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Handbook on Developing National Plastics Data Systems

A Practitioners' Guide

About the Global Ocean Accounts Partnership (GOAP)

The Global Ocean Accounts Partnership is a global, multi-institutional partnership established to enable countries and other stakeholders to go Beyond GDP to measure and manage progress toward ocean sustainable development. Co-chaired by the Ministry of Marine Affairs and Fisheries of Indonesia (Kementerian Kelautan dan Perikanan Republik Indonesia) and the Charles Darwin Foundation for the Galapagos Islands of Ecuador, GOAP brings together governments, international organisations and research institutions to build a global community of practice for ocean accounting.

The GOAP Secretariat is hosted by the UNSW Centre for Sustainable Development Reform (CSDR) at the University of New South Wales, Australia.

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Disclaimer: The case studies and examples referenced throughout this Handbook were selected to represent a wide variety of approaches across regions and capacity levels, rather than to present any single method as the only way to address a given data challenge. Approaches to plastics data collection vary widely depending on national context, resources, and institutional arrangements. Readers are encouraged to draw on whichever examples are most relevant to their own situation, consistent with the Handbook's aim of being useful to countries at different stages of data system development.

The authors welcome suggestions of additional case studies and methods for inclusion on the Handbook's webpage.

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Foreword from GOAP Co-chairs

Plastic pollution is one of the defining environmental challenges of our generation. The decisions that governments take over the coming decade - on production, on consumption, on waste management, and on the protection of marine and terrestrial environments - will depend on the quality, completeness and comparability of the data that underpin them.

This Handbook is offered as a practical companion to that work. It is designed to be used, by ministries assembling their first plastics data inventory, by national statistical offices integrating plastics into environmental-economic accounts, and by the wider community of practitioners working across the plastics life cycle.

The Global Ocean Accounts Partnership (GOAP) and its co-chairs commend this Handbook to all those engaged in building the evidence base for a circular economy for plastics, and in implementing national and international commitments to prevent and reduce plastic pollution.

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ACAP	Agreement on the Conservation of Albatrosses and Petrels
AI	Artificial Intelligence
AMDI	Australian Marine Debris Initiative
APCO	Australian Packaging Covenant Organisation
BACI	Base pour l'Analyse du Commerce International (CEPII's international trade database)
BC	Basel Convention
BEC	Broad Economic Categories (UN classification)
BTR	Biennial Transparency Report
CEPII	Centre d'Études Prospectives et d'Informations Internationales
CEWEP	Confederation of European Waste-to-Energy Plants
CN	Combined Nomenclature (EU trade classification)
COMTRADE	United Nations Commodity Trade Statistics Database (UN Comtrade)
COP	Conference of the Parties
CPC	Central Product Classification
CPR	Continuous Plankton Recorder
CSDR	Centre for Sustainable Development Reform (UNSW)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DPP	Digital Product Passport
DRS	Deposit Return Scheme
EEA	European Economic Area
EFTA	European Free Trade Association
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
EPS	Expanded Polystyrene
ESTP	European Statistical Training Programme
EU	European Union
EWC/LoW	European Waste Code / List of Wastes
FTIR	Fourier-Transform Infrared (spectroscopy)
GDP	Gross Domestic Product
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GPML	Global Partnership on Plastic Pollution and Marine Litter
GPS	Global Positioning System
HDPE	High-Density Polyethylene
HELCOM	Baltic Marine Environment Protection Commission (Helsinki Commission)
HS	Harmonised System

ILO	International Labour Organization
INC	Intergovernmental Negotiating Committee
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification
ISWM	Integrated Sustainable Waste Management
IT	Information Technology
ITC	International Trade Centre
IUCN	International Union for Conservation of Nature
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
LDPE	Low-Density Polyethylene
LLDPE	Linear Low-Density Polyethylene
MFA	Material Flow Analysis
MSW	Municipal Solid Waste
NACE	Statistical Classification of Economic Activities in the European Community
NAEI	National Atmospheric Emissions Inventory (UK)
NAICS	North American Industry Classification System
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration (US)
OECD	Organisation for Economic Co-operation and Development
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Commission)
PE	Polyethylene
PET	Polyethylene Terephthalate
PIC	Prior Informed Consent
PP	Polypropylene
PPIAF	Public-Private Infrastructure Advisory Facility
PRF	Pacific Recycling Foundation
PRODCOM	Production Communautaire (EU industrial production statistics)
PRTR	Pollutant Release and Transfer Register
PS	Polystyrene
PSUT	Physical Supply and Use Table
PUR	Polyurethane
PVC	Polyvinyl Chloride
QGIS	Open-source geographic information system software (originally “Quantum GIS”)
RAG	Red-Amber-Green (rating)
REP	Responsabilidad Extendida del Productor (Chile’s Extended Producer Responsibility law)
SDG	Sustainable Development Goal
SEEA	System of Environmental-Economic Accounting (includes the SEEA Central Framework and SEEA Ecosystem Accounting)
SIC	Standard Industrial Classification
SITC	Standard International Trade Classification

SWOT	Strengths, Weaknesses, Opportunities and Threats
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development (now branded "UN Trade and Development")
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
UNOSAT	United Nations Satellite Centre (UNITAR's Operational Satellite Applications Programme)
UNSW	University of New South Wales
WCO	World Customs Organization
WFD	Waste Flow Diagram
WIEGO	Women in Informal Employment: Globalizing and Organizing
WITS	World Integrated Trade Solution (World Bank)

How to Use This Handbook

"A practical step-by-step guide to help governments build National Data Systems that track plastics throughout the life cycle and inform evidence-based policy."

The Handbook on Developing National Plastics Data Systems gives government officials and practitioners a structured, practical approach to building national plastics data systems. Developed by the UNSW Centre for Sustainable Development Reform (CSDR), the Global Ocean Accounts Partnership (GOAP) in partnership with GRID-Arendal, it sets out seven steps, from identifying relevant data through to establishing systems for ongoing data management.

The Handbook is organised in four parts.

Part I - Foundations sets out the concepts, definitions and the three-level path forward that frame the rest of the Handbook. It is intended to be read once, before any data work begins.

Part II - The seven-step workflow is the procedural core of the Handbook. It describes the seven steps a country works through to build a national plastics data system, from initial data identification to ongoing data management. Each step follows the same template (Purpose, Key Actions, Key Tools, Outputs) so the reader always knows where to look.

Part III - Data category guides is a reference manual, organised by life cycle stage. Each chapter covers the data, methods and tools relevant to a single category - production, trade, consumption, waste generation, waste collection, treatment, disposal, plastics in the environment, and social indicators. The chapters can be read in any order, as needed.

Part IV - Cross-cutting methodologies brings together methods that apply across more than one data category, including material flow analysis, remote sensing, waste composition estimates and classification systems.

A data sources catalogue, terminology comparisons, and sampling techniques are collected in the annexes for reference.

Part I sets out the Handbook's purpose, scope, and key definitions, and introduces the three-level pathway for developing a national plastics data system and the seven-step workflow for building a National Plastics Data Inventory.

Part I

Foundations

Wild elephants at an open dumpsite in the Eastern Province of Sri Lanka
Photo Credit: Tharmapalan Tilaxan, Sri Lanka

1.1 Introduction

Plastic pollution crosses national borders and originates from diverse sources, ranging from single-use products to industrial waste streams. This creates complex challenges for regulation and environmental management. The ongoing negotiations under the Intergovernmental Negotiating Committee (INC) to develop a legally binding international instrument on plastic pollution, including in the marine environment (UNEP, 2022), underscore the urgency of building evidence-based policy frameworks at both national and international levels.

Countries worldwide recognise the urgent need to better understand how plastics move through their economies and environment. Yet plastics data remains weak globally, with significant gaps in availability, quality, accessibility and comparability (OECD, 2022). Limited technical capacity, insufficient funding and fragmented institutional infrastructure all compound the problem. Information is often siloed across agencies and sectors, collected using inconsistent definitions and monitoring protocols, making meaningful comparison and trend tracking difficult. Without robust, standardised datasets, policymakers lack the evidence base necessary to design targeted regulations, allocate resources efficiently, and evaluate the effectiveness of interventions. Addressing these systemic gaps requires data collection systems capable of quantifying pollution sources, tracking distribution patterns, and measuring the impact of policy measures.

Data on plastics spans the full life cycle: from production through to trade, waste management and environmental release (Geyer et al., 2017; Jambeck et al., 2015). Identifying, collecting and organising that data to inform policy and guide decision-makers presents significant technical and institutional challenges.

This Handbook is designed to address these challenges by supporting government officials and other users to identify relevant data sources and improve data collection methodologies. It supports the establishment of robust plastics data systems and the strengthening of institutional capacity and national systems for ongoing data management. The Handbook provides guidance across all stages of the plastics life cycle, while considering the roles of key stakeholders, from data generators to policymakers.

As a result, the Handbook aims to improve plastic data systems that will enable countries to effectively track progress on both national and international commitments to prevent and reduce plastic pollution across its full life cycle.

1.1.1 Objectives of this Handbook

The Handbook provides a step-by-step approach to enhancing national plastics data systems. Whether the user is focused on improving a single data category or building a comprehensive system, it provides practical guidance.

Not all countries will be able to collect data across the entire plastics life cycle immediately, and in some cases, this may not be necessary. The Handbook therefore supports incremental development, where improvements to individual data categories constitute meaningful progress toward better plastics management. A three-level path forward that underpins this approach is set out in Section 1.2.

1.1.2 Scope of this Handbook

The Handbook provides practical guidance for improving plastics data at each key stage of the plastics life cycle (Figure 1.1). The data categories include production data, trade data, consumption data, waste generation and collection data, treatment and disposal data, and data on plastics in the environment. The guidance applies to plastics consumed and disposed of within household, non-household, commercial and industrial settings.

The Handbook does not cover the extraction and processing of raw materials prior to their manufacture into plastic pellets or other forms of primary plastic. Further research is needed to develop guidance on translating these upstream flows into meaningful data. The Handbook does not provide explicit guidance specific to biodegradable materials or microplastics. However, many of the methodologies described can be applied or adapted to these categories.

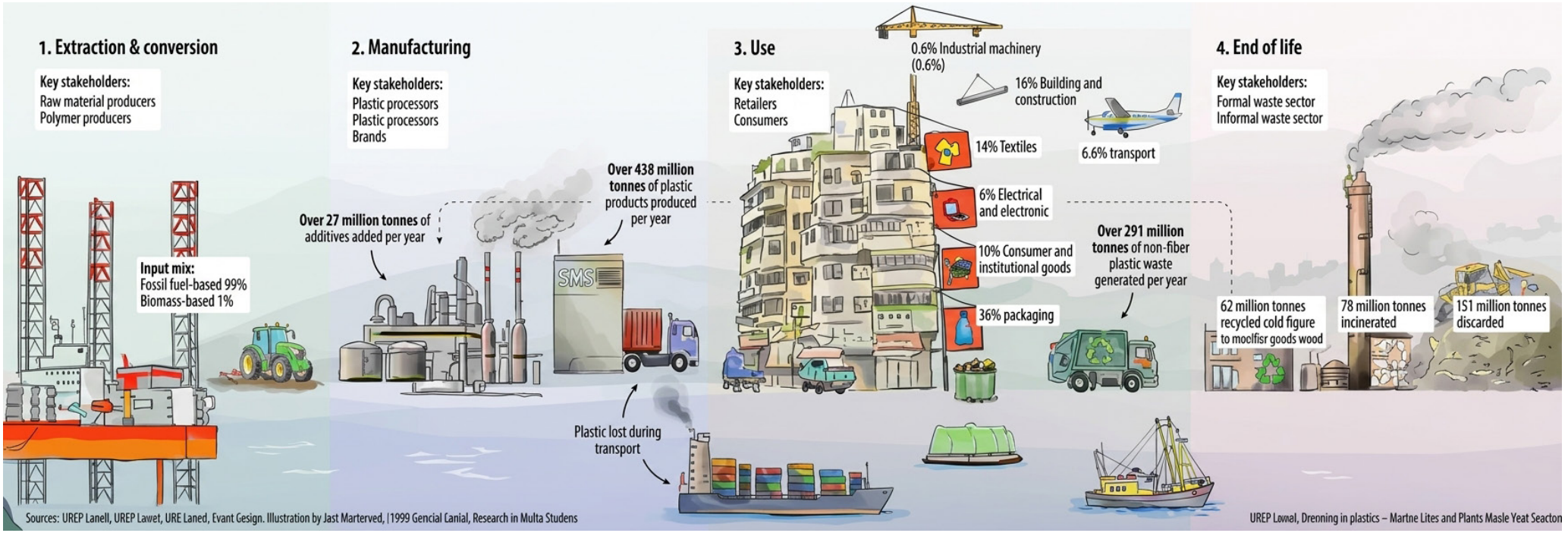


Figure 1.1: [The Plastics Life Cycle (GRID-Arendal, 2021)]

1.1.3 Who this handbook is for

The Handbook is suitable for policymakers and government officials responsible for environmental management, waste systems, and statistical development. The methodologies are also relevant to a broad range of stakeholders, including technical specialists, intergovernmental organisations, industries and researchers.

The methodologies presented are deliberately flexible and scalable. This ensures that all countries, regardless of economic development status, geographic context, or existing data capacities, can meaningfully participate in addressing plastic pollution through improved plastics data collection.

1.1.4 Relationship to international processes

Improved national plastics data systems will help countries meet their reporting obligations under any future international agreement on plastic pollution and will support implementation of relevant Sustainable Development Goals (United Nations, 2015), in particular SDG 12 (sustainable consumption and production) and SDG 14 (life below water, including target 14.1 on reducing marine pollution). The Handbook is designed to complement the work of the United Nations Environment Programme (UNEP), the United Nations Institute for Training and Research (UNITAR), the Global Partnership on Plastic Pollution and Marine Litter (GPML), and the Global Plastics Hub.

1.1.5 Reporting frequency

National plastics data systems are designed to report annually, with inventories and accounts updated each year. Reporting on a regular yearly cycle keeps the data consistent over time and comparable with other national statistics, including material flow accounts and the environmental-economic statistics compiled under the System of Environmental-Economic Accounting (SEEA).

1.2 A Three-Level Path Forward

1.2.1 The three levels

Countries approach building national plastics data systems from very different starting points, and meaningful progress is possible at every level. The Handbook reflects this through a three-level path forward, not because every country must reach the highest level, but to give a common reference against which a country can locate itself and choose its next step (Figure 1.2).

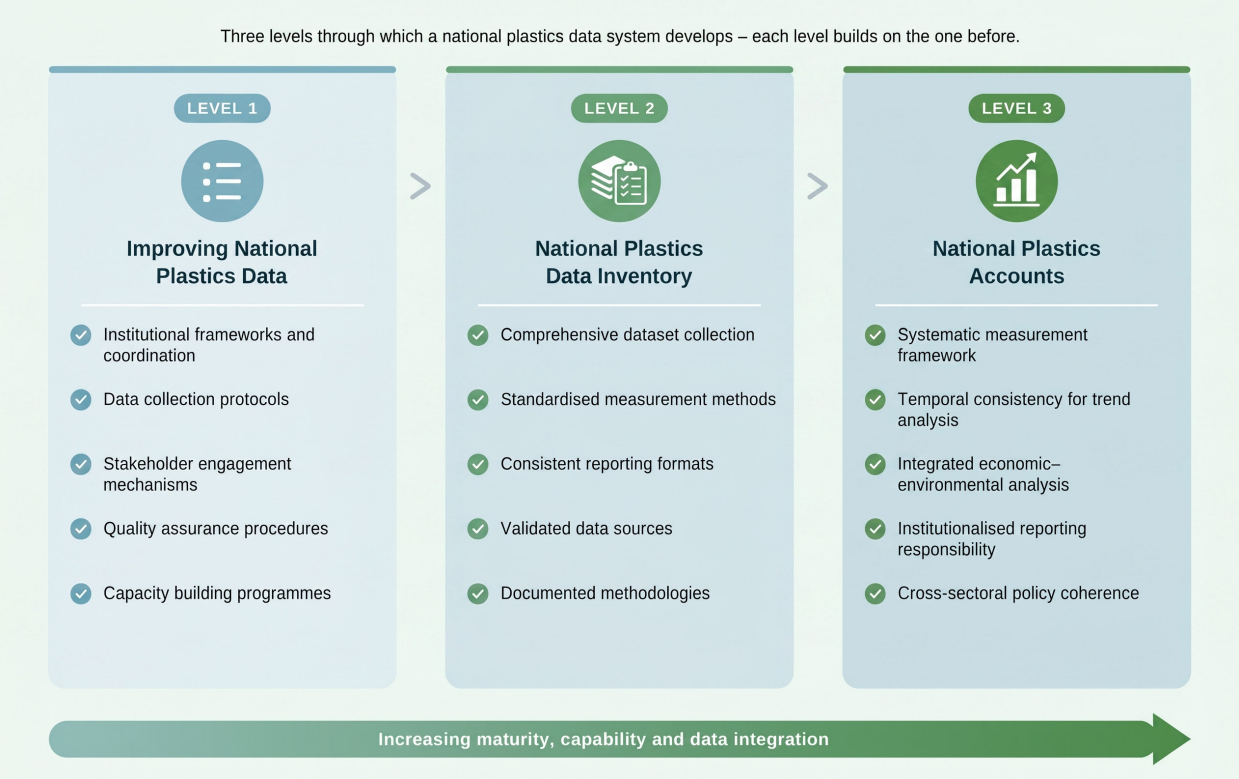


Figure 1.2: A three-level path forward

Level 1: Improving National Plastics Data

At Level 1, the priority is to improve specific data categories that align with the country's national priorities. A country at Level 1 may, for example, focus on improving the quality of waste collection records from its municipal authorities, or on extending coverage of plastics-related trade statistics under the Harmonised System (HS) codes. Each improvement strengthens the foundation for higher-level work.

Level 1 is the appropriate entry point for the majority of countries that do not yet have a comprehensive plastics data inventory. Improvements at Level 1 are not only preparatory. Targeted improvements to a single data category can themselves support significant policy decisions, for example on Extended Producer Responsibility schemes or on packaging waste regulations.

Level 2: National Plastics Data Inventory

At Level 2, sufficient coverage has been achieved across multiple data categories to allow the development of a National Plastics Data Inventory. The Inventory is a comprehensive collection of data points that measure and track plastic flows across the value chain including production, trade, consumption, waste generation, treatment and environmental releases.

A Plastics Data Inventory enables a country to understand the overall scale and structure of plastic flows in its economy and environment, to identify the largest sources of leakage, and to evaluate the effectiveness of interventions. The Inventory is typically maintained and updated on an annual basis.

Level 3: National Plastics Accounts

At Level 3, the data underpinning the Inventory are organised into a structured statistical framework that reveals the relationships between economic activities and environmental outcomes. Plastics Accounts integrate data from multiple sources over time into a coherent system aligned with the System of Environmental-Economic Accounting (SEEA).

Plastics Accounts allow a country to track plastics in a way that is compatible with national accounts, to link plastic flows to economic sectors and to compare its progress with other countries using the same measures. The development of Plastics Accounts requires sustained institutional commitment, standardised methodologies, and ongoing data collection capacity.

1.2.2 Entry criteria

Table 1.1 sets out the entry criteria for each level. A country need not meet every criterion to reach a given level. The table serves as a general guide rather than a firm requirement.

Table 1.1. Indicative entry criteria for each level

Criterion	Level 1 Improving National Plastics Data	Level 2 National Plastics Data Inventory	Level 3 National Plastics Accounts
Data categories covered	One or more priority categories	All life cycle stages with at least partial coverage	All life cycle stages with annual coverage
Institutional arrangements	A designated unit responsible for the category	A formal coordinating mechanism across agencies	Statutory authority for ongoing reporting
Methodology	Use of existing data; methodologies as available	Documented methodologies; increasingly standardised across categories	SEEA-aligned methodologies; explicit treatment of system boundaries
Reporting frequency	Ad hoc or as updates allow	Annual	Annual, with multi-year trend analysis
Public dissemination	Sector reports	National plastics dashboard or report	Plastics Accounts published alongside related environmental-economic accounts

BOX 1.1 : Defining National Plastics Data System, Inventory and Accounts

National plastics data system: The institutional, methodological and technical arrangements through which a country produces, manages and disseminates national statistics on plastics. A national plastics data system typically supports a plastics inventory and, at higher levels of maturity, plastics accounts.

National plastics inventory: A comprehensive collection of data points that measure and track plastic flows through an economy, including production, trade, consumption, waste generation, collection, treatment, disposal and environmental releases.

National plastics accounts: A structured statistical framework that organises plastics data to show the flows of plastic as it moves into and between the economy and the environment. Aligned with the System of Environmental-Economic Accounting (SEEA), these accounts integrate data from various sources over time into a coherent system that can inform policy development and monitor progress toward sustainability goals.

1.3 How a Country Uses This Handbook

The Handbook's seven-step workflow guides how a country builds its national plastics data system. It is intentionally short: each step is documented in its own chapter in Part II, and each data category is documented in its own chapter in Part III.

1.3.1 The seven-step workflow for developing a national plastics data system

The Handbook organises the development of a national plastics data system into seven steps. The steps are presented in a logical sequence, but the precise sequencing should be adapted to a country's specific circumstances.

Step 1: Identify Data Sources and Map Stakeholders

Existing data sources are reviewed and recorded in the Plastics Data Checklist. As each entry identifies a source organisation, this step also generates an initial list of stakeholders: those who hold or use plastics data.

Step 2: Assess Data Quality

Each identified source is assessed and scored for availability and reliability, allowing later steps to distinguish between data that meets the required standard and data that requires further development.

Step 3: Build the First Draft of the Data Inventory

The data identified and assessed under Steps 1 and 2 is compiled into the first draft of the Inventory, with data gaps and underlying assumptions clearly identified.

Step 4: Analyse Gaps and Set Priorities

The first version of the Inventory is used to identify genuine data gaps and decide which to address first, taking into account both data quality and the relative urgency of different reporting and policy needs.

Step 5: Engage Stakeholders to Close Priority Gaps

The prioritised gaps identified in Step 4 are used to approach the specific stakeholders holding the relevant data, through structured and lasting engagement rather than a general call for information.

Step 6: Improve, Verify and Consolidate the Inventory

Data received from stakeholders are incorporated into the Inventory, remaining gaps are addressed through the collection of primary data, and the resulting Inventory is presented to stakeholders for verification prior to being finalised as the working version.

Step 7: Institutionalise and Sustain the System

A durable institutional mandate is established, coordination arrangements are agreed among the institutions responsible for the various reporting and policy uses of the Inventory, and the system is embedded to ensure its ongoing operation and continuous update as new data becomes available.

1.3.2 Adaptation to national context

The seven steps are presented in a logical order, but they do not need to be followed strictly in sequence. Some countries may prefer to begin with stakeholder mapping or institutional capacity assessment before undertaking data analysis, while others might conduct these analyses at the same time. The sequence can be tailored to align with existing national priorities, available resources and institutional structures. The critical consideration is that all components are systematically addressed in a manner appropriate to each country's specific context and requirements.

1.3.3 Suggested reading pathways by maturity level

Level 1 - Improving National Plastics Data

The priority is to improve specific data categories aligned with national priorities. This is the appropriate entry point for countries without yet a comprehensive plastics data inventory. Recommended reading:

- Part II - The Seven-Step Workflow: Step 1 (Identify Data Sources and Map Stakeholders), Step 2 (Assess Data Quality) and Step 3 (Build the First Draft of the Data Inventory)
- Part III - Data Category Guides: chapters relevant to the data categories the country has chosen to prioritise

Level 2 - National Plastics Data Inventory

Sufficient coverage has been achieved across multiple data categories to support development of a National Plastics Data Inventory. Recommended reading:

- Part II - The Seven-Step Workflow: Step 4 (Analyse Gaps and Set Priorities), Step 5 (Engage Stakeholders to Close Priority Gaps) and Step 6 (Improve, Verify and Consolidate the Inventory)
- Part III - Data Category Guides: the full set
- Part IV - Cross-Cutting Methodologies

Level 3 - National Plastics Accounts

The data underpinning the Inventory is organised into a structured statistical framework aligned with the System of Environmental-Economic Accounting (SEEA), revealing the relationships between economic activities and environmental outcomes. Recommended reading:

- Part II - The Seven-Step Workflow: Step 7 (Institutionalise and Sustain the System)
- Part IV - Cross-Cutting Methodologies

BOX 1.2: Supporting Tools

Two supporting tools developed by the UNSW CSDR Plastics team accompany the Handbook.

The Plastics Data Checklist is the working instrument used in Steps 1 to 3. It allows a country to record the data sources it has identified, to score them for availability and reliability, and to translate the scoring into a prioritised list of gaps. The Checklist is referenced repeatedly in the workflow chapters.

The Global Plastics Data Tracker is a digital platform that supports recording, comparing and sharing national plastics data. It complements the Handbook and is referenced in Step 1.

The Handbook is also designed to be used alongside global tools such as the UNEP/ UNITAR Statistical guideline for measuring flows of plastic throughout the life cycle and the Global Plastics Hub, which provides international resources, case studies and integrated data.

BOX 1.3: Related frameworks

System of Environmental-Economic Accounting (SEEA): The international statistical standard for integrating economic and environmental data, adopted by the United Nations Statistical Commission. This includes the SEEA Central Framework (SEEA CF) and SEEA Ecosystem Accounting (SEEA EA). The SEEA provides the foundational framework for the development of Plastics Accounts (United Nations et al., 2014; 2021).

Material Flow Analysis (MFA): A systematic assessment of the flows and stocks of materials within a system defined in space and time (Brunner & Rechberger, 2016). MFA is a primary methodological tool for quantifying physical flows of plastics through an economy and is closely related to SEEA physical flow accounts.

Waste hierarchy: A conceptual ranking of waste management options in order of environmental desirability, typically: prevention, reduction, reuse, recycling, recovery (including energy recovery), and disposal (European Union, 2008)

1.3.4 Key Terms and Concepts

Key concepts used throughout the Handbook are grouped thematically in this section.

Types of plastics

Table 1.2. Types of plastics

Term	Definition
Macroplastics	Plastic particles, fragments or items greater than 5 mm in their largest dimension.
Microplastics	Plastic particles, fragments or fibres less than 5 mm in their largest dimension, including both primary microplastics manufactured at that size and secondary microplastics resulting from the fragmentation of larger plastic items (GESAMP, 2019).
Nanoplastics (used in some literature)	Plastic particles smaller than 1 micrometre (Gigault et al., 2018). Not addressed in this Handbook but flagged for users developing advanced monitoring.

Plastic forms

Table 1.3. Plastic forms

Term	Definition
Plastic in primary forms	Raw plastic polymers in their initial state after polymerisation, typically in the form of resins, powders, granules, flakes, pellets, liquids, or pastes that have not yet been processed into specific products.
Semi-finished plastic products	Plastic materials that have been processed from primary forms into standardised shapes, forms, or components intended for further processing, fabrication, or assembly into finished products.
Plastic in finished products	Products made wholly or partially from plastic that have completed all manufacturing processes and are in their final form for distribution, sale, and use by end consumers or businesses.

Table 1.4. Packaging Tiers

Term	Definition
Primary packaging	Packaging in direct contact with the product itself (for example, a bottle holding a liquid, or a wrapper directly enclosing an item).
Secondary packaging	Packaging that groups a number of primary-packaged units together (for example, a box containing several bottles).
Tertiary packaging	Packaging used for bulk handling, storage and transport of multiple secondary-packaged units (for example, shrink-wrap or a pallet wrap for a full shipment).

Plastics in the economy

Table 1.5. Plastics in the economy

Term	Definition
Plastic production	The total weight of virgin and recycled plastic materials manufactured within a country's economic territory during a specified reporting period (typically annual). The metric encompasses primary production of plastic pellets, as well as the conversion of these materials into intermediate and finished plastic products by domestic manufacturers. Production is reported gross.
Plastic consumption	The aggregate weight of plastic materials utilised within a country's economic territory during the reporting period. Plastic consumption accounts for all plastic materials entering the national economy, regardless of origin, and excludes domestically produced plastics exported for foreign consumption. Where direct measurement is unavailable, consumption is typically computed as apparent consumption, equal to production plus imports minus exports.
Virgin plastics consumption	The total weight of manufactured plastic materials derived from petrochemical feedstocks (primarily oil and natural gas) consumed within a country's economic territory during the reporting period. Virgin plastics consumption represents materials entering the economy for the first time, before any recycling or recovery processes.
Recycled plastics consumption	The aggregate weight of post-consumer and post-industrial plastic materials that have undergone recycling processes and are subsequently consumed in products within a country's economic territory during the reporting period. The metric encompasses mechanical, chemical, and other forms of recycled plastic materials incorporated into new products or packaging.

Waste flows and waste treatment

Table 1.6. Waste flows and waste treatment

Term	Definition
Plastic waste generated	The total quantity of plastic materials discarded as waste by a population and its economic activities within defined system boundaries during a specified time period, regardless of subsequent fate. It represents the amount of plastics entering the waste stream before any treatment, recovery, disposal, or leakage occurs. It includes all plastic polymer types and applications discarded after their intended use, expressed typically in mass units (kilograms or tonnes) per specified timeframe.

Term	Definition
Plastic waste collected	The amount of plastic waste collected by formal or informal waste management systems for further processing, treatment, or disposal. Plastic waste collected is measured at the point of collection, before sorting or processing, and may include contamination and materials that will be rejected during subsequent processing.
Uncollected waste	All plastic waste generated that is not captured by formal or informal waste collection systems and remains in the environment, including waste that is dumped, burned, or leaked into natural systems.
Municipal waste	Plastic waste typically associated with household consumption, including packaging, food scraps, and consumables, as well as waste arising within small businesses. Municipal waste comprises household and non-household waste.
Household waste	Plastic waste generated by households and residential settings.
Non-household waste	Household-like plastic waste that arises outside the home, including from public spaces, tourism activities, small businesses and institutional settings such as schools, hospitals, and government buildings.
Commercial and industrial waste	Plastics discarded from manufacturing processes, commercial activities, construction and demolition operations, and other industrial sectors.
Waste treated	The quantity of plastic waste that undergoes any form of processing or treatment, including mechanical recycling, chemical recycling, energy recovery, or other treatment processes. Waste treated is typically measured after sorting and cleaning processes.
Recovered tonnes	The amount of plastic material that successfully completes the recycling process and leaves the facility as a recycled commodity ready to be sold to an end market. The measurement occurs after sorting and processing, when the material has been transformed into recyclate that can be used to manufacture new products.
Reuse	The continued use of plastic items or packaging in their original form for the same or a different application, without significant modification, maximising their utility before they enter the waste stream.
Repair	The restoration of damaged plastic products to functional condition, prolonging their usable life as a means of waste prevention.
Upcycling	The creative transformation of plastic waste into new products of higher quality or environmental value than the original.
Mechanical recycling	The physical processing of plastic waste through sorting, washing, shredding, melting, and remoulding to produce recycled plastic pellets or products without altering the basic chemical structure of the polymer.
Chemical recycling	Advanced technologies that break down plastic polymers into their basic chemical constituents (monomers or other basic chemicals). These chemical building blocks can then be used to produce new plastics or other chemical products. Chemical recycling, as used in this Handbook, does not include processes whose principal output is energy.
Pyrolysis	The thermal decomposition of plastic waste in an oxygen-free environment at temperatures typically between 300 and 900 degrees Celsius, converting polymers into liquid oil, synthesis gas, and char residue.
Gasification	A high-temperature thermal process (typically above 700 degrees Celsius) that converts plastic waste into synthesis gas (syngas) through partial oxidation with controlled amounts of oxygen or steam.

Term	Definition
Co-processing	The simultaneous recovery of energy and recycling of mineral content from waste in industrial processes, particularly cement production, where plastics replace fossil fuels and any mineral content becomes incorporated into the final product.
Waste-to-Energy	Controlled combustion of plastic waste in specialised facilities to generate electricity, heat, or steam, while managing emissions and capturing pollutants.
Residual waste	Plastic materials that remain after processing and cannot be recycled in current systems, typically destined for landfill or incineration.
Open dumping and burning	Waste that is deliberately discarded in unauthorised, uncontrolled or unmanaged locations without proper containment or treatment. This includes waste that is deliberately set on fire as a means of volume reduction.
Fly tipping	The deliberate disposal of large items or quantities of litter (for example, a broken refrigerator or a single large bag of rubbish) in a random location.
Littering	Incorrect disposal of small, one-off items that are not collected by managed waste methods.

Collection systems

Table 1.7. Collection systems

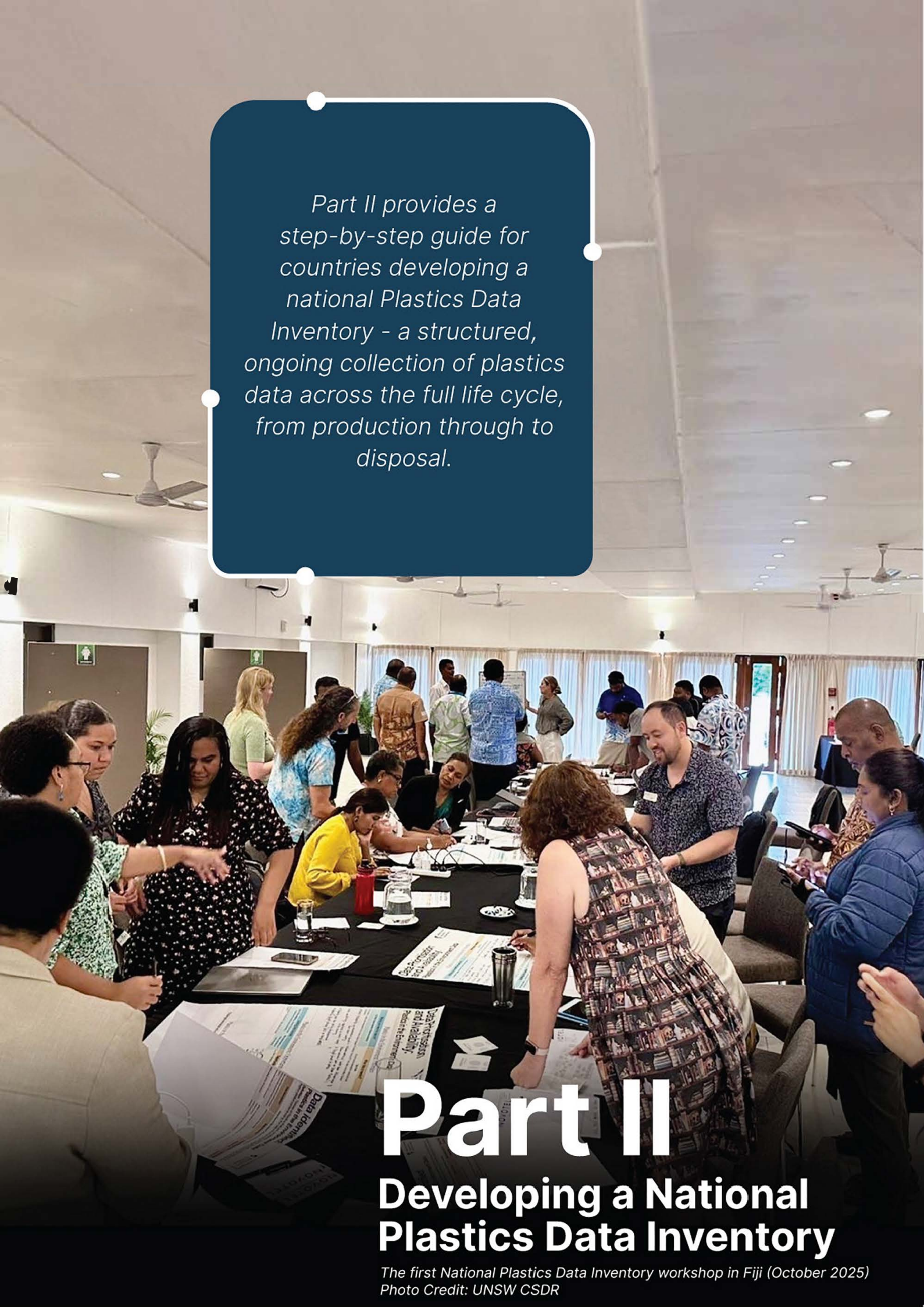
Term	Definition
Formal collection systems	Government-approved or contracted services operating through established infrastructure with regular schedules, designated equipment, and official protocols.
Informal collection systems	Activities performed by waste pickers, scavengers, and small-scale entrepreneurs who gather valuable plastic materials for sale to recyclers without formal integration into municipal systems.
Community-based collection systems	Organised initiatives led by environmental groups, community organisations, and volunteer networks that conduct regular or periodic plastic waste collection through cleanups, targeted collection drives, and awareness campaigns.

