hazardous waste.

The definition of **"hazardous waste"** provided in the Convention Article 1, paragraph 1:

- Waste that belongs to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III.

Annex I is further elaborated in Annexes VIII and IX that were adopted at COP-4. Waste listed in Annex VIII are presumed to be hazardous, while waste listed in Annex IX are presumed not to be hazardous. Annex III contains the list of hazardous characteristics, such as explosive, corrosive, poisonous or flammable.

Furthermore, Parties have specific obligations to transmit notifications of national definitions of "hazardous wastes" that are additional to the wastes listed in the Annexes of the Convention, thereby expanding the scope of the Convention. The definitions of hazardous and other wastes therefore may differ from one country to another.

The Basel Convention does not provide a definition of the term **"treatment"** but provides, in Annex IV to the Convention, a list of operations for the final disposal (coded D1-D15) and recovery (R1-R13) of hazardous wastes.

Parties to the Basel Convention submit data on transboundary movements of hazardous and other wastes for the purpose of disposal and/or recovery operations, listed in Annex IV, through their national annual reports. They also provide data on waste generation.

Under the Basel Convention, Parties are required to submit annual national reports (by the end of the year for the previous year), which include questions about the generation of hazardous and other waste, as well as imports and exports of hazardous and other wastes destined for reuse, recycling or recovery operations or final disposal. The Convention provides guidance on how to calculate the generation of the hazardous waste through the methodological guide for the development of inventories of hazardous waste and other waste under the Basel Convention and other specific methodologies for developing inventories on different types of hazardous waste.

In November 2013, the Secretariat launched the Electronic Reporting System (ERS) of the Basel Convention which is the tool to be used by Parties to submit their annual national reports.

Data collected through national reports:

- Data on the yearly basis;
- Focal Point and Competent Authority
- Waste controlled for transboundary movements
- Restrictions on transboundary movements
- Control procedure
- Disposal facilities within national jurisdiction
- Recovery facilities within national jurisdiction

III. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

DATE OF ADOPTION:	10 SEPTEMBER 1998 IN ROTTERDAM, NETHERLANDS
Date of entry into force:	24 February 2004
Number of signatories:	72
Number of parties:	160
Scope:	Banned or severely restricted chemicals (Annex III)

The main objectives of the Convention are:

I. to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm;
II. to contribute to the environmentally sound use of those hazardous chemicals, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties.

The Convention creates legally binding obligations for the implementation of the *Prior Informed Consent (PIC) procedure*.

Key aspects:

Annex II – Criteria for listing the banned or severely restricted chemicals in Annex III (done by Chemical Review Committee).

Annex III - List of Chemicals subject to the Prior Informed Consent Procedure (PIC).

The chemicals listed in Annex III include pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by two or more Parties and which the Conference of the Parties has decided to subject to the PIC procedure.

There are a total of 50 chemicals listed in Annex III, 34 pesticides (including 3 severely hazardous pesticide formulations), 15 industrial chemicals, and 1 chemical in both the pesticide and the industrial chemical categories.[64]

64 BRS Secretariat (Rotterdam Convention) http://www.pic.int/TheConvention/Overview/tabid/1044/language/en-US/Default.aspx, accessed on January 2017

IV. Minamata Convention on Mercury

DATE OF ADOPTION:	10 OCTOBER 2013 IN KUMAMOTO, JAPAN
Date of entry into force:	16 August 2017
Number of signatories:	128
Number of parties:	88
Scope:	Mercury

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds.

Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues.[65]

According to the Article 11 on Mercury Waste, the relevant definitions of the Basel Convention are applied to waste covered under the Minamata Convention. Parties to this Convention that are not Parties to the Basel Convention will use those definitions as guidance as applied to waste covered under this Convention.

The BRS Secretariat cooperates closely with the Secretariat of Minamata in areas of common interest to the Conventions, for instance, matters that are related to mercury wastes and their environmentally sound management, as set out in Article 11 of the Minamata Convention.

65 Official website of Minamata Convention http://mercuryconvention.org/Convention/tabid/3426/language/en-US/Default.aspx, accessed on January 2018

V. The Montreal Protocol on Substances that Deplete the Ozone Layer

DATE OF ADOPTION:	16 SEPTEMBER 1987 IN MONTREAL, CANADA
Date of entry into force:	01 January 1989
Number of signatories:	46
Parties that ratified:	197
Scope:	Substances that deplete the ozone layer

The Montreal Protocol on Substances that Deplete the Ozone Layer is a protocol to the Vienna Convention for the Protection of the Ozone Layer and was designed to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone layer.

The treaty is structured around several groups of *halogenated hydrocarbons* that deplete stratospheric ozone. All of the ozone depleting substances (ODSs) controlled by the Protocol contain either chlorine or bromine which harm the ozone layer. For each group, the protocol foresees a timetable on which the production of those substances must be eventually eliminated.

For the purpose of this Protocol and a correct understanding, a **controlled substance** means a substance in Annex A, B, C, E or F to this Protocol, whether existing alone or in a mixture. **Production** means the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties and minus the amount entirely used as feedstock in the manufacture of other chemicals. The amount recycled and reused is not to be considered as "production". **Consumption** means production plus imports minus exports of controlled substances.[66]

66 Ozone Secretariat website http://ozone.unep.org/en/handbook-montreal-protocol-substances-deplete-ozone-layer/7, accessed on February 2018

VI. Strategic Approach to International Chemicals Management (SAICM)

DATE OF ADOPTION:	06 FEBRUARY 2006 IN DUBAI (ICCM 1)
Scope:	2020 goal for sound management of chemicals

The Strategic Approach to International Chemicals Management (SAICM) is a policy framework to promote chemical safety around the world. The overall objective consists of achievement of the sound management of chemicals throughout their life cycle so that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health (2020 goal agreed at the 2002 Johannesburg World Summit on Sustainable Development).[67]

SAICM includes two important documents, which are the *Dubai Declaration on International Chemicals Management*, expressing high-level political commitment to SAICM, and an *Overarching Policy Strategy* which sets out its scope, needs, objectives, financial considerations underlying principles and approaches, and implementation and review arrangements.

Objectives are grouped under five themes:

- Risk reduction;
- Knowledge and information;
- Governance;
- Capacity-building and technical cooperation;
- Illegal international traffic.

A **Global Plan of Action** has been developed based on the Declaration and Strategy and inserted in the whole SAICM document. This Plan serves as a working tool and guidance document to support implementation of SAICM and other relevant international instruments and initiatives. Activities in the plan are to be implemented, as appropriate, by stakeholders, according to their applicability.

The Annex III of the Resolution of 2nd Session of the International Conference on Chemicals Management within SAICM document provides modalities for reporting by stakeholders on progress in implementation of the SAICM indicators. The data is collected from stakeholders by using an electronic data collection tool, developed by the Secretariat. A single set of indicators is proposed for all stakeholders: Governments, intergovernmental/ non-governmental organizations and are structured in such a way that can take advantage of existing reporting mechanisms and avoid duplication with reporting to other multilateral environmental agreements.

The table below provides the list of indicators for reporting by stakeholders on progress in the implementation of the SAICM. This data is collected nationally and monitored at the regional and global

67 SAICM official website http://www.saicm.org/About/SAICMOverview/tabid/5522/language/en-US/Default.aspx, accessed in February 2018

levels. Each of the indicators has a clear guidance on what is measured and what type of information is required. A preliminary guidance can be found in the SAICM document.[68]

VII. EUROSTAT

Eurostat's mission is to process and publish statistical information and to provide high quality data for Europe and to enable comparisons between countries and regions.

Eurostat's environmental statistics provides indicators for each of the following topics: air emissions, waste, water, biodiversity, hazardous substances.

In this regard, it has been developed an **Environmental Indicator Catalogue** which was last updated on May 24, 2017.[69] Currently, the catalogue includes indicators produced mainly by Eurostat and the European Environment Agency (EEA), but also some indicators from the Commission's Joint Research Centre (JRC) and other international sources.

The set of waste management indicators is based on waste treatment data collected under *Regulation (EC) No 2150/2002 on waste statistics*. The data are adjusted for imports and exports using international trade statistics (COMEXT data) or national data on imports and exports of waste. The indicator set is available for every second year starting with reference year 2010 and covers the 28 EU Member States.

The table below provides information extracted from Environmental Indicator Catalogue specifically on waste and chemicals themes. Waste-related indicators belong to the sets of Sustainable Development Indicators (SDIs) and resource efficiency indicators used to monitor the EU's strategic targets for smart, sustainable and inclusive growth.

68 SAICM texts and resolutions of the International Conference on Chemicals Management, page 141 (Guidance for indicators)

69 Environmental indicator catalogue. Indicator Profiles. Eurostat metadata. http://ec.europa.eu/eurostat/web/environment/environmental-indicator-catalogue, accessed in February 2018. The catalogue is organized according to environmental themes, sub-themes and indicators under each sub-theme. For each indicator there are clickable links to its data and metadata.

