Navigating Plastic Management

Tools for Government Action Planning

WORLD BANK GROUP

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October 2024

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Contents

Acknowledgments

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The team is grateful for the insights, comments, and contributions from reviewers and the developers of the tools and resources featured in the report, including Dr. Nivedita Biyani (University of California, Santa Barbara), Dr. Costas Velis and Dr. Josh Cottom (University of Leeds), Jo Royle and Carla Worth (Common Seas), Carla Friedrich, Heidi Savelli-Soderberg, and Nao Takeuchi (UNEP), Janaka De Silva and Lynn Sorrentino (IUCN), John Duncan (WWF), Margherita Pucino and Madeleine Sophia Brandes (GPAP),and Andrew Whiteman (RWA) and David Newby (DNA).

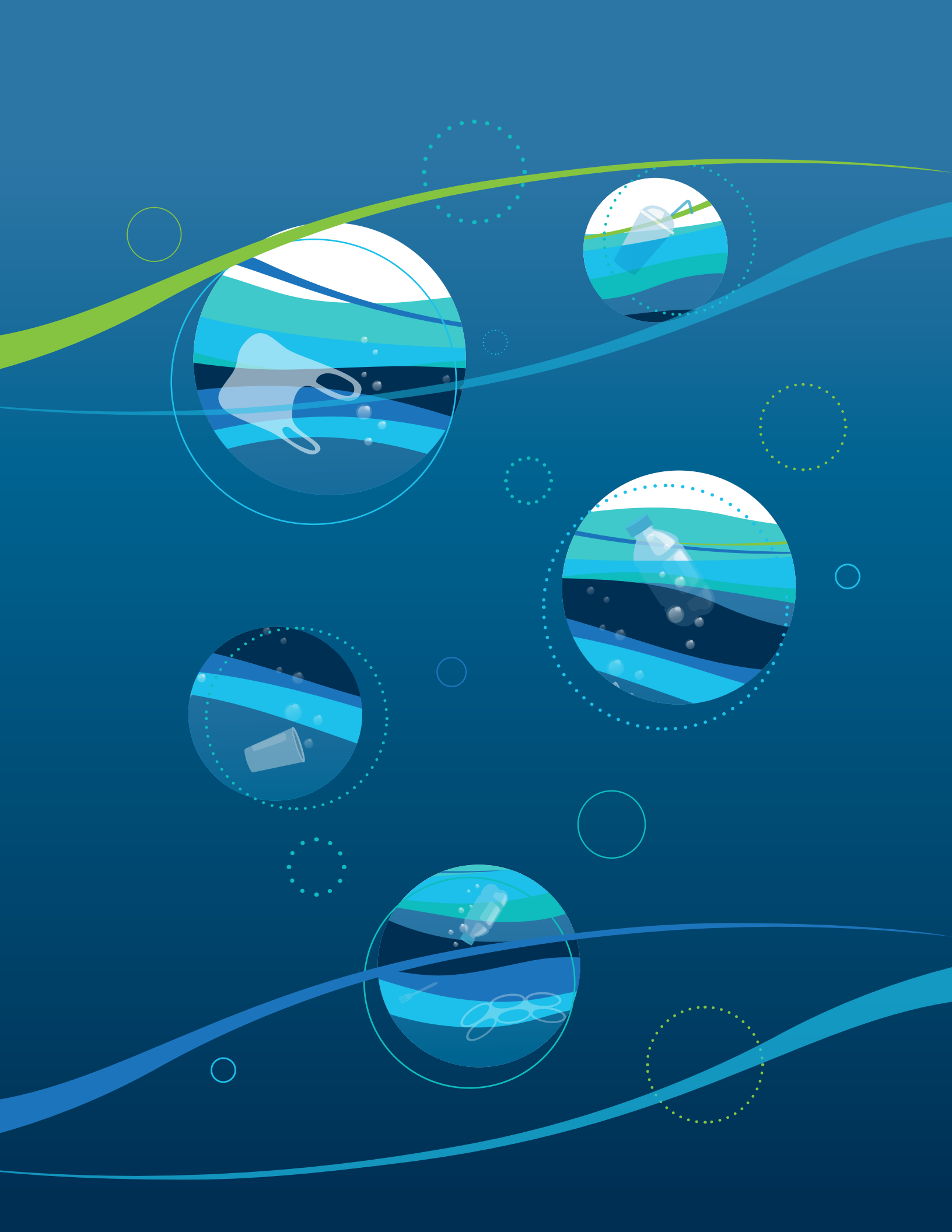
The team greatly appreciates the input and comments from the peer reviewers; Ashraf El-Arini (Senior Environmental Specialist, SSAEN), Rieko Kubota (Senior Environmental Engineer, SEAE2), Kate Almora Philp (Environmental Engineer, SEAE2) and Feng Wang (Programme Officer, UNEP).