Environmental sampling and monitoring

Table 1.8. Environmental sampling and monitoring

Term	Definition
Environmental sampling for debris	The process of collecting samples of debris from the environment.
Environmental monitoring of debris	The continuous sampling, observation or assessment of the environment over time. This technique is often used to identify changes or trends over time.

Part II provides a step-by-step guide for countries developing a national Plastics Data Inventory - a structured, ongoing collection of plastics data across the full life cycle, from production through to disposal.



Part II

Developing a National Plastics Data Inventory

The first National Plastics Data Inventory workshop in Fiji (October 2025)
Photo Credit: UNSW CSDR

2.1 Introduction

Part II is a step-by-step guide for countries developing a national Plastics Data Inventory: a structured, ongoing collection of data on plastics across the full life cycle, from production through to disposal and environmental leakage. It is intended primarily for the government agencies responsible for leading this work, typically the Ministry of Environment or the National Statistics Office, though it will also be useful to any other institution, project team, or partner supporting this effort.

While improving individual data points is valuable in its own right, this Part is intended to support countries in progressing from isolated improvements towards the establishment of a working Plastics Data Inventory. This is a shared reference point that compiles the full life cycle of plastics data so different parts of government can draw on it, refine it over time, and it may eventually inform the development of a Plastics Account. The workflow is designed to enable countries to establish a usable first version of the Inventory within a reasonable timeframe, then improve it through successive iterations, rather than delaying action until complete data become available.

2.1.1 The seven-step workflow for developing a National Plastics Data system

The workflow comprises seven steps, set out below.

Step 1: Identify Data Sources and Map Stakeholders

Existing data sources are reviewed and recorded in the Plastics Data Checklist. As each entry identifies a source organisation, this step also generates an initial list of stakeholders: those who hold or use plastics data.

Step 2: Assess Data Quality

Each identified source is assessed and scored for availability and reliability, allowing later steps to distinguish between data that meets the required standard and data that requires further development.

Step 3: Build the First Draft of the Data Inventory

The data identified and assessed under Steps 1 and 2 is compiled into the first draft of the Inventory, with data gaps and underlying assumptions clearly identified.

Step 4: Analyse Gaps and Set Priorities

The first version of the Inventory is used to identify genuine data gaps and decide which to address first, taking into account both data quality and the relative urgency of different reporting and policy needs.

Step 5: Engage Stakeholders to Close Priority Gaps

The prioritised gaps identified in Step 4 are used to approach the specific stakeholders holding the relevant data, through structured and lasting engagement rather than a general call for information.

Step 6: Improve, Verify and Consolidate the Inventory

Data received from stakeholders is incorporated into the Inventory, remaining gaps are addressed through the collection of primary data, and the resulting Inventory is presented to stakeholders for verification prior to being finalised as the working version.

Step 7: Institutionalise and Sustain the System

A durable institutional mandate is established, coordination arrangements are agreed among the institutions responsible for the various reporting and policy uses of the Inventory, and the system is embedded to ensure its ongoing operation and continuous update as new data becomes available.

> **NOTE:** These seven steps are presented in a logical sequence. It is provided as a starting point rather than a fixed process. Countries with more established statistical systems may complete certain steps simultaneously, while countries at an earlier stage of development may need to repeat parts of the workflow more than once before the Inventory is ready to use. The key consideration is that each step is carried out at a level appropriate to the country's own capacity and circumstances.

2.1.2 Structure of The Following Section of the Handbook

Each step is presented as its own section, following a consistent structure. A brief statement of Purpose introduces the step; Key Actions identify the actions to be undertaken; Key Tools list the templates, checklists and other resources available in support of the work; and Outputs describe what the step produces and how it feeds into the next one. Detail and supporting guidance section follows, providing further explanation, illustrative examples and context.

Cross-references point to related guidance elsewhere in the Handbook, including the data collection methods and sampling techniques used in Steps 3 and 6.

2.2 Step 1: Identify Data Sources and Map Stakeholders

2.2.1 Purpose

This work is most often carried out by the Ministry of Environment or the National Statistics Office. Step 1 combines two activities that are, in practice, one exercise: reviewing existing plastics and/or waste data sources and recording them in the Plastics Data Checklist to build an initial picture of who holds or uses plastics data. Since every entry in the Checklist names a source organisation, identifying a source and identifying a stakeholder happen at the same time.

A more comprehensive stakeholder analysis and engagement process is undertaken at a later stage, once the specific data gaps have been identified (Step 5). What is captured at this stage represents a preliminary review only, rather than a complete mapping.

2.2.2 Key Actions

1. Download the Plastics Data Checklist.
2. Identify and extract data - review published and unpublished sources across production, consumption, trade, waste, and environmental data, and record what is found directly in the Checklist or a spreadsheet as each source is identified, rather than treating identification and extraction as separate stages.
3. Compile the source organisations recorded in the Checklist into an initial stakeholder list, noting sector where known. This list is the starting point for Step 5. It is not yet analysed or prioritised.

2.2.3 Key Tools

Table 2.1. Key Tools

Key Tools	Access
Plastics Data Checklist (its "source organisation" field also serves as the initial list of stakeholders)	User Guide[1]
Global Plastics Data Tracker	Online tracker[2]

2.2.4 Outputs

A populated Plastics Data Checklist recording every identified source, its data category, source organisation, accessibility, and end-use tag(s) and, drawn directly from that same list, an initial stakeholder list of who holds or uses plastics data. Both feed Step 2, and the stakeholder list is picked up again in full in Step 5, once priority gaps are known.

2.2.5 Detail and supporting guidance

Using the Plastics Data Checklist

The Plastics Data Checklist is a tool developed by the Global Ocean Accounts Partnership and the UNSW Centre for Sustainable Development Reform to help governments, policymakers and practitioners evaluate their national plastics data. It is designed to:

- facilitate a systematic evaluation of national plastics data across the plastics life cycle and into the environment;

1 User Guide for the Plastics Data Checklist: https://drive.google.com/file/d/1uebbJE7dxd5nDY5z4CY574bIDEvob4qJ/view
2 Global Plastics Data Tracker: https://plastictracker.org/

- identify which data points are available and how reliable they are;
- identify areas for improvement in data collection and management;
- promote coordination across sectors and national data holders; and
- contribute to the development of a comprehensive national Plastics Data Inventory.

Before starting, users should familiarise themselves with the plastics data categories and how they connect to one another (Figure 2.1). The figure shows which sub-categories are summed to derive a data category - for example, total plastic waste treated should include both formally and informally managed plastic - and how plastic moves between categories.

A User Guide for the Plastics Data Checklist[3] has been published alongside this Handbook, together with a worked example of a completed Checklist.

Capacity tiers

Countries' starting points and capacity to collect and report plastics data differ widely. To support a practical, phased approach, countries should first identify which capacity tier they are closest to, and use the corresponding starting point in Table 2.2 below, not as a ceiling, but as a first target.

Table 2.2. Capacity tiers

Capacity Tier	Recommended Starting Point
Limited capacity	Start with up to 4 core data areas - commonly plastic imports, exports, waste collection and waste treatment.
Medium capacity	Expand to around 8 core data areas, adding the most significant waste treatment routes and leakage into the environment.
Advanced capacity	Assess data across the full plastics life cycle.

As capacity, data infrastructure and data quality improve, countries can expand their data collection and reporting incrementally over time.

Identifying and extracting data by category

The remainder of this section addresses each plastics data category in turn: what to look for, why it is significant, and where it is typically found. As sources are identified for each category, the available data should be extracted directly into the Checklist or a spreadsheet. Any assumptions or calculations underlying the figures should be recorded in the same entry and referenced to their source, so that the reasoning behind each number remains visible for the quality assessment undertaken in Step 2. Data should be presented in tonnes (t) or thousands of tonnes (kt); for cross-country comparisons, kg per capita should also be recorded.

Figure 2.2: Sources of Data

Administrative data of this kind is not limited to government agencies. Industry associations and, where a scheme exists, Extended Producer Responsibility organisations often hold comparable records. Such organisations should be treated as data holders in their own right, not only as informants to a government dataset, and should be added to the stakeholder list accordingly.

3 Plastics Data checklist https://drive.google.com/file/d/1uebbJE7dxd5nDY5z4CY574bIDEvob4qJ/view.

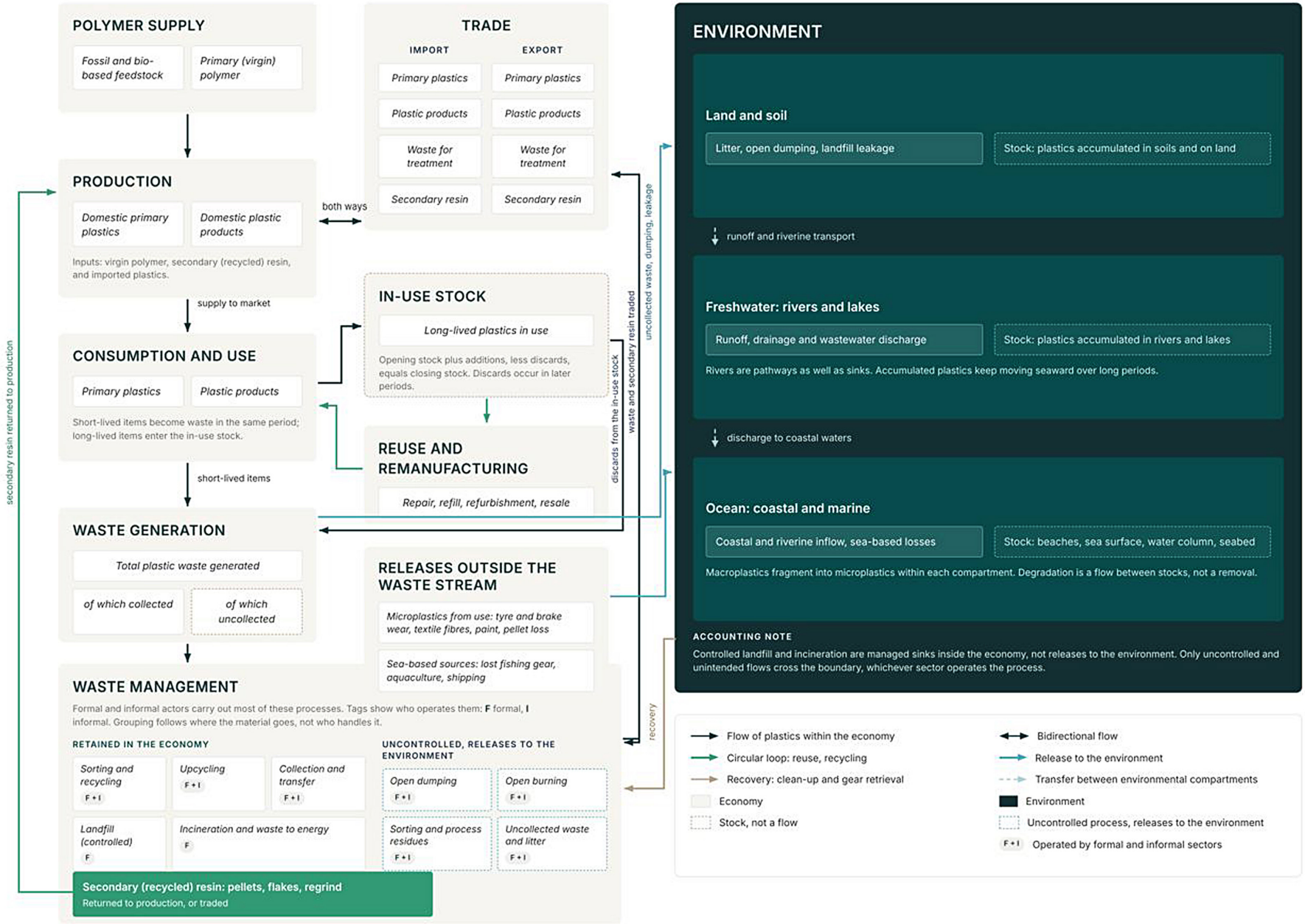


Figure 2.1: Plastics data categories and their interconnections.

Production data

Production data should only cover materials and products produced within a country's own borders, and should be split, where possible, between primary materials and products.

Primary plastic materials are polymers in their original, raw form after initial polymerisation but before being transformed into finished products - typically pellets, powders, flakes or liquid resins, categorised by polymer type (such as PE, PP, PVC, PET, PS). They are the first commercially usable stage in the plastics value chain and the input material for conversion processes. From an economic statistics perspective, primary plastics are themselves a product; the distinction drawn here is about their position in the value chain, not a claim that only finished goods count as products.

Plastic products are manufactured items made wholly or partly from plastics that have been through a conversion process such as moulding, extrusion or thermoforming - from packaging (bottles, films, containers) to durable goods, construction materials, textiles and single-use items.

The distinction matters for avoiding double-counting: primary plastic materials are inputs that are later transformed into plastic products at a subsequent stage of the value chain, so the same tonne of plastic should not be counted once as primary material and again as a finished product within the same national total.

Table 2.3. Production data

Source	What It Covers	Access
PRODCOM Ldatabase (Eurostat)	EU/EEA production statistics for primary plastics and plastic products, based on industrial survey returns. The most standardised source for countries covered by it.	Database[4]
Industry reports and datasets	Association- or company-level production figures. Often the only source available for countries outside PRODCOM's coverage, and a useful cross-check elsewhere.	Varies by country
National surveys	Government industrial or manufacturing surveys with a plastics production module, where one exists. Usually the most authoritative national source.	Held by National Statistics office

Consumption data

Check first whether the country already reports into one of the sources below.

Table 2.4. Consumption data

Source	What It Covers	Access
Extended Producer Responsibility (EPR) scheme reports	Producer-reported data on packaging or products placed on the market, where an EPR scheme is in force. Often the most granular consumption-side data available.	Varies by country
National consumption surveys	Household or business expenditure and consumption surveys with a plastics or packaging module. Captures domestic consumption not reflected in trade or production data alone.	Varies by country
Industry reports and datasets	Sector association data on domestic sales or distribution. Useful as a cross-check against survey- and trade-derived estimates.	Varies by country
Recycling facility reports / government recycling statistics	Data on recycled material used as an input to new products (recycled content). Relevant for circularity indicators.	Varies by country

As several of these sources can overlap for the same consumption category, identify a single primary source for each category and treat the others as validation checks rather than additional inputs to be summed. Where sources genuinely overlap, establish and document a hierarchy of preferred sources - for example, government statistics ahead of industry-reported estimates, so figures are not double-counted.

4 PRODCOM database (Eurostat): https://ec.europa.eu/eurostat/web/prodcom/database

For consumption data generally, distinguish household consumption (goods purchased and used by private households, including via retail and e-commerce) from non-household consumption (commercial, institutional and industrial use). Tourism-related consumption is captured within the hospitality category rather than tracked separately. Waste collected from public bins and street receptacles falls under municipal solid waste collection systems (see Waste data, below) rather than under household consumption.

Trade data

Check first whether the country already reports into one of the sources below.

Table 2.5. Trade data

Source	What It Covers	Access
UN Comtrade database	Global trade statistics by Harmonised System (HS) code, self-reported by national customs authorities. The most complete global source of plastics import/export volumes.	Database[5]
UNCTADstat Data Centre	Trade and development statistics, including plastics trade aggregates. Useful for regional and development-level comparisons.	Database[6]
Comext (Eurostat)	Detailed EU external and internal trade statistics. The most granular source for EU/EEA plastics trade.	Database[7]
UNEP Global Partnership on Plastic Pollution and Marine Litter – Global Plastics Hub	Consolidated plastics-relevant indicators, including trade.	Platform[8]
National customs data	A country's own customs declarations by HS code - usually the timeliest and most detailed source, and the basis for the international databases above.	Held by national customs authority

Trade data is usually categorised using Harmonised System (HS) codes or the Standard International Trade Classification (SITC). For most countries, the core plastic materials and products can be captured with the codes set out in Table 2.6.

Table 2.6. Core plastics trade codes

Category	HS codes	SITC codes
Primary plastics	3901-3914	571-575
Plastic products	3916-3926	581-583 and 893
Plastic waste	3915	579

HS 3901-3914 cover polymers in primary forms (including polyethylene, polypropylene, styrene and vinyl polymers, as well as silicones, petroleum resins, polyamides and cellulose-based polymers). HS 3915 covers plastic waste, parings and scrap, and HS 3916-3926 cover semi-manufactures and finished plastic articles. In SITC, semi-manufactured forms such as tubes, sheets and film are recorded under division 58 (581-583), while finished articles are recorded under 893.

These codes cover the core plastic materials and products. Countries with the capacity to do so may also examine a broader range of products that contain plastics such as textiles, packaging, building materials or consumer products using the additional codes in Table 2.7. This is not an exhaustive list. It is best suited to countries with more advanced data infrastructure, since it also requires examining indirect imports of plastics through product packaging and embedded components.

5 UN Comtrade database: https://comtradeplus.un.org
6 UNCTADstat Data Centre: https://unctadstat.unctad.org/datacentre/dataviewer/US.PlasticsTradebyPartner
7 Comext (Eurostat): https://ec.europa.eu/eurostat/web/international-trade-in-goods/database
8 UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform (trade/industry layer): https://globalplasticshub.org/

Table 2.7. Broader and associated plastics codes

Category	Example HS codes
Textiles	5401–5408
Packaging	3923
Building and construction	3916, 3918–3922, 3925
Consumer products	3924, 3926, and relevant sub-codes for specific products
Fishing gear	5608 (including 5608.11, made-up fishing nets)

The UNCTAD life cycle view

Classifying trade using HS Chapter 39 alone tends to undercount plastics trade, because it excludes the fossil-fuel feedstocks and chemical additives used to make plastics, textiles and packaging, fishing gear, and the large volume of plastic "embedded" in other manufactured goods. To address this, UNCTAD developed the first trade database to track plastics across their whole life cycle, and this dataset is hosted on the Global Plastics Hub Data Hub maintained under the Global Partnership on Plastic Pollution and Marine Litter (GPML).

Countries that wish to align their reporting with UNCTAD and the Global Plastics Hub can map their trade data to the life cycle categories in Table 2.8. The representative HS codes below are indicative; UNCTAD's full six-digit concordance and explanatory notes should be used for detailed work.

Table 2.8. UNCTAD plastics life cycle categories (indicative HS codes)

Life cycle category	Representative HS codes	Notes
Inputs to plastics		
Feedstocks and precursors	2707, 2710, 2711, 2901, 2902	Fossil-fuel by-products and chemical precursors used to make plastics; not exclusively plastics.
Additives	2917, 3204, 3206, 3812	Plasticisers, stabilisers and pigments; used in, but not exclusive to, plastics.
Plastics along the value chain		
Primary forms	3901–3914	Resins, pellets and primary polymers (SITC 571–575).
Intermediate forms	3916–3921	Monofilament, tubes, sheets, film and plates for further shaping (SITC 581–583).
Intermediate manufactured goods	Selected parts and components (per UNCTAD concordance)	Semi-finished plastic parts used as inputs to other manufactured products.
Final manufactured goods	3922, 3924–3926	Finished plastic articles (SITC 893).
Plastic waste	3915	Waste, parings and scrap of plastics (SITC 579).
Cross-cutting groups		
Plastic packaging	3923	Also captured under final manufactured goods; reported separately by UNCTAD.
Plastic textiles	5401–5408, 5501–5516, 6401–6402	Synthetic fibres, filaments, fabrics and plastic footwear (HS Chapters 54–55).
Fishing gear	5608	Made-up fishing nets and lines, largely plastic.

Note: *HS codes for feedstocks, additives, textiles and fishing gear are shared with non-plastic goods and should be treated as indicative. The definitive assignment of six-digit subheadings to each category is set out in Annex 1 of the UNCTAD methodology and on the UNCTAD Classifications page (see Sources).*

NOTE: Trade data from these sources primarily covers materials and products classified as plastics. It does not capture plastics embedded in, or forming part of, other products (such as electronic goods, vehicles, or textiles that are not separately coded), nor does it capture the packaging associated with a traded product - whether primary, secondary or tertiary - where that packaging is not separately coded. The packaging still enters the country along with the product and eventually becomes waste. As countries import a wide range of products, the volume of packaging entering this way can be significant, making its pathway into waste an important data gap to consider.

Transshipment is generally not a double-counting risk in trade data, since a shipment recorded as an export from one country is matched by a corresponding import elsewhere, leaving the net national trade balance unaffected. Matching trade data to other stages of the life cycle is more difficult, since a traded product's eventual end use is not always clear. This is addressed further in Part IV's guidance on material flow analysis and mass balance approaches.

Waste data

Waste data can refer to waste generated, waste collected, or waste treated. These terms describe different points in the life cycle, not interchangeable measures of the same thing:

- Waste generated: the total quantity of plastic materials and products discarded as waste by households, businesses, industries and other economic units within defined system boundaries during a specified period, regardless of what happens to it afterwards.
- Waste collected: the amount of plastic waste collected by formal or informal waste management systems for further processing, treatment or disposal, measured before sorting. May include contamination and material later rejected during processing.
- Waste treated: the amount of plastic waste that undergoes any form of processing, including mechanical recycling, chemical recycling, energy recovery, incineration and landfill, typically measured after sorting and cleaning. Part III of this Handbook treats Plastics Treatment (recycling and recovery) and Plastics Disposal (incineration and landfill) as separate chapters, with more detailed guidance[9] ; the broader definition used here is only for the purposes of this initial data identification pass.
- Recovered tonnes: the amount of plastic material that completes the recycling process and leaves the facility as a recycled commodity ready for sale, measured after sorting and processing.

Waste collection and treatment data should also be split into formal and informal waste management. Plastic waste rejected during sorting or recycling is counted within waste generated, since it is discarded regardless of its originally intended fate.

NOTE: Accounting for the gap between production/trade and waste generated.

In most countries, waste generated in any given year will be lower than the volume implied by production, imports and consumption in that year - because not all plastics consumed become waste in the same period. This gap is accounted for through three categories:

- In-use stock: plastics still embedded in long-lived products that have not yet reached end of life, tracked through stock-flow models based on average product lifespans.
- Informal and uncollected waste: plastics not captured by formal collection systems (open dumping, burning, littering), estimated through waste generation models or mass balance approaches.
- Environmental leakage: plastics that have escaped into the environment and are no longer tracked within the formal waste system.

Once waste generated, collected and treated data have been identified, link them to standard waste classification codes so figures can be compared across sources and, where relevant, reported internationally. Two systems are commonly used: the European Waste Code/ List of Wastes (EWC/LoW), a six-digit classification used mainly in EU/EEA reporting, and the Basel Convention classification, the international codes used to track transboundary movements of hazardous and plastic waste. The relevant codes under each system are set out in Table 2.9.

9 UN System of Environmental-Economic Accounting Central Framework (SEEA CF, 2012), for the distinction between waste residuals and waste products.

Table 2.9. Waste data

Category	Codes
EWC/LoW - clean plastics	02 01 04; 07 02 13; 12 01 05
EWC/LoW - plastic packaging	15 01 02
EWC/LoW - mixed plastics	19 12 04; 20 01 39
Basel Convention - plastic waste (special)	Y48
Basel Convention - hazardous plastic waste	A3210
Basel Convention - clean recyclable plastic waste	B3011

Source	What It Covers	Access
UNFCCC National Greenhouse Gas Inventory (Waste sector)	Greenhouse gas inventory data for the waste sector, which includes solid waste disposal data relevant to plastics. Where compiled annually, a ready-made, quality-assured national series.	Held by national UNFCCC focal point
Eurostat Waste Statistics	EU/EEA waste generation and treatment statistics by waste stream, standardised and comparable across reporting countries.	Database
Basel Convention Reporting	Annual national reporting on transboundary movements of hazardous and plastic waste. The authoritative source for a country's own transboundary plastic waste flows, and a binding reporting obligation in its own right.	Reporting portal
UNEP Global Partnership on Plastic Pollution and Marine Litter Global Plastics Hub	Consolidated waste-related indicators, useful as a cross-check against national figures.	Platform
National Inventory Reporting (waste composition)	Where a country's National Inventory Report includes a waste composition split, it may already contain a usable plastics disaggregation.	Held by national inventory compiler

Box 2.1: Using the World Bank's "What a Waste 3.0" dataset

What it is: a global waste dataset (published 2026) covering generation, composition, collection, treatment, disposal and related dimensions (including plastics management, institutional arrangements, and costs/ financing) for 217 countries and 262 cities, compiled primarily from official government statistics and publicly available data, supplemented by publications from international organisations and academic sources.

How to use it here: access the open dataset, filter to the relevant country (and city, if needed), and record the figures in the Checklist as a lower-confidence entry pending validation, rather than as an authoritative source on a par with national statistics.

The full dataset is available online.[10]

10 World Bank, What a Waste 3.0 https://www.worldbank.org/en/publication/what-a-waste

Data for plastics in the environment

Check first whether the country already reports into one of the platforms below.

Table 2.10. Data for plastics in the environment

Source	What It Covers	Access
UNEP Global Partnership on Plastic Pollution and Marine Litter -Global Plastics Hub	Consolidated global indicators on plastic pollution and marine litter, bringing several monitoring programmes together in one place.	Platform[11]
UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action	A methodology for identifying pollution hotspots at country level. Useful where a country wants to generate its own environmental-leakage estimates.	Guidance[12]
GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019)	The technical reference methodology most ocean litter monitoring programmes are built on.	Guidelines[13]
LITTERBASE (Alfred Wegener Institute)	A global database of literature-derived litter and biota records. Useful where no national monitoring exists, as a literature-based estimate.	Database[14]
Regional programmes: EMODnet, OSPAR Beach Litter Database, HELCOM Marine Litter Database	Regionally standardised monitoring data for participating European countries.	EMODnet[15] OSPAR[16] HELCOM[17]
National and citizen-science programmes: Ocean Conservancy's International Coastal Cleanup, Marine Debris Tracker, Litterati, the Australian Marine Debris Initiative Database (Tangaroa Blue Foundation), the NOAA Marine Debris Monitoring Program (USA), the Japanese Atlas of Ocean Microplastics	Often the only environmental-release data available where no formal monitoring programme exists. Generally lower in coverage and reliability than a structured monitoring programme - flag as such in the Checklist.	Tracker[18] Litterati[19] AMDI[20] NOAA[21] Japan Atlas[22]
Research institution databases: The Ocean Cleanup Research	Research-grade data, typically with a narrower geographic focus.	Research[23]

Informal-sector data

Many countries have a substantial informal sector operating across production, collection and recycling that will not appear in the official records above. Where this is the case, flag the relevant categories explicitly in the Checklist rather than leaving the gap unrecorded, even where no data point yet exists. Verifying and estimating informal-sector activity is addressed in more depth later in this workflow (Steps 5 and 6) and in Part III's guidance on disaggregating data by formal and informal actors.

11 UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform (environmental impact layer): https://digital.gpmarinelitter.org

12 UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action: https://www.unep.org/resources/report/national-guidance-plastic-pollution-hotspotting-and-shaping-action

13 GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019): http://www.gesamp.org/publications/guidelines-for-the-monitoring-and-assessment-of-plastic-litter-in-the-ocean

14 LITTERBASE (Alfred Wegener Institute): https://litterbase.awi.de/litter

15 European Marine Observation and Data Network (EMODnet): https://emodnet.ec.europa.eu/geoviewer/#!/

16 OSPAR Beach Litter Database: https://beachlitter.ospar.org/survey

17 HELCOM Marine Litter Database: https://helcom.fi/baltic-sea-trends/data/#DataPortals

18 Marine Debris Tracker: https://debristracker.org

19 Litterati: https://www.litterati.org

20 Australian Marine Debris Initiative Database (Tangaroa Blue Foundation): https://tangaroablue.org/database/

21 NOAA Marine Debris Monitoring Program: https://marinedebris.noaa.gov

22 Japanese Atlas of Ocean Microplastics: https://aomi.env.go.jp

23 The Ocean Cleanup Research: https://theoceancleanup.com/research/

Reconciling data discrepancies

Because data on different life cycle stages typically come from different sources, figures will rarely reconcile perfectly once brought together. Production plus imports, for instance, will not exactly equal consumption plus exports. Minor discrepancies are normal and should be documented rather than forced to balance. Larger discrepancies are often a sign that a definition, system boundary, or double-counting issue needs to be checked. Part IV of this Handbook sets out material flow analysis and other cross-cutting methods that can help reconcile discrepancies of this kind in more detail.

Disaggregating data

How granular a country makes this data, whether for its own national reporting, for regional platforms, or for international commitments such as Basel Convention Reporting or the INC process, is at the country's own discretion. Data can be split by the industry in which the plastic is used, the type of plastic resin, and the destination of plastic consumption or disposal (Figure 2.3).

In deciding on granularity, weigh the impact and feasibility of collecting more detailed data against the level of detail actually needed to develop and track national policy. Policy requirements can also change over time, so data systems should be designed with enough flexibility to accommodate greater granularity as more data becomes available.

Box 2.2: Tagging Data for Multiple End Uses

Most countries need the Plastics Data Inventory to serve more than one purpose. Tag every entry in the Checklist against the end use(s) it can support, rather than running a separate identification exercise for each:

- Basel Convention Reporting - transboundary movements of hazardous and plastic waste, reported annually against a fixed template. Often the fastest realistic win, since customs and trade records under HS or Basel Convention codes usually already exist.
- EPR scheme(s) - producer-level volumes placed on market, packaging composition, and collection/recycling rates. Often thin or absent until a scheme creates a reporting obligation - see Step 6.
- National policy commitments - the INC process, SDG tracking, and national reduction targets, which typically draw on the broadest life cycle picture and have more flexible timing than Basel reporting.

A data point tagged against more than one end use is a strong early candidate for inclusion in the first-draft inventory (Step 3) - it delivers the most value for the effort involved.

Disaggregating plastics data

Six dimensions for classifying plastics data. Dimensions 1–3 locate plastic in the flow; dimensions 4–6 describe the material itself.

A — LOCATING PLASTIC IN THE FLOW Where the plastic sits, and whose it is

1 Sector of use Sectors listed in UNEP/UNITAR *Statistical guideline for measuring flows of plastic throughout the life cycle.*

Packaging | Transportation | Building and construction | Electrical and electronic equipment | Consumer and institutional products | Industrial machinery | Textiles | Other

SOURCE	2 Consumption who uses the plastic	3 Waste who discards it, and by which pathways
Household	Plastics used in residential settings by individuals and families. Diverse polymer types, frequent small-volume purchases, and products designed for the end consumer.	Municipal solid waste collection, recycling through municipal facilities, waste-to-energy incineration, sanitary landfill, illegal dumping, and informal waste sectors.
Commercial and institutional	Plastics used by service-oriented businesses and public institutions: retail, hospitality, food service, offices, healthcare, schools and government buildings.	Pathways governed by organisational contracts. Regulatory compliance, service-level agreements and institutional sustainability targets influence material recovery.
Industrial	Plastics used in manufacturing and heavy industry: raw polymer inputs, components integrated into manufactured products, industrial packaging (pallets, bulk containers, protective wraps) and specialised technical plastics.	Plastic generated by manufacturing and industrial processes, including process scrap, off-specification product and spent industrial packaging.

The three sources are mutually exclusive and apply at both stages, so consumption and waste can be compared directly.

B — DESCRIBING THE MATERIAL Applies at every stage above

4 Form prevents double counting

Primary forms Pellets or nurdles → **Semi-finished products** → **Finished products** Assumed factors may be needed to estimate the plastic fraction.

5 Destination where the plastic goes

End-of-life fate	Recycled, incinerated, landfilled, or leaked to the environment.
Geographic destination	Retained for domestic use, or traded as product or as waste.
Destination sector	The sector where the plastic is finally used, which may differ from where it entered the economy.

6 Polymer the most commonly used plastic polymers, and why data is collected on each

POLYMER	COMMON PRODUCTS	RATIONALE FOR COLLECTING DATA
Polyethylene terephthalate (PET)	Beverage bottles	High recycling monetary value; used in beverage containers.
High-density polyethylene (HDPE)	Milk jugs, crates	Common in packaging and durable goods.
Polyvinyl chloride (PVC)	Pipes, cabling	Environmental concerns from chlorine content and additives.
Low-density / linear low-density polyethylene (LDPE, LLDPE)	Films, bags	Dominant in film applications and single-use packaging.
Polypropylene (PP)	Tubs, closures	Widespread in food packaging and durable goods.
Polystyrene / expanded polystyrene (PS, EPS)	Cups, trays	Environmental bioaccumulation, worsened by a lack of end markets.

WHY DISAGGREGATE Disaggregated plastics data allows precise progress tracking, identifies sector-specific recycling barriers, supports comprehensive material flow analysis, and enables meaningful international comparisons that account for economic differences between countries.

Figure 2.3: Disaggregating data

2.3 Step 2: Assess Data Quality

2.3.1 Purpose

Having completed Step 1, the lead agency will have a Checklist covering the full range of data sources. Not all of these, however, will be equally reliable or complete. Step 2 goes through each source in turn to assess its availability and quality, so that later steps can distinguish strong data from data that requires further development.

2.3.2 Key Actions

1. Document the characteristics of each data source.
2. Score data availability, using the RAG-rating (Green/ Amber/ Red).
3. Score data reliability (High/ Medium/ Low).
4. Verify data sources against each other and against their definitions.

2.3.3 Outputs

Every source in the Checklist ends this step with a documented characterisation and a paired availability and reliability score. This scored Checklist is used in Step 4 to identify and prioritise gaps.

2.3.4 Detail and supporting guidance

Documenting data characteristics

Before scoring a source, it helps to record how it was collected and what it actually measures - for example, whether a figure comes from a full census, a sample survey, an administrative record, or a modelled estimate, and what time period and geographic coverage it applies to. Capturing this for each source, rather than only the overall score, makes it much easier to explain later why a score was given, and to prioritise improvement efforts sensibly.

Scoring data availability

For each data point in the Checklist, assign a RAG-rating for data availability, as defined in Table 2.11. Sources rated Red or Amber should be considered for prioritised improvement in Step 4.

Table 2.11. Scoring data availability

Rating	Meaning	Descriptors
Green	Available and fit for purpose	Comprehensive data available at both national and sub-national level, collected periodically.
Amber	Partially available and/or partially fit for purpose	Data available at a limited spatial (for example, only some regions) or temporal resolution (for example, a single snapshot rather than a regular series), restricted to specific sectors, or difficult to access consistently.
Red	Not available and/or not fit for purpose	No data available, or data that does not allow plastic-relevant flows to be measured.

NOTE: Access is not the same as public availability.

A source that is not publicly published should not automatically be scored lower than one that is. Confidential administrative or industry data accessed through a formal data-sharing agreement - for example, a memorandum of understanding with an industry association, with the data anonymised for statistical use - can be just as available and reliable as a published dataset and is often the only way to obtain good-quality, regularly collected data on commercially sensitive categories.

Score restricted-access data on the actual comprehensiveness and regularity of the data itself. Note the access arrangement (public, restricted, or not yet accessible) separately in the Checklist, rather than folding it into the availability score.

Scoring data reliability

Reliability refers to the completeness and accuracy of the data - how far it can be counted on to be consistent and free from errors across time and sources. Score reliability as High, Medium or Low, as defined in Table 2.12.