TABLE I.A.1: Waste and Chemicals themes, sub-themes and related indicators extracted from the Environmental Indicator Catalogue

THEME	SUB-THEME	INDICATOR NAME (PRODUCER AND INDICATOR CODE)
Waste	e-Waste	Recycling rate of e-waste (Eurostat_t2020_rt130)*
		Waste electrical and electronic equipment (EEA_WST003)
	Hazardous waste	Generation of hazardous waste by economic activity* (Eurostat_tsdpc250)
	Municipal waste	Municipal waste generation and treatment, by type of treatment method* (Eurostat_tsdpc240)*
		Recycling rate of municipal waste* (Eurostat_t2020_rt120)
	Packaging waste	Recovery rate of packaging waste (Eurostat_ten00062)
		Recycling rate of packaging waste* (Eurostat_ten00063)
	Waste excluding major mineral waste	Generation of waste excluding major mineral waste* (Eurostat_tsdpc210)
		Landfill rate of waste excluding major mineral waste (Eurostat_t2020_rt110)
	Waste generation and management	Waste generation (EEA_CSI041/WST004)
		Generation of waste by economic activity (Eurostat_ten00106)
		Generation of waste by waste category (Eurostat_ten00018)
		Large combustion plants operating in Europe (EEA_INDP001)
		Management of waste excluding major mineral waste, by waste operations - pilot project data (Eurostat_env_wasoper)
		Waste recycling (EEA_CSI052/WST005)
Chemicals	Environmentally harmful or toxic substances	Production of toxic chemicals, by toxicity class (Eurostat_tsdph320)

Short descriptions of the above-mentioned indicators marked with asterisk (*)[70]

- Recycling rate of e-waste (Eurostat_t2020_rt130): It presents the "collection rate" multiplied by the "reuse and recycling rate". This indicator considers the entire chain from put on the market, collection and treatment.The "collection rate" equals the volumes collected of E-WASTE in the reference year divided by the average sum of EEE (electrical and electronic equipment) put on the market in the previous three years. The "reuse and recycling rate" is calculated by dividing the weight of the E-WASTE that enters the recycling/preparing for re-use facility by the weight of total treatment of E-WASTE.

- Generation of hazardous waste by economic activity (Eurostat_tsdpc250): It presents the amount of hazardous waste generated in the EU-28 and per Member State, expressed in **kg per capita and year**. The indicator covers hazardous waste from all economic sectors (all NACE activities) and from households, including waste from waste treatment (secondary waste). The indicator covers all waste that is classified as hazardous according to the definition of the Waste Framework Directive (Directive 2008/98/EC) and, accordingly, excludes radioactive waste.

- Municipal waste generation and treatment, by type of treatment method (Eurostat_tsdpc240)[71]: 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; this part of municipal waste may vary from municipality to municipality and from country to country, depending on the local waste management system. For areas not covered by a municipal waste collection scheme the amount of waste generated is estimated.

  This indicator consists of a set of three indicators: **municipal waste generated, municipal treatment** and **municipal waste treatment by type of treatment method:**

  - Recycling (including composting);
  - Incineration D10 (including energy recovery R1);
  - Landfilling.

  The amounts are expressed in **kilograms per capita**. The annual amount of waste is divided by the average population of the relevant year. The amount of municipal waste generated consists of waste collected by or on behalf of municipal authorities and disposed of through the waste management system. For areas not covered by a municipal waste collection scheme the amount of waste generated is estimated.

  Coverage: The data do not include waste from agriculture, from industries, from the municipal sewage network and treatment, as well as municipal construction and demolition waste. The data on waste treatment usually report the first treatment step, which possibly follows pre-treatment activities (like sorting, drying). These are not reported.

70 Descriptions from the Environmental Indicator Catalogue. Indicator Profiles. Eurostat metadata. Also, http://ec.europa.eu/eurostat/web/waste/indicators, accessed in March 2018

71 For a detailed description of the methodology, refer to the Manual on waste statistics-A handbook for data collection on waste generation and treatment – 2013 edition, http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015

Data on municipal waste are collected via the Eurostat/OECD Joint Questionnaire.

- Recycling rate of municipal waste (Eurostat_t2020_rt120): The recycling rate, expressed in **percentage**, means the total quantity of recycled municipal waste divided by the total quantity of generated municipal waste. It includes material recycling, composting and anaerobic digestion. The Member states report each year the amount recycled and the total municipal waste generated to Eurostat.

- Recycling rate of packaging waste (Eurostat_ten00063): "Recycling rate" (in percentage) means the total quantity of recycled packaging waste, divided by the total quantity of generated packaging waste per year. The packaging and packaging waste data are broken down by material.

  All packaging waste are covered, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used.

  The statistical units are households and all economic activities in accordance to NACE Rev 2 that generate or treat waste.

  Note: Packaging waste generated in another Member State or outside the Community which is sent for recycling to a Member State is not counted as recycled in the Member State to which this packaging waste was sent. Member States are transmitting data and methodology report by filling in web forms through eDAMIS platform.

- Generation of waste excluding major mineral waste (Eurostat_tsdpc210): The indicator presents the amount of waste, excluding major mineral wastes, generated in the EU 28, expressed in **kg per inhabitant and year**. The indicator allows to monitor waste generation over time for the EU as a whole and to compare the development of waste generation across countries.

  The indicator covers hazardous and non-hazardous waste from all economic sectors and from households, including waste from waste treatment (secondary waste) but excluding most mineral waste.

  The indicator is based on data compiled according to the waste categories listed in Annex I to the Waste Statistics Regulation (Regulation 2150/2002/EC). The indicator covers all wastes except the following waste categories:

  - Mineral wastes
  - Soils
  - Dredging spoils

VIII. Food Loss and Waste Accounting and Reporting Standard

The international Food Loss and Waste Accounting and Reporting Standard (FLWS, ibid) was developed in 2016 to provide consistency in reporting data using a common set of requirements. It requires describing the quantification method used and does not require use of a specific quantification method. It is broad enough to allow for reporting by individuals or by countries.

The stepwise approach described above goes beyond the intention of the FLWS by specifying types of methods appropriate for each level of reporting

at a national level and is broadly compatible with the FLWS in other regards. The influence of the FLWS can be seen in the terms and diagrams used in this document.

The reporting framework requires five types of information:

1. Level of quantification approach
2. Quantification method(s) type chosen
3. Scope of the data produced
4. Quantity of food waste in the appropriate unit for the Level of approach
5. Metadata: Size of the survey sample and other metadata on how data was collected

The information reported under the method used and scope of the data produced will vary depending on the Level used. A reporting template will be developed to enable countries to submit the required information to UNEP and will be compatible with the requirements of the FLWS.

IX. UNSD

UNDS collects significant amounts of data related, inter-alia, to the SDG indicators. Countries submit national data through filling out a questionnaire. The Questionnaire on Environment Statistics is part of the biennial UNSD data collection from all countries except those that are covered by the Joint OECD/Eurostat Questionnaire.

The UNSD Questionnaire 2004 on Environment Statistics contains tables under the headings Water, Air, Waste and Land. The UNSD Questionnaire 2006 onwards contain tables under the headings Water and Waste.

UNSD/UNEP Questionnaire 2020 on Environment Statistics (waste section) contains 7 tables in which countries are to fill in data for each year. The tables refer to:

- **Table R1** – Generation of Waste by Source. The following categories of sources are included:
  - Agriculture, forestry and fishing (ISIC 01-03)
  - Mining and quarrying (ISIC 05-09)
  - Manufacturing (ISIC 10-33)
  - Electricity, gas, steam and air conditioning supply (ISIC 35)
  - Construction (ISIC 41-43)
  - Other economic activities excluding ISIC 38 (ISIC 38 = waste collection, treatment and disposal activities; materials recovery)
  - Household
- **Table R2** – Management of hazardous waste. The following data are included in this table:
  - a) Stock of hazardous waste at the beginning of the year
  - b) Hazardous waste generated during the year
  - c) Hazardous waste imported during the year
  - d) Hazardous waste exported during the year
  - e) Hazardous waste treated or disposed of during the year (include recycling, incineration – total and incineration with energy recovery, landfilling and other – to be specified by reporting country)
  - Stock of hazardous waste at the end of the year = a) + b) + c) – d) – e)

- **Tables R3 to R5** focus on municipal solid waste:
  - R3: Management of municipal waste (collected from households and other origins, imported/exported for treatment/disposal, amounts going to recycling, composting, incineration total and with energy recovery, landfilling total and controlled landfilling, other (to be specified), and population served by collection services (total, urban and rural))
  - R4: Composition of municipal waste in %: paper, textiles, plastics, glass, metals, other inorganic, organic total and food and garden waste fraction of the organic
  - R5: Management of municipal waste - city data (population, % of population served by collection services, amounts collected from households/other origins, amounts going to recycling, composting, incineration total and with energy recovery, landfilling total and controlled landfilling, other (to be specified))

- **Table R6** focuses on electronic waste: The table includes variables on the total e-waste generated and the total e-waste collected. It also includes:
  - Amounts generated of: Large equipment; Screens, monitors, and equipment containing screens; Temperature exchange equipment (cooling and freezing equipment); Small E-waste; Small e-waste (of which: lamps); Small e-waste (of which: small equipment); Small e-waste (of which: small IT and telecommunication equipment); and
  - Amounts collected of: Large equipment; Screens, monitors, and equipment containing screens; Temperature exchange equipment (cooling and freezing equipment); Small E-waste; Small e-waste (of which: lamps); Small e-waste (of which: small equipment); Small e-waste (of which: small IT and telecommunication equipment).

- **Table R7:** Supplementary information sheet:
  - This sheet includes national definitions for waste, hazardous waste, municipal waste or other complementary information on waste which could be of help in interpreting the data.

X. UNECE

UNECE acknowledges on their website[72] that "data on the generation, use, disposal and environmental effects of wastes are unreliable in many countries of Eastern Europe, the Caucasus and Central Asia and do not meet priority demands.