PROBLUE provided funding for this publication. PROBLUE, a multi-donor trust fund administered by the World Bank, supports the sustainable and integrated development of marine and coastal resources in a healthy ocean.

Abbreviations

AI	artificial intelligence
B2B	business-to-business
CAPEX	capital expenses
CIEL	Center for International Environmental Law
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EA	Earth Action
EPR	Extended Producer Responsibility
EU	European Union
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GHG	greenhouse gas
GIS	geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPAP	Global Plastic Action Partnership
GPML	Global Partnership on Plastic Pollution and Marine Litter Digital Platform
HDPE	high-density polyethylene
HS	Harmonized System
ILBI	international legally binding instrument
INC	Intergovernmental Negotiating Committee
IOC	Intergovernmental Oceanographic Commission
IRAT	Implementation Readiness Assessment Tool
ISIC	International Standard Industrial Classification
IUCN	International Union for Conservation of Nature and Natural Resources
JRC	Joint Research Centre (European Commission)
LCA	life cycle assessment
LDPE	low-density polyethylene
M&E	monitoring and evaluation
MFA	Material Flow Analysis
mm	millimeter
N/A	Not applicable
NAM	National Analysis and Modelling
NIUA	National Institute of Urban Affairs
NOAA	National Oceanic and Atmospheric Administration
NPAP	National Plastic Action Partnership
ODE	ordinary differential equation

OECD	Organisation for Economic Co-operation and Development
OPEX	operating expenses
OSPAR	Oslo and Paris Conventions
PET	polyethylene terephthalate
PLAST	Plastic Pollution Assessment Methods Suitability Toolkit
PP	polypropylene
PPS	Plastics Policy Simulator
PS	polystyrene
PTSE	Plastic Substitution Tradeoff Estimator
PVC	polyvinyl chloride
RiLON	Riverine Litter Observation Network
RIMMEL	RIverine and Marine floating macro litter Monitoring and Modelling of Environmental Loading
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
SPOT	Spatio-temporal quantification of Plastic pollution Origins and Transportation
UN	United Nations
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
WCEL	World Commission on Environmental Law
WCOOMD	World Customs Organization Organisation mondiale des douanes
WWF	World Wide Fund For Nature



Executive Summary

Plastic pollution is a global challenge, affecting ecosystems, livelihoods, and human health. Its impacts are recognized at the international level where efforts are underway to develop an international legally binding instrument (ILBI) on plastic pollution ('Plastic Treaty'). In order to understand the scale and nature of plastic pollution—and identify and implement potential solutions—many different approaches, tools, methods, models, and information sources have been developed and applied by a wide range of different stakeholders. These resources are in many different forms (for example, guidance documents, academic research papers, technical reports, decision support software and publicly available data sets) and cover a diverse set of issues, ranging from detailed methodologies for assessing the flows of plastic pollution, to approaches for evaluating potential policy solutions and associated financing.

This report aims to provide information on key tools available to support national governments in planning action on plastic pollution. It is focused specifically on tools and toolkits, that is, methods with associated software and guidance, that have been specifically developed to undertake the process of planning action at the national level to tackle plastic pollution. This report identifies eleven key tools focused on plastic pollution and discusses them

Plastic pollution is a critical global environmental challenge that needs to be addressed at all levels – globally, regionally, and nationally

This report focuses on various tools available to national governments for plastic pollution action planning

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in terms of some critical factors that governments should consider when assessing the suitability of these tools (for example, data needs, technical capacity required, and outputs). This report is not meant to provide an exhaustive list of tools, and it is important to note that there are many other related tools that are available and that new ones are also being developed. There are also numerous other resources that may be relevant, such as guidance, datasets, and published technical studies. Some of these other tools and resources are discussed in the report and more are listed in the appendixes.

To describe the tools and their characteristics, they are presented within the framework of a simple, four step process that a national government might use for planning action to tackle plastic pollution:

Step 1: Conduct baseline analysis to develop a clear understanding of the scale and nature of the problem in terms of plastic leakage, legislative context, governance, and stakeholders.

Step 2: Assess potential solutions and develop a specific plan of action, with targets.

Step 3: Determine financial needs and investment plans for implementing the action plan.

Step 4: Implement actions and monitor and evaluate impact.

Overall, it is essential that the approach used takes account of context (for example, existing institutions, data, current initiatives, infrastructure, and so on). The Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform (table C.1, row 7) provides guidance on the action-planning process and provides a platform for national governments to collaborate with others stakeholders to develop national plastic strategies.