Table 2.12. Scoring data reliability

Rating	Meaning	Descriptors
High	Representative at the national level and compiled using consistent, well-documented methods.	For example: official government statistical surveys, customs records, or an established industry reporting system with a clear, repeatable methodology. Well-run industry or administrative data can score High even where it is not, strictly speaking, a scientific study - the test is methodological consistency, not the type of institution collecting it.
Medium	Partially representative of the national picture or compiled using a less preferred method.	For example: a component such as waste composition estimated from data in other regions or countries, or figures derived through proxy calculations.[24]
Low	Limited representativeness or methodological rigour.	For example: data derived from a proxy statistic such as monetary value, or a single, unverified estimate.

This step assesses each source's reliability on its own terms. Comparing sources against each other, and resolving discrepancies between them, is covered separately below and carried further in Step 4.

Verifying data sources

Data points from different sources can vary significantly, usually because of differences in methodology or in how a term is defined. For example, "municipal solid waste generated" could be interpreted as everything collected plus leakage along the supply chain, or only the material that physically arrives at a waste recovery or disposal facility, two different data points that are easy to mistake for the same measurement.

To verify data values and sources:

- check which definition is being used for the data category;
- cross-validate between different sources covering the same category;
- account for double-counting risk where the methodology involves summing data from more than one source; and
- check that assumptions and calculations behind a figure are recorded and evidence-based.

24 Apparent consumption, calculated as production plus imports minus exports, is used as a proxy for actual consumption. See UNITAR statistical guidelines on plastics data.

NOTE: A country may genuinely have no data at all for a category. This is different from having data that is simply weak, and the Checklist should reflect that difference. In such cases, record "no data available" rather than leaving the entry blank or entering a zero, since a blank entry or an unexplained zero could be mistaken for an actual measurement of nil activity, whereas a recorded absence gives a clear signal for Step 4's gap analysis.

Specific quality issues and quality-assurance approaches for each plastics data category are set out in Table 2.13.

Table 2.13. Verifying data sources

Data Category	Key Quality Issues	Quality Assurance Approaches
Production data	Time lags in reporting. Potential missing data from small producers. Data may cover total output without distinguishing what is later exported (see note below).	Cross-check between national and international databases. Compare with industry capacity data. Validate against trade flows.
Consumption data	Apparent consumption does not capture stockpiling. Informal market activity is often not captured.	Cross-validate apparent consumption calculations against market surveys. Compare with industry reports. Check consistency with waste generation data.
Trade data	Small shipments may fall below reporting thresholds. Plastic waste trade is often poorly recorded.	Compare mirror statistics between trading partners.
	Partner countries may report the same shipment differently. Low-value shipments (for example, waste or cheap plastic products) are more prone to estimation error in official statistics.	Cross-validate between national and international databases. Check for reporting thresholds and exemptions.
Waste data	Informal-sector activity is not typically captured. Mixed waste streams are difficult to characterise. Measurement approaches are inconsistent between jurisdictions.	Compare with consumption data. Cross-check between different stages of waste management. Validate against EPR collection data, where available.

On the production note above: a high reported production volume is not necessarily a domestic consumption or waste problem if most of that volume is exported. Cross-check production figures against trade data before drawing conclusions about domestic plastic flows.

2.4 Step 3: Build the First Draft of the Data Inventory

2.4.1 Purpose

By the end of Step 2, a country has a list of individually scored data sources, but not yet a single, usable picture of its plastics data. Step 3 brings that list together into a first version of the Plastics Data Inventory: a working document that records, in one place, what is known, how confident that knowledge is, and where the clear gaps lie. It will not be complete, nor is it intended to be. Its purpose is to provide Steps 4 to 6 a concrete basis on which to build.

2.4.2 Key Actions

1. Create the Plastics Data Inventory as a basic spreadsheet, with a separate sheet for each category in the plastics value chain and populate it using the scored Checklist from Step 2.
2. Within each category sheet, structure the entries as a time series, covering as many years as data availability or the country's specific requirements allow.
3. Clearly flag data gaps, low-confidence entries, and assumptions rather than leaving them blank. An explicit "not yet available" is more useful to the next reader than an empty cell.
4. Circulate the draft internally for a brief review, to check for entries that appear clearly incorrect or disproportionate, before it goes into the gap analysis in Step 4.

2.4.3 Outputs

A first draft Plastics Data Inventory, with gaps and confidence levels visibly marked and entries tagged by end use. This is the input to Step 4.

2.4.4 Detail and supporting guidance

There is often a temptation to delay sharing an inventory until it appears complete. In practice, this rarely happens without outside help. Most of the gaps remaining after Step 2 can only be closed with support from outside the lead agency, which is the purpose of Steps 4 to 6. Waiting for a complete picture before sharing the draft tends to delay progress rather than protect it.

A rough but honest first version is more useful than a polished but incomplete one. If a category is missing, this should be stated explicitly, rather than left as a blank cell that a later reader might mistake for a zero. Where a figure rests on an assumption, for instance, that this year's waste composition is the same as last year's, that assumption should be recorded alongside the figure.

This distinguishes an inventory that stakeholders can meaningfully engage with from one that risks misleading whoever relies on it next. This first version should be treated as a working document, not a finished product. It will be revisited and improved in Step 6, once institutional and stakeholder input (Step 5) has had a chance to fill in what this step could not.

Populating the Inventory, category by category

The most manageable way to populate the Inventory is one life cycle category at a time, moving through the same categories used for the Checklist in Step 2:

- Production
- Consumption
- Trade (imports and exports, of primary plastics, plastic products, and plastic waste)
- Waste generated
- Waste collected - formal and informal channels
- Waste left uncollected
- Waste treated (recycled or upcycled, used for energy recovery)
- Waste disposal (sent to landfills or dumpsites, incineration and open burning)
- Plastic leaking into the environment

Working category by category, rather than trying to complete the whole document at once, makes it easier to see which parts of the inventory are already strong and which still rest on a single source or an assumption.

BOX 2.3: A Quick Way to Tag Data Status

Add one word next to each entry, even before the fuller record is complete:

No data found - nothing usable exists yet for this category.
Estimated - calculated using a method such as mass balance or a regional default.
Partial - some real data exists, but coverage is incomplete.
Measured - based on direct, primary data collection.

This single column shows reviewers at a glance where the inventory is solid and where it still needs work.

Filling data gaps

Some categories will have no directly measured data at all. Rather than leaving these blank, two approaches can be used, provided the method used is written down next to the figure.

Approach 1: Estimate by difference (mass balance)

Where a category cannot be measured directly but sits between two categories that can, it can often be estimated by difference. For instance:

Waste Left Uncollected = Waste Generated − Waste Collected (Formal) − Waste Collected (Informal)

Where possible, this kind of derived figure should also be checked against a second, independent estimate, even a rough one, to confirm the result is plausible.

Approach 2: Borrow a default value, and flag it clearly

When no domestic figure exists, a default from a regional or international study can be used instead such as a standard composition breakdown or an average collection rate for a comparable country context. This is a legitimate way to avoid an empty inventory, but the entry should be clearly labelled as a placeholder, so it is replaced with a domestic figure as soon as one becomes available, rather than mistaken for local evidence. Where only two data points exist for a category (for example, two survey years several years apart), a simple growth-rate calculation between them can be used to estimate the years in between, again with the assumption stated alongside the figure.

Additional Sources of Data to Consider

A first inventory can often draw on data sources that are not immediately obvious:

Survey questions already being asked. An existing national population or household survey, even where originally designed for another purpose, can serve as a proxy for how households dispose of waste, once the relevant questions are identified and extracted.

Regional or international technical studies. These can supply a default figure for a category with no domestic data at all, pending a more locally specific source.

Community groups, youth-led initiatives, and informal-sector operators. They can hold some of the most detailed and disaggregated data available, despite limited institutional recognition or support.

The first inventory should actively look for useful data across this full range of sources, not only within formal government or industry bodies.

Coordination Challenges to Anticipate

Two recurring challenges can arise at this step, even though they are not fully resolved until Step 5:

Challenge 1: Centrally held data may only be released in aggregate. The authority best placed to hold much of the relevant data, most often the National Statistics office, may only be able to release figures at a national or aggregated level, owing to its own data-sharing arrangements with the agencies that supply it. Disaggregated figures, where needed, should be requested directly from the individual agencies or organisations that generate them.

Challenge 2: Willingness to share is uneven across the life cycle. Organisations on the collection, recycling, and disposal side of plastics tend to be more willing to share, while private-sector actors further upstream are often more cautious, citing commercial sensitivity. Where this is the case, an indirect proxy, such as trade data or a sector-level index, can serve as an interim stand-in in the first inventory while direct engagement is pursued through Step 5.

2.5 Step 4: Analyse Gaps and Set Priorities

2.5.1 Purpose

With a first-draft Inventory in hand, the next task is to determine which gaps matter most, and in what order to address them. Step 4 turns the Inventory's visible gaps into a short, well-supported list, which Step 5 uses to approach the right stakeholders with a specific request.

2.5.2 Key Actions

1. Assign scores for each data category.
2. Assign scores for each plastics data type.
3. Weight the resulting priority score by urgency as well as by data quality.
4. Validate the gap analysis with stakeholders and data custodians.

2.5.3 Outputs

A prioritised list of data gaps, weighted by both quality and urgency. This list is the input to Step 5.

2.5.4 Detail and supporting guidance

Scoring each data category

To decide what to improve first, assign a score for each data category using the descriptors in Table 2.14. The smaller the score, the stronger the case for prioritising that category's improvement. Where a category has no data at all, score it 0, to flag it for urgent attention.

Each sub-score below uses the same 0-2 scale: 0 marks the answer that most strongly supports prioritising the category now, 2 marks the answer that most strongly supports deferring it, and 1 mark the answer in between. This keeps Data Availability, Data Reliability, Ease to Fill Gap, and Impact of Filling Gap equally weighted in the total, so no single sub-score can dominate the ranking on its own.

The data availability and reliability scores should already exist from Step 2. At this stage, simply transpose those ratings into the numeric scores below, then add two further judgements:

- Expected ease to fill the gap: draw on stakeholders' own expertise to understand why a gap exists (a missing collection mechanism, insufficient resources, a regulatory limitation) and how hard it would realistically be to close.
- Impact of filling the gap: draw on stakeholders' expertise to gauge how much demand there is for the data - for example, how central it is to policy objectives or reporting requirements.

Table 2.14. Scoring each data category

Data Availability	Score	Data Reliability	Score	Ease to Fill Gap	Score	Impact of Filling Gap	Score
Yes	2	High	2	Challenging	2	Low	2
Partially	1	Medium	1	Moderate	1	Medium	1
No	0	Low	0	Easy	0	High	0

Sum the scores for each data category. The categories with the lowest totals are the strongest candidates for prioritised improvement.

Worked example: a category with all four sub-scores

Category: producer-reported packaging weights. Data Availability = Partially → 1. Data Reliability = Medium → 1. Ease to Fill Gap = Moderate → 1. Impact of Filling Gap = High → 0.

Total = 1 + 1 + 1 + 0 = 3, out of a possible 0-8 range (0 = strongest possible candidate for prioritisation). A total of 3 sits toward the lower end of that range, so this category is a reasonably strong candidate - mainly on the strength of its high policy impact, even though the data that exists is only partially reliable.

Where Data Availability is No, do not separately score Data Reliability - there is not yet any data to assess for reliability. Base that category's priority on the average of its three applicable sub-scores (Availability, Ease, and Impact) rather than a four-term sum, so it remains comparable to categories where all four sub-scores apply; for all other categories, use the average of all four sub-scores.

Worked example: a category with no data at all

Category: informal-sector collection volumes - the plastic waste collected by waste pickers and informal recyclers, which sits outside municipal collection statistics. Data Availability = No → 0. Data Reliability is not scored - there is no data yet to assess for reliability (see the rule above). Ease to Fill Gap = Challenging → 2. Impact of Filling Gap = Medium → 1.

Only three sub-scores apply here, so average them rather than summing four terms: (0 + 2 + 1) ÷ 3 = 1.0. Compare that to the example above, expressed the same way: 3 ÷ 4 = 0.75.

On this shared 0-2 average, the packaging-weights category (0.75) is actually the slightly stronger priority candidate, even though "no data at all" sounds more urgent than "partially available, moderately reliable." That is because this category's gap is hard to close and only moderately impactful. This is exactly why an average, not a raw sum, is used to compare categories that have a different number of applicable sub-scores.

Scoring by plastics data type

This is a separate prioritisation exercise from Table 2.14 and produces its own ranking; the two tables' totals are not added together.

A related decision is which type of plastic, for example primary forms, semi-finished products, finished products - to focus data collection on. If products are the focus, a further decision is needed on which kind of products: whether to prioritise 100% plastic items or composite products (pure plastic items are typically easier to measure), high-volume or low-volume categories, and environmentally problematic plastics.

Score these choices the same way: the ease of identifying data for each plastics stream against the impact of having that data, using Table 2.15. The lower the score, the stronger the case for prioritising that stream.

Table 2.15. Scoring by plastics data type

Ease to Fill Gap	Score	Impact of Filling Gap	Score
Challenging	2	Low	2
Moderate	1	Medium	1
Easy	0	High	0

Worked example: choosing between two plastics streams

Stream A - single-use PET beverage bottles: a largely single-material stream already tracked through many deposit-return and recycling schemes. Ease to Fill Gap = Easy → 0. Impact of Filling Gap = Medium → 1. Total = 0 + 1 = 1, out of a possible 0-4 range.

Stream B - multi-material flexible packaging (e.g., laminated pouches, chip bags): mixed materials make it hard to identify and measure separately. Ease to Fill Gap = Challenging → 2. Impact of Filling Gap = High → 0. Total = 2 + 0 = 2.

Even though Stream B carries the greater policy and environmental significance, its total (2) is higher than Stream A's (1), so Stream A is the stronger near-term candidate under this scoring. This is the same quick-wins logic used in Table 2.14: an easier-to-measure stream is prioritised ahead of a harder-to-measure one of greater underlying importance. Where a stream's importance is judged to outweigh its difficulty, that judgement is applied through the urgency-weighting step below, not by adjusting the Table 2.15 score itself.

Weighting priority by urgency, not only by quality.

Box 2.4: A lower quality score is not always the higher priority

A data category with a moderate quality score can still be more urgent than one with a worse score, if it sits behind a binding, deadline-linked reporting obligation. As a rule of thumb:

- Basel Convention Reporting gaps are annual and binding - treat these as a floor priority regardless of how they score on the rubric above.
- Extended Producer Responsibility (EPR) scheme gaps are usually driven by a scheme's own reporting calendar once it exists, and by the practical need for baseline data before a scheme is designed.
- National policy and reporting commitments (the INC process, SDG tracking, national targets) are typically the most flexible in timing and can absorb whatever prioritisation capacity is left over.

Validating the gap analysis

Once the initial gap analysis and prioritisation are complete, check the results before acting on them:

- Expert review - have subject matter experts check the findings for completeness and accuracy.
- Stakeholder validation - present the list to key stakeholders for feedback and anything that has been missed.
- Cross-reference with policy objectives - make sure the prioritised gaps line up with national policy goals and international commitments, not only with what is easiest to measure.
- Reality check - weigh the prioritised list against the resources genuinely available, to confirm it is achievable and not only correct in principle.

A gap analysis that has been through this validation gives Step 5 a list that stakeholders have already had a chance to see and shape, which makes the targeted engagement in that Step 5 more effective.

2.6 Step 5: Engage Stakeholders to Close Priority Gaps

2.6.1 Purpose

Plastics data is scattered across sectors and organisations in a way that no single agency will ever hold on its own - government departments, industry, waste management operators, the informal sector, research institutions, and civil society each hold a piece of the picture. Step 5 is where the lead agency goes out and engages the stakeholders who hold the missing pieces, using the priority list from Step 4 as a specific ask, rather than a general request for information. This is the step where stakeholder engagement is a dedicated effort in its own right, distinct from the light stakeholder scan already carried out alongside data identification in Step 1.

2.6.2 Key Actions

1. Translate the priority gap list from Step 4 into a specific data request for each relevant stakeholder.
2. Carry out full stakeholder mapping and analysis for the relevant sectors, building on the initial list from Step 1: desktop research, initial consultations, and snowball identification to find less visible data-holders, including in the informal sector.
3. Establish or activate structured engagement mechanisms, such as bilateral requests, sector working groups, or a multi-stakeholder forum - to request and receive the missing data.
4. Record what is received, from whom, and under what data-sharing terms, and note which stakeholders should also review the improved Inventory in Step 6.
5. Conduct several rounds of contact with the same stakeholder before a firm data-sharing commitment is reached; treat the priority list from Step 4 as the start of a relationship to be built over multiple engagements, not a single request-and-response exchange.

2.6.3 Outputs

Data or firm commitments to provide data against the priority gaps, including a documented, lasting stakeholder engagement mechanism that continues beyond this one round. This feeds directly into Step 6.

2.6.4 Detail and supporting guidance

A stakeholder, for the purposes of this Handbook, is any individual, institution or organisation that holds plastics-related data, needs it, or is otherwise affected by how it is collected and used. Many stakeholders do both at once. A municipal waste department, for instance, generates its own collection data and also relies on national statistics to plan its services. Therefore, this Handbook does not draw a hard line between "producers" and "users" of data. What matters in practice is mapping the different interests, capacities and constraints each stakeholder brings, not which side of an artificial line they sit on.

Box 2.5: Grounding Stakeholder Engagement in the Literature

The stakeholder engagement approach set out in this Handbook draws on established thinking in environmental governance.

Reed (2008) frames stakeholder participation as varying in depth and intensity - from one-way information-sharing through to full collaboration in decision-making and argues that effective engagement starts with systematic identification of stakeholders and a clear understanding of their differing interests, capacities and power, rather than a single uniform activity applied to everyone.

This power/interest-based approach to mapping has been applied directly in national plastics value chains. Gerassimidou et al. (2025) use structured stakeholder mapping to identify and prioritise external actors across Indonesia's plastics system, distinguishing stakeholders by influence and interest so that engagement effort is targeted where it is most needed.

Stakeholder analysis can also be used further upstream, to shape engagement itself. Scrich et al. (2024) show how it can inform the framing of collaborative governance arenas, helping identify who should be brought together and around what shared problem before a forum is convened.

Once stakeholders are at the table, Emerson, Nabatchi and Balogh's (2012) integrative framework for collaborative governance describes how engagement becomes durable joint action through cycles of principled engagement, shared motivation and shared capacity beyond a single data-request round.

2.6.5 Mapping stakeholders systematically

Table 2.16 sets out a suggested three-phase process for a thorough stakeholder mapping exercise, building on the light scan already carried out in Step 1.

Table 2.16. Mapping stakeholders systematically

Phase	Activities	Key Outputs
Phase 1: Desktop research	Identify relevant government agencies Analyse import/export databases Review business registries for plastics-related enterprises Map waste management service providers List active NGOs and research institutions	Initial stakeholder database Sector mapping Preliminary contact list Gap identification
Phase 2: Initial consultations	Interview key government agencies Meet with industry associations Consult municipal waste departments Engage civil society networks	Validated stakeholder list Key contact persons Initial relationship-building Refined understanding of the value chain
Phase 3: Snowball identification	Ask each stakeholder to identify others Map informal-sector networks Identify less visible actors in the value chain Verify and validate the stakeholder list	Comprehensive stakeholder map Informal-sector contacts Complete value-chain coverage Final stakeholder database

Stakeholder categories

Table 2.17 summarises stakeholder groups with particular data relevance across the plastics life cycle (Figure 2.4). Engagement approaches should be tailored to the specific circumstances and challenges of each group, rather than applied uniformly.

Table 2.17. Stakeholder categories

Category	Typical Entities	Data They Can Provide	Engagement Considerations
Production & import	Primary producers - polymer manufacturers and pre-production pellet producers (including upstream petrochemical or gas-to-plastics feedstock suppliers, where relevant). Product manufacturers - packaging, consumer goods, and construction material producers. Importers - raw material and finished-goods importers, traders.	Production volumes by polymer type; domestic sales and export volumes. Product output by category; plastic content percentages; distribution patterns. Import volumes by HS code; country of origin; end-use sector.	Commercial confidentiality is a common barrier. Sector representation and data systems vary widely between companies. Informal importers and traders are harder to capture through formal channels.

Category	Typical Entities	Data They Can Provide	Engagement Considerations
Distribution & retail	Distributors and wholesalers - the intermediaries between producers and retailers. Retailers - supermarkets, markets, specialty stores, and online/cross-border e-commerce sellers.	Sales volumes; geographic distribution; customer types. Sales data by product; packaging volumes; consumer behaviour, including whether goods are sourced through local markets or online/ international channels.	Record-keeping is often limited, and some distributors are reluctant to disclose sales data. The informal retail sector and high transaction volumes make full coverage difficult.
Consumption & Waste generation	Households (by income level and rural/urban location). Commercial - hotels, restaurants, offices, shopping centres, and tourism-related consumption (including short-term rental platforms and festivals, which can be significant contributors). Institutional - government buildings, schools, hospitals.	Consumption patterns; waste generation rates; disposal practices. Procurement data; waste volumes; current practices. Procurement records; specialised waste streams; disposal contracts.	Achieving genuinely representative sampling -across income groups, geography and season - is the goal; the risk to guard against is biased or unrepresentative sampling, not sampling itself. Tenant and staff turnover in commercial settings, and multiple departments in institutional settings, can disrupt consistent reporting.
Collection & recovery	Formal collectors - municipal services, licensed contractors. Informal collectors - waste pickers, itinerant buyers, cooperatives.	Collection volumes; route coverage; material recovery. Material flows; recovery rates; price information.	Incomplete weighing and mixed waste streams affect formal-sector data quality. Informal-sector engagement requires trust-building and should also account for open burning as well as open dumping, which remain common in some areas, including as a fuel source (Wilson et al., 2006).
Processing & disposal	Recyclers -mechanical and chemical recyclers, exporters of recovered material. Disposal facilities - landfills, incinerators, dumpsites.	Input volumes; output products; technology capacity. Receipt volumes; waste composition; leakage estimates.	Informal processing operations and variable quality data are common. Record-keeping at disposal sites is often poor, and confidentiality concerns can affect willingness to share data.

A note on units: when comparing data across stakeholder groups, check whether figures are reported by weight or by volume before combining them. The two are not interchangeable and mixing them without conversion is a common source of error.

2.6.7 Data-sharing agreements and confidentiality

Box 2.6: securing data that stakeholders are reluctant to share

Commercial confidentiality is one of the most consistent barriers raised by industry stakeholders and is not a minor administrative detail. It often requires legal and technical work to resolve properly.

- Use a memorandum of understanding (MoU) or similar agreement to set out what data will be shared, how it will be used, and how confidentiality will be protected.
- Anonymise or aggregate commercially sensitive figures (for example, reporting sector totals rather than company-level figures) where individual disclosure is not achievable (UN Statistical Commission, 1994/2014).
- Where the country has legislative levers available such as reporting obligations under environmental, waste, or producer-responsibility law, these can give the lead agency clear authority to request data, rather than relying solely on voluntary cooperation. Where no such legislation exists yet, this should be noted as an input to Step 7.
- Reputational risk is a distinct barrier from commercial confidentiality: a research partner or civil-society monitor holding sensitive findings (for example, data that names or implicates specific companies) may withhold or delay sharing them for fear of backlash, even where the data itself is not commercially confidential. Where this applies, the lead agency may need to offer an institutional publication channel or other legal cover before the data will be shared or released (Delmas & Burbano, 2011; Break Free From Plastic, 2023; Cowger et al., 2024).

This process takes time. Allow sufficient time in the engagement plan for legal review and negotiation, rather than expecting data-sharing agreements to be finalised in a single meeting.

2.6.8 Multi-stakeholder forums

In practice, bilateral consultation is usually the most effective starting mechanism, since it allows the lead agency to understand each stakeholder's specific position before bringing multiple parties together. Sector working groups and multi-stakeholder forums tend to work best once relationships and enough of a shared picture have been established and are typically convened at specific milestones to agree standards, resolve a cross-cutting issue, or validate findings across stakeholders rather than as a default first point of contact.

A multi-stakeholder forum brings data producers and users together, including government agencies, industry associations, research institutions, civil society, waste management authorities, and the informal sector, in a neutral, inclusive space to:

- agree data standards, protocols, and quality-assurance mechanisms;
- develop mechanisms for data sharing and integration across sectors; and
- work through coordination challenges and institutional silos that no single agency can resolve alone (Ansell & Gash, 2008).

Following these discussions, some form of agreement should be reached on who is responsible for what - which stakeholder collects, manages, shares, or reports on which data, how often, and through what channel.

A well-designed engagement process mobilises a broad range of expertise and data, encourages investment in data infrastructure and capacity, and - through sharing methodologies and lessons learned - strengthens both the national data system and the wider international knowledge base on plastics monitoring (Reed, 2008). In practical terms, it improves the evidence base for policymaking, supports industry compliance and due diligence, and strengthens accountability across the plastics value chain.

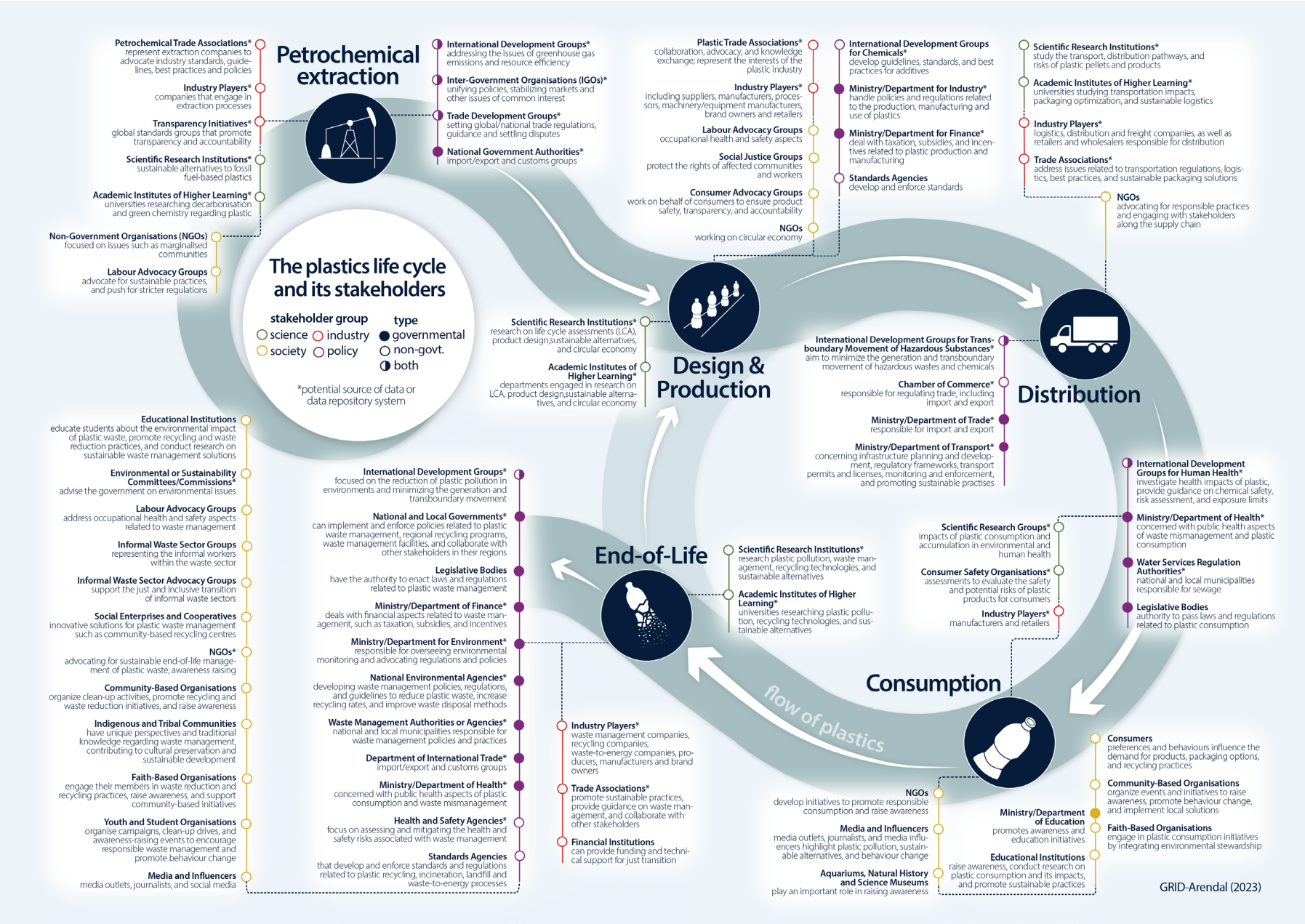


Figure 2.4: The Plastics life cycle and its stakeholders

Common challenges

Engaging a diverse set of stakeholders and building durable data-governance arrangements requires sustained effort. The following challenges should be acknowledged directly rather than overlooked.

Table 2.18. Common challenges

Challenge Category	Specific Challenges
Institutional and coordination	Data silos between institutions and sectors that limit information-sharing (Dawes, 1996). Sustaining stakeholder engagement over time, not just for an initial round. Unclear or overlapping roles and mandates across agencies. Balancing data confidentiality with transparency and accessibility. Unclear data ownership and chain of custody, such that data collected by one organisation does not reliably reach the decision-makers who need it (Khatri & Brown, 2010).
Capacity and technical	Limited technical capacity to collect, manage, analyse and share data Shortage of expertise to interpret and communicate complex data appropriately. Interoperability gaps between different data systems. Keeping systems functional as institutional arrangements change. The most granular, valuable data often sits with the least-resourced stakeholders (for example, civil society or youth-led groups), who may need dedicated support to sustain collection rather than being treated as a lower priority for engagement (Dias, 2016).
Political and economic	Commercial confidentiality and competitive sensitivity. Political sensitivity around some data (for example, illegal dumping). Securing sustainable, long-term funding rather than one-off project funding. Political and public acceptance of enforcement measures.
Engagement and communication	Inconsistent public engagement and messaging. Lack of standardised definitions and methodologies, nationally and internationally (UNEP, 2024). Communicating effectively across stakeholder groups with very different technical backgrounds.

2.7 Step 6: Improve, Verify and Consolidate the Inventory

2.7.1 Purpose

Step 5 should have brought in new data, or at least firm commitments to provide data. Step 6 incorporates that data into the Inventory. If there are any gaps stakeholders could not fill, these are addressed through primary data collection. The improved Inventory is presented to stakeholders for confirmation before it becomes the final working version.

2.7.2 Key Actions

1. Incorporate the data received in Step 5 into the Inventory.
2. Where priority gaps remain unfilled by stakeholders, commission primary data collection (waste audits, surveys, sampling) using the cross-cutting methodologies and sampling guidance in Part IV of this Handbook.
3. Re-score updated entries using the Step 4 rubric, and record what changed between the first and improved versions.
4. Present the improved Inventory to the stakeholders engaged in Step 5, to verify it is correct before treating it as the working version.
5. Flag scheme-dependent gaps - most often EPR producer-level data - that cannot realistically be closed until the relevant scheme or legal instrument exists.

2.7.3 Outputs

A verified, improved, higher-confidence Plastics Data Inventory, endorsed by the stakeholders who contributed to it. This is the basis for Step 7 and, in time, for a Plastics Account.

2.7.4 Detail and supporting guidance

Expect to go round Steps 4 to 6 more than once. This is a normal part of building an inventory, not a sign that something has gone wrong. Each pass should leave the Inventory measurably better than the last, and how many passes it takes depends on the country's own capacity and resourcing, not on a fixed schedule.

Verification matters as much as the improvement itself. An inventory that has picked up new data but was never checked back with the stakeholders who supplied it runs a risk of embedding a misunderstanding - a double-counted figure, a misapplied definition, a number attributed to the wrong year. Closing the loop by presenting the improved version for confirmation is what allows the country to treat it as a reliable working document from Step 7 onward.

Incorporating New Data and Tracking Progress

Incorporating the data received in Step 5 is largely mechanical: each entry is updated with the new figure, its source, and its date, and re-scored against the Step 4 rubric so the confidence rating reflects the improved evidence rather than the original placeholder.

What is easy to lose track of, across several rounds of Steps 4 to 6, is which entries have actually improved, and which have not. A simple way to keep this visible is to mark, alongside each entry, whether it has moved from a borrowed default to a domestic figure, from an estimate to directly measured data, or has not changed since the previous version. Reviewed together, this record makes it straightforward to see how much of the inventory now rests on primary data and helps focus the next round on the categories that have not yet moved.

BOX 2.7: Tracking Progress Toward a Fully Measured Inventory

For each updated entry, note which of the following applies:
Regional/default → Domestic - a borrowed placeholder has been replaced with a country-specific figure.
Estimated → Measured - a derived or mass-balance figure has been replaced with primary data.
No change - still awaiting data; carried forward to the next round.

Commissioning Primary Data Collection to fill data gaps

Where Step 5 has not been able to fill a priority gap, the next option is primary data collection to gather new data directly, rather than relying further on outreach. The Handbook's cross-cutting guidance on surveys, material flow analysis and sampling sets out the general methods. The examples below illustrate how they can apply in practice for a first improvement round.

1. Waste characterisation audits at disposal sites. Physically sampling waste arriving at a landfill or dumpsite is one of the most direct ways to convert a tonnage figure into a plastic-type breakdown, and to check whether a composition assumption borrowed from elsewhere still holds locally. Waste audits of households and commercial entities can also help establish waste composition and disposal pathways.

2. Sector-specific surveys with major resource-dependent industries. Where a sector's waste or production figures rest on a general regional default, for example for tourism, fisheries or agriculture, a short survey or consultation with the relevant industry association or Ministry can produce a figure specific to the country, replacing the default.

3. Combining spatial or satellite mapping with targeted ground-truthing. Where a broad spatial dataset already exists, for example mapping the size and location of dumpsites, pairing it with a smaller set of on-the-ground audits can convert a size estimate into a plastic tonnage estimate without requiring a full survey of every site.

4. Pilot studies to test assumption-based rates. Leakage percentages, informal collection rates and similar assumptions can be tested, even at a small scale, through a targeted pilot, and refined with real evidence rather than carried forward indefinitely on the basis of a borrowed default.

5. Using an existing periodic index as a proxy. Where no dedicated study exists for a category, for example production, a country's own periodic economic or production statistics can sometimes be adapted, with any assumptions used to translate the index into a plastics figure documented clearly alongside the number.

Closing the Loop: Verifying the Improved Inventory

Once the Inventory has been updated, it should be presented to the stakeholders engaged in Step 5, and to anyone else who will rely on it, before it is treated as the working version. The aim is not simply to inform them of the update, but to actively invite feedback - what looks wrong, what is unclear, and what does not yet meet their needs.

Consolidating this feedback into a single list of confirmed changes, and resolving each point before moving on, is what allows the Inventory to be used with confidence in Step 7 and beyond.

Scheme-Dependent Gaps

Not every remaining gap can be closed through further outreach or primary data collection. Some categories, most often producer-level data tied to an Extended Producer Responsibility (EPR) scheme, will show little or no data simply because the reporting mechanism that would generate it does not yet exist. Without a legal obligation or scheme in place, there is no established channel through which a producer would routinely report this information.

These gaps are worth flagging clearly as scheme-dependent, distinct from an ordinary data-quality gap that further stakeholder engagement could still close. Once flagged, the appropriate next step is not more data collection, but the institutional and legal work covered in Step 7 - establishing the scheme, mandate or reporting obligation that would allow the data to exist in the first place.

2.8 Step 7: Institutionalise and Sustain the System

2.8.1 Purpose

A National plastics data system only lasts if it has real institutional backing and the resources to match. Step 7 ensures that the provisional arrangements from Step 1 are turned into something durable, with a proper mandate, a functioning team, and agreed coordination across the institutions responsible for different end uses of the Inventory as well as embedded technical capacity to keep the data system reliable, accurate and improving over time.