Some important waste streams are not properly monitored. Inventories are lacking in several countries of waste of high potential hazard, which were and continue to be dumped on landfill sites, especially in rural areas. Data quality is often uncertain; data collected is often incomplete; little work has been done to analyse or synthesize data for policy development and assessment through appropriate indicators."

72 UNECE website, https://www.unece.org/env/europe/monitoring/waste_en.html, accessed January 2018.

XI. United Nations University-Vie-SCYCLE

The United Nations University-Vice rectorate in Europe, Team sustainable cycles (UNU-ViE-SCYCLE) has its mission to promote sustainable societies, with a prime focus on the development of sustainable production, consumption and disposal patterns for electrical and electronic equipment and other ubiquitous goods. The UNU supported the European Union in the recast of the WEEE-Directive, and the calculation of the statistical targets and the development of statistical tools for the EU Member States.

The SCYCLE team leads the taskforce on e-waste statistics from the Partnership for Measuring ICT for development. Under this Partnership, global guidelines on e-waste statistics have been developed, undergone public consultation, and were published. In 2017, SCYCLE formed the e-waste statistics Partnership together with International Telecommunication Unit (ITU) and International Solid Waste Association (ISWA). This Partnership has published the Global E-waste Monitor 2017 to increase awareness and draw attention to the growing issue of electronic waste and e-waste statistics. The objectives of the Global E-waste Statistics Partnership are to collect data, perform capacity building, and communicate the e-waste data to policy makers, researchers and the general public. The Global E-waste Statistics Partnership hosts the global database on e-waste, and which is expected to go live in the end of 2018.

Data compiled in the UNU statistics database includes:

- **EEE Put on the market and E-waste generated estimates**
  - Totals
    - 177 countries in the world
    - Time series: 1995-2016
  - Disaggregated to 6 e-waste categories EU → public. Rest of the world (internal dataset, but can be disclosed in the future)
    - 178 countries in the world
    - Time series: 1995-2016

- **E-waste collected and recycled**
  - 47 countries

- **National E-waste legislation in countries**
  - 67 countries in the world
  - Time series: 2014-2017

- **Statistics on E-waste imports and exports are currently being assess based on estimates based on Basel Convention**

The method that UNU developed to estimate e-waste flows is programmed together with Statistics Netherlands. It can be expanded to other materials to estimate other waste flows based on domestic production, import/export statistics and lifespans.

XII. 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. This indicator is measured in **thousand tonnes** and in **kilograms per capita**.[73]

Generated Municipal Waste data has been collected from 36 Countries, since 1975, with variations across the number of countries reporting each year:

- **Europe:** Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom
- **Asia, Australia& Oceania:** Australia, Israel, Japan, Korea, New Zealand, Russia,
- **Americas:** Chile, Colombia, Costa Rica, Mexico, United States

Non-OECD economies reporting data on municipal waste generated, up to 2012 included Brazil, China, Indonesia and Russia.

Data compiled in the OECD statistics database includes[74]:

- **Generation of waste by sector**
  This dataset presents waste produced by the various sectors of economic activity (agriculture, mining and quarrying, manufacturing industry, energy production, water purification and distribution, construction, etc.). The disaggregation of waste by sector follows the major divisions of International Standard Industrial Classification (ISIC) revision 4.

- **Municipal waste generated**
  - By origin (from households/other);
  - By type of waste (household and similar waste; bulky waste; electric and electronic equipment waste).

- **Municipal waste treated**
  - Amount designated for recovery operations (recycling, composting, incineration with energy recovery, other recovery);
  - Disposal operations (incineration without energy recovery, landfill, other disposal);
  - Total incineration.

- **Municipal waste generated per capita Total treatment (%)**
  - % material recovery = recycling + composting;
  - % recycling;
  - % incineration with and without energy recovery respectively;
  - % incineration;
  - % landfill.

This dataset shows data provided by Member countries' authorities through the joint OECD/ Eurostat questionnaire on the state of the environment.

The most consistent data is generally reported by high income countries. Reports often include incomplete data or breaks in reporting, estimated values or national estimates. The data is usually collected directly or indirectly from countries' official

73 OECD Data https://data.oecd.org/waste/municipal-waste.htm, accessed in February 2018

74 OECD Stat http://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG#, accessed in February 2018

statistics producers via questionnaires, web queries, online platforms and/or via SDMX.

These activities are also often carried out in association with other international organisations (e.g. Eurostat, UNSD, etc.). Over the long term, the OECD strategy is to collect data and metadata via SDMX as the most efficient and effective solution for countries, not only in their dealings with the OECD but also for responding to demands of other international organisations and exchanging data with major users.

XIII. System of Environmental-Economic Accounts: Waste Flow Accounts and Material Flow Accounts

The System of Environmental-Economic Accounting (SEEA) Central Framework[75] was reviewed to understand the point of potential connection to indicator 12.5.1 National Recycling Rate. The use of the SEEA framework allows robust indicators to be established for the consumption of resources relative to economic indicators such as output and value added, since there is a parallel in the underlying accounting principles.

Among the different subsystems developed within the broad supply and use of Central Framework, two key aspects were of interest related to the Physical flow accounts, namely:

- Waste Flow Account (WFA)
- Material Flow Accounts (MFA)[76]

However, in all subsystems, the scope of physical flow accounting includes flows from the environment to the economy, flows within the economy and flows back to the environment – three key flows: natural inputs, products and residuals.

- Waste Flow Account

Waste Flow Account is an accounting based on statistical data on generated, recycled, incinerated, otherwise treated and disposed waste amounts based on waste statistics. The types of solid waste are based on the European Waste Catalogue – Statistical Version.

As these accounts are built based on already collected waste statistics, using the same data and presenting these in a different way, namely in the Physical Supply and Use Tables that are a basic approach in the SEEA, available database on waste accounts is not of particular use for the National Recycling Rate indicator 12.5.1.

Definitions are given in SEEA central framework for solid waste and also hazardous waste and low-level radioactive waste as a fractions of solid waste. The following solid waste streams are acknowledged:

- Chemical and healthcare waste
- Radioactive waste
- Metallic waste
- Non-metallic recyclables
- Discarded equipment and vehicles
- Animal and vegetal wastes

75 System of Environmental-Economic Accounting Central Framework. Edited by the EC, FAO, IMF, OECD, UN, WB, 2012

76 Material flow accounting includes the recording of physical flows of products, air emissions, solid waste and other residual flows

- Combustion wastes
- Other wastes

Example on waste accounting from Denmark[77]: Waste accounts record how much waste is generated in different parts of the economy, what kind of waste it is and how it is treated. Imports and exports of waste are also covered. Waste accounts measure the amounts of generated waste distributed to 117 industry groups. The industry groups are the same as in the Danish National Accounts. These are based on the national version of NACE rev. 2, with a limited number of deviations. Within the industry groups, waste is distributed according to categories and forms of treatment. Imports and exports of waste are distributed according to form of treatment and waste category.

The purpose of the Economy-Wide Material Flow Accounts (EW-MFA)[78] is to provide an aggregate overview in tonnes, of the material inputs and outputs of an economy including inputs from the environment, outputs to the environment, and the physical amounts of imports and exports.

This is the basis from which a variety of material flow based indicators can be derived. Indicators that are grouped into input, consumption and output. The document refers to two main sources on more detailed information on MFA in relevant Eurostat and OECD publications.

Flows not statistically captured, according to the EW-MFA, includes packaging waste. Some material flows are not statistically observed. Indirect flows associated to imports or exports are generally not available from official sources and must be estimated. For imports and exports the packaging materials are often not recorded by foreign trade statistics. For domestic extraction, all materials are counted as direct material inputs (DMI) that have an economic use (including own use) but not all of these materials are actually marketed and appear in official statistics. The main categories of flows usually not captured by data sources are presented below.

Regarding the imports, recorded is the mass of commodities that cross the economy's border. The basis of the accounting of imports and exports is the official foreign trade statistics which gives data in monetary as well as physical units. Foreign trade statistics reports the net weight of traded commodities, excluding the weight of packaging materials.

In the European Council and Commission Regulations on intra-EU trade statistics (Intrastat) the net weight is defined as 'the actual mass of the good in kilograms excluding all packaging'. In practice, finished products may be recorded as they are sold in the shop. In the case of marmalade, for example, this would include the weight of the glass jars. Possible sources of data on packaging materials are the studies and analyses undertaken in Member States to fulfil the reporting obligations of the EU Packaging Directive.

Packaging coefficients for imports and exports is a tool useful for accounting.

The classification of materials used in EW-MFA and for which domestic material consumption (DMC) is calculated is a Eurostat based system. EW-MFA includes the material categories:

77 Denmark Statistics, Documentation of statistics for Waste Accounts for 2013 to 2015.

78 Economy-wide material flow accounts (EW-MFA) and derived indicators. A methodological guide. Eurostat 2001

- Biomass;
- Metal ores;
- Non-metallic minerals;
- Fossil energy materials/carriers;
- Other products;
- Waste for final treatment and disposal.

It is important to note that the term "consumption" as used in DMC denotes apparent consumption and not final consumption. DMC does not include upstream hidden flows related to imports and exports of raw materials and products.

XIV. World Bank - What A Waste

"What a Waste" (WaW) publication is a global review of Solid Waste Management produced by the World Bank's Urban Development and Local Government Unit of the Sustainable Development Network.

The first publication was released in 1999 and the second WaW report was published in 2012 with the objective to provide the status of today's global solid waste management practices: municipal solid waste generation, composition, collection data and disposal methods by city, by country and by region. It compiles solid waste management data from various sources and publications and examines the data to provide meaningful trends and assessments for policy makers and researches.