No single tool covers the entire action-planning process

There is no single tool that can help with the entire action-planning process. While there is a wide range of tools and other resources available to inform baselining (step 1), as well as various tools to compare different potential policy options and actions (step 2), there are very few tools to assist with identifying financing needs (step 3) and implementation (step 4). As such, it will be necessary for countries to use an approach that draws on appropriate tools, other resources, and support (for example, external specialists), as needed, at different stages of the process (see figure ES.1).

Ongoing efforts are needed to develop tools and resources to assist governments and other stakeholders in plastic pollution action planning. In particular, more tools are needed to identify necessary sources of finance for specific actions and to help with the implementation stage, areas where relatively few resources are available but where there are growing demands as action plans move into the implementation stage. There is a critical need to improve data availability and accuracy so that tools can be used effectively. Typologies and definitions also need harmonization to support data sharing and interoperability. Developing and maintaining a diversity of tools and associated resources will be essential in the coming years to help make effective, evidence-based decisions in tackling plastic pollution, particularly in the context of a global Plastic Treaty.

Various efforts are ongoing to develop tools and resources to help governments mitigate plastic pollution

Figure 1. Selected tools for government action planning

✓ Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment needed

✓✓ Tool specifically developed for this step

Low Open source, suitable for someone with some subject knowledge to apply

Medium Open or closed source, suitable for someone with good subject knowledge to apply

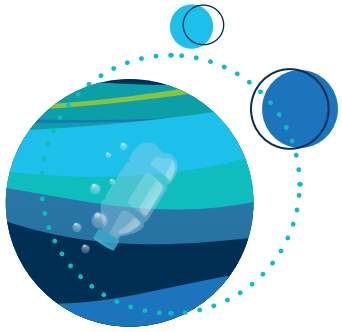
High Closed source, suitable for a specialist only

Low Specifically designed with minimal data needs required

Medium Moderate data needs and/or preloaded with selected generic data

High Large dataset inputs needed (e.g. GIS data points required at high level of granularity)

Key considerations	What action planning step needs to be conducted?				What technical capacity is available?	What is the level of data availability?	What sources of plastic pollution are most important?				What material granularity is needed?			
**Open source tool*	Action planning stage													
Selected key tools	**STEP 1** Baselining	**STEP 2** Options analysis	**STEP 3** Financial needs	**STEP 4** Implementation and M&E	**Technical capacity needed**	**Data needs**	**All sectors**	**Municipal**	**Construction**	**Fisheries**	**Total plastics**	**Specific items**	**Specific polymers**	**Microplastics**
Hotspotting Toolkit* (UNEP & IUCN)	✓✓	✓✓		✓	**Medium**	**High**	✓				✓	✓	✓	✓
Material Flow Analysis Tool* (Basel Convention)	✓✓				**Low**	**Low**		✓			✓			
National Analysis and Modelling Tool (GPAP)	✓	✓✓			**Medium**	**Medium**		✓			✓	✓		
Pathways tool* (Pew and University of Oxford)	✓✓	✓✓			**Medium**	**High**		✓			✓	✓		
Plastic Drawdown (Common Seas)	✓✓	✓✓		✓✓	**Medium**	**Medium**		✓	✓	✓	✓	✓		✓
Plastic Policy Simulator (World Bank, SystemIQ)	✓	✓✓			**High**	**High**		✓			✓	✓		
Plastics Substitution Trade-off Estimator (World Bank)		✓✓			**Medium**	**Low**		✓				✓		
PlastInvest (World Bank, SystemIQ)			✓✓		**Medium**	**Medium**		✓				✓		
Product-lifespan Toolkit* (Basel Convention)	✓✓				**Medium**	**Low**	✓				✓	✓	✓	
SPOT (University of Leeds)	✓✓				**High**	**High**		✓			✓	✓		
Waste Flow Diagram (GIZ)	✓✓	✓			**Low**	**Low**		✓			✓			



1. Introduction

Plastic pollution is a critical, global environmental challenge that various stakeholders are working hard to tackle. At the 5th United Nations Environment Assembly (UNEA) in March 2022, nations around the world adopted a resolution establishing an Intergovernmental Negotiating Committee (INC) to develop an international legally binding instrument (ILBI) on plastic pollution (henceforth referred to as 'Plastic Treaty'). The development of the Plastic Treaty builds on many years of efforts by national governments and a range of other stakeholders. As part of these efforts, a wide range of ***resources***[1] in the form of different approaches, tools, methods, models, and information sources have been developed and applied to assess plastic pollution and to help identify and implement solutions. However, navigating this complex landscape comprising governments, private and public stakeholders, different sectors, financing, and technologies requires consideration of various intersecting factors (for example, plastic pollution flows and sources, potential policy solutions, technology options, financing needs and sources, and so on).