2.8.2 Key Actions

1. Secure a durable institutional mandate and resources, now backed by a demonstrated working Inventory.
2. Establish or confirm implementation capacity, including the technical team and supporting infrastructure needed to sustain the work.
3. Agree a coordination mechanism across the institutions responsible for different end uses of the Inventory.
4. Embed the work in legislation and policy commitments; sustain the stakeholder engagement mechanism from Step 5; keep investing in capacity development and digitalisation; and set a regular update cycle.

2.8.3 Outputs

A durably mandated, adequately resourced plastics data system, with agreed cross-Ministry coordination, producing statistics on a regular cycle, and positioned to develop a Plastics Account aligned with the SEEA.

2.8.4 Detail and supporting guidance

Securing a mandate and resources

Without a clear mandate, an agency has no real authority to compel data provision or enforce reporting. Without a designated lead, coordination becomes fragmented. Without adequate, durable funding, even a well-designed system will not survive beyond its first pilot phase. Funding constraints are one of the most common reasons national data systems stall after an initial period of activity, and this point should be given serious attention rather than treated as a minor detail. Securing all three before expanding stakeholder engagement builds credibility with data providers and gives the system the stability it needs to last.

- Identify existing mandates and authorities - check which agencies already have legal authority to collect plastics-related data, and whether gaps can be closed through minor legislative amendments or administrative arrangements.
- Clarify lead-agency responsibilities - decide which agency is best placed to coordinate plastics data collection across the value chain, typically the Ministry of Environment, the National Statistics Office, or a waste management authority, depending on the country's own institutional structure.
- Map current agency roles - document who already collects relevant data (Customs for imports, industry ministries for production, municipalities for waste) and look for ways to coordinate within existing structures rather than building a parallel system.
- Assess data-sharing mechanisms - review how agencies currently exchange data, and agree standard formats, timelines, quality checks and contact points where this is not yet working well.
- Secure financing - fund not only the initial system build but its ongoing operation, including a dedicated budget line for regular reporting; a system that depends on one-off project funding is not sustainable.
- Evaluate institutional capacity and readiness - check whether current staffing, technical systems and coordination arrangements are enough for comprehensive plastics data work, as a diagnostic for where to invest, not as a case for restructuring the institution itself.

Box: 2.8: Institutional readiness checklist

Before scaling up a national plastics data system, it is worth checking readiness across the following areas:

- Is there a clear mandate or legal authority to collect and manage plastics data?
- Is adequate budget allocated for data collection, system development, and ongoing maintenance?
- Are data-sharing agreements or authority in place across the relevant agencies?
- Is the necessary IT infrastructure available to support a data management system?
- Are partnerships established with key stakeholders, including the informal sector?
- Is staff with the relevant technical capacity available or accessible?
- Are there existing data systems that can be built on or integrated with, rather than duplicated?

Countries that identify gaps in any of these areas are encouraged to address them as part of implementation planning, rather than proceeding without resolving them.

Establishing implementation capacity

A dedicated team, with clear roles and appropriate skills in data management, stakeholder facilitation and plastics value-chain knowledge, is what turns a mandate into working practice. The team's size and structure should match the country's own resources and the complexity of its plastics sector. Investing in this capacity early has a direct, positive effect on how well Step 5's stakeholder engagement and Step 6's data collection are carried out.

Coordinating across multiple end uses

Basel Convention Reporting, EPR schemes and national policy commitments rarely sit with the same institution. Basel Convention Reporting is usually coordinated through the national Basel Convention focal point (commonly the Ministry of Environment); EPR schemes are usually administered by the environment or trade/industry ministry, or a dedicated producer-responsibility organisation; and national policy commitments - including the INC process, SDG reporting and national reduction targets - usually require coordination across several ministries rather than a single owner.

Box 2.9: A national body to govern plastics data

The strongest long-term arrangement is a single, formally mandated and legally recognised national body to govern plastics data across ministries and agencies. Because plastics material flows cut across environment, industry, trade, customs, statistics, municipal, and sometimes health and fisheries institutions, a body with legal standing is what makes cross-sectoral participation and long-term continuity possible, rather than dependent on any one individual or political cycle. Such a body would typically be responsible for:

- oversight of plastics data collection, validation, and reporting;
- coordinating data flows across ministries and agencies;
- setting national data standards, definitions, and methodologies;
- managing digital reporting platforms and data-sharing agreements;
- ensuring continuity beyond changes in government; and
- serving as the national focal point for regional and global reporting - for example, under the UN Global Plastics Treaty process.

Where a country is not yet ready to establish a body with this full remit, the coordination mechanism agreed in this step should still name a lead convenor and a clear escalation path, so that cross-ministry issues have somewhere to go rather than stalling.

2.8.5 Ongoing plastics data collection and reporting

By working through this Handbook, a country will have improved plastics data for at least some categories. Continuing to build data across the full life cycle - from production through to disposal and leakage into the environment - is what turns those improvements into a Plastics Data Inventory. Where data categories can be reproduced periodically using an agreed, repeatable methodology, it becomes part of a Plastics Account. An ongoing, effective system for this rests on four elements.

1. Legislation and commitments

Plastics data collection holds up best when it is anchored in legislation, covering:

- Responsibility - clear legal mandates for data collection, with specified obligations for different agencies (for example, defined reporting duties for producers, importers, and waste handlers).
- Reporting rules - thresholds, frequencies and deadlines aligned with policy needs.
- Verification - procedures with proportionate penalties for non-compliance.
- Commercial protection - protecting commercial sensitivity while still enabling public access to aggregate statistics.
- International alignment - consistency with international commitments such as the (forthcoming) Global Plastics Treaty.

Countries with mature systems typically embed plastics data reporting in broader producer-responsibility legislation, waste management regulation, or a dedicated plastics monitoring law.

International examples: the EU's Packaging and Packaging Waste Directive[25] requires member states to report detailed packaging waste data by material, reinforced by the 2019 Single-Use Plastics Directive.[26] South Korea's 2003 Act on the Promotion of Saving and Recycling of Resources[27 28] established a comprehensive EPR system with mandatory producer and importer reporting, producing one of the world's most detailed plastics datasets. Canada's 2022 federal plastics registry[29] requires detailed reporting from manufacturers, importers and users above set thresholds, now the basis for national reduction targets.

2. Ongoing stakeholder engagement

Successful monitoring systems keep talking to their data providers and users, through advisory committees overseeing methodology and reporting formats; industry working groups on sector-specific measurement challenges; feedback mechanisms that let data providers shape reporting improvements; user forums that keep statistics relevant to policymakers, businesses and researchers; and international knowledge-exchange networks. Sustained engagement of this kind is what keeps reporting quality up and builds ownership of the system beyond the statistics agency itself. It is the same engagement mechanism built in Step 5, kept running rather than wound down.

International examples: Australian Packaging Covenant Organisation (APCO)[30 31] runs a collaborative model where industry, government and civil society jointly develop packaging data regulation. The UK Plastics Pact[32] brings together over 200 stakeholders across the value chain on shared metrics and reporting, including working groups on specific measurement challenges such as plastic in composite materials.

25 EU Packaging and Packaging Waste Directive (94/62/EC, as amended): https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML
26 EU Single-Use Plastics Directive (2019/904): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0904
27 Republic of Korea, Act on the Promotion of Saving and Recycling of Resources (2003): https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=62551&type=part&key=39
28 Summary of the Republic of Korea's EPR system: https://prevent-waste.net/wp-content/uploads/2023/06/Republic-of-Korea.pdf
29 Canada federal plastics registry: https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/reduce-plastic-waste/federal-plastics-registry.html#toc1
30 Australian Packaging Covenant Organisation (APCO): https://apco.org.au/consultation
31 Australian Government packaging regulation reform: https://www.dcceew.gov.au/environment/protection/waste/packaging/reforming-packaging-regulation
32 UK Plastics Pact Annual Report 2023–24: https://www.wrap.ngo/resources/report/uk-plastics-pact-annual-report-2023-24

3. Capacity development

Ongoing data collection needs continued investment in people: training on data collection methods, validation and statistical analysis; technical support for reporting entities; standard operating procedures and methodological guidance; knowledge transfer between experienced and new staff; international exchange with other countries' statistical offices; and research partnerships with academic institutions. Good capacity development develops both technical statistical skills and domain knowledge of plastics materials, products and waste systems - neither is sufficient on its own.

International example: Eurostat's European Statistical Training Programme (ESTP)[33] runs specialised courses on waste statistics, including modules on plastic waste characterisation and material flow accounting.

4. Digitalisation

Modern systems use digital tools to simplify reporting and gain more value from the data collected: secure online reporting platforms in place of paper submissions; automated validation checks and APIs for direct data transfer from company systems; integration with other databases such as customs data or business registries, to reduce reporting burden; and, increasingly, machine learning for pattern detection, dashboards for accessible data visualisation, blockchain for supply-chain traceability, and mobile applications for field data collection.

Digitalisation should be pursued for data quality and accessibility, not efficiency alone. Countries can fund this through environmental fees on plastic products, a share of waste management budgets, or international funding directed at plastic pollution reduction and circular-economy initiatives.

International example: Germany's LUCID packaging register[34] lets producers register and report packaging data digitally, with automated validation and visualisation tools for reporters and regulators alike.

2.8.6 Developing a Plastics Account

A well-established plastics data inventory is a good foundation for moving on to developing a Plastics Account. Once the main flow categories are populated, the figures have been cross-checked for consistency, and the inventory is updated on a regular cycle, countries may consider taking this step. It supplies the coverage and the data quality an account depends on. Building an account before the inventory is stable can risk reproducing the same coverage gaps and inconsistencies the account is meant to resolve.

This Handbook does not set out the technical detail needed to build a full Plastics Account. That is a substantial undertaking that lies beyond this Handbook's scope. Countries ready to take this step could find valuable guidance in the UNITAR/ UNEP Statistical Guideline for Measuring Flows of Plastic Throughout the Life Cycle - a methodology, developed jointly by UNITAR and UNEP with national statistical offices and other experts across UN Member States, that sets out how to build physical supply-use tables for plastic within the SEEA framework, covering plastic supply, use and waste accounting in turn. Waste accounts or plastics accounts already developed by a few countries, described later in this section, offer further practical reference points. This section introduces the concept, explains how it builds on the inventory described earlier in this chapter, and sets the pathway toward it.

A Plastics Account differs from an inventory in that it applies a standardised accounting methodology to guarantee full coverage of material flows within a clearly defined boundary, closing the blind spots that individual data-collection exercises can leave behind. Once a country is ready to build one, it could draw on this Handbook, the UNITAR/UNEP Statistical Guideline referenced above, and the inventory already in place as starting points for drafting a dedicated methodology document. An account built on a standardised framework can be linked to national economic accounts, supporting analysis of how plastic flows relate to broader economic indicators.

Grounding an Account in the SEEA Framework

The internationally agreed framework for this work is the System of Environmental-Economic Accounting (SEEA), and specifically its Central Framework for material flow accounts and physical supply-use tables. A physical supply-use table records, for a given material, three types of flow - natural inputs drawn from the environment, products moving through the economy, and residuals discarded to the environment or to waste management. These are set against columns for each industry (classified under ISIC), households,

33 Eurostat ESTP (European Statistical Training Programme): https://cros.ec.europa.eu/book-page/estp-training-offer
34 Germany, LUCID packaging register: https://www.verpackungsregister.org/en/registration/find-out-about-registrations

capital formation and trade. The table must balance. Total supply of the material in a given period equals total use, meaning every tonne of plastic entering the economy through domestic production or imports must be tracked through to where it leaves the economy, whether by export, by accumulation in the stock of goods still in use, or by disposal as a residual.

Examples in Practice

A small number of countries have already built material or waste accounts under SEEA that cover plastics. These show what an account can look like once assembled, and how it can be built from data systems many statistical offices already maintain in some form.

- Statistics Canada compiles a pilot physical flow account for plastic material, tracing plastic from domestic production and imports through use to its end-of-life fate - recycling, incineration, landfill or environmental leakage - broken down by resin type, product category and province. It draws on Canada's existing supply-use tables together with industry surveys and waste-management statistics, rather than a dedicated new collection exercise.
- Statistics Denmark has compiled a complete physical supply-use table for plastics, covering raw and processed plastics, plastics embedded in composite products, and both sorted and mixed plastic waste, disaggregated by industry and household final demand. The physical supply-use table was compiled first, from Denmark's existing material flow accounts and national accounts classifications. A plastics account and a set of circular material use rate indicators were then derived from it as a further stage.
- The Australian Bureau of Statistics produces an annual Waste Account within the SEEA Central Framework, structured as physical supply and use tables for solid waste across three sources (municipal, commercial and industrial, and construction and demolition) and five management fates (landfill, recycling, energy recovery, treatment and other disposal). It is compiled from Australia's existing National Waste Report, a dedicated business survey of waste-intensive industries, and international trade statistics, with waste allocated to industries in proportion to their intermediate use of the relevant products, taken from existing input-output tables.

In each case, the account was built by restructuring or extending data systems the country already maintained - supply-use tables, waste reports, business surveys, trade statistics - rather than by starting a new data collection programme. This is the same principle behind the sequencing set out at the start of this section. A well-established inventory is largely what an account needs. The remaining work is organising that same information into the SEEA's supply-and-use structure and closing the specific gaps that structure exposes.

Next Steps

Once a country's plastics data inventory is established and quality-assured, the next steps toward a Plastics Account are to:

- Map inventory categories to SEEA physical flow categories (natural inputs, products, residuals) and to the ISIC industry classification, identifying where existing categories need to be split or regrouped to fit.
- Identify a lead statistical or environmental agency, typically the national statistical office working jointly with the environment ministry, to hold formal responsibility for compiling and publishing the account. This can build directly on the national governance body described earlier in this chapter.
- Pilot a simplified physical supply-use table for plastics, starting with the largest flows (for example, production or imports, and end-of-life disposal) before extending it to smaller or more complex flows such as plastics embedded in composite products.
- Draft the methodology document described above, fixing definitions, responsibilities and processes before the account moves into regular production.

Part III presents methods for collecting plastics data across the life cycle - from production and trade through to waste, disposal, and leakage into the environment - helping each country select the approaches best suited to its context and build its national inventory incrementally.

Part III

Methods for Generating Plastics Data Across the Life Cycle

Conducting Plastics waste audits in Fiji (March 2026)
Photo Credit: Pacific Recycling Foundation (PRF), Fiji

3.1 Introduction

This part sets out methods for generating and collecting plastics data across the life cycle. The stages may be addressed independently and in any order, allowing each country to begin where the need is greatest, where data are most readily available, or where existing capacity allows. In most cases, a country will build its inventory incrementally, adding stages over successive reporting cycles rather than attempting full coverage at once.

Each section presents several methods for collecting data on the relevant stage, together with the advantages and limitations of each. No single method is universally appropriate: the most suitable choice depends on a country's national context, the data already available, and the resources at its disposal. Users should weigh the options on that basis and select the methods best suited to their circumstances, drawing on the guidance on prioritisation in Part II. For a comprehensive national inventory, a combination of methods is generally most effective.

The methods are presented in the following order, by life cycle stage:

- Plastic Production
- Plastic Trade (including Plastic Waste)
- Plastic Consumption
- Plastic Waste Generated
- Plastic Waste Collected
- Plastic Treatment
- Plastics Disposal
- Plastics in the Environment
- Social data

3.1.1 Core principles for data collection

When collecting new plastics data, users are advised to observe the following principles:

- **Consistency:** apply uniform methodologies over time, so that figures can be meaningfully compared and trends analysed.
- **Verification:** where possible, draw on multiple data sources to confirm accuracy and cross-validate findings.
- **Transparency:** document all assumptions, limitations, and methodological steps.
- **International alignment:** align with international classifications and definitions wherever feasible.
- **Proportionality:** balance the ambition of data collection with the resources and capacity available.

Minimum data requirements

When collecting a new data point, at a minimum, users should record data on the:

- **Weight of plastics** - the mass, in a stated unit (for example, 1,250 tonnes of plastic PET bottles exported).
- **Year of reporting** - the calendar or reporting year the figure refers to (for example, 2024).
- **Data source** - where the figure came from (for example, the national customs database, or municipal council's weighbridge data records).

However, for each data point, users are encouraged to also record data on:

- **Polymer type(s)** - the resin or resins involved (for example, PET, HDPE, or PVC).
- **Industry where plastic is consumed and/or disposed of** - the sector of use or end-of-life (for example, food and beverage packaging, construction, or agriculture).

- **Product lifespan, including data on formal reuse systems where applicable** - how long the product remains in use (for example, single-use packaging discarded within a year, compared with a PVC pipe lasting several decades; or a refillable-bottle scheme in which containers are reused before disposal).
- **Any assumptions, conversion factors and methodological processes used to estimate the data point** - the calculation steps behind the figure (for example, converting a count of bottles to a weight using an average bottle mass of 20 grams).

Dealing with inconsistent data

Data gathered in different locations and at different times are frequently inconsistent, which impedes the comparison of figures and the tracking of progress over time. The following measures help to keep reporting as consistent as possible:

- adopt standardised reporting templates and agreed conversion factors, so that figures are recorded on a consistent basis;
- incorporate validation checks into data entry to identify errors at an early stage;
- where data are missing, apply proxy measures or modelled estimates, clearly labelled as such;
- where sources overlap, rank them by reliability and give precedence to the more robust source;
- corroborate key figures against two or more independent sources;
- refer questionable data for expert review;
- communicate any uncertainty transparently, so that users can judge how much confidence to place in each figure.

3.2 Plastics Production

3.2.1 Definitions and scope

Plastic Production: The total weight of virgin and recycled plastic materials manufactured within a country's economic territory during a specified reporting period (typically annual). This metric encompasses primary production of plastic pellets, as well as the conversion of these materials into intermediate and finished plastic products by domestic manufacturers.

To calculate plastic production at the national level, three separate flows should be considered.

- Plastic in primary forms e.g., pellets or nurdles
- Semi-finished plastic products and;
- Plastic in finished products (this could be split between products containing plastics and fully plastic products).

The main benefit of capturing each of these flows is reduced risk of double-counting of plastics production e.g., plastic nurdles could be reported when first manufactured, and then reported again when they are moulded into semi-finished plastic products, and then reported again once embedded within a finished product.

Production data can also be split by Industry category, Plastics Polymer type and intended destination of plastic material product – see section Disaggregating Data for further details.

If it is not feasible to split plastics production data, users can focus on calculating aggregated plastic production.

Classification systems

Classification systems provide standardised frameworks that enable consistent reporting across countries and businesses. Several established systems are particularly relevant for collecting plastic production data, each offering different geographical coverage and levels of detail:

- PRODCOM (PRODuction COMmunautaire) - the European Union's system for statistics on industrial production; plastics are covered within its manufacturing categories, and it is most useful for European producers.
- North American Industry Classification System (NAICS) - classifies businesses in the United States, Canada and Mexico by industry, with plastics manufacturing as a distinct subsector.
- International Standard Industrial Classification (ISIC) -the United Nations reference classification of economic activities; plastics production falls mainly under Division 20 (chemicals and chemical products) and Division 22 (rubber and plastics products).
- Central Product Classification (CPC) - the United Nations classification of goods; plastics in primary forms sit in group 347, with semi-manufactures and other plastics products in groups 363, 364 and 369.

Further detail on classification systems can be found in *"Part IV Crosscutting Classification Systems".*

3.2.2 Why production data matters

Production data establishes the baseline for a country's plastics profile. As the entry point of the life cycle, it is the denominator against which consumption, waste generation, recycling rates and leakage are later assessed. Where a reliable production figure is missing, downstream estimates rest on weak foundations.

Reliable production data supports several uses: establishing national baselines and reduction targets; reporting against international obligations, including the global plastics instrument under negotiation and relevant Sustainable Development Goal indicators; identifying the polymers and product categories that dominate the domestic market; and designing policy instruments such as Extended Producer Responsibility (EPR), eco-modulation of fees, and restrictions on specific products.

3.2.3 Methods for generating production data

To obtain data on plastics production, users could consider rolling out one (or several) of the methods in **Table 3.1.** The methods are grouped by who is most likely to lead or supply the data, though this may vary between countries.

- **Government:** methods that rely on government oversight, funding or regulatory authority – for example extended producer responsibility, environmental permits and reporting, and national production statistics.
- **Private sector:** data generated by producers and businesses – for example industry and market-research reports, voluntary producer declarations, digital product passports, retail sales data, and factory sensors.
- **Research and academia:** studies by universities and research institutes, such as material flow analysis

Table 3.1. Tools for Generating Data on plastics production

Method	Description	Advantages	Limitations
Government			
Regulated Producer responsibility schemes (including Extended Producer Responsibility or "Take Back schemes") *The Japan Containers and Packaging Recycling Association (Japan)* *LUCID (Germany)* *CITEO (France)* *UK Government* *Central Pollution Control Board – EPR Portal (India)* *Korea Environment Corporation – EPR (Republic of Korea)* *REP Law / Ministry of the Environment (Chile)*	• Producers are made to be responsible (usually financially) for the treatment and disposal of the products that they place on the market. • Data collection occurs through mandatory reporting requirements where producers document the types and quantities of plastic products placed on the market • Governments are responsible for implementing Extended Producer Responsibility when the scheme is mandatory	• Ensures participation and accountability for data reporting • Establishes consistent formats and frameworks for data collection • Spans multiple product sectors • Creates predictable, scheduled reporting periods	• Reporting burden on businesses. • Reporting accuracy varies significantly with enforcement levels • Systems often exclude small producers. • Requires complex processes to validate submitted data • Substantial paperwork and compliance costs. • Often narrowly focused on packaging only, missing other product categories • Creates financial incentives to minimise reported quantities • Cross-border trade and online marketplaces often create reporting loophole
Environmental Permits and Reporting *Environment Protection License (Sri Lanka)* *Industrial Emissions Portal / E-PRTR (European Union)* *EPA Toxics Release Inventory (USA)*	• Production facilities report material throughput for environmental compliance with permits. • Permit data can also be used to determine maximum production potential for specific sites.	• Legally mandated reporting • Consistent time periods • Facility-level granularity • Independent verification potential	• Requirements can vary by jurisdiction, which standardisation could address • Limited to regulated facilities
Private Sector			
Business Reports, National Production Surveys and Market Research *American Petroleum Institute (USA)* *PlasticsEurope – "Plastics – the Facts" (Europe)*	• Can collect a variety of data • Types and quantities of plastics produced • Amounts of raw materials used in plastic production • Production capacities and actual output from companies • Raw materials sourced from other countries for plastic production	• Can capture both domestic and international operations • Can provide polymer-specific data • Can link production to specific Industrial Sectors	• Reporting burden on businesses • Potential commercial confidentiality issues • Voluntary surveys may have incomplete participation • Data quality varies between companies

Method	Description	Advantages	Limitations
Voluntary Producer Declarations (including under a voluntary EPR scheme) *The UK Plastics PACT (UK)* *Plastics Pact Network (Global)* *Ellen MacArthur Foundation – Global Commitment (Global)* *U.S. Plastics Pact (USA)* *Australian Packaging Covenant Organisation (Australia)*	• A policy approach where producers voluntarily take action to support the treatment or disposal of the products that they place on the market. • Data collection occurs through voluntary reporting where producers document the types and quantities of plastic products placed on the market.	• Establishes consistent formats and frameworks for data collection. • Spans multiple product sectors. • Creates scheduled reporting periods.	• Reporting accuracy varies significantly. • Systems often exclude small producers. • Requires complex processes to validate submitted data. • Creates substantial paperwork. • Often narrowly focused on packaging only, missing other product categories.
Digital Product Passports *European Union*	• Requirement for digital documentation of product composition could be uploaded to generate a digital passport. This data could include detailed information on plastic content and polymer types by weight	• Detailed material composition data. • Standardised digital format. • Enables product-level tracking.	• Still emerging technology. • Implementation costs for businesses. • Requires digital infrastructure.
Retail Sales Data *Euromonitor International (Global)* *NielsenIQ retail scanner data (Global)*	• Aggregation of retail sales data to estimate plastic placed on market. • Particularly useful for consumer goods and packaging.	• Leverages existing business data systems. • Product-specific information. • Real-time data potential.	• Limited visibility of plastic content. • Confidentiality constraints. • Conversion from expenditure to weight/ volume needed which will vary significantly by sector/product.
Sensors and Real-time Tracking *HolyGrail 2.0 / Digital Watermarks Initiative (Europe)* *Industrial IoT / smart-manufacturing sensors (emerging)*	• Implement sensors at production facilities to measure output in real-time	• Automated data collection • High temporal resolution • Reduced reporting burden	• Implementation costs • Limited to equipped facilities • Integration with legacy systems • Data privacy concerns
Research and Academia			
Material Flow Analysis Kawecki et al (2018) (Europe) Ivanovic et al (2022) (Germany - Healthcare) Regional Knowledge Centre for Marine	• A systematic assessment of the flows and stocks of plastic materials within a defined system boundary over a specified period.	• Comprehensive system perspective • Identifies data inconsistencies • Combines multiple data sources • Highlights knowledge gaps	• Relies on quality of input data • Multiple assumptions required • Complex to implement nationally

Method	Description	Advantages	Limitations
Plastic Debris (Thailand, Philippines, Malaysia and Viet Nam) Deshpande et al (2020) (Norway) Department of Climate Change, Energy, the Environment and Water (Australia) Lobelle et al (2023) (Netherlands) Ministry of Environment (Sri Lanka) Geyer et al. (2017), all plastics ever made (Global) OECD Global Plastics Outlook (Global) Plastic flows and stocks study (South Africa) Probabilistic MFA of commodity plastics (China)	• This methodology can trace plastics from production through consumption to disposal, using input-output analysis and mass balance principles to identify key flows and leakages. Detailed guidance provided in Section 4.1.3. Material Flow Analysis.		

3.2.4 Disaggregating production data

Aggregated production tonnage is a useful headline figure, but disaggregated data shows where plastics originate and which interventions are likely to be most effective. Wherever the underlying sources allow, production data should be broken down along the following dimensions:

- **Polymer type** (e.g., PET, HDPE, LDPE, PP, PS, PVC, PUR), to target specific polymer value chains.
- **Production flow and form** (primary forms, semi-finished products, finished products), following the three flows in 3.2.1 to avoid double-counting.
- **Virgin versus recycled (secondary) material,** to monitor recycled-content targets and circularity.
- I**ndustry or application sector** (e.g., packaging, construction, automotive, textiles, agriculture, electrical and electronic equipment).
- **Intended destination and end-market,** including domestic use versus export.
- **Formal versus informal production,** where a significant informal manufacturing sector exists.

Further detail on these categories is provided in the Disaggregating Data section.

3.2.5 Data challenges and a tiered approach to getting started

Several challenges recur in production-data collection: double-counting as material moves between the three flows; commercial confidentiality, which constrains company-level disclosure; incomplete coverage of small and informal producers; converting sales or expenditure figures into mass; and accounting for imported intermediate goods. No single method resolves all of these; therefore sources should be combined and cross-checked.

A practical way to begin is to match the method to current data capacity and to strengthen it over time:

- **Basic:** estimate aggregated national production from existing industry-association statistics, trade data and reports from a small number of large producers. Appropriate where reporting infrastructure and resources are limited.

- **Intermediate:** introduce mandatory or voluntary producer reporting – for example through an EPR or environmental-permit scheme – to capture polymer- and sector-level detail for major producers, supported by national production surveys.
- **Advanced:** reconcile production, trade, conversion and waste data in a national material flow analysis, disaggregated by polymer, sector and flow, with routine validation against independent sources.

Countries can progress through these tiers over time as institutional capacity and data systems develop; at every stage the priority is a transparent, well-documented method that can be repeated and improved.

3.3 Trade of Plastics (including plastics waste)

3.3.1 Definitions and Scope

Plastics trade: the import and export of plastics across national borders during a reporting period, recorded by weight (tonnes) and/or value. It spans the full life cycle – plastics in primary forms (e.g., resins and pellets), intermediate and semi-finished forms, finished products made of or containing plastic, and plastic waste and scrap traded for recycling, recovery or disposal.

Trade statistics should distinguish imports, exports and re-exports, and, as far as possible, separate plastic traded as waste from plastic traded as new product. A key boundary issue is that plastic embedded in other goods – for example, the packaging around imported electronics, or the plastic content of vehicles – is generally not captured by trade codes for plastics; this is discussed further in 5.2.5.

When developing plastics trade data, several complementary classification systems could be considered to ensure comprehensive coverage and international comparability – the main systems are listed in Table 3.2. Classification systems for trade data.

Table 3.2. Classification systems for trade data

Classification	Description
Harmonised System (HS):	The Harmonised System (HS) codes form the foundation for plastics trade data collection and analysis. The 6-digit international standard allows for global comparison of plastic trade flows, while country-specific 8 or 10-digit extensions provide greater granularity for specific plastic polymers, products, and waste streams. The HS is maintained by the World Customs Organization (WCO).
Standard International Trade Classification (SITC):	The SITC offers an alternative organisation of trade data that focuses on materials and their level of processing rather than product categories.
UNCTAD plastics life cycle classification:	Developed by UN Trade and Development (UNCTAD), this classification groups HS codes into five life cycle stages – primary forms, intermediate forms, intermediate manufactured products, final manufactured products, and plastic waste – making it well suited to tracking plastics trade across the full life cycle. Available via the UNCTAD Plastics Data Hub.

Further detail on classification systems can be found in Part IV Crosscutting Classification Systems.

3.3.2 Why trade data matters

For most countries, a large share of the plastics they consume is imported rather than produced domestically, and much of what they discard for recycling is exported. Trade data is therefore essential to completing the national picture: apparent consumption is commonly estimated as production plus imports minus exports.

Trade in plastics is large and growing: UN Trade and Development (UNCTAD) estimates it exceeded US$1.1 trillion in 2023, around 5% of global merchandise trade (UNCTAD, 2025). Trade data underpins several uses: estimating apparent consumption, identifying transhipment and re-export hubs, monitoring exports of plastic waste and the leakage risks they create, and reporting against instruments such as the Basel Convention and the global plastics treaty under negotiation.

3.3.3 Methods for generating plastic trade data

To obtain data on plastics trade, users could consider rolling out one (or several) of the methods in Table 3.3. The methods are grouped by who is most likely to lead or supply the data.

- **Government:** methods based on official trade and customs systems – for example customs and trade documentation, national trade statistics, and business surveys.
- **Private sector:** commercial and third-party trade databases that compile and analyse trade data – for example the Observatory of Economic Complexity, ITC Trade Map and World Bank WITS.
- **Research and academia:** studies by universities and research institutes, such as material flow analysis

We have also included a cross-cutting section on technological solutions that could be employed by any of the above organisations to improve trade data.

Table 3.3. Tools for developing plastic trade data

Method	Description	Key Advantages	Limitations
Government			
Trade Documentation and Records *UK Government* *Statistics Canada (Canada)* *Eurostat (The European Union)* *Statistics Norway (Norway)* *Statistics NZ (New Zealand)* *UN Comtrade (Global)* *UNCTAD Plastics Data Hub (Global)* *Basel Convention – plastic waste trade (Global)*	• Official documentation systems used to track materials and products across borders, including import/export declarations and waste shipment notices.	• Legal mandate for accurate reporting. • Comprehensive coverage of formal trade. • Standardised classification systems. • Regular data collection periods.	• May miss informal or illegal trade. • Aggregation may obscure product details. • Reporting delays reduce timeliness.
Surveys of businesses *UK Government*	• Systematic questionnaires administered to representative samples of businesses to gather data on trade. See Section 4.1.2 Surveys. for more details.	• Provides direct insights from importers/ exporters.	• Resource-intensive to administer. • Subject to reporting biases. • Requires statistical expertise for proper sampling

Method	Description	Key Advantages	Limitations
Private Sector			
Market Intelligence *(Industry associations, Market research, Academia, NGOs* *Observatory of Economic Complexity (Global)* *ITC Trade Map (Global)* *World Bank WITS (Global)*	• Private sector data collection and analysis focused on commercial aspects of plastic trade, including pricing, competitive intelligence, and supply-demand dynamics.	• Captures market dynamics beyond volumes • May include informal/ unreported flows • Provides pricing and value information • Often includes forecasting elements	• Methodological variability • Potential commercial bias • Sampling issues limit representation • Often costly to access comprehensive data
Research and Academia			
Material Flow Analysis *Houssini et al. (2025), trade-linked MFA (Global)* *CEPII BACI database (Global)*	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		
Cross-cutting technology Solutions			
Digital Documentation and Reporting systems *Automated Commercial Environment (ACE) (USA)* *European Commission (Europe)*	• Digital platforms and electronic systems that capture, process, and share plastic trade data, replacing paper-based processes with automated information management.	• Reduces manual reporting errors • Accelerates data collection and analysis • Improves accessibility for stakeholders • Enables automated validation checks	• Digital divide limits global implementation • Requires technical capacity building • Initial implementation costs • System compatibility challenges
Data Integration and Analysis (Harmonisation systems, Cross-border tracking systems) *OECD (Global)*	• Systems and processes designed to combine, standardise, and analyse plastic trade data from multiple sources.	• Improves data comparability across sources • Enables cross-country analysis • Standardises diverse data formats • Facilitates international cooperation	• Complex implementation requirements • Depends on quality of input data • Requires ongoing maintenance • Standardisation may reduce specificity

Method	Description	Key Advantages	Limitations
Trade Flow Monitoring (Blockchain, RFID, GPS, Port monitoring systems) *Many global organisations offer relevant technical solutions.*	• Digital tracking technologies that provide automated, real-time monitorin of plastic material movements through supply chains and across borders. g	• Real-time tracking capability • Tamper-resistant documentation • Detailed chain of custody information • Automated data collection	• Requires technological infrastructure • Implementation costs can be high • Limited to participating supply chains • Technical expertise requirements

3.3.4 Disaggregating trade data

As with production data, disaggregated trade data is far more useful than a single import or export total. Wherever the source data allows, trade flows should be broken down along the following dimensions:

- **Direction of flow:** imports, exports, re-exports and net trade.
- **Life cycle category:** primary forms, intermediate forms, intermediate manufactured products, final manufactured products, and plastic waste (per the UNCTAD classification).
- **Polymer type,** where codes allow (e.g., PET, HDPE, LDPE, PP, PVC).
- **Code granularity:** 6-digit international HS lines versus national 8- or 10-digit lines.
- **Partner country or region** (origin and destination), to map trade routes and waste-export destinations.
- **Value versus weight,** and waste versus non-waste – separating Basel-controlled plastic waste from new product. Mass is needed for material accounting; value supports economic analysis.

Further detail on these categories is provided in the Disaggregating Data section and in Section 4.2 Crosscutting Classification Systems.

3.3.5 Data challenges and a tiered approach to getting started

Trade data carries specific challenges. HS Chapter 39 ("plastics and articles thereof") does not capture all traded plastics: many plastic items sit in other chapters, and plastic embedded in other goods – packaging, vehicles, electronics – is invisible to plastics trade codes. "Mirror" discrepancies arise when a reporter's recorded exports do not match the partner's recorded imports. Value and weight are not always both reported; waste can be mis-declared to avoid controls; and confidentiality rules suppress some flows.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** extract plastics trade (HS Chapter 39, plus key codes in other chapters) from UN Comtrade or a national customs portal, reported as imports, exports and net trade.
- **Intermediate:** apply the UNCTAD life cycle classification to capture plastics across all relevant HS codes, reconcile reporter and partner figures using mirror statistics, and use Basel notifications for plastic-waste flows.
- **Advanced:** integrate trade with production and waste data in a trade-linked material flow analysis, disaggregated by life cycle stage, polymer and partner, with routine validation against independent sources.

As with other stages, countries can move up the tiers as capacity grows. Being transparent about which codes, sources and assumptions were used is what makes trade figures comparable over time and across borders.

3.4 Plastics Consumption

3.4.1 Definitions and scope

"Plastics production" and "plastics consumption" are terms often and incorrectly used interchangeably. To avoid confusion, it is recommended to adhere to the definitions used in this Handbook.