Both developing and developed countries were included. Also, the 2012 report makes projections on MSW generation and composition on a country and regional level for 2025, based on expected population and economic growth rates.

Although WaW reports are intended to present a broad global review, it provides decision makers with a sufficient foundation for waste management policy decisions.

Both WaW publications (1999 and 2012) are primarily focused on municipal solid waste, as defined, it encompasses residential, industrial, commercial, institutional, municipal and construction and demolition (C&D) waste. The report provides the types of generated solid waste according to sources, including also the hazardous waste (e.g. paints, aerosols, gas tanks, waste containing mercury, motor oil, cleaning agents, sharps, instruments, chemicals, pesticides).

- **Regarding municipal waste generation data**
  The waste generation data are presented in the report mostly as per capita (kg/capita/day) and total (tonnes/day). MSW generation data provided in the report were collected from official government publications, reports by international agencies, articles in peer-reviewed journals (i.e. data for high-income countries are from OECD publications; countries in Latin America and the Caribbean from PAHO studies; and some Middle Eastern countries from METAP data; other important sources used: UNSD, USAID, EEA, UNE, etc.).

  In cases where only per capita waste generation rates were available, the total urban population for that year (World Bank, World Development Indicators) was used to calculate the total urban MSW generation.

- **Regarding municipal waste disposal data**
  The waste disposal data sets, used in the report, are

generally available as percentages of the various waste disposal options, commonly divided into the following categories: dumps, landfills, compost, recycled, incineration, anaerobic digestion, other. Each waste disposal category was calculated using waste generation figures for the individual country.

In low- and middle-income countries, MSW is often dumped in low-lying areas and land adjacent to slums. Lack of enforced regulations enables hazardous waste to be mixed with MSW, which is harmful to human health and the environment.

The next WaW publication – A Global Snapshot of Solid Waste Management to 2050 (published on 20 September 2018)[79] foresee the inclusion of data regarding the total weight of hazardous waste (tonnes per year) within special waste amounts category, generated at country level. The publication defines municipal solid waste as residential, commercial and institutional waste. Industrial, medical, hazardous, electronic, construction and demolition waste are reported separately from total national waste generation to the extent possible.

XV. Waste Atlas

The Waste Atlas[80] was developed as a non-commercial initiative involving D-Waste consultants, the University of Leeds, the International Solid Waste Association, GIZ/SWEEP-Net, the Waste to Energy Research Council (WTERT) and the Solid Waste Network of Asian and Pacific Islands.

The Atlas is a web access map that visualizes municipal solid waste management data from all over the world. It aims to provide free and easy access to waste management data and relevant documents for comparison and benchmarking purposes between countries, cities and waste management systems.

Waste Atlas already includes data for: 164 countries, 1799 cities, 1626 sanitary landfills, 93 dumpsites, 130 Mechanical Biological Treatment units (MBT), 78 Biological Treatment, 716 Waste-to-Energy plants.

The second heading **"Visualizations"** within the platform provides options to choose one of the indicators in order to visualize data on the map as per selected country. The indicators are:

- Collection coverage (%) – the amount of MSW collected as a proportion of total MSW generated;
- Environmental stress (ton of MSW/km2) - the amount of the municipal solid waste generated in a country divided by country's area, expressed in tonnes/km^2.
- Organic, paper, plastic (%) – the percentage in the country's waste composition;
- Recycling rate (%) – the amount of MSW recycled as a proportion of total MSW generated;
- Unsound disposal (%) – the percentage of total MSW generated that is disposed or burnt in controlled and uncontrolled dumpsites;
- Waste generation per capita (kg/yr.) – the average amount of MSW generated annually per person;

79 https://openknowledge.worldbank.org/handle/10986/30317, accessed in October 2018

80 The Waste Atlas http://www.atlas.d-waste.com/, accessed in March 2018

- Waste intensive consumption (kg/$) – the amount of MSW generated in a country per dollar of household consumption expenditure.

The **"Global Charts"** heading provide graphs that correlate waste management parameters vs. economic and social parameters. **"Charts"** heading gives access to customized charts based on Waste Atlas data. **"Global Waste Clock"** – is a clock counting the waste generated globally second by second (started counting from 2012). The platform also provides **"Country Profiles"**, automatic generated up-to-date country waste profiles for all available countries on the Atlas, and other headings.

B. Current status of reporting

I. Stockholm Convention reporting

Proportion of reporting parties

Overall, only 43% of the Parties reported in the fourth and third cycle as compared to 56% in the second and 34% in the first *(see table below)*.

The decrease in the number of reports submitted by Parties between the 2nd and the 3rd cycle can be explained, among other challenges, by the difficulties in accessing and using the new electronic reporting system. There has been a slight increase of 2% in the 4th reporting cycle from 16 to 18%. Most of the Parties that submitted national reports (64-95%) have successfully completed their National Implementation Plans (NIPs). The majority of Parties had difficulties in providing complete national reports and/or provided data that was clearly erroneous or inconsistent.

The below table provides an overview on the number of reports received in each of the reporting cycles:

TABLE I.B.1: Number of national reports received in each of the reporting cycles as of 02 October 2020

	1ST REPORTING CYCLE	2ND REPORTING CYCLE	3RD REPORTING CYCLE	4TH REPORTING CYCLE
Number of reporting parties	45	95	77	80
Number of parties at that date	131	171	179	184
Overall percentage of reporting parties	**34%**	**56%**	**43%**	**43%**

The total number of parties who submitted NIPs before the deadlines of the first, second and third national reporting cycles were: 59, 136, and 159, respectively. Those who submitted first, second and third national reports, had submitted NIPs at a high rate i.e. 64%, 92% and 95%, respectively. This indicates that majority of the Parties that submitted national reports have successfully completed their NIPs. Further, of the 38 parties that have not designated NFPs, 17 have never reported in any of the reporting cycles.

Proportion of parties indicating that information is not available for specific questions

The majority of parties have difficulties in providing complete reports, either by stating that information is not available to specific questions or not answering at all to certain questions.

As highlighted in sections II.B.1, II.B.2 and II.B.3 above, in addition to the completion of the report, the quality of the data is as important (e.g. inconsistencies among import and export data, gross errors that lead to evident outliers, reported data clearly not matching units). The lack of a validation step of reported data seems a major shortcoming.[81]

II. Basel Convention reporting

The Conference of the Parties has noted that the level of reporting appears to be declining and that lower levels of reporting occur in relation to data on the generation of hazardous and other wastes.

The problem of non-reporting, incomplete reporting or late reporting, has been acknowledged by the Conference of the Parties as being all the more serious because of the close link between the core obligations of the Convention and the obligation to submit national reports in accordance with paragraph 3 of Article 13 of the Convention. Among the difficulties encountered by parties in submitting information is the lack of availability of data and information (e.g. lack of inventory).[82]

Data on the generation of hazardous waste has been collected by the BRS Secretariat, however, the revised reporting format to be used as of 2016 provides that submission of data on waste generation is optional, which may reduce the number of submissions for this question.

The table below shows the ratio between the number of Parties to the Basel Convention in each of the UN geographical region and the number of Parties which transmitted their national reports within each of these regions.[83] The European Union is not considered in these numbers.

81 UNEP/POPS/COP.8/INF/40 Report on the effectiveness evaluation of the Stockholm Convention 2016, page 140

82 **Note |** A Methodological guide for the development of inventories of hazardous waste under the Basel Convention has been developed in order to provide guidance to the Competent Authorities and other stakeholders on the methods of developing national inventories for the preparation of the annual national reports.

83 BRS Secretariat website (Basel Convention) http://www.basel.int/Countries/NationalReporting/NationalReports/BC2018Reports/tabid/8202/Default.aspx , accessed on October 2020

TABLE I.B.2: The ratio between no. of Parties under the Basel Convention and no. of Parties that submitted national reports (as of 01 October 2020)

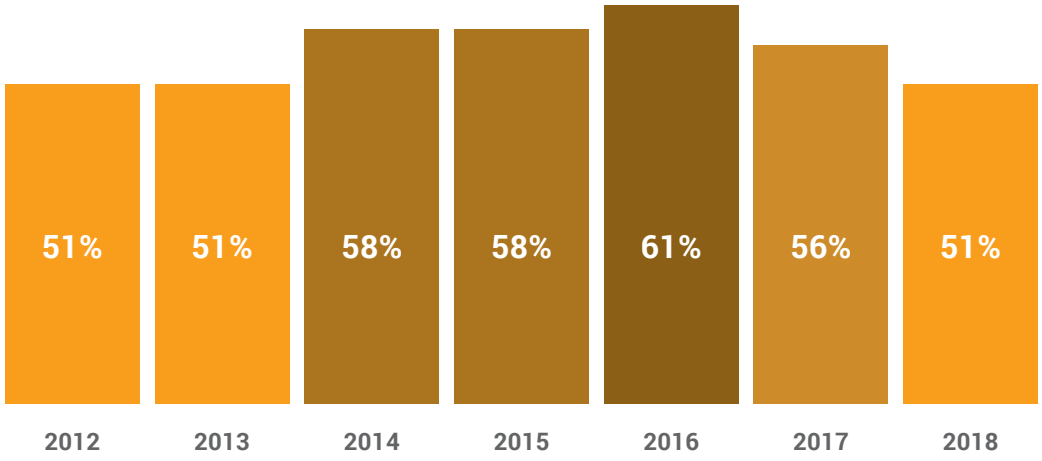
REGION	CONCEPT	2012	2013	2014	2015	2016	2017	2018
Africa	Number of Parties	50	50	51	51	51	53	53
	Reporting Parties	18	17	18	23	21	20	16
Asia and Pacific	Number of Parties	48	49	**49**	**51**	**52**	**52**	**52**
	Reporting Parties	22	22	29	27	30	29	25
Central and Eastern Europe	Number of Parties	22	22	22	22	22	22	22
	Reporting Parties	15	16	16	16	18	18	15
Latin America and Caribbean	Number of Parties	31	31	31	31	31	31	31
	Reporting Parties	16	16	20	18	21	16	15
Western Europe and Others	Number of Parties	27	27	27	27	27	27	27
	Reporting Parties	19	21	22	22	21	21	23

Number of countries that have submitted their National Reports:[84]

- 2015: 106 countries;
- 2016: 111 countries;
- 2017: 104 countries;
- 2018: 94 countries.