This report aims to help governments navigate the complexities surrounding plastic pollution by providing information on the variety of tools available to support planning action at the national level. It is aimed primarily at national governments seeking further information on the specific tools that are available for assessing and taking action on plastic pollution. Clearly, there are numerous available resources that relate to plastic pollution. This report is not intended to provide an exhaustive review of this large and growing body of work. The focus of this report is on ***tools***[2] that have been specifically developed for use by governments and their partners for plastic pollution-related ***action planning***[3] at the national level (noting that some tools for this purpose can also be applied at other scales, particularly sub-national). Tools that have a wider scope (for example, for assessing waste management systems) or tools that are intended to be applied at different geographic scales (for instance, for use at municipal scale) are not covered in detail. However, where relevant, a selection of these associated resources is identified in the report and referenced in the appendixes.

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1 Resources are defined here as tools, information sources, and methods that are available to help assess plastic pollution and to consider different actions that can be taken to tackle it.

2 Tools are defined here as methods and associated software that have been developed specifically to allow bespoke assessments to be undertaken and to allow consideration of potential actions that can be taken across the life cycle of plastics at the national level, without significant adjustment or enhancement. These tools are based on fully developed methodologies, often with accompanying guidance and software to allow them to be applied by skilled or knowledgeable practitioners.

3 In the context of this report, action planning is defined as the strategic process by which a government assesses, develops, and implements a coordinated series of policies, measures, or interventions to reduce plastic pollution. The term is used here without prejudice to any specific definition of national action plan that may be developed as part of the INC process and the draft Plastic Treaty. A more detailed discussion of national action plans and associated mechanisms can be found in IUCN, CIEL, and WCEL (2023).

This report summarizes the key available tools to assist with plastic pollution action planning, compares their characteristics (for example, scope, technical capacity needed, and so on), and identifies how they can be applied given a country's action planning context. The tools are discussed within the framework of the typical steps and approaches that are normally used in action planning. It should be noted that Parties to the ILBI on plastic pollution may be required to meet a number of obligations under the agreement, including for example, the development of national action plans, so the context to planning actions on plastic pollution may change over time.

This report offers recommendations on the critical factors that governments should consider when assessing the suitability of the different tools. There is no single tool that can help with the entire action-planning process, so it will be necessary for countries to use an approach that draws on appropriate tools, other resources, and support (for example, external specialists), as needed, at different stages of the process. Overall, this report is intended to help countries structure their approach to managing plastics throughout their life cycle.

The report also identifies a selection of other supporting resources, such as online portals, datasets, or published reports that provide useful information to specifically support the action-planning process. For example, the Global Partnership on Plastic Pollution and Marine Litter (GPML) Digital Platform (table C.1, row 7), hosts several hundred reports and case studies relating to plastic pollution, provides an online workspace to guide governments in the action-planning process, and also provides a platform for national governments to collaborate with others stakeholders to develop national plastic strategies.

The tools and key information sources included in this report have been identified via a desk study process conducted between October 2023 and March 2024. The desk study comprised a review of online sources, supplemented by inputs from project partners and, where appropriate, direct discussions with tool developers. Details of the review process used to identify, screen, and group relevant tools for inclusion in this report are provided in **appendix A**. Details of the key tools identified in the review process are presented in **appendix B**. A selection of other resources cited in this report can be found in **appendix C**. The full list of sources identified by the review is available in **appendix D**. Please note that more resources are being developed and created over time, so those detailed in this report should not be considered an exhaustive list.

2. Typical Steps for Action Planning on Plastic Pollution

Plastic pollution is a complex, multi-faceted problem. Assessing the issues and taking action at the national level requires consideration of many diverse, intersecting issues. It requires an assessment of the scale and nature of the plastic pollution problem, as part of a baseline analysis. The nature of plastics as a group of materials, their production and consumption, their generation as waste materials, and their behavior once released into the environment need to be considered as part of a plastic flow analysis. Action planning also requires analysis of the institutional, governance, and legislative contexts. The needs, priorities, preferences, and behaviors of various stakeholders (that is, consumers, value chain actors, public institutions, and civil society) also need to be understood, and changes over time need to be considered. It is important that any action planning is based on a forecast of plastic flows that recognizes changes in the nature of the problem, such as growth in plastic leakage.[4]

In terms of implementing solutions, tackling plastic pollution will take many years, both in terms of addressing current and future plastic pollution emissions and remediating legacy plastics that have historically been released into the environment and ecosystems. Some actions can be implemented over relatively short timescales (for instance, focused communication campaigns to discourage littering). Others take longer and will require careful planning and development work, such as building recycling infrastructure. And different actions will require resources to implement (for example, financial and technical resources and capacity). Potential solutions in the form of specific **actions**[5] need to be assessed and compared so that decisions can be made about how best to use the available resources. Financial and investment requirements need to be carefully evaluated and their sources identified and secured.