Plastics production: The total weight of virgin and recycled plastic materials manufactured within a country's economic territory during a specified reporting period (typically annual). This metric encompasses primary production of plastic pellets, as well as the conversion of these materials into intermediate and finished plastic products by domestic manufacturers.

Primary production refers to the manufacture of virgin polymer in primary forms, such as pellets, flakes and resins. Where recycled plastic is reprocessed into new primary forms, it is counted as secondary production. The split between virgin and secondary production should be recorded where the data allow.

Plastics consumption: The aggregate weight of plastic materials utilised within a country's economic borders during the reporting period. Plastic Consumption accounts for all plastic materials entering the national economy, regardless of origin, and excludes domestically produced plastics exported for foreign consumption.

The formula above sets out apparent consumption. Production is the total plastic manufactured in the country, imports are added, since imported plastic is also used domestically, while exports are subtracted, as plastic sent abroad is consumed elsewhere. Production here is gross domestic output rather than output net of exports, and subtracting exports therefore does not cancel it out.

Apparent consumption is a demand-side estimate and is not adjusted for changes in stock. Plastic held in warehouses, or accumulating in long-life products such as pipes, vehicles and buildings, is not separated out; the figure therefore reflects material entering use rather than material discarded in the same year. Production, import and export data should be compiled on the same annual basis, so that the three sources reconcile.

Users may wish to distinguish the amount of virgin material consumed from the amount of recycled plastic consumed.

Virgin plastics consumption: The total weight of manufactured plastic materials derived from petrochemical feedstocks (primarily oil and natural gas) used within a country's economic territory during the reporting period. Virgin plastics consumption represents materials entering the economy for the first time, before any recycling or recovery processes.

Recycled plastics consumption: The aggregate weight of post-consumer and post-industrial plastic materials that have undergone recycling processes and are subsequently consumed in products within a country's economic borders during the reporting period. The metric encompasses mechanical, chemical, and other forms of recycled plastic materials incorporated into new products or packaging.

Consumption data can also be split by industry category, type of plastics polymer and destination of consumption – see the Section on Disaggregating Data for further details.

3.4.2 Why consumption data matters

Consumption is the point where plastic enters everyday use, and it influences every subsequent stage of the life cycle. How much plastic a country consumes, and of what kind, determines how much waste it will later generate, collect, treat and, where systems fall short, release into the environment. Measuring consumption therefore gives an early signal of future waste flows and a baseline against which reduction policies can be judged.

Consumption data also connects the plastics system to the economy. Linked to economic sectors and product types, it shows which industries and which goods account for most plastic use, which helps target design standards, reuse schemes and extended producer responsibility. It supports reporting against Sustainable Development Goal 12 on responsible consumption and production, and provides the demand-side figures needed for Plastics Accounts compiled under the System of Environmental-Economic Accounting (SEEA).

Because a large share of plastic arrives inside imported finished goods, consumption data also captures pressures that production and trade figures alone can miss. A country with little domestic production can still be a major consumer, and only consumption data reveals this.

3.4.3 Methods for generating consumption data

To obtain data on plastics consumption, users could consider applying one (or several) of the methods in Table 3.4. The methods are grouped by who is most likely to lead or supply the data:

- **Government:** methods based on official statistics – for example apparent consumption from production and trade data, national consumption surveys, and extended producer responsibility.
- **Private sector:** data generated by businesses – for example voluntary producer declarations, retail and banking data, shipping and logistics records, and business and market-research reports.
- **Waste-management sector:** data from waste-treatment and recycling facilities, used as a proxy for the plastic consumed.
- **Research and academia:** studies by universities and research institutes, such as household consumption studies and material flow analysis

Table 3.4. Tools for developing plastic consumption data

Method	Description	Key Advantages	Limitations
Government			
Apparent Consumption from Production and Trade Data	• Combine domestic production with import and export data to estimate apparent consumption (Production + Imports − Exports). Trade data can be drawn from the UN Comtrade database and the UNCTAD life cycle plastics trade dataset, which split plastic into primary forms, semi-finished and finished products. See Section 4.1.3 Material Flow Analysis and the Trade section	• Uses data many countries already compile; internationally comparable through HS and SITC codes; gives a whole-economy estimate.	• Not adjusted for changes in stock; depends on the plastic fraction of mixed product codes; plastic hidden inside imported finished goods must be estimated.
National Consumption Surveys *Bureau of Labor Statistics (US)* *Statistics Bureau (Japan)* *Eurostat (Europe)*	• Systematic collection of data through questionnaires administered to households, businesses, or institutions to gather information on plastic consumption • Participation could be voluntary or mandatory See Section 4.1.2 Surveys for more details.	• Official statistics with high credibility • Standardised methodologies • Representative sampling • Regular reporting cycles • Direct source information	• Resource-intensive to implement • Time lag in data publication • May lack product-specific detail and polymer-type information

Method	Description	Key Advantages	Limitations
Regulated Producer Responsibility schemes (including Extended Producer Responsibility)	See "Producer Responsibility schemes (including Extended Producer Responsibility)" in the Production section for more detailed guidance. The data will reflect material that is placed on the market (produced), but may not actually be consumed. There may also be more material that is consumed but is not registered within an EPR scheme due to it being imported (the treatment of import data will differ between jurisdictions - some schemes have tighter restrictions than others when it comes to imports).		
Private Sector			
Voluntary Producer Declarations (including under a voluntary EPR scheme)	See "Voluntary Producer Declarations (including under a voluntary EPR scheme)" in the Production section for more detailed guidance.		
Retail and Banking Data	• Analysis of point-of-sale data, transaction records, and financial information from retailers and financial institutions to estimate plastic consumption. • Volumes could be estimated based on standardised assumptions or more accurately, expenditure could be integrated with information from digital product passports (DPP).	• Leverages existing business systems • High coverage of formal market • Real-time consumption tracking • Financial valuation	• Limited plastic content visibility • Data access restrictions • Privacy concerns limit data sharing
Shipping and Logistics Records)	See "Trade Documentation (Shipping companies, Port authorities, Bills of lading)" in the Trade section for details. It is important to capture imported products within consumption data.		
Business Reports, National Production Surveys and Market Research	See "Business Reports, National Production Surveys and Market Research" (manufacturers and Industry Associations)" in the Production section for details.		
Waste Management Sector			
Waste Treatment Reporting and Recycling Facility Data	• Systematic documentation of plastic quantities received at recycling plants, landfills, incineration plants, and other treatment facilities	• Captures plastic volumes disposed of that could be used as a proxy for a proportion of plastics consumption	• Requires estimation of the plastics fraction through waste composition sampling • Disposal does not necessarily equal consumption – some items might be disposed of that might be decades old. Whilst some consumed items from a given year might be held onto • Methodological variations between sites

Method	Description	Key Advantages	Limitations
Research and Academia			
Household Consumption Studies *Northen et al (2023) (UK)* *The Big Plastic Count (UK)*	• Studies that measure the plastic a sample of households buys or throws away, for example by weighing and recording plastic packaging and products over a set period	• Captures real household consumption and product-level detail; can reveal where single-use plastic is concentrated	• Small sample sizes limit representation • Resource-intensive methodologies • Self-reporting inaccuracies • Limited geographic coverage
	• Citizen-science counts, in which households record every piece of plastic they throw away over a week, can extend coverage at low cost		
Material Flow Analysis	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		

3.4.4 Disaggregating consumption data

Total consumption is most useful when it can be broken down. The main dimensions are:

- **Product form:** plastic in primary forms (pellets, flakes and resins), semi-finished products, and finished products. Keeping these separate avoids double counting, since primary plastic is often processed into finished goods within the same country.
- **Polymer type:** for example PET, HDPE, LDPE, PP, PS and PVC, which behave differently in use and at end of life.
- **Application or sector:** packaging, building and construction, textiles, transport, electrical and electronic goods, agriculture, and other consumer products.
- **Origin:** virgin or recycled content, and domestically produced or imported.
- **End use:** intermediate consumption by industry, final consumption by households, and plastic added to long-life stock such as infrastructure and durable goods.

Further detail on these categories is provided in the Disaggregating Data section.

3.4.5 Data challenges and a tiered approach to getting started

Consumption is rarely measured directly, and most estimates are therefore built from other data. A few challenges recur:

- **Hidden plastic in imports:** much plastic arrives inside finished goods, from vehicles to electronics, and must be estimated from the plastic content of each product type.
- **Double counting:** primary, semi-finished and finished plastic can each be counted, which inflates totals unless the three flows are kept separate.
- **Stock changes:** apparent consumption does not capture plastic that accumulates in long-life products or sits in inventories, and therefore measures material entering use rather than material discarded.
- **Polymer and product detail:** trade and production codes rarely give the polymer split, which must often be modelled.

A country can start simply and add detail over time:

- **Basic:** estimate apparent consumption from existing production and trade data (Production + Imports − Exports), using HS or SITC codes.
- **Intermediate:** add producer declarations and extended producer responsibility data, national consumption or household budget surveys, and market research to refine the estimate and split it by sector and polymer.
- **Advanced:** reconcile all sources in a physical supply and use table or material flow analysis that links consumption to production, trade and waste, disaggregated by polymer, product form and sector, and integrated into Plastics Accounts under the SEEA.

3.4.6 Further materials

- UNEP and UNITAR (2023), Statistical guideline for measuring flows of plastic throughout the life cycle — the reference methodology for apparent consumption and the physical supply and use table (PSUT) framework.
- OECD (2022), Global Plastics Outlook - global and regional data on plastics use, with projections to 2060.
- UNCTAD life cycle plastics trade dataset - imports and exports of plastic by life cycle stage (stats.unctad.org/plastics).
- UN Comtrade database - detailed trade data by HS code, useful for the trade side of apparent consumption.
- The Big Plastic Count (UK) - a citizen-science household plastic count, and an example of a low-cost household study.
- National physical flow accounts for plastic compiled by Statistics Denmark and Statistics Canada offer worked examples of consumption measurement.

3.5 Plastics Waste Generated

3.5.1 Definitions and Scope

Plastics waste generated: The total quantity of plastic materials discarded as waste by a population and their economic activities within defined system boundaries during a specified time period. It represents the amount of plastics entering the waste stream before any treatment, recovery, disposal, or leakage processes occur. This includes all plastic polymer types and applications that are discarded after their intended use, expressed typically in mass units (kilograms or tonnes) per specified timeframe.

For effective measurement and analysis, plastics waste generation is typically categorised into three main streams:

- **Household municipal waste:** Plastics discarded from homes and residential settings
- **Non-household municipal waste:** Household-like plastic waste that arises outside the home, including from public spaces, tourism activities, and institutional settings such as schools, hospitals, and government buildings.
- **Commercial and industrial waste:** Plastics discarded from manufacturing processes, commercial activities, construction and demolition operations, and other industrial sectors.

Scope note: waste generation is intended to capture plastic waste from all sectors, activities and populations within the economy – including waste arising from government and institutional operations. Some countries may also wish to report separately the plastic waste generated by tourism, given its scale and seasonality in certain economies.

3.5.2 Why waste generation data matters

Waste generation is a pivotal stage in the plastics life cycle: it links what is consumed to what must be collected, treated, recycled or, if mismanaged, left to leak into the environment. A credible waste-generation figure is the denominator for recycling rates, collection coverage and leakage estimates.

Reliable waste-generation data supports several uses: setting baselines and reduction or recycling targets; sizing collection and treatment infrastructure; reporting against SDG indicator 11.6.1 and the global plastics instrument under negotiation; and targeting the polymers, products and sectors that dominate the waste stream.

3.5.3 Methods for generating waste generation data

To obtain data on plastics waste generation, users could consider applying one (or several) of the methods in Table 3.5. The methods are grouped by who is most likely to lead or supply the data:

- **Government:** methods that rely on government oversight, funding or regulatory authority – for example household and business surveys, waste-composition audits, and national or municipal waste-reporting systems.
- **Private sector:** data from businesses and other non-governmental actors – for example corporate waste audits, and NGO and citizen-science initiatives.
- **Research and academia:** studies by universities and research institutes, such as modelling approaches and material flow analysis

Table 3.5. Tools for developing waste generation data

Method	Description	Key Advantages	Limitations
Government			
Surveys (Including Direct measurement (Waste audits) *WasteDataFlow (UK* *Further information (UK)DEFRA (UK* *Environmental Protection Agency (US)* *Canada Sri Lanka Municipal Cooperation Program (Sri Lanka)* *UN-Habitat Waste Wise Cities (Africa & Asia)*	• Collection of data on waste generation patterns of household, household-like and Industrial waste through questionnaires and waste sampling • Can be used to understand waste generated regardless of whether it ends up being managed formally or informally. See Section 4.1.2 Surveys for more detailed guidance.	• Provides detailed information about quantity and composition of waste at the household and/or businesses level • Captures variations in waste generation across different socioeconomic groups, housing types, and seasons	• Labour-intensive: staffing is required for activities such as waste collection, sorting, and interviewing • Staff may lack expertise in identifying different plastic types requiring training on material identification, with multilayer and composite packaging being particularly challenging to classify correctly • Participants may alter their normal waste behaviours when under observation or not make an accurate statement.

Method	Description	Key Advantages	Limitations
Private Sector			
Corporate Waste Audits *Chemical Waste Management Environment Group (CHWMEG) (Global)*	• Companies conducting their own waste assessments for compliance or sustainability reporting	• Provides detailed facility-level data • Can identify waste reduction opportunities	• Methodology may vary between companies • Data may be proprietary
Social initiatives (NGOs, Global Programmes etc) *The Big Plastic Count (UK)* *Break Free From Plastic – Global Brand Audit (Global)*	• Citizen science and community-led waste monitoring programs where volunteers collect and analyse waste data through standardised protocols, often supported by NGOs or international organisations	• High public engagement and awareness-raising potential • Cost-effective data collection through volunteer participation • Builds community capacity and environmental stewardship • Can reach areas with limited formal waste management systems • Generates grassroots support for policy changes	• Data quality may vary due to inconsistent training or methodology application • Volunteer availability and retention can affect data continuity • Limited technical expertise compared to professional assessments • Potential bias in data collection based on volunteer demographics or locations • Difficulty in standardising methods across different groups or regions
Research and Academia			
Modelling approaches *SPOT model (India)* *Edirisinghe et al (2023) (Sri Lanka)* *Breaking the Plastic Wave, Pew/SYSTEMIQ (Global)* *OECD Global Plastics Outlook (Global)*	• Using mathematical models to project waste generation	• Can integrate multiple data sources into a cohesive framework for more comprehensive analysis	• Accuracy heavily depends on the quality of both the model design and input data • May oversimplify complex waste generation behaviours when data inputs are limited
Material Flow Analysis (MFA) *National Plastic Waste Inventory, MFA (Sri Lanka)*	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		

3.5.4 Disaggregating waste generation data

As with the other life cycle stages, a single waste-generation total is more useful when broken down. Wherever the source data allows, waste-generation data should be disaggregated along the following dimensions:

- **Source stream:** household municipal, non-household municipal, and commercial and industrial waste (as defined in 5.4.1), with tourism shown separately where significant.
- **Polymer and product type:** e.g., PET, HDPE, LDPE, PP, PS, PVC, and applications such as packaging, single-use items and textiles.

- **Format:** rigid versus flexible, and mono-material versus multilayer or composite packaging (the hardest to classify).
- **Socio-economic and spatial breakdown:** by income group, urban versus rural, and season.
- F**ormal versus informal:** waste captured by formal systems versus that handled by the informal sector or self-managed (burned, buried or dumped).

Further detail on these categories is provided in the Disaggregating Data section.

3.5.5 Data challenges and a tiered approach to getting started

Waste-generation data carries specific challenges. Waste audits are labour-intensive and seasonal; multilayer and composite items are easily mis-classified; the informal sector and self-managed waste (burning, burying, dumping) are often invisible to official figures; and "waste generated" is frequently confused with "waste collected," which understates generation where collection coverage is incomplete. Methods should be combined and clearly documented.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** estimate total waste generation from per-capita generation rates and population, applying a plastic fraction from a single waste-composition study or a regional default (e.g., What a Waste 3.0).
- **Intermediate:** conduct periodic waste-characterisation studies and audits across representative households and key non-household and commercial sources, using a standard protocol such as the UN-Habitat Waste Wise Cities Tool.
- **Advanced:** combine audit, survey and administrative data in a material flow analysis that reconciles generation with consumption, collection and treatment, disaggregated by stream and polymer, with routine validation.

Countries can move up the tiers as capacity grows; the priority at every stage is a transparent, repeatable method, and consistency in whether figures refer to waste generated or waste collected.

3.5.6 Further materials

- Eurostat Waste Statistics - the EU's waste statistics database, covering generation, treatment and management data for member states, including circular-economy Sankey flows.
- UN-Habitat Waste Wise Cities Tool - a step-by-step method for collecting data on municipal solid waste generated, collected and managed in controlled facilities, aligned with SDG indicator 11.6.1.
- Basel Convention plastic-waste reporting - the annual national reporting system for transboundary movements of hazardous and plastic wastes, including exports, imports and disposal methods.
- UNEP Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform - country dashboards with plastic-flow data, policy tracking and consolidated global datasets to support evidence-based policymaking.
- World Bank What a Waste 3.0 - a global waste database covering 217 countries, with generation, composition and treatment data and projections to 2050.
- The Waste Flow Diagram (WFD) Toolkit - an Excel-based rapid-assessment tool that maps municipal waste flows and quantifies plastic leakage, supporting SDG indicator 11.6.1.
- The Waste Flow Diagram (WFD) User Manual - guidance on applying the WFD toolkit, including data collection and plastic-leakage estimation methods.
- SPOT model (University of Leeds) - a GIS-based model for identifying plastic-pollution hotspots, applicable globally or at higher resolution with local data.

- Guidance on conducting a successful waste audit (ENGIE Impact) - practical guidance on planning and running a waste audit.
- IUCN/UNEP Plastic Pollution Hotspotting - a UNEP/IUCN/Life Cycle Initiative methodology to identify leakage hotspots by polymer, application and sector and to prioritise interventions.

3.6 Plastics Waste Collected

3.6.1 Definitions and Scope

Plastic waste collection: The organised process of collecting, storing, and transferring discarded plastic materials from their point of generation (households, businesses, institutions, public spaces etc.) to facilities for sorting, processing, recycling, recovery, or final disposal. This encompasses all activities and systems - both formal and informal - designed to remove plastic waste from the immediate environment where it is generated and channel it into waste management pathways.

This definition encompasses both mixed waste collection (where plastics are collected alongside other materials) and separate collection systems specifically targeting plastic waste streams.

There are three types of collection systems that should be considered.

- **Formal collection systems:** Government-approved or contracted services operating through established infrastructure with regular schedules, designated equipment, and official protocols.
- **Informal collection systems:** Activities performed by waste pickers, scavengers, individuals and small-scale entrepreneurs who gather valuable plastic materials for sale to recyclers without formal integration into municipal systems.
- **Community-based collection systems:** Organised initiatives led by environmental groups, community organisations, and volunteer networks that conduct regular or periodic plastic waste collection through cleanups, targeted collection drives, and awareness campaigns to supplement formal systems in areas with service gaps.

Self-haul where households or businesses transport their own waste directly to a facility, dumpsite or recycler - is a distinct pathway. Whether it is counted as "collected" depends on the destination. Material delivered to a controlled facility is collected and managed, while material self-hauled to an open dump should be treated as uncollected or self-managed. Countries should decide and document how self-haul is handled, especially for material-flow accounting.

Possible components of waste collection data could include:

- **Collection coverage:** The geographic area and population with access to plastic waste collection services, expressed as a percentage of total area or population.
- **Types of plastics:** The separation of plastic types, which may affect collection methodologies and subsequent processing. Example plastic polymers are - Polyethylene Terephthalate (PET), High-Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low-Density Polyethylene (LDPE)/ Linear Low-Density Polyethylene (LLDPE), Polypropylene (PP), Polystyrene (PS) and Expanded Polystyrene (EPS).
- **Location:** The type of building (household, public building, business etc) or environment (e.g., beach or park) the plastic is collected from.

3.6.2 Why waste collection data matters

Collection is the link between waste generation and everything that follows. Only material that is collected can be sorted, recycled, recovered or safely disposed of. The share of generated plastic waste that is collected – and the share left uncollected – is therefore one of the most policy-relevant figures in the whole life cycle, and a direct input to estimates of mismanaged waste and leakage.

Collection data supports several uses: measuring collection coverage and the gap to universal collection; planning and financing services and infrastructure; recognising the contribution of the informal sector; and reporting against SDG indicator 11.6.1 and the global plastics instrument under negotiation.

3.6.3 Methods for generating waste collection data

To obtain data on plastics waste collected, users could consider applying one (or several) of the methods in Table 3.6. The methods are grouped by who is most likely to lead or supply the data:

- **Government:** methods that rely on government oversight, funding or regulatory authority – for example weighbridge and collection-route records, household and business surveys, and mandatory schemes such as extended producer responsibility, deposit-return systems and digital waste tracking.
- **Private sector:** voluntary schemes run by producers or retailers, such as in-store take-back programmes, that generate data on the plastic they collect.
- **Voluntary commitments and partnerships:** voluntary, coalition-led initiatives in which businesses – and in some cases governments – commit to shared targets and report annually on their plastic packaging.
- **Waste-management organisations:** public or private operators that collect and handle waste, whose operational records – weighbridge data, route monitoring and corporate reporting – can be used directly.
- **Informal sector:** methods that capture collection by informal waste workers who earn a living from waste but are not formally employed, such as waste-picker surveys, records from junk shops and sorting facilities, and mobile data-collection apps.
- **Research and academia:** studies by universities and research institutes, such as GIS mapping and spatial analysis and material flow analysis.
- **Environmental groups and citizen science:** voluntary, community-led data collection, such as community waste audits, clean-up and litter monitoring, and citizen-science reporting apps.

Any plastics material collected through studies looking at "plastics in the environment" could also be calculated and added to the "plastic waste collected" data figure.

Table 3.6. Tools for developing waste collection data

Method	Description	Advantages	Limitations
Government			
Weighbridge Data Collection *UK Government* *Environmental Protection Agency (USA)*	• Systematic recording of incoming and outgoing waste by weight at transfer stations, recycling facilities, and disposal sites.	• Provides precise quantitative measurements • Creates ongoing data record over time • Enables tracking of seasonal variations • Relatively simple to implement at formal facilities	• Misses waste outside formal systems • Doesn't differentiate plastic types without additional sorting • Requires functioning weighbridge infrastructure
Surveys (Households and/or Businesses)	See Section 4.1.2 Surveys for more detailed guidance		

Method	Description	Advantages	Limitations
Regulated Producer responsibility schemes (including Extended Producer Responsibility or "Take Back schemes") *The Japan Containers and Packaging Recycling Association (Japan)* *LUCID (Germany)* *CITEO (France)* *UK Government*	• Mandatory frameworks requiring producers to take financial and/or operational responsibility for the collection, sorting, and treatment of post-consumer packaging waste. • In some cases businesses might report data on the amount of material that they collect in order to reduce payments through an EPR scheme.	• Creates dedicated funding streams for collection systems • Establishes systematic data reporting mechanisms • Enables tracking of specific packaging materials	• Requires robust regulatory framework and enforcement • Complex to implement and administer • Data quality depends on producer compliance • May not capture informal sector activities
Deposit Return Schemes (DRS) / container deposits *Reloop Global Deposit Book (Global)*	• Refundable deposits on beverage containers (also called "bottle bills" or "container deposit schemes") that drive high-capture separate collection. Scheme operators report units and tonnes returned and overall return rates	• Very high return rates and clean, well-quantified material streams / Robust, audited unit-level data / Captures containers whether or not collected at kerbside	• Usually limited to beverage containers (e.g., PET, HDPE, glass, cans) / Requires deposit infrastructure and a clearing system / May overlap with kerbside and EPR data, creating double-counting risk
Collection Route Monitoring	• Tracking formal collection vehicles using GPS and digital logging systems to map collection coverage and quantify collected materials.	• Provides real-time operational data • Identifies gaps in collection coverage • Enables optimisation of collection routes • Facilitates accurate record-keeping	• Limited to formal collection systems • Requires technological infrastructure • May not account for collection quality • Initial implementation costs can be high
Waste Management Records analysis	• Examination of official waste management records, contracts, and budgets to determine service provision extent and effectiveness.	• Utilises existing data sources • Provides historical trends • Cost-effective data collection method • Offers insights into financial sustainability	• May contain incomplete or inaccurate records • Doesn't capture informal sector activities • Often lacks detailed waste composition data • Variable record quality between jurisdictions

Method	Description	Advantages	Limitations
Digital Waste Tracking *UK Government – mandatory digital waste tracking*	A national, mandatory digital system in which waste producers, carriers and permitted sites record every waste movement online, replacing paper waste-transfer notes. Records capture the type, quantity, origin and destination of waste, giving regulators a complete view of collected and transferred material.	• Legally mandated, with comprehensive coverage of formal waste movements • Standardised, machine-readable records • Tracks waste from source to destination • Reduces waste crime and mis-reporting	• Covers only formal, permitted operators, so misses the informal sector and self-haul • Requires digital infrastructure and compliance capacity • Recently introduced, so time series are short • Plastic must be separated from mixed-waste records
Private Sector			
Take-back program data (voluntary) *Retailer take-back: Woolworths soft-plastics collection (Australia)*	• Data from manufacturer programs that collect their products for recycling	• Closed-loop tracking potential • Product-specific recycling rates • Direct producer involvement • Design for recycling insights	• Limited to participating companies • Often focused on high-value products • Small portion of total plastic volume • Selective reporting of successful programs
Voluntary commitments and partnerships			
Voluntary Commitments and Reporting Initiatives *Ellen MacArthur Foundation Global Commitment (Global)* *The Plastics Pact network (Global)*	Voluntary, coalition-led initiatives in which businesses – and in some cases governments – sign up to shared targets and report annually on their plastic packaging, including recycled content, reuse, and the material recovered through their systems.	• Standardised annual reporting across many large organisations • Internationally comparable • Captures major brands and signatories • Publicly available	• Voluntary and self-selected, so not nationally representative • Focused on packaging, recycled content and reuse rather than total collected tonnage • Self-reported, with limited independent verification
Waste Management Organisations			
Weighbridge Data Collection	Weighbridge data and collection route monitoring can be collected from government sites or privately only sites. For more detailed guidance, see "Weighbridge Data Collection" and "Collection Route Monitoring" in this table above under the "Government" heading.		
Collection Route Monitoring			

Method	Description	Advantages	Limitations
Corporate Reporting analysis	• Examination of waste management companies' operational reports, service records, and sustainability disclosures to extract data on plastic waste collection volumes, coverage areas, and processing methods	• Provides data directly from collection service providers • Contains detailed operational metrics and performance indicators • Often includes temporal data showing collection trends over time • May include previously aggregated and analysed data sets	• Commercial sensitivities may limit full data disclosure • Reporting standards vary between companies hampering comparability • Primarily focuses on areas with profitable collection operations • May emphasise positive outcomes in corporate sustainability reports
Informal Sector			
Waste Picker Surveys *Iyer et al (2012) (India)*	• Direct interviews and questionnaires with informal waste collectors to document their collection routes, volumes, material preferences, and selling channels. See Section 4.1.2 Surveys for more detailed guidance	• Captures data outside formal systems • Provides insights into recovery of high-value plastics • Documents socioeconomic aspects of collection • Identifies informal sector integration opportunities	• Challenging to establish representative samples • Potential distrust of official data collection • Labor-intensive fieldwork required • Self-reported data may lack precision
Data from junk shops / sorting facilities	• Collection of purchase records from informal sector middlemen who buy materials from waste pickers and sell to cyclers.	• Captures quantitative data on material flows • More centralised than individual waste picker surveys • Provides price data for different plastic types • Identifies market dynamics and value chains	• Reliant on cooperation of private businesses • Record-keeping may be inconsistent or informal • May miss materials that bypass these intermediaries • Potential reluctance to share commercially sensitive data
Real-time data collection (Mobile Applications) *KOLEKT (Global* *University of Colombo and Fcode Labs (Sri Lanka)*	• Digital tools tailored for informal sector workers to log collection activities, routes, and quantities through smartphone applications.	• Enables real-time data collection • Reduces barriers to participation • Provides geospatial data on collection patterns • Potential to formalise and recognise contributions	• Requires smartphone access and digital literacy • May face adoption barriers among waste pickers • Needs ongoing technical support • Potential privacy and trust concerns

Method	Description	Advantages	Limitations
Research and Academia			
GIS Mapping and Spatial Analysis *Zulkifi et al (2022) (Malaysia)* *Hamidu et al (2015) (Ghana)*	• Using geographic information systems to map collection coverage, waste generation hotspots, and service gaps	• Visualises spatial dimensions of collection systems • Identifies underserved areas precisely • Supports evidence-based infrastructure planning • Enables correlation with socioeconomic factors	• Requires specialised GIS expertise and software • Data-intensive for comprehensive mapping • Needs regular updating as conditions change • May oversimplify complex social dynamics
Material Flow Analysis	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		
Environmental Groups and Citizen Science			
Community Waste Audits	• Participatory events where volunteers sort and categorise plastic waste from designated areas to identify collection gaps and characterise local waste streams.	• Builds community awareness and engagement • Provides hyperlocal data on waste composition • Low-cost methodology with educational benefits • Can be replicated across different contexts	• Variability in implementation affects data quality • Limited sample sizes may not be representative • Typically conducted as one-off events • Volunteer capacity affects thoroughness
Plastic Pollution Monitoring *Tangaroa Blue Foundation (Australia)* *International Coastal Cleanup® (Global)*	• Clean-up initiatives that occur periodically at the same sites. Information gathered can include quantity, categories and composition of debris	• Creates temporal data set, which can be used to identify trends • Establishes baseline measurements, which can be used to assess the effectiveness of interventions • Raises awareness of collection inadequacies. • Engaging volunteers (citizen scientists) leads to cost-effective long-term monitoring	• Methodological inconsistencies between groups • Focuses on outcomes rather than collection processes. • Variable volunteer commitment affects data continuity • Typically limited to accessible public spaces

		• Before collected debris is diverted back to formal waste management streams (e.g., landfill or recycling facilities), information on the weight of material can be collected, providing information on the quantity of debris diverted back to managed waste streams	• Event organisation, people management and data collection and sorting require human and financial resource and capacity. It is important to consider all stakeholders that could be engaged and partnerships
Digital Reporting Platforms *Litterati (Global)*	• Mobile applications and web platforms that enable citizens to report uncollected waste, illegal dumping, and collection service issues	• Creates real-time data on collection failures. • Wide geographic coverage potential. • Empowers community participation. • Direct feedback loop to authorities	• Self-selected reporting creates sampling bias. • Requires digital access and awareness. • Data verification challenges. • May focus on complaints rather than systematic data

3.6.4 Disaggregating waste collection data

As with the other stages, collection data is most useful when disaggregated. Wherever the source data allows, it should be broken down along the following dimensions:

- **Collection system:** formal, informal and community-based, and separate versus mixed collection.
- **Collection coverage:** population and area with access to a service, as a percentage of the total.
- **Polymer and product type:** e.g., PET, HDPE, PVC, LDPE/LLDPE, PP, PS/EPS--.
- **Source location:** household, business, institution, public space, or environment (e.g., beach, park).
- **Operator and pathway:** who collects (municipality, private contractor, waste pickers, retailers, DRS) and where the material goes next.

Further detail on these categories is provided in the Disaggregating Data section.

3.6.5 Data challenges and a tiered approach to getting started

Collection data carries specific challenges. Formal-system records (weighbridges, route logs) miss the informal sector, community collection and self-haul. As most collection is mixed, plastic is usually weighed only as part of a larger waste stream, and a plastic fraction must therefore be estimated and applied. “Collected” is easily confused with “generated” or “recycled,” and double-counting is a risk where deposit, EPR and kerbside data overlap. Sources should be combined and clearly documented.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** estimate collected tonnage from formal-system records (weighbridge and collection contracts) and a collection-coverage rate, applying a plastic fraction to mixed waste.

- **Intermediate:** add separate-collection and EPR/DRS reporting, household and business surveys, and structured engagement with the informal sector (waste-picker surveys, junk-shop records).

- **Advanced:** reconcile all sources in a material flow analysis that links generation, collection (formal, informal and community) and downstream treatment, disaggregated by system and polymer, with routine validation.

Countries can move up the tiers as capacity grows; the priority at every stage is a transparent, repeatable method and consistency about what "collected" includes – for example, whether informal-sector and self-haul flows are counted.

3.6.6 Further materials

- Eurostat Waste Statistics - the EU's waste statistics database, covering generation, treatment and management data for member states, including circular-economy Sankey flows.

- Basel Convention plastic-waste reporting - the annual national reporting system for transboundary movements of hazardous and plastic wastes, including exports, imports and disposal methods.

- UNEP Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform - country dashboards with plastic-flow data, policy tracking and consolidated global datasets to support evidence-based policymaking.

- World Bank What a Waste 3.0 - a global waste database covering 217 countries, with generation, collection and treatment data and projections to 2050.

3.7 Plastics treatment

Once plastic waste is collected, it follows various management pathways towards treatment. These pathways include reuse, repair of damaged products, upcycling into higher-value applications, recycling through mechanical or chemical processes, and energy recovery through various technologies (e.g., waste-to-energy, pyrolysis, co-processing in cement kilns, gasification to produce syngas).

3.7.1 Definitions and Scope

Plastics treatment: the pathways that recover value from plastic rather than disposing of it - reuse, repair, upcycling, mechanical recycling, chemical recycling, and energy recovery (for example, incineration with energy recovery, or co-processing in cement kilns). Treatment data record how much plastic enters each pathway, usually in tonnes over a reporting period. Final disposal, such as landfill, is covered separately in Section 3.8.

Treatment takes place in both formal and informal settings. Reuse and repair in particular happen at the point of use - for example, refilling containers at home, or local repair - and are hard to measure yet they can offer valuable insight for raising public awareness and advancing the circular economy. It therefore helps to record formal treatment, informal treatment, and product-use-level activity (reuse and repair) separately, where the data allow.

Repurposing processes

Repurposing processes include methods that maintain or transform plastic materials into new usable products while preserving their material value.

- **Reuse:** The process of using plastic products or packaging again without significant modification, extending the life cycle of materials. Examples include refillable bottles, reusable containers, and repurposed plastic packaging.

  It helps to distinguish formal reuse systems such as deposit-return or refill-and-return schemes, where flows are recorded, from informal reuse and repurposing by households and businesses, which extends a product's life but is difficult to capture in data.

- **Repair:** The restoration of damaged plastic products to functional condition, prolonging their usable life. This includes mending broken parts, replacing components, or fixing structural issues.
- **Upcycling:** The creative transformation of plastic waste into new products of higher quality or value than the original. This process adds value to waste materials by creating items with enhanced functionality, aesthetics, or durability.
- **Mechanical recycling:** The physical processing of plastic waste through sorting, washing, shredding, melting, and remoulding to produce recycled plastic pellets or products without altering the basic chemical structure.

Thermal processes

Thermal processes utilise heat-based technologies to convert plastic waste into feedstock, energy or fuel products.

- Chemical recycling: Advanced technologies that break down plastic polymers into their basic chemical constituents (monomers or other basic chemicals). These building blocks can then be used to produce new virgin-quality plastics or other chemical products.
    - Pyrolysis: The thermal decomposition of plastic waste in an oxygen-free environment at temperatures between 300-900°C, converting polymers into liquid oil, synthetic gas, and char residue. The resulting products can serve as fuel or chemical feedstock.
    - Gasification: A high-temperature (>700°C) thermal process that converts plastic waste into synthesis gas (syngas) through partial oxidation with controlled amounts of oxygen or steam. The produced syngas can be used for electricity generation or as chemical feedstock.
- Waste-to-Energy: Controlled combustion of waste including plastics in specialised facilities to generate electricity, heat, or steam while managing emissions and capturing pollutants.
- Co-processing: The simultaneous recovery of energy and recycling of mineral content from waste in industrial processes, particularly cement production, where plastics replace fossil fuels and any mineral content becomes incorporated into the final product.