84 BRS Secretariat website: http://www.basel.int/Countries/NationalReporting/NationalReports/BC2018Reports/tabid/8202/Default.aspx , accessed on 02 October 2020

The below figure provides an overview on the reporting rates under the Basel Convention for 2012-2018 period.[85]



▲ **Figure I.B.1:** Reporting rates for 2012-2018

III. Rotterdam Convention reporting

According to the BRS Secretariat, national reporting under the Basel and Stockholm Conventions was one of the areas recommended by the Joint Working Group on enhancing cooperation and coordination among the Conventions.

The Rotterdam Convention does not foresee the obligation of national reporting. Nevertheless, Parties are discussing efforts and proposals to enhance the effectiveness of the Rotterdam Convention, including the process for listing chemicals in Annex III to the Convention.

If the effectiveness evaluation of the Basel and Stockholm Conventions is primarily based on reports submitted by each Party, in case of Rotterdam Convention the basis of the effectiveness evaluation or the attempt to improve the effectiveness, consists of information provided by Parties on priority actions to enhance the effectiveness and key information gaps related to such actions.

For this purpose, an online survey was developed and available (in 2017) to gather this information. The results of the survey[86] have been compiled by

85 BRS Secretariat (Juliette Voinov Kohler, Policy and Legal Advisor). Presentation on Basel Convention.

86 Results of the survey available online (version of 15 January 2018) http://www.pic.int/Implementation/EnhancingtheeffectivenessofRC/Onlinesurvey/tabid/6215/language/en-US/Default.aspx, accessed on January 2018

the Secretariat. Therefore, the Secretariat prepared a report[87] analysing the legal and operational implications of the priority actions received through the online survey. This report forms the basis of a set of prioritized recommendations and further steps for enhancing the effectiveness of the Convention.

IV. Minamata Convention reporting

According to the Article 22 of the Convention, the effectiveness evaluation based on monitoring reports, national reports submitted, etc. shall begin no later than six years after the date of entry into force of the Convention (16 August 2017).

In MC-1/8 on the Timing and format of reporting by the Parties, the Conference of the Parties at its first meeting (2017) agreed on the full format of reporting and decided that each Party shall report every four years using the full format and report every two years on four questions marked by an asterisk in the full format.

The Conference of the Parties further decided on the following timing with regards to the short and full reporting:

- Deadline for the first biennial short report: 31 December 2019
- Deadline for the first full report: 31 December 2021

V. SAICM reporting

The Policy Strategy within SAICM, in paragraph 24, foresees that the International Conference on Chemicals Management (ICCM) will undertake periodic reviews of SAICM. In this regard, it will receive reports from all relevant stakeholders on progress in SAICM implementation.

So far, the SAICM Secretariat developed a baseline report 2006-2008 and 3 progress reports[88]: first progress report (2009-2010), second progress report (2011-2013) and third progress report (2014-2016).

All SAICM stakeholders were invited to complete the online survey for the third progress report (2014-2016 reporting period) by 31 March 2018. The third meeting of the Open-ended Working Group requested the secretariat to develop a simple progress report for the period 2017–2019 and invited all the stakeholder groups to submit their progress reports to the International Conference on Chemical Management at its fifth session by 28 February 2020.

87 Report available online http://www.pic.int/Implementation/EnhancingtheeffectivenessoftheConvention/Reportonpriorityactions/tabid/6234/language/en-US/Default.aspx, accessed on January 2018

88 SAICM official website http://www.saicm.org/Implementation/Reporting/tabid/5462/language/en-US/Default.aspx, accessed in February 2018

According to the third Progress Report process for 2014-2016, submitted reports were received from 54 governments. This is an overall response rate of almost 28 per cent of the current 193 government member States of the UN General Assembly. That shows a reduction of 15 per cent of government participation from PR2.

The table below provides the number of stakeholder registrations and submissions for the third Progress Report.[89]

TABLE I.B.3: Numbers of stakeholder submissions – Progress Report 3

	PR3 (2014-2016)			PR2 (2011-2013) SUBMISSIONS
	COUNTRIES	SUBMITTING	NOT SUBMITTING	
Africa	54	3	51	10
Asia-Pacific	53	6	47	18
CEE	23	17	6	18
LAC	33	8	25	14
WEOG	30	20	10	23
Subtotals	193	54	139	83

Additionally, five Intergovernmental Organizations (OECD, UNDP, UNEP, UNITAR and WHO) submitted their full progress reports via the online questionnaire and four civil society non-governmental organizations.

Also, the third SAICM Progress Report provides a table regarding the top 9 selected individual activities across all questions within the third Progress Report process.

89 SAICM/OEWG.3/INF/4 Progress in SAICM implementation for 2014-2016, page 8

TABLE I.B.4: Top 9 individual activities reported by all respondents in PR3[90]

INDICATOR	QUESTION AND ACTIVITY DESCRIPTION	% RESPONDENTS SELECTING PR3
11	D2.1.1A The ministries are represented on your government only committee:	
	Environment	100.00%
	Health	100.00%
11	D2.1.2 (b) The interests represented on your multi-stakeholder committee:	
	Environment	93.94%
	Industry	93.94%
10	D1.1 Commitment to SAICM implementation over the 2014 to 2016 period:	
	Attendance at SAICM related meetings	91.30%
11	D2.1.2 (a) The types of stakeholders included on your multi-stakeholder committee:	
	Government	90.91%
2	B2.1 Address the waste management cycle:	
	Prevention/reduction in generation of hazardous waste	95.65%
	Collection and interim storage	89.13%
	Disposal	89.13%
1	B1.1.1 Programme to encourage compliance with mechanisms	89.13%
7	C2.1 Communicate chemical safety issues to:	
	Workers	89.13%
	The general public	86.96%
1	B1.1 Mechanisms to address key categories of chemicals:	
	Legislation/regulation	86.96%
	Policies	84.78%
	Programmes	89.13%
1	B1.2 Prioritize groups of chemicals for risk management:	
	Persistent organic pollutants	86.96%
	Mercury	86.96%
	Pesticides	86.96%

The above list may be an indication of respondents' key priorities, since they are acted upon by the most respondents.

90 SAICM/OEWG.3/INF/4 Progress in SAICM implementation for 2014-2016, page 64

VI. EUROSTAT reporting

The Regulation (EC) no. 2150/2002 on Waste Statistics sets out the data to be submitted by the Member States and the quality required, while the choice of the specific method for the elaboration of waste statistics is left to the discretion of the Member States.

Along with the data, Member States are required to submit a quality report which refer to quality elements commonly used in the European Statistical System[91]. Data and quality reports are to be submitted biennially to the Commission (Eurostat) within 18 months of the end of the reference year.[92]

The implementation report from 2016 provides the following data quality information:[93]

In total, 21 Member States and EEA/EFTA countries delivered their 2012 data sets and quality reports on time or within 1 month of the deadline. Both data and quality reports arrived more than 3 months after the deadline for 5 Member States (Denmark, Ireland, Italy, Lithuania and Romania) and 1 EEA/EFTA country (Iceland). Parts of data sets or quality reports arrived more than 3 months after the reporting deadline for 3 countries (Finland, Latvia and the United Kingdom).

The number of missing values and the number of countries reporting missing values fell considerably between the reference years 2010 and 2012 for the waste generation data set. In 2010, 8 countries reported missing values but this dropped to 3 in the reference year 2012. The total number of missing values fell from 4.1% in the reference year 2010 to 1.5% in 2012.

The tendency is the same for the waste treatment data, though less pronounced. The share of missing values fell from 3.5% in the reference year 2010 to 3.1% in 2012 and the number of countries reporting missing values decreased from 8 to 6.

More than half of the missing values in the waste treatment data sets (55%) concern the treatment category 'backfilling'. Backfilling data was collected for the first time in 2010 after an amendment of the Regulation.

91 Eurostat website on Quality: http://ec.europa.eu/eurostat/web/quality, accessed in March 2018

92 Eurostat waste database: https://ec.europa.eu/eurostat/web/waste/data/database

93 Report from the Commission to the European Parliament and the Council on statistics compiled pursuant to Regulation (EC) no. 2150/2002 on waste statistics and their quality_2016 Brussels

A2

Annex II: Methods appropriate for each food chain stage

The following methods have been deemed appropriate for each relevant food chain stage.