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4 Plastic leakage refers to the escape of plastic waste into the environment, including into terrestrial environments, freshwater and marine waterbodies, and as airborne particles (e.g., from tire wear or open burning of plastic waste).

5 Specific actions refer to those that can be implemented to reduce plastic pollution. For the purposes of this report, the term is used in its broadest sense to include all potential tangible actions that could be taken to reduce plastic leakage, including policy, regulatory, and enforcement measures; economic instruments; financing; capacity building, innovation, and knowledge creation; behavior change; and improvements to governance (UNEP 2020). Examples of specific actions include bans on specific single-use plastic items (as featured in the Plastic Drawdown tool), increasing efficiency from mechanical recycling (PPS), and increasing waste collection coverage (NAM and Pathways).

Note that 'actions' are referred to differently in different tools, for example: 'policy instruments' (PPS, World Bank), 'intervention levers' (NAM, GPAP), 'instruments' (UNEP, Hotspotting Tool), 'policy interventions' (Plastic Drawdown, Common Seas), and 'system interventions' (Pathways, Pew).

Finally, action plans need to be monitored, evaluated, and adapted over time to ensure that they have the intended effects. This will require the level and nature of plastic leakage to be reassessed at regular intervals to consider whether and how the situation is changing. The impacts of actions will need to be assessed to consider whether they are effective or need to be adapted, or if the overall plan needs to be revised. In short, assessing the scale of the issues, exploring the potential solutions to plastic pollution and implementing them requires a systematic approach that serves to navigate this complexity in a way that facilitates effective, transparent, and evidence-based decision making.

As such, there are numerous ways that action plans can be developed. The approach should take account existing institutions, availability of information, stakeholder views, current initiatives, actions and infrastructure, capacities, and local circumstances (UNEP 2019). All these factors affect the feasibility and suitability of different solutions. Therefore, throughout this report, we follow a series of key steps that serve as a framework to present the tools for developing a plan of action (UNEP 2023). The four steps are intended to be helpful—rather than prescriptive—guidance and are used here solely to help present the different tools identified by this review:

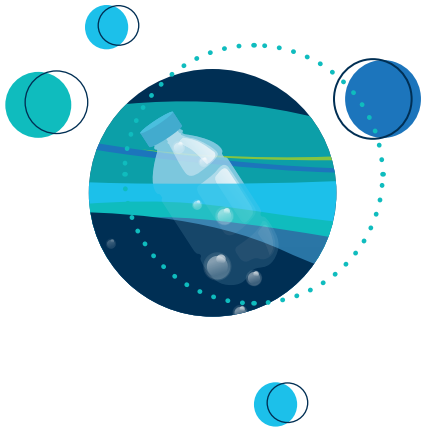
- **Step 1: Conduct baseline analysis** to develop a clear understanding of the scale and nature of the plastic pollution problem in the wider context. This includes:
  - Assessing plastic flows and leakage; and
  - Analyzing the institutional and legislative contexts, governance arrangements, and stakeholder aspects.

- **Step 2: Assess potential solutions** for reducing plastic pollution by prioritizing the most impactful policies and specific measures. This step typically involves the following elements, which are often undertaken iteratively or in parallel:
  - Identify priorities and goals as part of an overarching strategy;
  - Compare different potential actions that can form part of the action plan; and
  - Define an action plan and set appropriate targets.

- **Step 3: Determine financial needs** and investment plans for implementing the action plan.

- **Step 4: Implement actions, and subsequently monitor impact** so as to enable the action plan to be adjusted and continually improved, including developing institutions and legislation and conducting monitoring and evaluation (M&E).

Two key resources are helpful to plan and organize the process outlined above. Firstly, the UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action Tool (referred to as 'Hotspotting' in this document, table B.1, row 1) provides an overall process for planning action and engaging with stakeholders. The tool sets out the key steps involved and provides detailed guidance, supported by training materials. Secondly, the GPML Digital Platform (table C.1, row 7) provides an online, interactive workspace that allows stakeholders to collaborate on the development of national strategies for plastic management. The workspace is structured around a series of systematic steps (broadly aligned to steps 1 and 2) and provides links to supporting guidance, resources, and case studies.



3. Tools to Conduct a Baseline Analysis (Step 1)

Step 1: Conduct baseline analysis to develop a clear understanding of the scale and nature of the problem in terms of plastic leakage, legislative context, governance, and stakeholders.