Note: Pyrolysis and gasification count as recycling only where the output is used as feedstock or new material; where the output is burned as fuel, they are a form of energy recovery. Countries should record and document which applies.

3.7.2 Why treatment data matters

Treatment data shows what actually happens to plastic waste after it is collected: how much is reused, repaired, recycled, recovered for energy, or sent on to disposal. It is the basis for a country's recycling rate and for checking whether waste is being managed in the way that policies intend.

Reliable treatment data supports several uses: measuring recycling and recovery rates; planning recycling and energy-recovery capacity; tracking progress against recycled-content and circular-economy targets; and reporting against SDG indicators and the global plastics instrument now being negotiated.

3.7.3 Methods for generating treatment data

Repurposing processes

Data collection for repurposing activities should include both formal and informal sectors to capture the full picture of waste recovery. This includes tracking materials from municipal collection systems, commercial recycling operations, and informal waste collectors who often recover significant quantities of valuable materials. Tools are listed in Table 3.7. The tools are grouped by who is most likely to lead or supply the data.

- **Government:** methods that rely on government oversight, funding or regulatory authority – municipal recycling records, council and contractor reports, waste audits, recycler and small-business surveys, and extended producer responsibility.
- **Private sector:** operational data from recyclers, reprocessors and producers – for example recycling company processing reports and refillable-station tracking systems.

- **Small-scale and informal sector:** data from recycling cooperatives, upcycling and social enterprises, and repair initiatives.
- **Other organisations:** data from environmental groups, charities, industry bodies and NGOs.
- **Research and academia:** analytical studies such as material flow analysis.

Table 3.7. Tools for Generating Data for plastics treatment (repurposing processes)

Method	Description	Advantages	Limitations
Government			
Municipal recycling facility records *US EPA national recycling data (US)*	• Basic data collection from council-operated material recovery facilities tracking plastic materials processed and sold	• Direct source of local recycling volumes • Regular reporting already in place • Shows seasonal and local trends • Usually includes plastic type breakdown	• Only covers materials in municipal system • May count sorted materials, not final recycling • Quality and contamination issues often overlooked • Doesn't include C&I or informal waste.
Council waste contractor reports *Somerset Council (UK)*	• Required reporting from private companies managing waste and recycling on behalf of local councils	• Contractual obligation ensures data collection • Covers entire municipal service area • Can include both collection and processing	• Reporting quality varies between contractors • Focus often on weight not material quality • Different councils use different metrics
Waste audits *Pacific Region Infrastructure Facility (PRIF)* *Waste Audit training (Sri Lanka)*	• Physical sorting and weighing of waste samples to determine plastic content and recycling potential	• Actual physical verification • Detailed composition analysis • Identifies missed recycling opportunities • Can assess contamination levels	• Resource intensive process • Point-in-time snapshot • Sample selection affects results • Requires trained personnel
Plastic recycler surveys	• Regular surveys of companies that convert collected plastics into reusable materials See Section 4.1.2 Surveys for more detailed guidance	• Focus on actual recycling not just collection • End-market insights • Product applications tracked • Processing capacity information	• Voluntary participation limits data • Business confidentiality concerns • Response rates vary • Self-reported data with limited verification

Method	Description	Advantages	Limitations
Small recycling business surveys	• Questionnaires or interviews with small-scale recyclers about plastic volumes and types See Section 4.1.2 Surveys for more detailed guidance	• Captures activities outside formal system • Identifies specialised niche recyclers • Local economic activity measurement • Reveals entrepreneurial innovations	• Time-consuming to conduct • Self-reported data with limited verification • Informal operations may be reluctant to share • Irregular or seasonal operations
Regulated Producer responsibility schemes (including Extended Producer Responsibility or "Take Back schemes") *The Japan Containers and Packaging Recycling Association (Japan)* *LUCID (Germany)* *CITEO (France)* *UK Government*	• Mandatory/ voluntary reporting from producers under EPR schemes on recycling of their products • As part of an EPR scheme, Local Authorities or Municipalities may be required to report the amount of plastics that is recycled to determine the total amount of fees needing to be paid by producers to offset the costs of managing packaging waste.	• If mandated, legal requirement can ensure reporting • Standardised methodology	• Limited to covered products/packaging • Definition of recycling can vary. • Attribution challenges in mixed systems
Private Sector			
Recycling company processing reports *Plastics Recyclers Europe (Europe)*	• Regular reporting on plastic volumes received, processed, and sold by private recycling companies	• Direct source of actual processing data • Usually includes polymer types (PET, HDPE, etc.) • Market reality reflected in operations • Shows yield rates from input to output	• Commercially sensitive information • Limited public access to data • Focused on profitable materials • Different companies use different metrics
Refillable Station Tracking Systems (Brand Owners and Manufacturers)	Digital monitoring systems that record the quantity and types of plastic packaging in refill operations, including container reuse counts and product volumes dispensed	• Captures consumer participation rates • Provides brand-specific packaging reuse data	• Limited to formal refill locations • Does not capture at-home refilling • Requires infrastructure • Does not track container end-of-life

Method	Description	Advantages	Limitations
Small-Scale and Informal Sector			
Recycling cooperative data collection **Pacific Recycling Foundation, Fiji**	• Basic record-keeping systems for waste picker groups and recycling cooperatives	• Ground-level data on valuable plastics • Community participation opportunity • Socioeconomic benefits documented • Captures materials missed by formal systems	• Limited record-keeping resources • Focus on higher-value plastics only • Variable data quality • Challenging to aggregate across groups
Upcycling enterprises/ Social enterprises/ repair cafes records	• Basic production records from businesses transforming plastic waste into value-added products	• Documents creative reuse solutions • Tracks higher-value transformations • Product development innovations	• Often very small production volumes • Diverse businesses difficult to categorize • Inconsistent measure-ment approaches • Limited to specific plastic types
Other organisations			
Reports from Recycling programs (Environmental groups, Charities, Industry groups, NGOs) *NAPCOR's PET recycling report*	• Data collection by organisations working on plastic waste and recycling initiatives	• Independent verification role • Community engagement focus • Documentation of innovative approaches • Education and awareness integration	• Often project-specific not systematic • Variable methodologies between organisations • Funding limitations affect scope • Advocacy focus may affect objectivity
Research and academia			
Material Flow Analysis (MFA) *OECD Global Plastics Outlook (Global)*	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		

Thermal Processes

For energy recovery operations, facility reporting forms the primary data source. Regulatory authorities should collect comprehensive data on plastic waste input quantities to thermal treatment facilities. Tools are outlined in Table 3.8.

Table 3.8. Tools for Generating Data for plastics treatment (thermal processes)

Method	Description	Advantages	Limitations
Weighbridge records	Recording the weight of incoming waste loads at facility entrance, often with estimation of plastic content	• Continuous data collection of all incoming waste • Simple infrastructure already in place • Total volume tracking by source/hauler • Basic data already required for operations	• Limited plastic-specific information • Visual estimation has high error rates • Mixed waste composition challenges • No tracking of individual plastic types
Contracted waste deliveries (Waste to energy facility) *CEWEP – European Waste-to-Energy Plants (Europe)* *EU Industrial Emissions Portal / E-PRTR (European Union)*	Formal documentation of plastic content in contracted waste deliveries	• Contractual documentation • Regular reporting structure • Source-specific tracking • Economic incentives for accuracy	• Self-reported by waste providers • Limited verification mechanisms • Contract terms affect reporting • Focus on contaminants not plastics
Material recovery pre-processing (pre-processing facility)	Data from systems that extract recyclable plastics before waste-to-energy processing	• Direct measurement of diverted plastics • Polymer-specific recovery potential • Value recovery documentation • Efficiency measurement of sorting	• Captures only easily recovered plastics • Efficiency varies by technology • Economic rather than comprehensive focus

3.7.4 Disaggregating treatment data

As with the other stages, treatment data is most useful when broken down. Wherever the source data allows, it should be disaggregated along the following dimensions:

- **Treatment pathway:** reuse, repair, upcycling, mechanical recycling, chemical recycling, and energy recovery (waste-to-energy, pyrolysis, co-processing, gasification), so each can be tracked separately.
- **Stage of recycling:** material sorted and sent for recycling versus material actually recycled into new products, since the two are often confused.
- **Polymer and product type:** e.g., PET, HDPE, PVC, LDPE/LLDPE, PP, PS/EPS, and the applications the recyclate goes into.
- **Sector and destination:** formal versus informal, municipal versus commercial and industrial, and recycled domestically versus exported for treatment.

Further detail on these categories is provided in the Disaggregating Data section.

3.7.5 Data challenges and a tiered approach to getting started

Treatment data carries several challenges. “Recycling” is defined in different ways – some figures count material sorted or sent to a recycler, others count only what becomes a new product. Each figure should

therefore state which is meant. Recycling into lower-value uses is sometimes described as downcycling. Waste-to-energy plants burn mixed waste rather than plastic alone, therefore the plastic share of the feedstock must be estimated. Chemical recycling is still developing, and its data and definitions are not yet settled. Much processing data is commercially sensitive, and informal reuse, repair and recycling are hard to measure. Sources should therefore be combined and clearly documented.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** estimate treatment shares from EPR and municipal recycling reports and national statistics, applying a plastic fraction to any mixed waste sent to energy recovery.
- **Intermediate:** add surveys of recyclers and waste-to-energy operators, facility permit and reporting data, and structured engagement with the informal sector, separating material sorted from material actually recycled.
- **Advanced:** reconcile all sources in a material flow analysis that links collection, treatment and end-markets, disaggregated by pathway and polymer, with routine validation.

Countries can move up the tiers as capacity grows; at every stage the priority is a transparent, repeatable method and a clear statement of what each figure counts as "recycled" or "recovered."

3.7.6 Further Materials

- Eurostat Waste Statistics - the EU's waste statistics database, covering generation, treatment and management data for member states, including circular-economy Sankey flows.
- Basel Convention plastic-waste reporting - the annual national reporting system for transboundary movements of hazardous and plastic wastes, including exports, imports and disposal methods.
- UNEP Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform - country dashboards with plastic-flow data, policy tracking and consolidated global datasets.
- World Bank What a Waste 3.0 - a global waste database covering 217 countries, with generation, collection and treatment data and projections to 2050.

3.8 Plastics disposal

Once plastic waste is collected, it is typically directed to treatment facilities for recovery of materials or energy, with the remainder that cannot be treated being sent to disposal facilities such as landfills or dumpsites. In some instances, particularly in regions with limited infrastructure, the entire collected amount or a large volume of the collected waste may be directed straight to disposal without any treatment.

Note: The disposal methods described in Section 3.8.1 apply to all waste types. Users should therefore also collect data on the proportion of plastics within each disposal stream in order to derive plastics-specific estimates for each disposal method.

3.8.1 Definitions and Scope

Plastics disposal: the final management of plastic waste that is not reused, recycled or recovered for energy – mainly landfilling, disposal at open dumpsites, and incineration without energy recovery. Disposal data records how much plastic waste ends up in each of these routes, usually in tonnes over a reporting period.

Disposal facilities handle mixed waste rather than plastic alone, and the plastic share of what is disposed must therefore usually be estimated (see 5.7.5). Scope should also include open or informal burning of plastic – for example, household backyard burning and burning at dumpsites – which is common in some countries, is a source of greenhouse gas and air-pollutant emissions and is hard to measure.

Incineration without energy: Incineration without energy recovery refers to the controlled combustion of waste in dedicated facilities where the heat generated is not captured or utilised. This process reduces waste volume by up to 90% and generates ash, flue gas, and heat, but differs from waste-to-energy processes in that the thermal energy is released to the environment without any recovery systems.

Landfill: Landfill disposal involves the engineered deposit of waste in specifically designed facilities where waste is systematically buried. Sanitary landfills incorporate multiple protective components including base liners (clay or synthetic), leachate collection and treatment systems, gas management infrastructure, daily/intermediate/final cover materials, and surface water management controls.

Open dumpsites: Open dumpsites are uncontrolled waste disposal sites where plastic and other waste materials are deposited without engineered containment systems or environmental protections. These sites lack proper management systems such as leachate collection, gas control, or systematic covering of waste.

3.8.2 Why disposal data matters

Disposal data shows how much plastic waste is not recovered and instead ends up in landfills, at open dumpsites, or is burned without energy recovery. A high share of disposal points to gaps in collection and recycling, and to the risk of environmental leakage and emissions.

Disposal data supports several uses: completing the picture of where plastic waste ends up; measuring how much is landfilled, dumped or burned; supporting greenhouse-gas reporting under IPCC guidance and Biennial Transparency Reports; and reporting against SDG indicators and the global plastics instrument now being negotiated.

3.8.3 Methods for generating disposal data

Disposal data is collected by disposal type. The parts below set out the main methods and tools for incineration without energy recovery, landfill, and open dumpsites. Within each part, the tools are grouped by who is most likely to lead or supply the data.

- **Government and waste-management companies:** facility and operational data – weighbridge and gate records, waste-arrival records, visual estimates, and satellite monitoring used by the authorities and companies that run disposal sites.
- **Research and monitoring:** analytical and monitoring methods such as material flow analysis and satellite imagery.

3.8.4 Incineration without Energy Recovery

Similar to waste to energy data collection, incineration without energy requires data collection from the facility to use as the primary data source. Facilities should record tonnage data of plastic waste incinerated to track the volume of materials managed through its pathway.

Table 3.9. Tools for Generating Data for plastics disposal (Incineration without Energy Recovery)

Method	Description	Advantages	Limitations
Government/ Waste Management companies			
Weighbridge data *EU Industrial Emissions Portal / E-PRTR (European Union)* *IPCC 2019 Waste Guidelines (incineration & open burning)*	Weighing incoming loads and requiring declaration of estimated plastic content	• Captures 100% of incoming waste • Continuous data collection • Simple implementation using existing infrastructure • Can be categorised by source	• Relies on estimates or declarations • Limited verification of actual content • General waste classifications only • Accuracy varies by source
Visual estimation	Standardised procedure for visually estimating plastic percentage in loads	• Quick assessment of each load • No specialised equipment needed • Can identify major shifts in composition • Applicable to all facilities	• Subjective assessment method • Limited to visible surface materials • Variable accuracy between inspectors • Qualitative rather than precisely quantitative

3.8.5 Disposal in Landfill

To collect data on plastic waste disposed in landfills, facilities should maintain weighbridge records with waste categorisation data to quantify the amount incoming that is plastic and track trends over time. Regular waste characterisation studies should be conducted to determine the percentage, types, and sources of plastic materials within the general waste stream, with sampling methodologies designed to account for seasonal and operational variations.

Table 3.10. Tools for Generating Data for plastics disposal (landfill)

Method	Description	Advantages	Limitations
Government/ Waste Management companies			
Weighbridge records	Weighing all incoming loads with waste type classification that includes estimated plastic content. Could be implemented at landfill sites or transfer stations.	• Captures 100% of incoming waste • Continuous data collection • Uses existing infrastructure	• Relies on general waste classifications • Limited plastic-specific information • No verification of actual plastic content • Classification accuracy varies by source
Truck load estimates	Random selection of incoming trucks for detailed waste analysis before landfilling	• Direct inspection of actual loads • Can identify major shifts in composition • Opportunity for hauler education • More frequent than full waste audits	• Limited number of loads can be inspected • Disrupts normal operations • Staff availability constraints • May trigger hauler behaviour changes
Visual estimation protocol	Standardised procedure for visually estimating plastic percentage in each load	• Quick assessment method • Applicable to all incoming loads • Minimal equipment needed • Can identify major composition changes	• Subjective assessment method • Limited to visible surface materials • Operator training affects quality • Less accurate than physical sorting
Research and monitoring			
Material Flow Analysis (MFA) *OECD Global Plastics Outlook (Global)* *Olatayo et al. (2024) (South Africa)*	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		

3.8.6 Open Dumpsites Managed by Authorities and Waste Management Companies

In regions with limited waste management infrastructure, collected plastic waste is often disposed in open dumpsites managed by local authorities or private waste management companies in the absence of proper treatment facilities. These sites lack engineered containment systems, with waste frequently subjected to controlled burning to reduce volumes, while spontaneous combustion can also occur due to methane

generation and heat accumulation within the waste mass. Data collection at these sites is crucial as burning plastic waste contributes significantly to greenhouse gas emissions and air pollutants, which must be captured and reported under IPCC guidelines and included in Biennial Transparency Reports (BTR) for national climate accounting.

Table 3.11. Tools for Generating Data for plastics disposal (open dumpsites)

Method	Description	Advantages	Limitations
Government/ Waste Management companies			
Visual surveys and mapping	Regular site visits using standardised protocols to document dumpsite area and visible plastic distribution	• Minimal equipment required • Direct observation of site conditions • Can document burning activities	• Subjective assessment • Safety risks for personnel • Limited to accessible areas
Waste arrival records	Basic tracking of incoming waste trucks with simplified classification of load types and estimated volumes	• Low technology requirement • Continuous data collection • Implementation with minimal training	• Often lacks weighing infrastructure • Estimated volumes less accurate • Limited plastic-specific data
Government/ Waste Management companies			
Satellite imagery analysis *Global Plastic Watch, Minderoo (Global)* *UN Satellite Centre, UNOSAT (Global)* *Kruse et al. (2023), satellite monitoring of terrestrial plastic waste (Global)*	Periodic review of freely available satellite images to track dumpsite expansion, visible burning, and major compositional features + ground truthing See Sections 5.8.2 Tools for Generating Data for Plastics in the Environment and 5.10.4. Remote Sensing Approaches for more details.	• Cost-effective remote monitoring • Covers entire site area	• Resolution limitations • Cloud cover interference • Limited compositional detail • Requires technical skills

3.8.7 Disaggregating disposal data

As with the other stages, disposal data is most useful when broken down. Wherever the source data allows, it should be disaggregated along the following dimensions:

- **Disposal route:** landfill (sanitary or controlled), open dumpsite, and incineration without energy recovery, plus open or informal burning where it occurs.
- **Plastic share:** the estimated proportion of plastic within each mixed-waste disposal stream, so that plastic-specific figures can be derived.
- **Managed versus unmanaged:** waste going to engineered, managed sites versus dumpsites and uncontrolled disposal, which matters for leakage and emissions estimates.
- **Polymer type, location and operator,** where sampling and records allow.

Further detail on these categories is provided in the Disaggregating Data section.

3.8.8 Data challenges and a tiered approach to getting started

Disposal data carries several challenges. Disposal sites receive mixed waste, and the plastic share must therefore be estimated from waste-characterisation studies rather than measured directly. Open dumpsites and informal burning are common in many countries but are poorly recorded, and burning plastic produces greenhouse-gas and air-pollutant emissions that need to be estimated using IPCC methods. Weighbridge and visual estimates are approximate, and small or remote sites are often missed. Sources should be combined and clearly documented.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** estimate disposal shares from national waste statistics and weighbridge or gate records, applying a plastic fraction from a waste-characterisation study or a regional default.
- **Intermediate:** add waste-characterisation sampling at the main disposal sites, gate and permit records, and satellite imagery to locate and size dumpsites.
- **Advanced:** reconcile all sources in a material flow analysis that links collection, treatment and disposal, disaggregated by route and by managed versus unmanaged disposal, with emissions from burning estimated using IPCC methods.

Countries can move up the tiers as capacity grows; at every stage the priority is a transparent, repeatable method and a clear statement of how the plastic share of disposed waste was estimated.

3.8.9 Further materials

- Eurostat Waste Statistics - the EU's waste statistics database, covering generation, treatment and management data for member states, including circular-economy Sankey flows.
- Basel Convention plastic-waste reporting - the annual national reporting system for transboundary movements of hazardous and plastic wastes, including exports, imports and disposal methods.
- UNEP Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform - country dashboards with plastic-flow data, policy tracking and consolidated global datasets.
- World Bank What a Waste 3.0 - a global waste database covering 217 countries, with generation, collection and treatment data and projections to 2050

3.9 Plastics in the Environment

3.9.1 Definitions and Scope

Plastics in the environment refers to plastics that are uncollected, openly dumped or burned, littered or legacy plastics contaminating the natural environment. The leakage of plastic into the environment, whether intentional or accidental, can occur at every stage of the life cycle.

Uncollected waste: All solid plastic waste that escapes waste management systems (formal and informal).

Open dumping and burning: Waste that is deliberately discarded in unauthorised, uncontrolled or unmanaged locations without proper containment or treatment by households, businesses or industries. This includes waste that is deliberately set on fire by households, businesses or industries as a means of volume reduction.

Fly tipping: the deliberate disposal of large items or quantities of litter (e.g., broken refrigerator, single large bag of rubbish) in a random location (Boucher et al., 2020)[35]

Littering: incorrect disposal of small, one-off items that are likely not collected by managed waste methods (Velis et al., 2017)[36]

Environmental sampling for debris: the process of collecting samples of debris from the environment.

35 Boucher et al., 2020
36 Cottom et al., 2024

Environmental monitoring of debris: the repeated measurement, observation or assessment of the environment over time. This technique is often used to identify changes or trends over time (GESAMP, 2019).

3.9.2 Why environment data matters

Plastics in the environment are the end point that the whole life cycle is meant to prevent. Measuring how much plastic reaches land, rivers and the sea shows the scale of leakage, where it comes from, and whether efforts to reduce it are working.

This data supports several uses: estimating national leakage and mismanaged waste; finding pollution hotspots and priority sites for action; reporting against SDG indicator 14.1.1 on marine litter and the global plastics instrument now being negotiated; and building the evidence base for clean-up and prevention programmes.

3.9.3 Methods for generating environment data

Data on plastics in the environment can be generated using one or more of the methods summarised in Table 3.12. Because environmental leakage is diffuse and difficult to observe directly, most methods rely on field sampling, repeated monitoring or remote observation rather than administrative records. The methods are grouped by who is most likely to lead or supply the data:

- **Government:** official surveys and estimates, including transect or distance sampling of shorelines, structured questionnaires, and estimates of open burning drawn from national greenhouse-gas inventories.
- **Academia and Research:** analytical approaches such as material flow analysis that infer environmental leakage from wider production and waste data.
- **Citizen Science:** data generated by volunteers, including coastal clean-up records and public reporting of illegal dumping or fly-tipping.
- **Cross-cutting methods:** repeated environmental monitoring at fixed sites, which may be led jointly by governments, researchers and volunteers.
- **Technology options:** remote-sensing approaches that use satellite or drone imagery to detect and quantify plastic accumulation across large or inaccessible areas.

Table 3.12. Tools for Generating Data for plastics in the environment

Method	Description	Advantages	Limitations
Government			
Transect walk or distance sampling (for open burning and/or dumping) *Das et al (2018) (Nepal)*	Systematic transect walks in sampled locations to record instances of open dumping and open burning.	• Data can be gathered on waste quantity, composition and burn condition, supporting detailed waste characterisation • Values can be extrapolated to calculate open dumping and burning incidents per square kilometre over time and identify spatial patterns of dumping / burning • Creates baseline data for future monitoring	• Labour intensive, time consuming and requires trained personnel • May miss incidents that occur outside sampling times or locations • Limited access to certain areas

Method	Description	Advantages	Limitations
Surveys / questionnaires *Pansuk et al (2018) (Thailand)* *The Ocean Strainer (Sri Lanka)*	Systematic collection of data through standardised questionnaires administered to representative samples of households, individuals, businesses or institutions. See Section 4.1.2 Surveys for more details.	• Regularly reported data can inform the total waste dumped/burned and frequency or seasonal patterns or behaviour • Official statistics are regarded as more credible • Representative sampling • Cost effective for large areas • Potential for data collection from diverse stakeholders	• Data collection is resource-intensive • May lack product-specific detail and polymer-type information • Potential for response bias, especially regarding illegal practices such as open dumping and burning • Potential sampling bias e.g., potential difficulty engaging with remote communities due to location or language difficulties • Requires careful questionnaire design
National Greenhouse Gas Inventories Equation (open burning only)	Calculation or emissions related to open burning of plastics or waste using the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. See Section 4.1.6. IPCC 2006 Guideline for National Greenhouse Gas Inventories for more details.	• Standardised methodology • Enables comparison between regions / countries • Integrates with national greenhouse gas reporting and national climate plans or commitments	• Focus primarily on emissions caused by waste rather than waste • Requires technical expertise to implement
Academia and Research			
Material Flow Analysis (MFA)	See Section 4.1.3. Material Flow Analysis for more detailed guidance.		

Method	Description	Advantages	Limitations
Citizen Science			
Clean-up collection data *International Coastal Cleanup® (Global)* *Tangaroa Blue Foundation (Australia)* *Beach-litter citizen-science baseline, East Pacific coast (De Veer et al., 2023)*	Participatory events held irregularly where participants (usually volunteers) collect, sort and categorise debris collected.	• Before collected debris is diverted back to formal waste management streams (e.g., landfill or recycling facilities), data can be collected, indicating the quantity diverted back to managed waste streams. • When methods are co-designed by scientists, researchers and statistics offices, the information gathered can contribute to official national datasets and statistics. • Engaging volunteers (citizen scientists) leads to cost-effective long-term monitoring	• Sampling biases based on cleanup locations (e.g., favouring more accessible or popular locations) • Variable data quality from volunteer collectors. This can be overcome with detailed training and guidance for volunteers • Event organisation, people management and data collection and sorting require human and financial resource and capacity
Surveillance systems and citizen science *Portal to report fly-tipping or illegal waste dumping (UK)*	Surveillance systems or community citizen science groups can patrol known hotspots for open burning and dumping to monitor their instances, quantities and composition.	• Engages the community, leading to cost-effective long-term monitoring • Can detect incidents in real-time • Raises public awareness about waste issues • Systems can be as detailed as capacity and resources allow • Field officers can further sample reported sites weighing and categorising samples of waste burned and dumped	• Variable data quality from volunteer or citizen observers. This can be overcome with detailed training and guidance for volunteers • Requires coordination and verification systems • Potential barriers to set-up or access technology for reporting barriers

Method	Description	Advantages	Limitations
Cross-cutting methods: Citizen science, academia, government and research organisations			
Environmental monitoring *Tangaroa Blue Foundation (Australia)* *Operation Clean Sweep (Global)*	• Sampling initiatives that occur periodically at the same site. Information gathered can include quantity, categories and composition of debris collected For more detailed guidance, see Section 4.1.2 Surveys - Environmental surveys.	• Creates temporal data sets which can be used to identify trends • Establishes baseline measurements, which can be used to identify debris "hotspots" and assess the effectiveness of interventions • Engaging volunteers (citizen scientists) leads to cost-effective long-term monitoring • Digital platforms and mobile applications can be used to streamline reporting, although this requires financing and capacity to set-up. Several publicly accessible applications already exist (see Section 6.2) • Before collected debris is diverted back to formal waste management streams (e.g., landfill or recycling facilities), data can be collected, providing information on the quantity diverted back to managed waste streams	• Methodological inconsistencies between groups. To overcome this, methods should be co-designed by scientists to ensure methods align with global best practice • Variable volunteer commitment affects data continuity • Typically limited to accessible public spaces • Variable data quality from volunteer or citizen observers. This can be overcome with detailed training and guidance for volunteers

Technology options			
Remote sensing approaches *Plastic Litter Project, Marine Remote Sensing Group, Department of Marine Sciences, University of the Aegean (Greece)* *Riverine plastic monitoring using UAVs, Klang River (Malaysia)*	Aerial imagery through openly available satellites or private drones can be utilised to detect, visualise and quantify geographic areas of open dumping or burning, or large accumulations of plastic. See Section 4.1.4. Remote Sensing Approaches for more details. .	• Existing publicly available libraries of remote sensing data can make these approaches cost-effective • Data available over large geographic areas as well as remote or hidden areas • Provides temporal and spatial data • Particularly useful when on-the-ground sampling is not possible, for example due to limitations in accessibility in remote areas or capacity for financing, human resource or time • Thermal imagery can be used to detect heat signatures for open burning	• Drones or other private technologies can be costly • Factors such as resolution, cloud cover or others can interfere with accurate data collection • Image analysis requires specialised skills • Technology is still in early stages, but with financing and capacity building it has promising potential

3.9.4 Disaggregating environment data

As with the other stages, data on plastics in the environment is most useful when broken down. Wherever the source data allows, it should be disaggregated along the following dimensions:

- **Environment:** terrestrial (land, soil, roadsides), freshwater (rivers, lakes) and marine (shoreline, sea surface, water column, seafloor). Separating land from water matters for finding sources and for reporting.
- **Leakage pathway:** uncollected waste, open dumping and burning, fly-tipping, and littering (as defined in 5.8.1).
- **Size class:** macroplastics, mesoplastics and microplastics, since these need different methods.
- **Polymer, item type, location and time,** including the most common items found and repeated measurement over time to show trends and hotspots.

Further detail on these categories is provided in the Disaggregating Data section.

3.9.5 Data challenges and a tiered approach to getting started

Data on plastics in the environment carries several challenges. Litter is spread unevenly, and results therefore depend heavily on where and when sampling takes place. Methods differ between groups, which makes data hard to compare unless a common protocol is used. Microplastics need specialised sampling and laboratory work. Much of the data comes from volunteers, and training and quality checks are therefore essential. And clean-up data measures what was removed, not the total amount present. Sources should be combined and clearly documented.

A practical way to begin is to match the method to current data capacity and strengthen it over time:

- **Basic:** use existing clean-up and citizen-science records (for example, coastal clean-ups), and estimate leakage from waste data using a recognised method such as plastic-pollution hotspotting.

- **Intermediate:** run repeated monitoring at fixed sites using an internationally agreed protocol (for example, the UNEP/IOC or NOAA shoreline methods, and the UNEP guidelines for rivers and lakes), covering both land and water.

- **Advanced:** combine field monitoring, remote sensing and modelling in a material flow analysis that estimates leakage by pathway and environment, with routine validation.

Countries can move up the tiers as capacity grows; at every stage the priority is a transparent, repeatable method and a clear record of where and how samples were taken.

3.9.6 Further materials

- GESAMP Guidelines for the monitoring and assessment of plastic litter in the ocean (2019) — internationally agreed guidelines for monitoring and assessing marine litter across shorelines, the water column, the sea surface and biota.

- UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter (2009) - standardised operational protocols for beach, benthic and floating-litter surveys, including rapid methods suitable for community volunteers.

- Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, 14.2.1 and 14.5.1 (UNEP, 2021) - guidance on monitoring techniques for reporting on marine-debris SDG indicators.

- The Marine Plastic Footprint (IUCN) - a science-based framework for estimating the quantities of plastic leaking into the marine environment during the waste stage.

- GPML Community of Practice on Harmonisation of Monitoring and Assessment of Plastic Pollution - an expert group addressing harmonisation, interoperability and data comparability across life cycle stages.

- UNEP GPML Digital Platform - country dashboards with plastic-flow data, policy tracking and collaboration tools that consolidate global datasets.

- Monitoring Plastics in Rivers and Lakes: Guidelines for the Harmonisation of Methodologies (UNEP, 2020) - methods for assessing plastic contamination in freshwater environments, including rivers and lakes.

- UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action - a framework for identifying leakage hotspots and prioritising interventions along the plastic value chain.

- Tangaroa Blue Foundation Australian Marine Debris Initiative (AMDI) Database — a free repository and data-collection app for recording marine debris, usable in any region of the world.

- CSIRO resources on marine debris - survey resources and a Survey Methodology Handbook (available in English and Portuguese).

- Deep-sea Debris Database (JAMSTEC, 2017) - public access to seafloor imagery from the Pacific, Indian and Atlantic Oceans since 1983.

Regional tools

- Marine Debris Monitoring and Assessment Project protocols and datasheets (NOAA) - protocols, field datasheets and quick guides for shoreline monitoring and assessment.

- European Marine Observation and Data Network (EMODnet) - protocols and internationally endorsed datasets for shoreline, seafloor and sea-surface litter.

- Guidance on Monitoring of Marine Litter in European Seas (European Commission, 2023) — updated protocols and recommendations to improve the comparability of marine-litter data among Member States.

3.10 Social data and indicators

3.10.1 Definitions and Scope

Social data represents critical information about the human dimension of plastic production, trade and waste management systems, including employment characteristics, working conditions, community impacts, and public engagement patterns. Social data on waste is collected less consistently than direct waste data in many countries, but it remains an important part of the plastic life cycle and should be included in broader data collection efforts.

Globally, millions of people depend on waste collection, sorting, and recycling for their livelihoods, with informal waste workers playing a particularly significant role in developing economies. In developing countries, 15 million people are expected to work as informal waste collectors (about 1% of the total urban population). Collecting accurate social data is therefore crucial to understand the positive contributions of this sector to sustainable development, areas requiring intervention to improve human wellbeing and ensure a just and equitable transition to more sustainable economies.

> **NOTE:** Global estimates of informal waste workers vary widely.
>
> The widely used figure above (15 million, about 1% of the urban population) comes from Medina (2008) and is now more than fifteen years old. More recent sources give different figures depending on definition and methodology: the ILO and WIEGO's 2013 statistical brief gives roughly 15–20 million; O'Hare and Talbott (2025) estimate up to 40 million; and the ILO's 2025 review of the recycling sector finds that formal labour statistics capture only around 6.9 million recycling workers globally, against grey-literature estimates for the informal sector alone ranging from 12.6 to 56 million.
>
> This spread reflects a genuine and persistent data gap rather than disagreement over one correct number – informal waste workers are structurally undercounted by standard labour force surveys because many lack a fixed address or formal registration, work seasonally or as a secondary activity, or are embedded within other industries. Countries should treat any global estimate as indicative only, and prioritise building their own national or city-level counts (for example through waste picker cooperative registries or targeted survey modules) rather than relying on global figures to represent domestic conditions.

Social data on plastics extends beyond the workforce to the demand side of the value chain. Consumer awareness, attitudes and behaviour strongly influence how much plastic is used, how it is discarded, and how well downstream collection and recycling systems perform. Public perception surveys consistently find high levels of concern about plastic pollution, alongside a persistent gap between stated concern and actual behaviour: a five-country consumer survey found that 91 per cent of respondents were concerned about plastic waste, yet only around half currently recycled or avoided non-recycled products (United Nations Environment Programme [UNEP], 2020). A broader review of survey-based research on plastic use similarly found that awareness and concern are consistently high across countries, but do not reliably translate into reduced consumption or improved disposal practices (Walker et al., 2023). Understanding this awareness-action gap matters for national data collection because it helps identify where policy levers – such as improved collection infrastructure, standardised labelling, or targeted public communication – are most likely to be effective.

A further, and increasingly prominent, dimension of social data concerns equity and a 'just transition' for those affected by changes to plastics production, use and waste management. Applied to the plastics and waste sector, just transition thinking is a more recent development than in the energy sector, and has grown rapidly alongside negotiations toward a global plastics treaty (O'Hare & Talbott, 2025). It is commonly organised around three dimensions: distributional equity (fair compensation and the ability of workers to move up the value chain), procedural equity (genuine inclusion of affected workers and communities in the design of policies and programmes, rather than token consultation), and recognition equity (formal acknowledgement of the social, economic and environmental contribution of informal workers) (O'Hare & Talbott, 2025). International guidance frames a just transition for the sector around several concrete principles: legal recognition of informal workers, income security, access to social protection, mechanisms for worker voice, gender equity, and the prevention of child labour (GIZ/PREVENT Waste Alliance, 2023; United Nations Human Settlements Programme [UN-Habitat], 2024). Capturing social data across these three dimensions – not just headline employment numbers – gives national governments a fuller picture of who benefits, who bears the costs, and where policy intervention is needed to make the transition to more sustainable plastics management equitable.

3.10.2 Example Indicators and Methodologies

The table below summarises examples of indicators that can be used to better understand the social dimension of plastics data and the recommended methods to collect this information.

These social indicators can support progress toward multiple Sustainable Development Goals, including:

- SDG 1 No Poverty
- SDG 3 Good Health and Well-being
- SDG 5 Gender Equality
- SDG 8 Decent Work and Economic
- SDG 10 Reduced Inequalities
- SDG 11 Sustainable Cities and Communities
- SDG 12 Responsible Consumption and Production

More detail can be found in Section 4.1 Crosscutting Methodologies for Generating Data - 5.10.2 Surveys.