Manufacturing/processing

WASTE STREAM	APPROPRIATE MEASUREMENT METHODS	APPROPRIATE MEANS FOR NATIONAL GOVERNMENT TO OBTAIN THE MEASUREMENTS FROM COMPANIES
Food waste in a container (single stream – not mixed with other wastes)	Use of records specifying volume or weight e.g. from waste contractor Volume assessment Weighing, of whole containers or samples	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
Food waste in a container (mixed with other wastes)	Weighing, via waste composition analysis or trial weighing Volume assessment	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
Uncontained food waste (not mixed with other wastes and not discharged to sewer)	Weighing, of samples or entire stream depending on feasibility Volume assessment	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)

Waste discharged to sewer (Level III)	Use of biological / chemical oxygen demand (BOD and COD), suspended solids (SS). For further advice see: https://www.wrap.org.uk/sites/files/wrap/food-waste-in-effluent-guidelines_1.pd	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/ require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
All waste streams	Waste co-efficient applied to material flow Mass balance (i.e., inputs minus outputs)	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/ require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)

It is possible that food manufacture companies keep records of their waste already. Companies may call it something other than waste e.g. leakage, slippage, residue, etc. Therefore, a degree of relationship building and understanding between governments and food manufacturers/processors in the country may need to be built before either understands whether it is possible or not to use company records to build a national picture.

Informal food processing may not be at the scale necessary to quantify under 12.3.1a but this should be an informed decision. It is possible that informal processing occurs on farm or in some households as local business in rural areas. Food removed from the human supply chain in those cases may either be picked up in 12.3.1b or as part of in-home consumption under 'household' studies. If the latter, it may be useful to use diaries or surveys to determine how much food waste is likely to be discarded for that reason.

Retail (Formal and Informal)

WASTE STREAM	APPROPRIATE MEASUREMENT METHODS	APPROPRIATE MEANS FOR NATIONAL GOVERNMENT TO OBTAIN THE MEASUREMENTS FROM COMPANIES
Food waste in a container (single stream – not mixed with other wastes)	Use of records specifying volume or weight e.g. from waste contractor (direct measurement) Waste composition analysis Scanning items as they are wasted Volume assessment Weighing, of whole containers or samples	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
Food waste in a container (mixed with other wastes)	Use of records specifying volume or weight e.g. from waste contractor (direct measurement) Waste composition analysis Scanning items as they are wasted	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)

The methods appropriate for formal and informal retail differ slightly. First, informal retail is unlikely to keep records so weighing or volume assessments are necessary. Secondly, the manner of scaling any measurements for informal retail is likely to be difficult. If informal retail is a large proportion of food retail in a country, an effort will have to be made to quantify the number and type of informal food retailers across different geographic areas. This will help to determine a sample frame for the measurement studies and provide the basis for scaling. However, it is likely that the study on number and type of informal retailers will need to be repeated as a country's retail market changes between reporting periods.

Food Service (hospitality and food service including plate waste and within hospitals, etc., formal and informal)

WASTE STREAM	APPROPRIATE MEASUREMENT METHODS	APPROPRIATE MEANS FOR NATIONAL GOVERNMENT TO OBTAIN THE MEASUREMENTS FROM COMPANIES
Food waste in a container (single stream – not mixed with other wastes)	Use of records specifying volume or weight e.g. from waste contractor Scanning items as they are wasted	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
Food waste in a food waste-only container shared with other businesses or households	Volume assessment Weighing, of whole containers or samples *Intercepting waste when shared with other businesses or households*	
Food waste in a container (mixed with other wastes)	Weighing, via waste composition analysis or trial weighing Volume assessment *Intercepting waste when shared with other businesses or households*	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)
Food waste in a container mixed with other wastes and shared with other businesses or households		
Uncontained food waste (not mixed with other wastes and not discharged to sewer)	Weighing, via waste composition analysis or trial weighing Volume assessment	Use of nationally held records e.g. regulatory returns Audit (face-to-face survey) to take measurements Self-completion or telephone survey – to request/require provision of measurement data Data provision as part of a framework to tackle food waste (e.g., a voluntary agreement)

The diversity of entity types within this food chain stage is such that records are unlikely to cover them all. Larger public establishments like hospitals or schools may have records or can be more easily regulated than private organisations. The restaurant sector is likely to be diverse and made up of majority small and medium enterprises, many of which may be informal in certain countries. Appropriate methods for measurement are therefore likely to be volume assessments or weighing in a sample study over a series of site visits. The same challenges for scaling such measurement studies apply here as for

informal retail; getting as accurate an understanding of the quantity of waste producing entities as possible is as important as the measurement study and not likely to be easy. This is directly linked to SDG 11.6.1 and could be measured as part of a waste composition analysis.

Households

WASTE STREAM	APPROPRIATE MEASUREMENT METHODS	APPROPRIATE MEANS FOR NATIONAL GOVERNMENT TO OBTAIN THE MEASUREMENTS FROM COMPANIES
Food waste in a container (single stream – not mixed with other wastes)	Use of records specifying volume or weight e.g. from waste contractor Volume assessment Weighing, of whole containers or samples Food waste diaries	Commission organisation to conduct studies and scale up on behalf of governments Directly commission studies and maintain oversight of estimates
Food waste in a container (mixed with other wastes)	Weighing, via waste composition analysis or trial weighing (linked with SDG 11.6.1)	
Uncontained food waste (not mixed with other wastes and not discharged to sewer)	Weighing, via waste composition analysis or trial weighing (linked with SDG 11.6.1) Diaries Volume assessment	
Waste discharged to sewer (for Level III) and food home composted, animal feed	Diaries Diversion and weighing	

Methods most appropriate for households food waste vary by the destination of that waste. If generation and collection are equivalent, then a synthesis of waste composition analyses of samples of collected waste from around the country with the total waste collected figure can give a relatively accurate picture of food waste generated in the home without conducting a household study. However, this will ignore the amount of waste composted at home. These amounts, if likely to be a smaller part of the waste stream, are likely best quantified by a diary study and scaled via population demographic statistics e.g. number of households. If they are likely to be a larger part of the food waste generated from households, a direct measurement study may be more appropriate using in-home observers or measurement devices. This is directly linked to SDG 11.6.1 and could be measured as part of a waste composition analysis.

A3

Annex III: Data Assessment Tool

"The current tool was developed as part of UN Environment's efforts to collect data and assess the status of information available for drafting waste management related indicators, as part of the the 2030 Agenda for Sustainable Development and the subsequent SDGs.

Objective: The purpose of this tool is to collect information on waste management practices, to serve the following purposes:

1. Provide better understanding of waste management system characteristics and waste management practices for each responding country
2. Inform policy makers on challenges countries face in terms of waste management data generation and reporting
3. Provide insight on possible ways to facilitate the improvement of country reporting on waste management data

Instructions for filling in the data assessment tool: Please fill in the spaces marked in grey. In case no information is available, please leave space blank. Only fill in '0' where actual figures are zero. When quantities are asked in tonnes, these reffer to metric tonnes. "

Introduction

GENERAL INFORMATION		
Name		
Title		
Affiliation		
Contact information		
Country		
National Currency		
Date of filling in form (mm/yyyy)		
Relevant Waste Management Contacts in the country	<<Please provide names, positions, affiliations and contact details>>	
Please provide name and contact details for enytity responsible on reporting on SDGs	<<Please provide names, positions, affiliations and contact details>>	
Current Population of the country		**Inhabitants**
In which year was the population data collected?		
Surface of the country		**Square kilometers**

Glossary of terms

This section includes explanations and guidance on the terms used in this tool, which will clarify and facilitate the process of filling in the tables

Note | Please complete the list below with other terms you consider need defining

TERM	DEFINITION/ EXPLANATION	SOURCE
Waste	"Materials, substances or objects 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."	*UNSD-UNE Questionnaire 2016, adjusted*
Management of waste	Collection, transport, treatment and disposal of waste, including after-care of disposal sites. Waste management includes activities of the informal waste sector, and/or illegal disposal, open burning.	*UNSD-UNE Questionnaire 2016*
Municipal solid waste	"Municipal solid waste, collected by or on behalf of municipalities (both urban and rural), by public or private enterprises, includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, government buildings, etc.). 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. The definition includes waste that is self-collected and disposed by population, informally collected or captured by authorised collection or disposal entities by clean-up of unauthorised disposal to land or sea. Ideally, special waste streams (such as WEEE, hazardous waste, medical waste, etc.) should be excluded. In case such streams are included, please provide an indication in comments/footnotes explaining what types of waste are included in the quantity of Municipal Solid Waste "	*Adapted from UNSD-UNE Questionnaire 2016*
Landfilling	Final placement of waste into or onto the land in a controlled or uncontrolled way. The definition covers both landfilling in internal sites (i.e., where a generator of waste is carrying out its own waste disposal at the place of generation) and in external sites.	