1a. Assess plastic flows and leakage

- What technical capacity is available to conduct the analysis?
- Is an open-source tool needed?
- Is data available to provide the necessary inputs?
- What parts of the lifecycle are priorities for analysis (e.g. upstream, midstream, down stream, or combination)?
- What level of material granularity analysis is needed (e.g. polymer level, products, macros and microplastics)?
- What are the likely main potential sources of plastic pollution (e.g. municipal, construction, fisheries, etc).
- What different archetypes need to be considered (e.g. urban versus rural)?
- Is a forecast of how levels of plastics pollution leakage will change over time needed to inform decision-making?

Key tools: Breaking the Plastic Wave Pathways Tool (Pathways), Product-lifespan Toolkit, National Guidance for Plastic Pollution Hotspotting and Shaping Action (Hotspotting Tool), Plastic Drawdown, Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) model, Toolkit for Material Flow Analysis (MFA tool), Waste Flow Diagram (WFD)

Useful resources: Plastic Pollution Assessment Methods Suitability Toolkit (PLAST), GPML Digital Platform, Plasteax

1b. Analyze the institutional and legislative context, governance arrangements, and stakeholder aspects.

- Who are the key stakeholders and how do they need to be engaged?
- What are the current institutional and governance arrangements?
- What policies and regulations exist in the context of plastics?
- What is the status of existing markets, supply chains and investment context in relation to plastics and recycling?

Key tools: BGPML Digital Platform

Useful resources: Plastics Legislation Explorer, Global Plastics Laws Database, Global Plastic Policy Reviews, Plastics Policy Inventory

Tools for assisting with the baseline analysis step (sometimes referred to as situational analysis) of action planning fall into two main groups, aligned to the two main aspects of a typical baselining process:

1. Assessing plastic flows and leakage; and
2. Understanding the institutional, governance, legislative, and stakeholder aspects.

Conducting the baselining provides sound, evidence-based understanding of the current situation and serves as a basis for making effective decisions. Initial observations on the situation in terms of key sources and causes of plastic leakage may prove to be incorrect (GESAMP 2019). For example, plastic items that appear on beaches or as street litter may be the most visible and attract the most public attention, but they are likely to form only one aspect of plastic leakage in a country and may not provide insight into where the root of the problem lies, potentially further upstream in the value chain. Having a detailed understanding of the existing situation helps inform effective decisions that tackle the problem holistically.

Assessing Plastic Flows and Leakage

Modelling and quantifying plastic flows are complex tasks given relatively poor data availability and the limited understanding of these flows, particularly the movement of plastics in the environment. To overcome these challenges, tools typically use a simplified representation of the plastic flow. This reduces data needs and provides a simpler and more pragmatic basis for action planning. Different tools use different system boundaries (for instance, upstream versus downstream), material granularity (for example, polymers versus

item type), and scope (for example, municipal, agriculture, and so forth). The geographic scale at which different tools operate also varies, and the level of technical expertise and data inputs required to apply different tools also differs significantly. Each of these dimensions is explored further below.

The use of a flow model approach illustrates how plastic flow across each stage of the life cycle and allows practitioners to consider key questions such as how much plastic is produced, consumed, generated as waste, recovered for reuse, repair or recycling, or disposed of in landfill, as well as points of leakage into the environment. It also helps identify which stakeholders are associated with each stage, which is an important consideration for implementing solutions. For example, actions related to plastic production require collaboration with plastic manufacturers or importers, whilst actions to address leakage from the waste management system require collaboration with formal and informal waste management operators.

Existing tools analyze the plastic life cycle, focusing on upstream, downstream, or a combination thereof. The life cycle of plastics extends from raw material extraction to its potential leakage into the environment as plastic pollution (see box 3.1 for more information on the plastic life cycle). The approaches taken by different tools in terms of life cycle stage can be considered in terms of those that focus on specific points in the upstream component (that is, plastic product production and consumption), those that focus on the downstream part (waste generation and management), and those that draw on a combination of points in both the upstream and downstream parts of the life cycle.

Many of the key tools identified in this study consider both upstream and downstream components of the life cycle, drawing on plastic waste generation data (that is, part of the downstream stage of the life cycle) and plastic production and consumption data (that is, upstream) to create models of plastic flows. The Breaking the Plastic Wave Pathways Tool ('Pathways', table B.1, row 5) developed by Pew Charitable Trusts and the University of Oxford is one example (see appendix B for more examples). While not being a tool as such, the Plasteax platform (table C.1, row 20) is also relevant here in that it provides data on plastic flows across the life cycle at polymer and application-specific levels. The data from Plasteax can be used to support modelling of plastic flows at a country level.