The categories in Table 3.13 draw on established approaches to measuring decent work and the informal economy, including the International Labour Organization's Decent Work Indicators (International Labour Organization, 2012) and WIEGO's Informal Economy Monitoring Study of waste pickers across five cities (Dias & Samson, 2016), supplemented with more recent evidence on gender, occupational health, formalisation and public perception, described in the rows below. Table 3.14 (Section 3.10.3) compares these and other established frameworks against the approach set out here, for countries that wish to align national data collection with international practice.

Beyond structured surveys and administrative data, qualitative approaches such as social-systems mapping and stakeholder-network analysis can help identify why particular social outcomes are occurring and where the most effective points of intervention lie, complementing the indicators in Table 3.13 with a fuller picture of local dynamics (Conlon, 2021).

Table 3.13. Example indicators and methodologies for developing social data on plastics

Category	Indicators	Method
Employment	• Total employment count across the plastic value chain (production, collection, sorting, recycling, administration) • Demographic breakdown of employment (age, gender, education levels, socioeconomic status) • Gender-disaggregated employment shares across the value chain (World Bank/Solutions for Youth Employment [S4YE], 2024 International Labour Organization, 2025) • Potential to create jobs	• Employee surveys • Industry reports and census data • Company employment records • Labour force survey modules adapted to capture informal and recycling-sector categories (Dias & Samson, 2016)

Category	Indicators	Method
Livelihood	• Economic dependency ratios (Medina, 2008) • Rates of participation in formal vs informal sectors • Income levels and stability compared to regional living wage standards • Comparative earnings and position within the value chain (Dias & Samson, 2016) • Barriers facing informal recyclers and waste-based micro-enterprises, e.g. access to finance, business skills and markets (Jayasinghe, Liyanage & Baillie, 2021)	• Household income surveys • Income documentation through financial diaries • Multi city monitoring studies co-designed with waste picker organisations (Dias & Samson, 2016) • Triple Bottom Line (social, economic, environmental) impact assessment and SWOT analysis of waste-based micro-enterprises (Jayasinghe, Liyanage & Baillie, 2021)
Working Conditions	• Working hours • Occupational injury and illness rates, including musculoskeletal, respiratory and dermatological conditions Cruvinel et al., 2019 • Access to personal protective equipment	• Workforce surveys • Workplace inspections and audits • Health records and incident reporting • Occupational health surveys and clinical screening of worker cohorts (Cruvinel et al., 2019)
Community Engagement	• Community awareness of waste management • Participation rates in recycling • Community-based initiatives for plastic pollution prevention	• Community or household surveys • Waste characterisation studies
Community Impact	• Distribution and severity of impacts felt by community members around waste facilities or plastic pollution	• Community impact assessment • Focus group discussions
Gender Equity	• Gender participation ratios in formal and informal roles (WIEGO Statistical Brief No. 39, 2024) • Gendered division of labour across collection, sorting and trading roles • Income disparities by gender • Prevalence of harassment, discrimination or safety risks specific to women workers (Kariveliparambil et al., 2026)	• Sex-disaggregated household and worker surveys (Ogando, Roever & Rogan, 2016) • Targeted studies on women waste workers (Kariveliparambil et al., 2026)

Category	Indicators	Method
Integration and Formalisation Status	• Legal or regulatory recognition of waste pickers • Cooperative or association membership • Existence of contracts or agreements with municipal authorities • Access to social protection (healthcare, pensions)	• Administrative and registry data • Policy and legal review • Cooperative membership records (Dias & Fernandez, 2017 WIEGO Statistical Brief No. 39, 2024)
Consumer Perception and Behaviour	• Public awareness of and concern about plastic pollution • Self-reported recycling and waste sorting behaviour • Attitudes toward and support for policy interventions (e.g. bans, levies, extended producer responsibility)	• Household and consumer perception surveys (UNEP, 2020) • Nationally representative behaviour surveys (Walker et al., 2023)

3.10.3 Complementary Frameworks and a Value-Chain View of Social Data

Several international organisations already publish structured frameworks for measuring the social dimensions of informal work, decent work and the circular economy. Table 3.14 compares these against the approach set out in this Handbook, to help countries align national data collection with recognised international practice where useful.

Table 3.14. Comparison of established social indicator frameworks

Framework	Focus	Example Indicator Categories	Relevance to This Handbook
ILO Decent Work Indicators *(International Labour Organization, 2012)*	Employment, earnings, working conditions, rights and social protection across all economic sectors	Earnings and productivity, working hours, occupational safety, social security coverage, worker voice and representation	Provides ready-made categories that this Handbook's Employment and Working Conditions rows draw on; not waste-sector specific and needs adaptation.
WIEGO Informal Economy Monitoring Study and Statistical Briefs *Dias & Samson (2016)* *Chikarmane & Narayanan (2024)*	City-level, sector-specific data on informal workers, including waste pickers	Earnings and income volatility, position in the value chain, occupational hazards, harassment and eviction risk, access to infrastructure, organisational membership	The closest existing waste-picker-specific toolkit; directly informs this Handbook's Livelihood, Gender Equity and Integration and Formalisation Status rows.
World Bank What a Waste 3.0 *Solutions for Youth Employment [S4YE], 2024)*	Global and national solid waste management performance, and, more recently, waste-sector employment and livelihoods	Waste generation, composition and collection coverage; waste-sector employment share and gender composition	Useful for benchmarking national waste-sector employment data alongside physical waste statistics collected elsewhere in this Handbook.

Framework	Focus	Example Indicator Categories	Relevance to This Handbook
Wasteaware ISWM Benchmark Indicators *(Wilson et al., 2015)*	City-level integrated sustainable waste management performance	Twelve indicators, including "provider inclusivity" (informal-sector integration) and "user inclusivity" (equitable access and citizen participation)	The most direct precedent for scoring informal-sector integration as part of a national or city waste system assessment.
GIZ/PREVENT Waste Alliance – Just Transition and Recognition of the Informal Sector (Factsheet 08, 2023)	Equity principles for a just transition for informal waste and plastics workers	Legal recognition, income security, social protection, worker voice, gender equity, child labour prevention, non-discrimination	Directly informs the equity and just-transition framing in Section 3.10.1 and the Gender Equity and Integration and Formalisation Status rows of Table 3.13

3.10.4 Further Materials

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Part IV sets out cross-cutting methods and classification systems for plastics data collection across the life cycle, from field-based approaches to standardised reporting frameworks.

Part IV

Crosscutting Methodologies for Generating Data

Baled PET bottles sorted by colour at a recycling facility in Sri Lanka
Photo Credit: Sampath Bandara, Sri Lanka

4.1 Crosscutting Methodologies for Generating Data

This section provides additional detail on methodologies that have been previously referenced and are relevant to data collection for several data types.

4.1.1 Collection records from municipal and private sector groups

Collection records maintained by municipalities and private waste operators provide the foundation for reliable waste collection data. These records capture operational information about waste quantities, collection coverage, and service frequency, making them essential for understanding the formal waste management system's performance. When properly maintained and aggregated, these records offer the most direct measurement of collected waste within a jurisdiction.

Municipal Departments (including Local Authorities and/or Local Government)

Implementation steps

1. Identify all collection entities
    a. Create a comprehensive registry of all municipal departments and private companies involved in waste collection
    b. Document contact information, service areas, and types of waste collected
    c. Update this registry annually to account for new operators or changes in service provision
2. Develop standardised reporting templates
    a. Create forms for reporting collected waste quantities including fields for date, collection route/area, waste type, weight/volume, and vehicle information
3. Establish weighing infrastructure
    a. Install weighbridges at key points in the waste collection system
    b. If weighbridges are not feasible, develop alternative measurement approaches:
        i. Volume to weight using standard densities
        ii. Vehicle load counting with estimated capacity
4. Implement data collection protocol
    a. Train collection staff on record-keeping procedures
    b. Establish recording timelines of data collection
    c. Create verification procedures to ensure accuracy
5. Develop data management systems
    a. Establish a central database for collection records
    b. Design simple data entry procedures for staff
    c. Monitor and verify the data through audits, comparisons and spot checks.

Licensed Recycling Facilities

In the formal recycling sector, regulatory authorities should require record-keeping from licensed recycling facilities. These records should track volumes of plastic received, processed, and sold to end markets as well as the plastic types and quality levels.

Implementation Steps

1. Create a registry of licensed recycling facilities
2. Develop a standardised reporting method focusing on the following metrics
    a. Tonnage of plastics collected for recycling (tons/year)
    b. Percentage of collected waste diverted to recycling

c. Types of plastics recovered and their percentage distribution
d. End markets for recycled materials

3. Establish a reporting schedule and submission process
4. Implement verification procedures including:
    a. Site visits
    b. Cross-checking data
5. Provide feedback and incentives to reporting facilities

Informal sector

The informal collectors/ recyclers often play a significant role in material recovery, particularly in developing countries. Conducting surveys with waste pickers and informal collectors provides valuable data on materials that bypass formal collection systems. Periodic spot checks and interviews can help estimate volumes handled by the informal sector when direct measurement is not feasible.

Implementation Steps

1. Identify key informants or organisations who understand the informal recycling networks
2. Design sampling approaches and survey instruments
    a. Identify a representative sample of socio-economic status, geography, urban versus rural contexts, types of informal collectors.
3. Collect field-data on informal waste collectors for recycling
    a. Conduct interviews with waste collectors
    b. Implement waste accumulation studies at aggregation points
    c. Record a sample of materials at various points in the value chain for:
        i. Tonnage of plastics collected for recycling
        ii. Price
        iii. End markets for recycled materials
        iv. Temporal/spatial variations
4. Ensure appropriate compensation mechanisms for the participants' time
5. Establish trust through transparency about study objectives, results and long-term engagement

4.1.2 Surveys

Social science surveys

Social science surveys are structured data collection instruments used to gather valuable insights into human practices, behaviours, consumption patterns, and waste generation practices that may not be directly observable through other methods.

Types:

- Household surveys: Collect data on residential consumption and/or waste generation, and disposal practices.
- Businesses/industry surveys: Gather information on commercial and industrial production and waste streams.
- Institutional surveys: Target educational institutions, hospitals and government facilities for plastics consumption and waste arising.

Steps:

1. Co-design the work with relevant end-users, agreeing on shared objectives, key research questions, geographic coverage, and the team's capacity and skills.
2. Establish the survey design, including whether it will be quantitative, qualitative, or both, and which variables need to be collected.
3. Define a sampling approach that ensures representative coverage across factors such as socio-economic status, institution or household type, and geographic distribution.
4. Assess the team's capacity and skills, then recruit and train staff for the work ahead (e.g. interviewing).
5. Pilot the survey through pre-testing.
6. Implement the survey.
7. Collect data through questionnaires.
8. Analyse and interpret the results and communicate them to end-users and then to wider audiences.
9. Extrapolate the findings to the wider area using appropriate statistical methods.
10. Compare the results against other data sources.
11. Report and disseminate the findings.

Environmental surveys

Environmental surveys are systematic data collection methods used to assess environmental conditions, impacts, and natural resources through direct field measurements and observations. They assess environmental conditions, impacts, and resources through ecological assessments, water and soil sampling, habitat mapping, pollution monitoring, and biodiversity inventories to inform conservation efforts, development planning, regulatory compliance, and environmental management decisions.

Steps:

1. Design the sampling strategy and protocol
    - Define the study's objectives and scope.
    - Define target environments using the IUCN Global Ecosystem Typology .
    - Design the sampling method. Ecosystems, realms, and biomes vary widely, so different methods are needed for each; choose standards that are nation-ally or internationally agreed to ensure comparability. Suggested methods for each ecosystem type are set out in Annexures, "Techniques for Scientific Sampling for Plastics in the Environment."
    - Select study sites, informed by factors such as social, economic, or environ-mental significance, accessibility, or institutional capacity.
    - Set out clear team roles and responsibilities.
    - Establish monitoring protocols and safety procedures for fieldwork.
2. Categorise the debris
    - Separate plastic from natural (e.g. sand, soil, sticks), metallic, or ceramic ma-terials.
    - Categorise plastic according to agreed groups, such as material, polymer, or use.
    - Where possible or necessary, verify identified groups using scientific tech-niques such as Fourier-Transform Infrared (FTIR) or Raman spectroscopy; this step can be skipped where resources are not available.

- Record information on the isolated plastics, including total weight or quantity by plastic type, polymer, or use.

3. Analyse and report on the data
    - Engage research institutions or academic partners to carry out statistical analysis of the results. Examples include density metrics (items/m², g/m², particles/kg), maps of debris' spatial distribution, analysis of composition and likely sources, and assessment of temporal trends.
    - Apply the findings to broader environmental management contexts, using ap-propriate statistical and spatial methods.
    - Compare the results against baseline data and regulatory standards.
4. Report and disseminate the findings.

4.1.3 Material Flow Analysis

Material flow analysis (MFA) is a systematic assessment methodology that quantifies the flows and stocks of materials within a defined system boundary over a specified time period.

Types:

- Substance Flow Analysis: Focuses on specific compounds within plastic materials
- Economy-wide MFA: Examines all material flows across an entire economic system or region.

Steps

1. Define the system
    a. Define clear geographical and temporal boundaries for the analysis
    b. Identify key processes and stakeholders within the plastic value chain
2. Collect data
    a. Gather quantitative data on plastic production, import/export, consumption, and waste (where possible)
    b. Collect information on waste management routes and treatment efficiencies
3. Quantify the flows
    a. Calculate material transfers between system components
    b. Identify and quantify stock accumulations within the system
4. Verify the mass balance
    a. Apply mass balance principles to verify data consistency
    b. Identify data gaps and uncertainties in the analysis
    c. Where a specific flow or stock cannot be measured directly, it can instead be estimated as the residual needed to balance the system .
5. Visualise and interpret the results
    a. Create Sankey diagrams or flow charts to visualise material pathways
    b. Identify hotspots, inefficiencies, and intervention opportunities

Modelling tools: Where system-level MFA data is available, dedicated modelling tools can translate it into policy-relevant scenarios. The Breaking the Plastic Wave Pathways Tool, developed by The Pew Charitable Trusts with the University of Oxford, is a free, open-access model that projects plastic flows through the value chain under different policy and intervention scenarios at city, national, or regional scale, together with the associated costs, jobs, and greenhouse gas emissions.

4.1.4 Remote Sensing Approaches

Remote sensing refers to the collection and analysis of data about objects or areas from a distance, typically using satellite-based sensor technologies or private aerial technologies. In plastic management, these approaches enable the detection, monitoring and quantification of waste sites across large geographical areas without requiring extensive ground-level fieldwork. Remote sensing approaches offer significant advantages including their cost effectiveness, high-precision, and openly available data.

Types:

- Satellite Imagery: Uses Earth observation satellites to identify and monitor larger waste areas.
- Drone surveys: Employs unmanned aerial vehicles for high-resolution imaging of specific waste areas of interest.
- Thermal imaging: Detects heat signatures from active burning sites using infrared sensors.
- Multispectral analysis: Utilises different spectral bands to identify waste material signatures.
- LiDAR (Light Detection and Ranging): Measures distances using laser light to create detailed topographical models for volume estimation.
- Fixed monitoring cameras: Provides continuous observation of specific waste accumulation hotspots.

Steps:

- Site selection
    - Prioritise target areas based on existing information or preliminary assessments
    - Identify areas with limited accessibility or monitoring coverage
- Platform selection
    - Determine appropriate technology based on location, required resolution, and project scope
    - Select suitable software platforms (Google Earth Engine, ArcGIS, QGIS) for analysis
    - Consider cost-effectiveness and technical requirements
- Image acquisition
    - Select optimal imagery sources (open-source, commercial, or locally deployed)
    - Establish regular imaging schedule to track changes over time
    - Account for environmental conditions (cloud cover, lighting, seasonality)
    - Maintain consistent methodology for longitudinal monitoring
    - Document environmental conditions during each acquisition period
- Image processing and analysis
    - Apply specialised algorithms to detect waste accumulation
    - Utilise machine learning or artificial intelligence for automated identification
    - Calculate surface areas and estimate volumes of identified waste sites
    - Validate results through ground-truthing at selected locations
- Data integration and visualisation
    - Convert identified waste sites to quantity estimates using validated models
    - Integrate findings with GIS systems for spatial analysis
    - Combine with complementary environmental and socioeconomic datasets
    - Develop visualisation tools for decision-makers and stakeholders

4.1.5 Waste Composition Estimates

Plastic waste composition studies involve systematic sampling and manual sorting of incoming waste streams to determine plastic percentages by weight and polymer type. These studies provide detailed breakdowns of various plastics present - from PET and HDPE to PVC, LDPE, PP, and PS - establishing critical baseline data that enables tracking of plastic pollution trends and identification of targeted plastic recycling opportunities.

The methodology employs statistical sampling techniques that allow for extrapolation to total plastic waste volumes. When properly conducted, these studies capture seasonal variations in plastic disposal patterns and provide precise data on plastic contamination across different sources and geographical areas.

Despite their analytical value, plastic waste composition studies present several operational challenges. They are notably resource-intensive, requiring specialised polymer identification equipment and personnel trained in plastic categorisation. The process of sorting and identifying different plastic types is labor-intensive and potentially costly, limiting the frequency of plastic data collection to typically quarterly or annual intervals rather than continuous monitoring.

The representativeness of results can be compromised by plastic sample selection methods, as chosen samples may not accurately reflect all plastic waste streams. Additionally, these studies provide only point-in-time measurements of plastic composition, necessitating repeated analyses to maintain current plastic pollution data.

Types:

- Physical sorting analysis: Direct manual separation and weighing of waste samples
- Visual characterisation: Observers estimate the composition through visual inspection and separating into waste fractions

Steps:

- Study design and planning
  - Define clear objectives and determine appropriate sample size
  - Select representative sampling locations and establish material categories
- Sample collection
  - Collect representative waste samples from predetermined sources
  - Ensure adequate sample size (typically 100-200 kg per sampling event)
- Physical sorting and analysis
  - Sort waste into predetermined material categories
  - Weigh each fraction and calculate percentage by weight
- Data analysis and interpretation
  - Calculate composition percentages by weight for each material category
  - Compare results across different sources or time periods
- Reporting and application
  - Document methodology, assumptions, and limitations
  - Establish baseline for monitoring composition changes over time

4.1.6 IPCC 2006 Guideline for National Greenhouse Gas Inventories

This subsection draws on two elements of the IPCC 2006 Guidelines for National Greenhouse Gas Inventories that can be adapted to estimate plastic waste quantities: standardised data on waste composition, used to estimate the plastics share of the waste stream, and a standardised equation for solid waste that is openly burned, used to estimate the quantity of plastic lost to uncontrolled burning.

Waste composition

Many countries collect detailed waste composition data through their National Atmospheric Emissions Inventory (NAEI) reporting, mainly to estimate landfill emissions; this is the same data used to compile the reports submitted to the UNFCCC.

Where countries do not have accurate waste composition data of their own, they can instead use the IPCC fixed assumptions for Municipal Solid Waste (MSW) composition set out in Table 4.1, below.

Table 4.1. IPCC standardised assumptions on the plastics proportion of municipal solid waste in each region

Region	Plastic Percentage of MSW (%)
Asia	
Central Asia	8.4
Eastern Asia	6.5
South-Eastern Asia	10.2
Southern Asia	7.0
Western Asia	17.2
Africa	
Northern Africa	13.8
Eastern Africa	8.0
Middle Africa	7.1
Southern Africa	26.5
Western Africa	6.4
Europe	
Eastern Europe	4.6
Northern Europe	4.9
Southern Europe	11.8
Western Europe	20.5
America	
Central America	10.3
South America	13.7
Northern America	15.8
Oceania	
Australia and New Zealand	8.3

Solid waste openly burned

Although designed for greenhouse gas inventories, the IPCC 2006 Guidelines for National Greenhouse Gas Inventories set out a standardised equation for solid waste that is openly burned, which can be adapted to estimate plastic waste quantities.

Chapter 5 of the IPCC Guidelines, "Incineration and Open Burning of Waste," sets out this equation. Applying a plastics fraction drawn from waste composition data (see Waste composition, above) to the equation's output isolates the plastic-specific component of openly burned waste.

The equation below is Equation 5.7 of Chapter 5: Incineration and Open Burning of Waste of the IPCC Guidelines, with variable names aligned to this Handbook's existing convention.

$$MSWB = P \times Pfrac \times SWc \times Bfrac \times 365 \times 10^{-6}$$

Where:

- SW = Total municipal solid waste open-burned (gigagrams/year)
- P = Total population (persons)
- Pfrac = Fraction of population burning waste
- MSWP = municipal solid waste generation rate per capita (kg/person/day)
- Bfrac = Fraction of waste that is burned relative to total waste treated
- 365 = Days per year
- 10^{-6} = Conversion from kg to gigagrams

Some of this openly burned waste will come from uncollected sources, and some will come from collected sources. The 2019 Refinement to the 2006 IPCC Guidelines (Volume 5, Chapter 5) updates the default data and methods underlying this equation and should be consulted alongside it. The worked example below illustrates how the equation can be applied, using hypothetical figures.

Worked example (illustrative figures only)

Suppose a population of 5,000,000 people, of whom 15% burn their waste (Pfrac = 0.15), generates 0.6 kg of solid waste per person per day (SWc), with 40% of that waste burned relative to total waste treated (Bfrac = 0.40).

SW = 5,000,000 × 0.15 × 0.6 × 0.40 × 365 × 10^{-6} ≈ 65.7 Gg/year of solid waste openly burned.

If waste composition data indicate that plastics make up 10% of the waste stream (see Table 4.1, above, for regional assumptions), the plastic-specific estimate is 65.7 × 0.10 ≈ 6.6 Gg/year.

4.2 Crosscutting Classification Systems

The following classification systems provide the structured taxonomies to support consistent data collection across different aspects of the plastics life cycle. Several classification systems are relevant to multiple stages of the supply-chain. Table 4.2 illustrates which classification systems are applicable to different types of plastic data collection, with systems ordered to match the document structure.

The most universally used systems are those with legal mandates - particularly HS codes for trade data, NAICS/ISIC for production data, and the Basel Convention for waste management. Other key drivers for adoption of classification include international body enforcement (e.g., from the UN), regular updates (to maintain relevance), clear implementation guidance and electronic systems for usability.

Table 4.2. Descriptions of classification systems

Method	Description	Key Codes/Categories for Plastics
PRODUCTION CLASSIFICATION SYSTEMS		
International Standard Industrial Classification (ISIC) *(Used for: Production, Consumption)*	Global system organising economic activities UN-endorsed standard; most countries have adapted ISIC for national use	Division 20: 'Manufacture of chemicals and chemical products' • 20.13: Manufacture of plastics in primary forms (and synthetic rubber) Division 22: 'Manufacture of rubber and plastics products' • 22.20: Manufacture of plastic products Division 38: 'Waste collection, treatment and disposal activities; materials recovery' • 38.30: Recovery of sorted materials (includ-ing plastic recycling)
North American Industry Classification System (NAICS) *(Used for: Production, Consumption)*	Used in US, Canada, and Mexico; Six-digit code system for classifying business activities. Required by law for business establishments in North America Adopted in 1997 to replace Standard Industrial Classification (SIC) system	325211: Plastics Material and Resin Manufacturing 326: Plastics and Rubber Products Manufacturing 326199: All Other Plastics Product Manufacturing
PRODCOM (PRODuction COMmunautaire) *(Used for: Production)*	EU system for industrial production statistics with 8-digit codes; First 4 digits reference the Statistical Classification of Economic Activities (NACE) Mandatory for EU countries, Iceland, and Norway (via EEA Agreement) Required under European business statistics regulation	Division 20: Manufacture of chemicals Division 22: Manufacture of rubber and plastic products The current PRODCOM plastics data codes (Divisions 20 and 22) can be found in Eurostat's official PRODCOM List (current edition).
UN Industrial Commodity Statistics Database *(Used for: Production, Consumption)*	Provides annual production data for major commodities in standardised units Used primarily for international statistical compilation	Primary plastic materials production Manufactured plastic products Industrial processing quantities
Central Product Classification (CPC) *(Used for: Production, Consumption and Trade)*	Focuses on products rather than industries; Tracks plastics across the value chain	In division 34 'Basic chemicals' • Group 347: Plastics in primary formsIn division 36 'Rubber and plastics products' • Group 363: Semi-manufactures of plastics • Group 364: Packaging products of plastics • Group 369: Other plastic products

Plastic-KEYs *(Used for: Production, Consumption and Trade)*	Classification system developed by UNITAR for finished products; 65 keys aggregated into 8 groups based on function, material composition, and end-of-life attributes No identified legal mandate	Eight Plastic-KEY Groups: P1: Packaging P2: Transport P3: Building and construction P4: Electrical and electronic equipment P5: Consumer and institutional products P6: Industrial machinery P7: Apparel and textile furnishing articles P8: Other
TRADE CLASSIFICATION SYSTEMS		
Harmonised System (HS) *(Used for: Trade)*	Foundation for trade data with 6-digit codes; Countries can add more digits for national detail; Approximately 5,300 article/product descriptions	Chapter 39: • 39.01-39.14: Primary forms of plastics • 39.15: Plastic waste and scrap • 39.16-39.26: Plastic products • Upcoming: the WCO's HS 2028 edition (in force 1 January 2028) restructures heading 39.15 into subheadings distinguishing hazardous, PIC-controlled, and other plastic waste, and adds a new Chapter 39 legal note covering single-use plastic products
Standard International Trade Classification (SITC) *(Used for: Trade)*	Organises by processing level; Hierarchical organisation with 5 levels (from 1-digit sections to 5-digit basic headings)	Division 57: Plastics in primary forms Division 58: Plastics in non-primary forms Section 893: Articles of plastic
Broad Economic Categories (BEC) *(Used for: Consumption and Trade)*	UN classification that groups commodities according to their main end use; Allows analysis of trade flows by three basic classes of goods	Three basic classes: • Capital goods • Intermediate goods • Consumption goods
Combined Nomenclature (CN) *(Used for: Trade)*	SEU-specific 8-digit codes for detailed classification of extra-EU transactions; Builds upon the HS system Mandatory for EU trade statistics and customs	[Builds on HS system]
UNCTAD Plastic Trade Classification *(Used for: Trade)*	Specialised classification for tracking global plastic trade flows	[Not specified in document]

Method	Description	Key Codes/Categories for Plastics
WASTE CLASSIFICATION SYSTEMS		
Basel Convention Classification *(Used only for Trade of waste)*	Regulates transboundary movements of hazardous and non-hazardous wastes including plastic waste; Takes effect January 1, 2021 with new requirements for plastic waste; Technical Guidelines on the environmentally sound management of plastic wastes most recently updated by COP-16 (2023), decision BC-16/4 190 countries and the European Commission are parties	Specific entries for plastic waste: • Entry Y48 in Annex II • Entry A3210 in Annex VIII • Entry B3011 in Annex IX
European List of Waste (LoW) *(Used for: Waste)*	Mandatory across all EU member states Required under EU Waste Framework Directive Comprehensive waste classification with 6-digit EWC codes	Eight codes for non-hazardous plastic waste • Eight codes for non-hazardous plastic waste • 15 01 02: Plastic packaging • 02 01 04: Waste plastics (except packaging) from agriculture, horticulture, etc. • 07 02 13: Waste plastics from plastics manufacturing • 12 01 05: Plastics shavings and turnings • 16 01 19: Plastics from end-of-life vehicles • 17 02 03: Plastics from construction and demolition • 19 12 04: Plastics and rubber from mechanical treatment of waste • 20 01 39: Plastics from separately collected municipal waste fractions
European Waste Classification for Statistics (EWC-Stat) *(Used for: Waste)*	Statistical reporting system for Eurostat; Hierarchical structure with main categories and sub-categories Mandatory across all EU member states Required under EU Waste Framework Directive	Key categories for plastics: • 07.4: Plastic waste • 07.4.1: Plastic packaging waste • 07.4.2: Other plastic wastes

Annexes

Benjamin Von Wong's installation "The Thinker's Burden"
at the Palais des Nations, marking the opening of INC 5.2 in Geneva.
Photo Credit: Randika Jayasinghe (UNSW CSDR)

Annex A: Data Sources Catalogue

Production data

Both the Industrial Commodity Statistics Database and the Prodcom database provide data in physical and monetary terms.

Prodcom database (Eurostat)

Table A.1 Prodcom database (Eurostat)

Category	Details
Reporting Requirements	• Mandatory for EU member states • Standardised reporting format required • Minimum thresholds for reporting apply (enterprise size and production value)
Responsible Parties	• Data Collection: National statistical offices • Data Submission: Mandatory for businesses above certain thresholds • Data Validation: Eurostat and national authorities
Coverage	EU member states + some EFTA countries
Data	Detailed production statistics including volume and value
Quality	High - mandatory reporting with standardised methodology
Reliability	Updated annually with good reliability

A list of the PRODCOM plastics data codes are listed in the document linked here.

Industry reports and datasets

Table A.2 Industry reports and datasets

Category	Details
Reporting Requirements	• Voluntary • No standardised format • Often proprietary data
Responsible Parties	• Data Collection: Industry associations, market research firms • Data Submission: Voluntary by participating companies • Data Validation: Varies by source
Coverage	Varies, often focused on major markets
Data	Market sizes, production patterns
Quality	Can be detailed but may have commercial bias
Reliability	Methodology often not transparent

National surveys

Table A.3 National surveys

Category	Details
Reporting Requirements	• Mandatory in many countries via statistical acts/legislation • Annual or quarterly reporting typically required • Standardised questionnaires with specific production categories • Threshold requirements for enterprise size (usually >10 or >20 employ-ees) • Production volumes can be reported in both monetary and physical units

Responsible Parties	• Data Collection: National statistical offices • Data Submission: Manufacturing enterprises • Data Validation: Government statistical authorities
Coverage	• Country-specific with varying levels of detail • Generally covers formal manufacturing sector • May exclude smaller enterprises below reporting thresholds
Data	• Production volumes (physical units) • Production values (monetary units) • Industrial inputs and raw materials • Capacity utilisation • Detailed product-level information for plastics production
Quality	• Generally high quality for formal sector • Systematic collection through established methodologies • Subject to statistical quality control processes • Can have gaps for informal production
Reliability	• Reliable source for national production statistics • Comprehensive coverage of registered manufacturers • May undercount total production due to: o Informal sector exclusion o Reporting thresholds o Non-response from some enterprises o Delays in publication (typically 6-18 months)

Trade Data

UN Comtrade database

Trade data can be extracted from the Comtrade database based on the Harmonised System (HS), the Standard International Trade Classification (SITC), or the Classification by Broad Economic Categories (BEC). The platform has since relaunched with a new interface, Comtrade Plus, at comtradeplus.un.org.

Table A.4 UN Comtrade database details

Category	Details
Reporting Requirements	• Voluntary submission by countries • Recommended monthly reporting • Standard UN classification systems required
Responsible Parties	• Data Collection: National customs authorities • Data Submission: National statistical offices • Data Validation: UN Statistical Division
Coverage	~200 countries
Data	Import/export values and quantities, highly detailed product classifications
Quality	Most comprehensive global trade database
Reliability	Government-reported but with varying reliability - some countries report irregularly or with delays

For COMTRADE data either HS codes or SITC codes can be used.

HARMONISED SYSTEM (HS) CODES

Primary Plastics: 3901-3914 (Primary forms of plastics)
Plastic Products: 3916-3926 (Manufactured plastic articles)
Plastic Waste: 3915 (Waste, parings and scrap of plastics)

SITC (Standard International Trade Classification) CODES

Primary Plastics: 571-575 (Plastics in primary forms)
Plastic Products: 581-583 (Plastics in non-primary forms) and 893 (Articles of plastics)
Plastic Waste: 579 (Plastic waste and scrap)

UNCTAD Data Hub (formerly UNCTADstat Data Centre)

In the database, plastic trade flows are divided into five life cycle categories, which are primary plastic, intermediate forms of plastic, intermediate manufactured plastic products, final manufactured plastic products, and plastic waste. It is also based on the Harmonised System (HS) (UNCTAD, 2020).

Table A.5 UNCTAD Data Hub (formerly UNCTADstat Data Centre) details

Category	Details
Reporting Requirements	Extracted from Comtrade
Responsible Parties	Processed and harmonised COMTRADE statistics
Coverage	Global
Data	• Includes specific plastic trade classifications • Less frequent updates than Comtrade • Less detailed product classifications

Quality	Uses UN Comtrade data but with additional validation:
	• Data Processing
	  o Harmonisation of different national classifications and con-version to standard units
	  o o Gap filling for missing data by estimating unreported trades
	• Additional Context
	  o Economic development indicators
	  o Trade dependency metrics
	  o Market concentration indices

Reliability	High Quality

Comext database from Eurostat

Comext database from Eurostat. Comext is the database for detailed statistics on international trade-in goods for the European Union. The Combined Nomenclature (CN) is applied in the database. A CN code, a subdivision of the nomenclature, is an 8-digit number, whose first 6 digits follow the same coding system as the Harmonised System (HS).