TERM	DEFINITION/ EXPLANATION	SOURCE
Hazardous waste	"Hazardous waste definition will be considered based on the wastes covered by the Basel Convention. The Convention defines hazardous waste in Article 1, paragraph 1 (a) as the waste pertaining to any category listed in Annex I, unless they do not possess any of the characteristics contained in Annex III. Waste listed in Annex VIII are presumed to be hazardous, while waste listed in Annex IX are presumed not be hazardous. For the purpose of the SDGs, due to comparability reasons, additional wastes considered hazardous as per national definitions are excluded. In case excluding is not possible, a note in comments/ footnotes explaining what categories of hazardous waste are included, besides the ones covered by the Basel Convention should be inserted in the Data Collection Form."	*Basel Convention, adjusted*
Industrial waste	Waste generated from industry or related processes, irrespective if hazardous or non-hazardous	
Recycling	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. Recycling within industrial plants i.e., at the place of generation should be excluded.	*UNSD/OECD definition, adjusted*
Recycling rate	Proportion of material recycled in the country plus quantities exported for recycling out of total waste generated in the country.	*Global Chemicals and Waste Indicator Review document and Guidance on 12.4.2 and 12.5.1 indicators document (not yet published)*
Composting	Biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered and can be used to increase soil fertility.	*UNSD-UNEP Questionnaire 2016*
Anaerobic digestion	Managed decomposition of organic solid or liquid materials in the absence of air, often under pressure.	
EPR	Extended Producer Responsibility	

TERM	DEFINITION/ EXPLANATION	SOURCE
Multilateral Environmental Agreements (MEAs)	"MEAs are international conventions and treaties on environment and natural resources. These agreements between states may take the form of "soft-law", setting out non legally-binding principles which parties are obligated to consider when taking actions to address a particular environmental issue, or "hard-law" which specify legally-binding actions to be undertaken toward an environmental objective. Examples of MEAs: Basel Convention on hazardous waste; Stockholm Convention on Persisten Organic Pollutants; Minamata Concention on Mercury; UNFCCC Framework convention on Climate Change, etc."	
	WASTE TYPE	
Construction and demolition	Construction and demolition waste includes numerous materials and debris such as wood, concrete, metals, bricks, gypsum, plastic, solvents, glass, asbestos and other building components, excavated soil as well.	
Food/organic waste	Food waste, waste from kitchens, HORECA sector, etc.	
E-waste	Refers to all electrical and electronic equipment (EEE) and its parts that have been discarded by its owner as waste without the intent of re-use. The totals of e-waste are disaggregated into six main categories: (1) temperature exchange equipment; (2) screens and monitors (referred to as screens); (3) lamps; (4) large equipment; (5) small equipment; and (6) small IT and telecommunication equipment with an external dimension of less than 50 cm.	*UNU*
Batteries and accumulators	Spent or discarded batteries and accumulators, irrespective of the shape, type and source (zinc, alkaline, button alkaline, silver zinc, button zinc, lithium ion and all types of rechargable batteries and accumulators: Nickel-cadmium, NiMH (Nickel metal Hydride), Lithium, Lithium-Ion Polymer , Alkaline, chargeable Titanium, Lead SLI, Lead traction, Lead stationary, Nickel-iron, Nickel-zinc)	*Eurostat*
Medical and pharmaceutical waste	Medical waste is generated at healthcare facilities, and includes biomaterials, sharps, bandages, gloves and other medical instruments. Pharmaceutical waste includes expired medicine, discarded tablets, capsules, powders, etc., intended either for human or animal use.	
Chemicals, solvents, paints	Discarded or expired chemicals, solvents and paints, coming from industry, laboratories, manufacturing companies, households cleaning or upkeep products, etc.	
Non-hazardous industrial waste	Non-hazardous materials resulting from the industrial production of goods and products.	

1. Country information

NATIONAL AND INTERNATIONAL REPORTING		PROVIDE INFORMATION SOURCE
Which Multilateral Environmental Agreements (MEAs) has the country adhered to?	<<Comments>>	
On which of the above MEAs do you report data, and what data do you report on each?	<<Comments>>	
Which Bilateral or Regional Agreements has your country adhered to, which also adress waste management in general, and/or management of particular waste streams? When has your country adhered to these agreements?	<<Comments>>	
What waste-management data (in general and/or per particular waste stream or generating sector) do you report on the above-mentioned Bilateral or Regional Agreements, and with what frequency?	<<Comments>>	
In which year has your country responded to UNSD/UN Environment Questionnaire, and/or OECD/Eurostat Questionnaire	<<Comments>>	
"What data do you report based on national legislation? Who (which entity)reports this data to whom? "	<<Comments>>	
Please provide sources of available statistics (studies, reports, database) compiled by your country.	<<Comments>>	
"Is there an EPR system in your country and is related data available? What materials are covered by the EPR system?"	<<Comments>>	

NATIONAL AND INTERNATIONAL REPORTING		PROVIDE INFORMATION SOURCE
"What data do you report on city/ municipality level? Does this apply to all municipalities, or only to ones above certain size/ area? Please provide details. What is the frequency of reporting?"	<<Comments>>	
Is the reported data validated and if so what is the validation process?	<<Comments>>	
Is there any other waste related data you report (based on sub-regional agreements or agreements between cities)? If yes, please provide details on the type of data, frequency of reporting , entities reporting and destination of data.	<<Comments>>	

LEGISLATIVE AND POLICY FRAMEWORK			PROVIDE INFORMATION SOURCE
Is there a national law governing waste management in the country?	Yes | No	<<Additional Comments>>	
Are there any laws governing particular waste streams in the country? i.e. WEEE, packaging, hazardous waste, food waste, etc.	Yes | No	<<Additional Comments>>	
"What are the main national legal provisions in terms of waste management in general, and per waste type/stream/generating sector in particular? For example: What national legal provisions are in place for managing: • municipal solid waste and similar materials; • industrial, mining, hazardous and medical waste; • packaging, electronic waste, food waste; -etc.?"	<<Comments>>		

LEGISLATIVE AND POLICY FRAMEWORK			PROVIDE INFORMATION SOURCE
Does the country have a waste management strategy?	Yes | No	<<Additional Comments>>	
Does the country have waste strategies per specific waste streams/ sectors? Example: Does the country have a food-waste/hazardous waste/ packaging waste strategy?	Yes | No	<<Additional Comments>>	
Has the country adopted waste diversion or waste recycling rate targets, either general or per different waste streams?	Yes | No	<<Additional Comments>>	
Do municipalities/provinces/ districts/etc. have their own waste management rules and regulations?	Yes | No	<<Additional Comments>>	
Do municipalities have the obligation to prepare a waste management plan?	Yes | No	<<Additional Comments>>	
What is the percentage of municipalities who have a recent waste management plan (no older than 5 years)?	<<Comments>>		
Additional legislative and policy framework notes (Optional)			

INSTITUTIONAL FRAMEWORK			PROVIDE INFORMATION SOURCE
"Does the national government have an agency mandated to enforce solid waste laws and regulations? Please fill in the comments which institutions play the role of environmental regulator (permitting and enforcement)?"	Yes | No	<<Additional Comments>>	

INSTITUTIONAL FRAMEWORK			PROVIDE INFORMATION SOURCE
"What entity(s) is(are) responsible for the management of municipal solid waste? Please include reponsible entity for: • policy/planning/legislation • collection/treatment/disposal • enforcement/compliance • data reporting"	<<Comments>>		
"What entity(s) is(are) responsible for the management of industrial waste? Please include reponsible entity of: • policy/planning/legislation • collection/treatment/disposal • enforcement/compliance • data reporting"	<<Comments>>		
"What entity(s) is(are) responsible for the management of hazardous waste? Please include reponsible entitied for: • policy/planning/legislation • collection/treatment/disposal • enforcement/compliance • data reporting"	<<Comments>>		
"What entity(s) is(are) responsible for the food waste? Please include reponsible entity for: • policy/planning/legislation • collection/treatment/disposal • enforcement/compliance • data reporting"	<<Comments>>		
Do municipalities have have a department dedicated to waste management?	Yes | No	<<Additional Comments>>	
Do municipalities have waste management rules and by laws?	Yes | No	<<Additional Comments>>	
Do municipalities have a unit enforcing waste issues in the city such as littering or illegal dumping?	Yes | No	<<Additional Comments>>	

INSTITUTIONAL FRAMEWORK			PROVIDE INFORMATION SOURCE
Do municipalities have separate budget lines for waste management? Is this budget established at national or municipality level? Please provide explanations also in case of various set-ups.	Yes | No	<<Additional Comments>>	
List of international partners and NGOs currently working with municipalities and briefly describe each project	<<Comments>>		

DEFINITIONS		PROVIDE INFORMATION SOURCE
How is waste defined in your country?	<<Comments>>	
How is municipal waste defined in your country?	<<Comments>>	
How is hazardous waste defined in your country?	<<Comments>>	
How is food waste (or related terms, e.g. food loss) defined in your country?	<<Comments>>	
What streams of waste are automatically classified as hazardous waste in your country? (e.g medical waste, WEEE, etc.)	<<Comments>>	
How is recycling defined in your country?	<<Comments>>	
What materials are defined as "recyclables" in your country?	<<Comments>>	
What operations/technologies does recycling include in your country?	<<Comments>>	
"Is informal recycling captured in national recycling data? What are the estimates of informal recycling performance in your country?"	<<Comments>>	

2.Gaps and challenges

NATIONAL PRIORITIES			PROVIDE INFORMATION SOURCE
What do you consider to be the top priorities of your country in terms of waste management in general and per waste stream/source?	<<Comments>>		
Are there any plans or strategies in place adressing these priorities?	Yes | No	<<Additional Comments>>	
Is the elaboration of the above mentioned plans or strategies derived from international conventions your country has adhered to?	Yes | No	<<Additional Comments>>	

GAPS AND CHALLENGES		PROVIDE INFORMATION SOURCE
What do you consider to be the most significant gaps/challenges in terms of waste management data generation in general and per specific waste types/ streams/sources?	<<Comments>>	
What do you consider to be the most significant gaps/challenges in terms of waste management data collection?	<<Comments>>	
What do you consider to be the most significant gaps/challenges in terms of waste management data reporting?	<<Comments>>	
What do you consider to be appropriate solutions in overcoming the above mentioned gaps or challenges?	<<Comments>>	

	GAPS AND CHALLENGES	PROVIDE INFORMATION SOURCE
"Are there any projects with international participation currently under way, tackling the above mentioned gaps/ challenges? Please provide a brief description of these projects."	<<Comments>>	
"What do integovernmental agencies provide: financial assistance or technical assistance? What other entities provide financial assistance or technical assistance?"	<<Comments>>	
What are the priorities for reporting and tracking of waste and recycling processes in your country? What are the most important gaps in the collection and management of information and statistics on municipal, hazardous, organic, industrial waste, ad recovery or recycling?	<<Comments>>	

3. Reporting status

For each of the Bilateral, Regional, Multilateral or National Agreement/Convention/Standard/Reporting obligation mentioned in Section 1 - Country Information, please fill in the table below.