This flow model approach provides the data that can be used as a basis for considering the implication of interventions in both the upstream and downstream parts of the life cycle. It also allows data on plastic product consumption and production to be compared with waste generation data, which can help provide more confidence in the analysis and can also often allow key leakage points to be identified. For example, if plastic production or consumption is far higher than plastic waste generation (for the same products) then this may suggest that data on waste generation is missing some fraction that is leaking via other routes (for example, uncontrolled dumping or burning).

Upstream-focused tools, such as the Basel Convention Toolkit for the Product-Lifespan Method, use data on production and consumption of plastics to develop a picture of plastic

flows. This tool draws on Harmonized System (HS) code trade data from sources, such as UN Comtrade, to estimate quantities of different types of plastic products placed on the market in a country. It combines this data on quantities of plastic production and imports with estimates of typical product lifespans to estimate the quantities of waste plastic products. These types of tools provide useful granularity on consumption and waste quantities, but since they are focused on the upstream part of the plastic life cycle, they do not directly provide information on the leakage element of the plastic life cycle. However, data from these tools could be integrated with other tools that provide more information on the downstream life cycle stages.

There are also other tools and resources that focus on plastic production and consumption but which are primarily focused on assisting private companies to understand their plastic footprints. For example, the Ellen MacArthur Foundation Global Commitment reporting platform is a source of information on plastic production (and reduction) as reported by the major brands that are signatories to the Global Commitment. These types of tools are not covered in detail in this report but it is possible to draw on such tools to help provide more information on the upstream component of a plastic flow assessment.

Downstream-focused tools can provide a simpler way to understand plastic pollution flows because data for this part of the flow is typically easier to access. In many contexts, it may not be possible to obtain detailed data on plastic flows across the life cycle but it is possible to obtain data on waste generation and management (from public authorities, for instance). Two examples of this type of tool are the Basel Convention Toolkit for Material Flow Analysis Method (MFA tool, table B.1, row 3) and the GIZ Waste Flow Diagram (WFD, table B1, row 11). These tools allow an assessment of flows of plastic from the point of waste generation and provides a basis for assessing the scale of leakage from different parts of the waste management system, including unmanaged (that is, uncollected) and mismanaged (that is, dumped, burned, or littered) plastic waste.

Some tools that focus on the downstream part of the life cycle provide a more granular approach to considering how waste plastic might escape into — and move within — the environment, using data for individual geographical areas and often combining this with a geographic information system (GIS)-based approach. The University of Leeds Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) model (table B.1, row 10), for example, allows for municipal-level, spatial analysis of the escape of plastic waste from various parts of the waste management system. This approach has the potential to provide a much more granular understanding of the impacts in the environment (for example, differentiating between littered plastics and plastics escaping from dumpsites in different areas). However, it typically requires more data and often necessitates a GIS-based approach.

Box 3.1: The Plastic Life Cycle

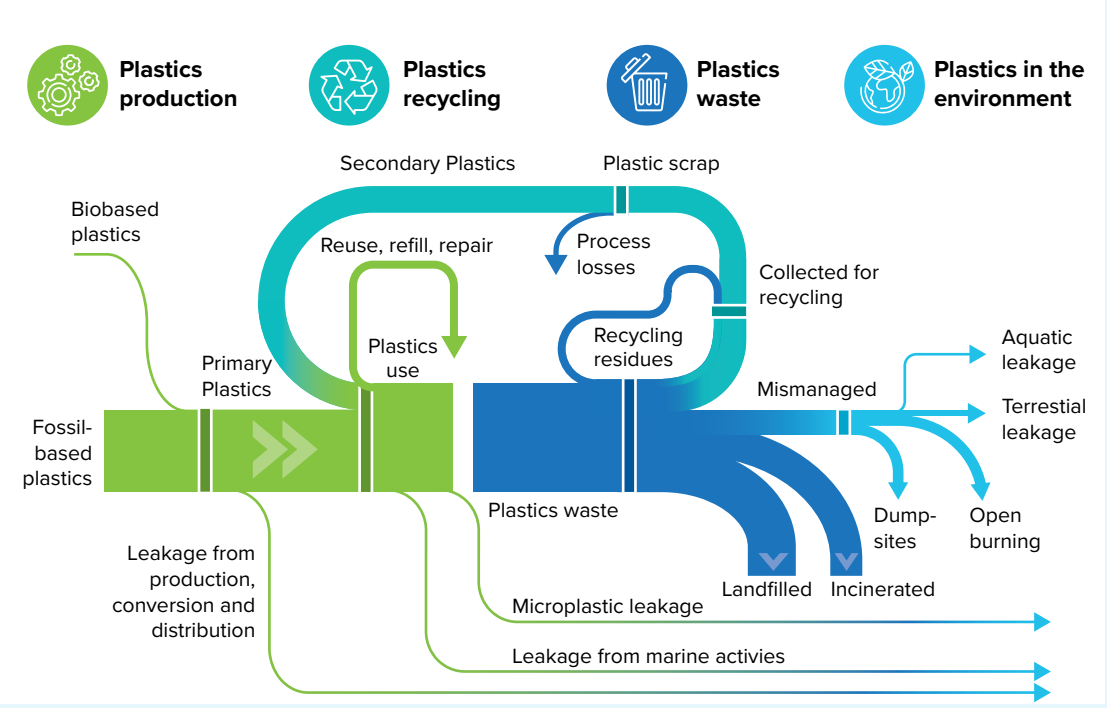
The life cycle of plastic is relatively complex, extending from raw material extraction and primary polymer production, through conversion and manufacturing of plastic components and products, into distribution and retail, use by consumers, and ultimately to the point of waste generation. Imports and exports of plastic raw materials and plastic-containing products also need to be considered.