Table A.6 Eurostat Comext database details

Category	Details
Reporting Requirements	• Mandatory for EU member states under EU regulations • Monthly reporting required • Standardised format and classifications
Responsible Parties	• Data Collection: National customs authorities • Data Submission: Mandatory for businesses above thresholds • Data Validation: Eurostat and national authorities
Coverage	EU member states + some trading partners
Data	Highly detailed intra-EU and external trade
Quality	Very high - mandatory reporting with strict standards
Reliability	• Most reliable trade data for European countries • Small shipments may be excluded due to reporting thresholds

UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform

Table A.7 UNEP Global Partnership on Plastic Pollution and Marine Litter data details

Category	Details
Reporting Requirements	• Voluntary contributions from countries, organisations, and researchers • No standardised reporting format but follows data templates when availa-ble • Varying submission frequencies (not time-bound) • Quality criteria for data inclusion • Metadata documentation requirements
Responsible Parties	• Data Collection: Multiple stakeholders (governments, NGOs, researchers, citizen scientists • Data Submission: Partner organisations and affiliated researchers • Data Validation: UNEP technical team and regional nodes • Platform Management: UNEP (secretariat); platform rebranded "Global Plastics Hub"
Coverage	• Global scope with country-level dashboards • Variable coverage across regions (more comprehensive for developed re-gions) • Integrates multiple data sources and initiatives • Includes both marine and freshwater environments • Cross-sectoral approach (production to waste management to environ-mental presence)
Data	• Beach litter density and composition • Floating plastic debris concentrations • National policy frameworks and commitments • Waste management infrastructure • Stakeholder initiatives and projects • Scientific research outcomes • Educational resources and methodologies
Quality	• Variable depending on data source • Peer-reviewed scientific data prioritised • Metadata quality indicators where available • Harmonisation efforts for diverse data sources • Transparent documentation of methodologies
Reliability	• Comprehensive integration of diverse data sources • Interactive visualisation capabilities • Significant data gaps for many regions • Inconsistent methodologies between data sources • Limited temporal coverage for trend analysis • Ongoing development with continuous improvements • Variable update frequencies across datasets • Provides access to both raw data and synthesised information

National customs data

Table A.8 National customs data details

Category	Details
Reporting Requirements	• Mandatory under national customs laws • Requirements vary by country • Usually includes threshold values for reporting

Responsible Parties	• Data Collection: National customs authorities • Data Submission: Importers and exporters • Data Validation: Customs authorities
Coverage	Country-specific
Data	Most detailed level of trade data
Quality	Usually high but varies by country
Reliability	Access and format vary significantly by country

Consumption Data

Extended producer responsibility scheme reports

Table A.9 Extended producer responsibility scheme reports data details

Category	Details
Reporting Requirements	• Mandatory where EPR legislation exists • Requirements vary by jurisdiction • Usually includes regular reporting cycles (monthly/quarterly/annual)
Responsible Parties	• Data Collection: EPR schemes/organisations • Data Submission: Producers and importers • Data Validation: National authorities or designated bodies
Coverage	Mainly developed countries with EPR legislation
Data	Product quantities placed on market, collection rates
Quality	Can be reliable but “placed on market” data may be underreported due to financial incentives and “collection rates” may be overestimated (also due to financial incentives)
Reliability	Only covers products under EPR schemes

National consumption surveys

Table A.10 National Consumption surveys data details

Category	Details
Reporting Requirements	• Typically conducted by government statistical agencies • Standardised survey methodology and questionnaires • Representative sampling approaches required • implementation cycles (e.g., annual or biennial) • May include mandatory participation for selected households/businesses
Responsible Parties	• Data Collection: National statistical offices • Data Submission: Households, businesses, and institutions • Data Validation: Government statistical authorities and research institutions
Coverage	• National level with stratified sampling • Usually covers both household and industrial/commercial sectors • Representative of different geographic regions and socioeconomic groups • May have specialised modules for plastic consumption

Data	• Household expenditure on plastic products • Consumption patterns by product category • Purchasing frequencies and volumes • Product lifespans and disposal behaviours • Consumer attitudes toward plastic use • Industrial/commercial plastic product consumption
Quality	• High methodological rigour in survey design • Statistical validation through established processes • Sampling error quantified and reported • Non-response adjustments typically applied • Potential recall bias in self-reported data
Reliability	• High methodological rigour in survey design • Statistical validation through established processes • Sampling error quantified and reported • Non-response adjustments typically applied • Potential recall bias in self-reported data

Industry reports and datasets

Table A.11 Industry reports and datasets details

Category	Details
Reporting Requirements	• Voluntary • No standardised format • Often proprietary data
Responsible Parties	• Data Collection: Industry associations, market research firms • Data Submission: Voluntary by participating companies • Data Validation: Varies by source
Coverage	Varies, often focused on major markets
Data	Market sizes, consumption patterns
Quality	Can be detailed but may have commercial bias
Reliability	Methodology often not transparent

Reports from recycling facilities (recycled content)

Table A.12 *Reports from recycling facilities data details*

Category	Details
Reporting Requirements	• Varies by jurisdiction - mandatory where recycling legislation exists • Format often specified by local/regional authorities • Reporting frequency typically monthly or quarterly • May include threshold requirements for facility size/throughput • Required documentation of material sources and destinations
Responsible Parties	• Data Collection: Recycling facility operators • Data Submission: Facility management or environmental compliance of-ficers • Data Validation: Environmental agencies or waste authorities
Coverage	• Facility-specific with regional aggregation • Typically covers formal recycling sector only • May exclude smaller operations below reporting thresholds • Coverage rates vary significantly between regions

Data	• Input material quantities by polymer type • Output quantities of recycled plastics • Yield rates and processing losses • Quality grades of recycled content • Contamination levels and rejected materials
Quality	• Variable depending on facility measurement systems • More reliable for larger, established facilities • Often lacks standardisation between facilities • Measurement methodologies may differ significantly
Reliability	• First-hand data from processing operations • Subject to commercial confidentiality constraints • Potential reporting biases (environmental performance metrics) • Limited verification of self-reported data • Gaps in traceability between collection and processing • May not distinguish between different plastic waste streams

Government recycling statistics (recycled content)

Table A.13 Government recycling statistics details

Category	Details
Reporting Requirements	• Typically mandatory under waste management legislation • Standardised reporting formats required • Annual or quarterly submission cycles • May be linked to recycling targets and compliance schemes • Often requires third-party verification for certain metrics
Responsible Parties	• Data Collection: National/regional environmental agencies • Data Submission: Local authorities, waste management organisations, and EPR schemes • Data Validation: Government statistical offices or environmental regula-tors
Coverage	• National or regional level aggregation • Coverage varies by policy framework and enforcement • Usually more comprehensive in countries with established recycling tar-gets • May have gaps for certain sectors or plastic type
Data	• Collection rates for different waste streams • Processing volumes at recycling facilities • Material flow analysis through recycling systems • Recycled content incorporation rates • Compliance with recycled content mandates • End markets for recycled materials
Quality	• Generally reliable but methodological inconsistencies exist • Differences in measurement points (collection vs. actual recycling) • Varying definitions of “recycling” between jurisdictions • Statistical adjustments may be applied to raw data
Reliability	• Official statistics with standardised methodologies • Subject to government quality control processes • Potential for overestimation of recycling rates • Time lag in publication (typically 6-24 months) • May not fully capture leakage points in recycling systems • Limited tracking of material fate after initial processing • Challenges in accounting for exported waste

Waste Data

UNFCCC National Inventory Reporting (Net Zero Waste Sector data)

Many countries collect detailed waste composition data as part of their National Atmospheric Emissions Inventory (NAEI) reporting, particularly for calculating landfill emissions. NAEI data is used to compile the reports submitted to UNFCCC.

These existing datasets can be analysed to extract plastics-specific information. Small/Mid-small sized economies often have limited waste composition data as their NAEI reporting requirements are less stringent. While this data may not be comprehensive, it can provide initial insights into plastics waste streams.

Table A.14 UNFCCC National Inventory Reporting details

Category	Details
Reporting Requirements	• Mandatory for parties that have signed and ratified the convention (197 countries) • Annual reporting for developed countries • Bi-annual reporting for developing countries • Must use IPCC methodology and guidelines
Responsible Parties	• Data Collection: National environmental agencies • Data Submission: National focal points • Data Validation: UNFCCC secretariat and expert review teams
Coverage	All parties that have signed and ratified the UNFCCC
Data	Not all of this data will be published, but will likely be needed to calculate emissions: • Waste generation volumes • Waste composition data • Treatment methods • Emissions from waste sector • Activity data and emission factors
Quality	High for developed countries, variable for developing nations
Reliability	• Time lag in reporting (typically 2 years) • Limited detail on specific waste streams • Focus on emissions rather than material flows • Standardised methodology across countries

Eurostat Waste Statistics

Table A.15 Eurostat Waste Statistics details

Category	Details
Reporting Requirements	• Mandatory for EU Member States • Annual reporting cycle • Must use standard statistical classifications • Minimum data quality thresholds • Required verification procedures
Responsible Parties	• Data Collection: National statistical offices • Data Submission: Designated national authorities • Data Validation: Eurostat statistical team
Coverage	EU Member States + EEA countries

Data	• Municipal waste generation and treatment • Industrial waste quantities • Treatment facility capacities • Recycling rates • Separate collection data • Specific material streams including plastics
Quality	Very high with standardised methodology
Reliability	Comprehensive coverage and detailed categorisation

Basel Convention Reporting

Table A.16 Basel Convention Reporting details

Category	Details
Reporting Requirements	• Mandatory for parties to the Convention • Annual reporting cycle • Specific forms for different waste types • Prior informed consent procedures • Incident reporting requirements
Responsible Parties	• Data Collection: National environmental authorities • Data Submission: Basel Convention focal points • Data Validation: Basel Convention Secretariat
Coverage	Parties to the Basel Convention
Data	• Transboundary waste movements • Generation of hazardous wastes • Treatment and disposal operations • Accidents and illegal traffic • Plastic waste reporting added in 2019 (effective January 2021)
Quality	Variable depending on national capacity
Reliability	• Incomplete reporting common • Delays in data submission • Limited verification capacity

Reporting includes:

- Amount of waste imported/exported
- Countries of origin/destination
- Types of plastics
- Treatment methods

Alternatively, EWC Waste codes can be searched.

UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform – waste data

Table A.17 UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform details focused on waste

Category	Details
Reporting Requirements	• Voluntary contributions from countries, organisations, and researchers • No standardised reporting format but follows data templates when availa-ble • Varying submission frequencies (not time-bound) • Quality criteria for data inclusion • Metadata documentation requirements
Responsible Parties	• Data Collection: Multiple stakeholders (governments, NGOs, researchers, citizen scientists • Data Submission: Partner organisations and affiliated researchers • Data Validation: UNEP technical team and regional nodes • Platform Management: UNEP (secretariat); platform rebranded "Global Plastics Hub"
Coverage	• Global scope with country-level dashboards • Variable coverage across regions (more comprehensive for developed re-gions) • Integrates multiple data sources and initiatives • Includes both marine and freshwater environments • Cross-sectoral approach (production to waste management to environ-mental presence)
Data	• Municipal Solid Waste Generation - Daily per capita measurements at both country and city levels, as well as annual aggregate totals • Plastic Waste Generation - Annual totals, daily per capita measure-ments, and specific plastic waste derived from municipal solid waste (dai-ly and annual metrics) • Waste Composition Analysis - Municipal solid waste plastic composi-tion data at both country and city levels • Collection Coverage - Municipal solid waste collection coverage statis-tics at country and city levels
Quality	• Variable depending on data source • Peer-reviewed scientific data prioritised • Metadata quality indicators where available • Harmonisation efforts for diverse data sources • Transparent documentation of methodologies
Reliability	• Comprehensive integration of diverse data sources • Interactive visualisation capabilities • Significant data gaps for many regions • Inconsistent methodologies between data sources • Limited temporal coverage for trend analysis • Ongoing development with continuous improvements • Variable update frequencies across datasets • Provides access to both raw data and synthesised information

Data for plastics in the environment

UNEP Global Partnership on Plastic Pollution and Marine Litter Digital Platform – plastics in the environment data

Table A.18 UNEP Global Partnership on Plastic Pollution and Marine Litter Digital platform details with focus on plastics in the environment

Category	Details
Reporting Requirements	• Voluntary contributions from countries, organisations, and researchers • No standardised reporting format but follows data templates when availa-ble • Varying submission frequencies (not time-bound) • Quality criteria for data inclusion • Metadata documentation requirements

Responsible Parties	• Data Collection: Multiple stakeholders (governments, NGOs, researchers, citizen scientists • Data Submission: Partner organisations and affiliated researchers • Data Validation: UNEP technical team and regional nodes • Platform Management: UNEP (secretariat); platform rebranded "Global Plastics Hub"
Coverage	• Global scope with country-level dashboards • Variable coverage across regions (more comprehensive for developed re-gions) • Integrates multiple data sources and initiatives • Includes both marine and freshwater environments • Cross-sectoral approach (production to waste management to environ-mental presence)
Data	• Marine, freshwater and terrestrial litter density and composition, disaggre-gated by ecosystem/biome • Microplastic and macroplastic concentration measurements in water, sed-iment, soil and biota • Species entanglement and ingestion records for marine and freshwater wildlife • Ecological exposure and risk indicators for affected habitats • Habitat-level contamination hotspot mapping • Scientific research outcomes on the environmental fate, transport and ecological impact of plastics • Environmental sampling and monitoring methodologies (including citi-zen-science protocols)
Quality	• Variable depending on data source • Peer-reviewed scientific data prioritised • Metadata quality indicators where available • Harmonisation efforts for diverse data sources • Transparent documentation of methodologies
Reliability	• Comprehensive integration of diverse data sources • Interactive visualisation capabilities • Significant data gaps for many regions • Inconsistent methodologies between data sources • Limited temporal coverage for trend analysis • Ongoing development with continuous improvements • Variable update frequencies across datasets • Provides access to both raw data and synthesised information

UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action

Table A.19. UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action details

Category	Details
Reporting Requirements	• Voluntary framework for countries, regions, and cities • Structured approach for systematic data collection and analysis
Responsible Parties	• Development: UNEP, IUCN, and the Life Cycle Initiative • Data Collection: National/regional authorities, researchers • Implementation: Countries, regions, and cities
Coverage	• Global scope with local/regional implementation • Value chain approach (across production, consumption, waste manage-ment)

Data	• Plastic flows and leakage by location or sector • Segmentation by polymer, application, and sector • Hotspot identification (components contributing to plastic leakage)
Quality	• Standardised methodological framework • Data collection modules for specific survey requirements
Reliability	• Three-stage process (identifying hotspots, prioritising interventions, align-ing instruments) • Focus on modelling and prioritisation for targeted interventions

GESAMP Guidelines for the monitoring and assessment of plastic litter in the ocean (2019)

Table A.20 GESAMP Guidelines for the monitoring and assessment of plastic litter in the ocean (2019) details

Category	Details
Reporting Requirements	• Voluntary guidelines for establishing monitoring programs • Harmonised approach to data collection and reporting
Responsible Parties	• Development: GESAMP Working Group (WG40) • Leadership: IOC-UNESCO and UNEP • Implementation: National and regional monitoring programs
Coverage	• Primary focus on marine environments • Adaptable to freshwater environments (rivers and lakes)
Data	• Distribution and abundance of plastic litter/debris • Sample characterisation • Uncertainties assessment
Quality	• Standardised sampling methodologies • Protocols and data recording sheets for field use • Guidance on selecting appropriate indicators
Reliability	• Promotes harmonised approach to program design • Supports establishment of official monitoring programs • Links to field-tested protocols

LITTERBASE (Alfred Wegener Institute)

Table A.21. Litterbase data details

Category	Details
Reporting Requirements	• Voluntary contributions (based on peer-reviewed publications)
Responsible Parties	• Data Collection: Academic researchers • Data Submission: Alfred Wegener Institute • Data Validation: Scientific review team
Coverage	Global marine environments
Data	• Distribution of marine litter • Interactions with marine life • Microplastic concentrations

Quality	• Based on peer-reviewed scientific literature
Reliability	• Publication time lag and a focus on academic literature only

Regional Monitoring Programs

European Marine Observation and Data Network (EMODnet)

Table A.22. EMODnet data details

Category	Details
Reporting Requirements	• Mandatory for EU member states • Standard monitoring protocols • Regular submission schedule
Responsible Parties	• Data Collection: National monitoring agencies • Data Submission: Member state authorities • Data Validation: EMODnet quality control team
Coverage	European seas
Data	• Beach litter data • Seafloor litter data • Floating macro-litter
Quality	• High – standardised protocols
Reliability	• High quality and regular updates

OSPAR Beach Litter Database

Table A.23. OSPAR Beach Litter Database details

Category	Details
Reporting Requirements	• Mandatory for contracting parties • Quarterly surveys required • Standard protocols
Responsible Parties	• Data Collection: National authorities • Data Submission: OSPAR contracting parties • Data Validation: OSPAR Secretariat
Coverage	Northeast Atlantic
Data	Beach litter counts
Quality	• High – standardised monitoring • Focuses only on beaches
Reliability	• Regular monitoring • Limited geographic scope • Resource intensive

HELCOM Marine Litter Database

Table A.24. HELCOM Marine Litter Database details

Category	Details
Reporting Requirements	• Regular monitoring required (minimum quarterly) • Standard protocols aligned with EU Marine Strategy Framework Directive • Annual reporting to HELCOM Secretariat • Use of harmonised survey forms • Photo documentation required for unusual items
Responsible Parties	• Data Collection: National marine monitoring institutes • Data Submission: HELCOM member states • Data Validation: HELCOM Expert Network on Marine Litter • Quality Control: HELCOM Monitoring and Assessment Group
Coverage	Baltic Sea
Data	Beach litter counts
Quality	• High – standardised monitoring • Focuses only on beaches
Reliability	• Regular monitoring • Limited geographic scope • Resource intensive

National Monitoring Programs

National Oceanic and Atmospheric Administration (NOAA) Marine Debris Monitoring Program

Table A.25. NOAA Marine Debris Monitoring Program details

Category	Details
Reporting Requirements	• Monthly shoreline surveys required • Standardised survey protocols • Photo documentation of items • GPS coordinates for all surveys • Data submission within 14 days • Quality assurance documentation

Responsible Parties	• Data Collection:
	  o NOAA trained observers
	  o Partner organisations
	  o Certified volunteers
	• Data Submission: Survey coordinators
	• Data Validation: NOAA Marine Debris Program staff

Coverage	US waters and coastlines
Data	• Shoreline monitoring • At-sea observations • Plastic accumulation rates
Quality	• High - standardised protocols

Reliability	• Rigorous scientific protocols • Long-term dataset • Quality control measures • Standardised methodologies • Limited to US territories • Resource-intensive protocols • Volunteer dependence • Geographic gaps

Japanese Marine Plastic Monitoring Program

Table A.26 Japanese Marine Plastic Monitoring Program details

Category	Details
Reporting Requirements	• Quarterly monitoring mandatory • Standardised sampling protocols • Annual reporting cycle

Responsible Parties	• Data Collection:
	  o Government research institutes
	  o Environmental monitoring stations
	  o Certified laboratories
	• Data Submission: Research organisations
	• Data Validation: Ministry of Environment

Coverage	Japanese waters
Data	• Microplastic concentrations • Beach accumulation rates • Source identification
Quality	• High - government monitored
Reliability	• Advanced analytical methods • Comprehensive monitoring network • Government support • Regular data updates • Integrated approach • Limited geographic scope • High operational costs • Language barriers • Complex methodology

Citizen Science Platforms

Marine Debris Tracker

Table A.27. Marine Debris Tracker details

Category	Details
Reporting Requirements	• User registration required • Location services enabled • Optional photo submission • Basic training completion
Responsible Parties	• Data Collection: Volunteer citizens • Data Submission: Mobile app users • Data Validation: Platform administrators

Coverage	Global
Data	• Litter item counts • Location data • Temporal patterns
Quality	• Moderate - volunteer collected
Reliability	• Wide geographic coverage • Real-time data collection • Variable data quality • Inconsistent coverage • User bias • Limited verification

Litterati

Table A.28. Litterati data platform details

Category	Details
Reporting Requirements	• Photo documentation required • Location tagging mandatory • Item categorisation • Community verification
Responsible Parties	• Data Collection: Global volunteers • Data Submission: App users • Data Validation: AI systems and community
Coverage	Global
Data	• Geotagged litter data • Brand identification • Material types
Quality	Moderate - crowd-sourced
Reliability	• Visual verification possible • Global accessibility • Urban sampling bias • Variable user commitment • Data consistency challenges Note: the platform has also expanded into B2B/ commercial data services (e.g., brand audits, packaging-footprint studies) alongside its original citizen-science model.

Research Institution Databases

The Ocean Cleanup Research

Table A.29 The Ocean Cleanup Research platform details

Category	Details
Reporting Requirements	• Scientific protocols compliance • Standardised sampling methods • Detailed documentation • Quality assurance procedures • Peer review process

Responsible Parties	• Data Collection: Research teams • Data Submission: Scientific staff • Data Validation: Scientific advisory board
Coverage	Ocean gyres and rivers
Data	• Macro-plastic concentrations • River output estimates • Temporal variations
Quality	High - scientific methodology
Reliability	• Scientific rigor • Global relevance • Limited sampling locations • Data access restrictions • Temporal gaps

Annex B: Waste Management Terminology Comparison

Consistently using the same definitions when developing plastics data is critical to success. In September 2024, UNEP's Global Partnership on Marine Litter Community of Practice circulated a working document summarising plastics definitions and which organisations advocated for each definition .

Whilst there will likely continue to be variation between organisations on certain definitions (e.g., see variations for "mismanaged waste" below), individual countries should set out what they consider to be encompassed within each definition.

CSDR have made recommendations for key terms – see the Key Definitions section.

Table A.30. UNEP Waste terminology assessment

Term	Description	Advocated By
Total Uncollected MSW	Calculated by subtracting the total MSW regularly collected from the total MSW generated.	Waste Wise Cities (UN-Habitat)
Total MSW Collected	The amount of MSW generated that is moved from the point of generation (specific addresses or designated collection points) to facilities where the waste is recovered or disposed, regardless of collection modality. The remaining share of MSW generated is considered "uncollected".	Waste Wise Cities (UN-Habitat)
Unmanaged Waste	Consists of uncollected waste and waste that leaks out from the solid waste management system, both intentionally and non-intentionally, as well as illegally dumped waste in the environment.	Waste Flow Diagram (GIZ)
Mismanaged Waste (Definition 1)	Defined as the sum of uncollected and improperly disposed waste. It is plastic that is prone to be released to the environment.	Hotspotting Methodology (UNEP/IUCN) and PLASTEAX (EA)
Mismanaged Waste(Definition 2)	Waste that is not captured by any state-of-the-art waste collection or treatment facilities. It includes waste that is burned in open pits, dumped into seas or open waters, or disposed of in unsanitary landfills and dumpsites.	Organisation for Economic Co-operation and Development (OECD)

Littering	The incorrect disposal of small, one-off items, such as throwing a cigarette, dropping a crisp packet, or a drink cup. Most of the time these items end up on the road or sideways. They may or may not be collected by municipal street cleaning.	Hotspotting Methodology (UNEP/IUCN) and PLASTEAX (EA)
Litter	Waste that results from littering by individuals in the environment and from fly-tipping. Littered waste is distinct from mismanaged waste, because littering behavior is not necessarily correlated to the provision of basic waste collection and disposal infrastructure. Littered waste can either be collected for further disposal or remain uncollected and leak into the environment.	Organisation for Economic Co-operation and Development (OECD)
Fly-tipping	The deliberate disposal of large quantities of litter in the environment without any specific location. This could be anything from a single bag of rubbish to a large sofa to a broken refrigerator (e.g., accumulating on the roadside or remote places).	Hotspotting Methodology (UNEP/IUCN) and PLASTEAX (EA)
Leakage (Definition 1)	A quantity of plastic entering the oceans as well as other environmental compartments (e.g. rivers, soil, air).	Hotspotting Methodology (UNEP/IUCN)
Leakage (Definition 2)	Plastic that is released to rivers, lakes and oceans.	PLASTEAX (EA)
Plastic Leakage (Definition 3)	Refers to plastics that enter terrestrial and aquatic environments.	Organisation for Economic Co-operation and Development (OECD)
Loss	The quantity of plastics that leaves a properly managed product or waste management system, as the fraction of materials that is detached from the plastic product during manufacturing, use or transport for microplastics or as mismanaged waste for macroplastics. Losses are specific to various sources and activities (e.g., the processes of losing all types of plastics into the environment through abrasion, weathering or unintentional spills during production, transport, use, maintenance or recycling of products containing plastics, littered plastic packaging).	Hotspotting Methodology (UNEP/IUCN)
Releases	The fractions of the loss that are ultimately released into different environmental compartments including (i) waterways and oceans; (ii) shallow and deep soils; (iii) terrestrial environment other than soils, such as dumpsites, buildings or trees, or littered plastic packaging; and (iv) air, such as plastic micro-fibers emitted when synthetic textiles are worn.	Hotspotting Methodology (UNEP/IUCN)
Landfill	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.	Waste Wise Cities Tool (UN-Habitat)

Dumping	The deliberate disposal of large quantities of litter in a particular area, that is not controlled. Dumping can be the result of the formal or informal collection sector. This could be anything from a single bag of rubbish to a large sofa to a broken refrigerator.	Hotspotting Methodology (UNEP/IUCN)
Sanitary Landfill (Definition 1)	A method of disposing waste on land without disturbing the environment and public health.	PLASTEAX (EA)
Sanitary Landfill (Definition 2)	The final disposal of waste in or on land in a controlled way and according to state-of-the-art sanitary, environmental protection and other safety requirements.	Not specified in the image
Solid Waste Disposal	The discharge, deposit, injection, dumping, spilling, leaking or placing of solid waste on or in the land or water. This definition may vary under diverse local, state, provincial and national laws.	Organisation for Economic Co-operation and Development (OECD)
Disposal	Encompasses multiple operations categorised with codes D1-D15, including: deposit into land (D1), land treatment (D2), deep injection (D3), surface impoundment (D4), specially engineered landfill (D5), release into water bodies (D6), release into seas/oceans (D7), biological treatment (D8), physicochemical treatment (D9), incineration on land (D10), incineration at sea (D11), permanent storage (D12), blending or mixing (D13), repackaging (D14), and storage pending operations (D15).	Basel Convention
Disposal Facilities	Sites which are regularly used by 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 official recognition, a permit or a license. Disposal sites may be managed in either a controlled or uncontrolled manner. The definition excludes unrecognised places where waste is deposited occasionally in small amounts which public authorities may clean up from time to time.	Waste Wise Cities Tool (UN-Habitat)

Annex C: Strategies for handling inconsistent reporting

Inconsistent reporting across different classification systems and jurisdictions presents significant challenges for comprehensive plastic data collection. Variations in definitions, methodologies, and reporting frequencies can create gaps and contradictions that undermine data quality and comparability. This section outlines systematic approaches to address these challenges, from standardising data collection protocols to developing robust methods for handling missing or conflicting information.

1. Standardisation Protocols

- Develop and distribute standardised reporting templates with clear instructions
- Create conversion tools to translate between different categorisation systems
- Establish minimum reporting requirements that all stakeholders must meet

2. Phased Implementation

- Begin with core data elements and gradually expand reporting requirements
- Allow transition periods when introducing new reporting standards
- Provide simplified reporting options for smaller entities with limited capacity

3. Incentive Structures

- Recognise and reward consistent, high-quality reporting
- Provide technical assistance for improved data collection
- Consider regulatory requirements for essential data points

4. Automated Validation

- Implement digital systems with built-in validation checks
- Flag statistically improbable or inconsistent submissions for review
- Develop systems that prevent submission of incomplete data

5. Proxy Measurements

- Use related economic indicators as proxies (e.g., GDP, manufacturing output)
- Apply industry benchmarks and ratios (e.g., plastic-to-product weight ratios)
- Leverage data from similar economies or regions when local data is unavailable

6. Statistical Modelling

- Employ regression analysis to estimate relationships between known variables
- Use time-series forecasting to fill temporal gaps
- Apply machine learning techniques to predict missing values based on available data

7. Scaling Methods

- Apply appropriate scaling factors based on population, economic activity, or other relevant parameters
- Use step-down approaches from national to regional or local estimates
- Develop category-specific multipliers based on known relationships

8. Boundary Analysis

- Establish upper and lower bounds for missing values
- Perform sensitivity analysis to understand the impact of estimates
- Document confidence levels for different data categories

9. Hierarchical Data Integration

- Establish a clear hierarchy of data reliability
- Define primary sources for each data category
- Create protocols for when and how to override primary data with secondary sources

10. Triangulation Techniques

- Compare multiple independent data sources
- Identify patterns of convergence and divergence
- Document and investigate significant discrepancies

11. Metadata Documentation

- Maintain comprehensive records of data sources, methodologies, and assumptions
- Create data lineage tracking systems
- Document reconciliation decisions and rationales

12. Expert Review Panels

- Establish technical committees to review problematic data
- Engage industry, academic, and governmental experts
- Develop consensus approaches for handling persistent discrepancies

13. Uncertainty Communication

- Clearly report confidence levels and uncertainty ranges
- Use data quality indicators to communicate reliability
- Provide transparency about reconciliation methods and limitations

Annex D: Techniques for scientific sampling for plastics in the environment

Table A.31 Summary of methods available for environmental realms and biomes. Classification of realms and biomes is based on the IUCN Global Ecosystem Typology to remain consistency with accounting frameworks.

Biome	Example functional groups	Example sampling / monitoring methods	Available protocols
Type of Realm: Core			
Marine			
M1 Marine shelf	Seagrass meadows, kelp forests, photic coral reefs, shellfish beds and reefs, subtidal sand beds, mud plains and rocky reefs, upwelling zones	• Underwater surveys for debris or entanglement • Remote sensing & aerial surveys for debris or entanglement	The following guidelines are tailored to the transitional zone of shorelines but can be adapted to for use in the marine shelf: • GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010) • Marine Debris Monitoring and Assessment Project Protocol Documents and Field Datasheets (NOAA)
M2 Pelagic ocean waters *Note: Sampling in these areas often requires specialist and expensive means. It is recommended these surveys are completed opportunistically,*	Epipelagic, mesopelagic, bathypelagic and abyssopelagic ocean waters, sea ice	• Photographic surveys (from vessels) • Remote sensing & aerial surveys • Water sampling • Net tows • Visual observations (from vessel) • Fisheries observer (opportunistic capture of debris using pelagic fishing gear) • Bongo nets or horizontal nets (microplastics only)	• GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021)

for example during biodiversity surveys, oceanographic research, fisheries assessments or engineering and exploitation missions.		• Underway sampling using seawater intakes from vessel (microplastic only) • Submersible pumps lowered from vessel to known depth • Continues plankton recorder (CPR) towed from ships underway	
M3 Deep sea floors	Continental and island slope, sub-marine canyons, abyssal plains, seamounts, ridges and plateaus	• Underwater sampling while scuba diving (for depths < 30m) • Video (towed, Remotely Operated Vehicles (ROV)) • Trawling • Sediment cores • Acoustic methods including sonar, side imaging, sounder (to locate and assess potential accumulation points of debris)	• GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019) • European Marine Observation and Data Network (EMODnet) • Guidance on Monitoring of Marine Litter in European Seas – updated (European Commission, 2023) • Deep-sea Debris Database (JAMSTEC, 2017)
M4 Anthropogenic or artificial marine	Submerged artificial structures, marine aquafarms	• Underwater surveys for debris or en-tanglement • Remote sensing & aerial surveys for debris or entanglement	As of 2025, no methods exist specifically for artificial marine structures, however where possible, guidelines and methodologies for the marine environment can be adapted to suit, including: • GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021)
Freshwater			
F1 Rivers and streams	Permanent upland and lowland streams, freeze-thawed rivers and streams, seasonal upland streams, seasonal lowland rivers	Techniques will change depending on the area of interest (e.g., surface water, water column, river or lake bed / sediment, lake shores, riverbank, etc.). Many of the methods used in the marine environment can be applied to freshwater environments, including:	• Monitoring Plastics in Rivers and Lakes: Guidelines for the Har-monisation of Methodologies (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010) has previous-ly been adapted to monitor plastics on riverbanks and support identification of items collected.

F2 Lakes	Large and small permanent freshwater lakes, seasonal, freeze-thaw and ephemeral freshwater lakes, ephemeral salt lakes, geothermal pools and wetlands, subglacial lakes	• Net sampling and tows (from vessels, riverbanks or bridges) • Surface or sediment trawls • Sediment grabs (e.g., Ekman grabs, metal spoon) and cores (e.g., gravity coring) • Water sampling • Surface pumps • Visual observation (from vessels, riverbanks or bridges)	• River-OSPAR Guidelines are currently in the scoping phase but preliminary guidance is available: Scoping study on methods for riverine litter monitoring (OSPAR, 2024)
F3 Artificial wetlands	Large reservoirs, rice paddies, freshwater aquafarms, canals, ditches and drains	• Reservoirs should be sampled according to zoning (riverine, transitional and lacustrine zones) to determine gradients of plastic contamination	
Terrestrial (including urban & industrial ecosystems)			
T1 Tropical-subtropical forests	Tropical/subtropical lowland rainforests, tropical heath forests	• Quadrat sampling • Transect surveys • Soil sampling for buried plastics • Drone imagery	As of 2025, no methods exist specifically for the terrestrial environment, however where possible, guidelines and methodologies for the marine environment can be adapted to suit, including: • GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021)
T2 Temperate-boreal forests and woodlands	Boreal and temperate high montane forests and woodlands, deciduous temperate forests, oceanic cool temperate rainforests		
T3 Shrublands and shrubby woodlands	Seasonally dry tropical shrublands, cool temperature heathlands		
T4 Savannas and grasslands	Trophic, pyric tussock or hummock savannas, temperate woodlands		

T5 Deserts and semi-deserts	Thorny deserts, semi-deserts, hyper-arid deserts		
T6 Polar-alpine (cryogenic)	Ice sheets, glaciers and perennial snowfields, polar tundra and deserts, tropical alpine grasslands and herbfields		
T7 Intensive land-use	Urban and industrial ecosystems, annual croplands, plantations, sown pastures, derived semi—natural pastures and old fields	• Wastewater, raw sewage and sewage sludge are typically sampled for microplastics by: o Filtration or sieving o Grab sampling (manually or using an autosampler) o Surface skimming • Open burning and/or dumping are usually sampled using: o Transect surveys or walks o Surveillance systems and local citizen science o Remote sensing o National Greenhouse Gas Inventories Equation • Market sampling of fish and shellfish to estimate human exposure to plastic through seafood consumption (microplastics)	• Wastewater and sampling of wildlife: Monitoring Plastics in Riv-ers and Lakes: Guidelines for the Harmonisation of Methodolo-gies (UNEP, 2021) • Guideline for National Greenhouse Gas Inventories in Chapter 5: Incineration and Open Burning of Waste (IPCC, 2006) Note: IPCC subsequently published the 2019 Refinement to the 2006 Guide-lines, which updates this chapter (Volume 5, Chapter 5) with re-vised methodology.
S1 Subterranean lithic	Aerobic caves, endolithic systems	• Sediment sampling from cave floors • Cave sediment collection and densi-ty separation • Targeted sampling or surveys	As of 2025, no methods exist specifically for the terrestrial environment, however where possible, guidelines and methodologies for the marine environment can be adapted to suit, including: • GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021)
S2 Anthropogenic subterranean voids	Anthropogenic subterranean voids		

Type of Realm: Transitional			
MT Marine-Terrestrial			
MT1 Shorelines	Rocky, muddy or sandy shorelines, boulder and cobble shores	• Surveys using transects or quadrats • Remote sensing & aerial surveys • Sieving for buried macro-litter in top 5-10cm (Ryan et al,. 2018) • Sediment cores	• GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • UNEP / IOC Guidelines on Survey and Monitoring of Ma-rine Litter (UNEP / IOC, 2009) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010) • Marine Debris Monitoring and Assessment Project Protocol Documents and Field Datasheets (NOAA) • Guidance on Monitoring of Marine Litter in European Seas – up-dated (European Commission, 2023) • Australian Marine Debris Initiative (AMDI) Monitoring Protocols • European Marine Observation and Data Network (EMODnet)

MT2 Supralittoral coastal	Coastal shrublands and grasslands, large seabird and pinniped colonies	• Surveys using transects or quadrats • Remote sensing & aerial surveys • Beach surveys or opportunist sampling for stranded or dead marine mammals on and seabirds to measure entanglement risk • Opportunistic sampling of marine mammals and seabirds to check for plastic ingestion	The following guidelines are tailored to the transitional zone of shorelines but can be adapted to for use in other transitional zones: • GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010) • Marine Debris Monitoring and Assessment Project Protocol Documents and Field Datasheets (NOAA) • Guidelines series on assessing plastic ingestion by ACAP-listed species (The Agreement on the Conservation of Albatrosses and Petrels, 2020)
MT3 Anthropogenic shorelines	Artificial shorelines	• Surveys using transects or quadrats • Remote sensing & aerial surveys	The following guidelines are tailored to the transitional zone of shorelines but can be adapted to for use in other transitional zones: • GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010)

FM1 Semi-confined transitional waters	Deepwater coastal inlets, permanently open riverine estuaries and bays, intermittently closed and open lakes and lagoons	• Shoreline surveys using transects or quadrats • Remote sensing & aerial surveys • Sieving for buried macro-litter in top 5-10cm (Ryan et al,.2018) • Sediment cores (typically most use-ful for micro-plastics) • Surface water sampling	• Monitoring Plastics in Rivers and Lakes: Guidelines for the Harmonisation of Methodologies (UNEP, 2021) • GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010) • Australian Marine Debris Initiative (AMDI) Monitoring Protocols
TF1 Palustrine wetlands	Tropical flooded forests and peat forests, permanent marshes, subtropical/temperate forested wetlands, seasonal floodplain marshes	• Surveys using transects or quadrats • Remote sensing & aerial surveys • Sieving for buried macro-litter in top 5-10cm (Ryan et al,.2018) • Vegetation entanglement surveys & observations • Sediment cores (typically most useful for micro-plastics)	As of 2025, no methods exist specifically for these environments, however where possible, guidelines and methodologies for the marine environment can be adapted to suit, including: • GESAMP Guidelines for the Monitoring and Assessment of Plas-tic Litter in the Ocean (2019) • Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021) • Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR Commission, 2010)
MFT1 Brackish tidal biome	Intertidal forests and shrublands (including mangroves), coastal river deltas, coastal saltmarshes and reedbeds		
SF1 Subterranean-Freshwater	Underground streams and pools, groundwater ecosystems		
SF2 Anthropogenic subterranean-Freshwater	Water pipes and subterranean canals, flooded mines and other voids		
SM1 Subterranean tidal	Anchialine caves, anchialine pools, sea caves		

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