Please copy and paste the sample table below for as many times as necessary, in order to have one table for each convention/standard.

Name of Agreement/Convention/Standard/ National reporting obligation	<<Comments>>	
Type (provide comments on wether data reporting is obligatory or voluntary)	National Bilateral Regional Multilateral	<<Comments>>
Year of adherence/coming into force/ first year of reporting required	<<Comments>>	
Focal point/ Designated Competent Authority	<<Comments>>	
Frequency of reporting	<<Comments>>	
Year reporting started	<<Comments>>	
Waste data reported	<<Comments>>	
Level of dissagregation (i.e. national/city level, by generating sector, by waste type, per volume, per quantity)	<<Comments>>	
Responsible entity for collecting and reporting the data to national entities	<<Comments>>	
National entity to which the data is reported	<<Comments>>	
Responsible entity for data verification and validation and validation methodology.	<<Comments>>	
Responsible entity for data reporting to international entities	<<Comments>>	
International entity to which the data is reported	<<Comments>>	

4. Data collection form

Please fill in the forms below with latest available yearly data, which is most complete as per your expert judgement, however, not older than 2015.

Please provide all quantities in tonnes.

In case of unavailable data for certain table items, please leave space blank, and do not '0'. Only insert '0' for actual null values. Tonnes refer to metric tonnes.

Please insert the reference year for the data below:

WASTE GENERATION DATA	OUT OF WHICH, HAZARDOUS WASTE	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
Out of the above quantity of total generated waste, please provide:			

WASTE GENERATION DATA		OUT OF WHICH, HAZARDOUS WASTE	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE	
Out of the above quantity of total generated waste, please provide quantities divided per ISIC sector :					**Is waste from the below sectors captured in the MSW stream?**
Agriculture, forestry and fishing (ISIC 01-03)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Mining and quarrying (ISIC 05-09)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Manufacturing (ISIC 10-33)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Electricity, gas, steam and air conditioning supply (ISIC 35)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Construction (ISIC 41-43)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Wholesale and retail trade excluding motor vehicles (ISIC 46-47)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Accomodation and foodservice activities (ISIC 55-56)	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Other economic activities excluding ISIC 38	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No
Households	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>		Yes | No

WASTE GENERATION DATA		OUT OF WHICH, HAZARDOUS WASTE	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
Quantity of municipal waste generated	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>	
Quantity of non-hazardous industrial waste generated	<<Please insert quantity in tonnes>>		<<Please provide comments or explanations, if the case>>	
Generated waste unaccounted for				
Please estimate the quantity of generated waste which is unaccounted for	<<Please insert quantity in tonnes>>	<<Please insert quantity in tonnes>>	<<Please provide comments or explanations, if the case>>	

WASTE COLLECTION COVERAGE	QUANTITY OF WASTE IN TONNES				
WASTE STREAM	FORMALLY (BY APPOINTED ENTITIES)	INFORMALLY (BY WASTE PICKERS)	UNCOLLECTED	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
Total				<<Please provide comments>>	
Municipal waste				<<Please provide comments>>	
Hazardous waste				<<Please provide comments>>	
Non-hazardous industrial waste				<<Please provide comments>>	
Other (please specify in comments section)				<<Please provide comments>>	

WASTE TREATMENT AND DISPOSAL DATA	QUANTITY OF WASTE TREATED OR DISPOSED OF IN THE COUNTRY, PER OPERATION TYPE IN TONNES								
WASTE STREAM	RECYCLED	INCINERATED	INCINERATED WITH ENERGY RECOVERY	LANDFILLED TOTAL	LANDFILLED IN SANITARY LANDFILL	LANDFILLED IN UNCONTROLLED LANDFILL	OTHER (PLEASE SPECIFY IN COMMENTS)	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
Municipal waste								<<Please provide comments>>	
Hazardous waste								<<Please provide comments>>	
Non-hazardous industrial waste								<<Please provide comments>>	
Other (please specify in comments section)								<<Please provide comments>>	

WASTE RECYCLING DATA	QUANTITY OF WASTE (TONNES) RECYCLED, PER TYPE OF WASTE AND RECYCLING OPERATION					
WASTE TYPE	**TOTAL GENERATED**	**MATERIAL RECYCLING**	**ENERGY RECOVERY**	**OTHER (PLEASE PROVIDE INFORMATION IN COMMENTS)**	**COMMENTS**	**PROVIDE INFORMATION SOURCE AND DATE**
General recyclables						
Metal					<<Please provide comments>>	
Paper and cardboard					<<Please provide comments>>	
Plastic					<<Please provide comments>>	
Glass					<<Please provide comments>>	
Construction and Demolition					<<Please provide comments>>	
Textiles					<<Please provide comments>>	
Organic waste fractions						
Food / Organic waste					<<Please provide comments>>	
Yard / Garden / Green waste					<<Please provide comments>>	
Agricultural waste					<<Please provide comments>>	

WASTE RECYCLING DATA	QUANTITY OF WASTE (TONNES) RECYCLED, PER TYPE OF WASTE AND RECYCLING OPERATION					
Hazardous waste						
E-waste					<<Please provide comments>>	
Batteries and accumulators					<<Please provide comments>>	
Medical and pharmaceutical waste					<<Please provide comments>>	
Chemicals, solvents, paints					<<Please provide comments>>	
Other hazardous waste (please provide information in comments)					<<Please provide comments>>	
Other						
Wood					<<Please provide comments>>	
Rubber / Leather					<<Please provide comments>>	
Non hazardous Industrial waste					<<Please provide comments>>	
Other (please provide information in comments)					<<Please provide comments>>	

WASTE MOVEMENT DATA	QUANTITY OF WASTE (TONNES)				
WASTE STREAM	EXPORTED	COMMENTS	IMPORTED	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
Municipal waste		<<Please provide comments on purpose of export,, i.e. incineration, landfill, etc.>>		<<Please provide comments on purpose of import, i.e. incineration, landfill, etc.>>	
Hazardous waste		<<Please provide comments on purpose of export,, i.e. incineration, landfill, etc.>>		<<Please provide comments on purpose of import, i.e. incineration, landfill, etc.>>	
Non-hazardous industrial waste		<<Please provide comments on purpose of export,, i.e. incineration, landfill, etc.>>		<<Please provide comments on purpose of import, i.e. incineration, landfill, etc.>>	

FOOD WASTE DATA	DESTINATIONS								
SECTOR	AMOUNT (TONNES)	CO/ ANAEROBIC DIGESTION	COMPOST / AEROBIC	CONTROLLED COMBUSTION	LAND APPLICATION	LANDFILL	REFUSE / DISCARDS	SEWER	PROVIDE INFORMATION SOURCE AND DATE
Household									
Out of home consumption									
Agriculture, post-harvest losses and storage									
Retail/ wholesale/ markets/ street vending									
Manufacturing									
HORECA (hotel, restaurant and café), and institutions									
Food processing industry									
Food processing artisanal									

WASTE TREATMENT FACILITY	TYPES OF WASTE TREATED	TREATMENT/ OPERATION TYPE	TREATMENT CAPACITY PER EACH TYPE OF WASTE [TONNES/YEAR]	AVERAGE YEARLY QUANTITIES OF WASTE PROCESSED, PER EACH TYPE OF WASTE [TONNES/YEAR]	PROVIDE INFORMATION SOURCE AND DATE
<<Please provide the name and location of the facility >>					
<<Please provide the name and location of the facility >>					
<<Please provide the name and location of the facility >>					
<<Please provide the name and location of the facility >>					
<<Please provide the name and location of the facility >>					

WASTE DISPOSAL FACILITY	TYPE OF LANDFILL	TYPES OF WASTE ACCEPTED	TOTAL LANDFILLED CAPACITY	REMAINING LANDFILL CAPACITY	ARE RECORDS KEPT ON WASTE DEPOSITED	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
<<Please provide the name and location of the facility >>					Yes | No	<<Please provide comments on type of records kept, i.e. waste source, type,quantity, volume, etc..>>	
<<Please provide the name and location of the facility >>					Yes | No	<<Please provide comments on type of records kept, i.e. waste source, type,quantity, volume, etc..>>	
<<Please provide the name and location of the facility >>					Yes | No	<<Please provide comments on type of records kept, i.e. waste source, type,quantity, volume, etc..>>	
<<Please provide the name and location of the facility >>					Yes | No	<<Please provide comments on type of records kept, i.e. waste source, type,quantity, volume, etc..>>	
<<Please provide the name and location of the facility >>					Yes | No	<<Please provide comments on type of records kept, i.e. waste source, type,quantity, volume, etc..>>	

OTHER	ESTIMATE	COMMENTS	PROVIDE INFORMATION SOURCE AND DATE
<<Please estimate the percentage of generated waste which is subjected to open burning>>		<<Please provide comments on weather this is done at household or municipality level, or other>>	

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UN environment programme

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