There are also many important circulating loops of flows, including the reuse, refill, and repair of products and items, and the recycling of plastics via closed-loop or open-loop recycling systems. The waste management phase itself is also complex, with many different actors (formal and informal) managing, separating, treating, recycling, recovering, and disposing of different plastic materials.

Leakage of plastics into the environment can occur at various points in the flow, including during production and manufacturing (for example, accidental release of plastic pellets, the precursors to plastic product manufacture), at the point of waste generation (for example, littering, uncontrolled dumping, or burning of plastic waste); and during the waste management phase (for example, leakage during waste collection or from landfills and dumpsites).

Furthermore, the movement of plastic waste within the environment after leakage is also complex, with plastics often transported and transformed after their initial release into the environment (for example, littered plastic waste may be moved by wind or water; plastic waste may escape from dumpsites; and plastic waste can be degraded and fragmented in the environment producing smaller fractions and particles, such as microplastics and nanoplastics).

Source: OECD 2022.



Material granularity. The level of material granularity used by different tools ranges from a simple assessment of total plastic waste flows to a much more detailed flow analysis based on different polymers (for example, HDPE, PET, PS) or types of plastic products (for example, plastic bottles). Some tools also include assessments of different types of microplastics (that is, particles less than 5 mm in size, such as particulates from tire wear). If there are specific items or products that are of concern in a specific country (for example, disposable plastic sachets, multi-laminate plastic products, and so forth) then it will be important to apply tools that allow this granularity to be assessed so that the costs and benefits of focused policies and interventions can be analyzed.

A simple analysis of total plastic flows has benefits in that an assessment can be conducted with a limited amount of data (for example, waste composition analysis which indicates the proportion of waste plastic that arises within waste can be used as a starting point). The MFA tool uses this approach and allows a relatively simple assessment of plastic flows, helping to identify the main flows of waste plastic in the waste management system and potential sources and scale of leakage into the environment.

Several tools assess the flow of plastics in terms of different types of plastic products. The National Analysis and Modelling Tool (NAM) tool (table B.1, row 4), for example, assesses five different plastic types based on physical characteristics: flexible monomaterials, bottles, rigid monomaterials, multimaterials, and other household goods. The benefit of this approach is that the way that these types of materials behave in the environment is quite different. For example, flexible materials, such as plastic bags, are easily moved by wind and rain and are, therefore, common components of litter. Additionally, the interventions that may be used to tackle plastic pollution often vary depending on the material, so considering them separately allows for a more granular assessment of potential interventions (see chapter 4). The Common Seas' Plastic Drawdown tool (table B.1, row 7), for example, uses an item-specific approach and models 24 different macroplastics items, focusing on items commonly found in marine litter (for example, single-use plastic bags or fishing gear). It also models four different types of microplastics (tire and brake wear particles, microfibers, and pellets). The UNEP/IUCN National Guidance for Plastic Pollution Hotspotting and Shaping Action (Hotspotting tool, table B.1, row 1) provides a comprehensive framework for analyzing plastics by polymer, application, sector, and waste management route, although it needs to be supplemented by specific modelling approaches to provide quantitative analysis of flows.

The majority of tools focus on plastic waste generated from municipal sources (for example, the Plastics Policy Simulator (PPS, table B.1, row 8), NAM, and the MFA Tool. The municipal sector is a dominant source of plastic pollution, so needs to be a primary focus of baseline assessments.[6] However, some other sectors may be important to consider depending on the context, such as fisheries and aquaculture, agriculture, and construction. The Plastics Drawdown tool, for example, includes an assessment of lost and abandoned fishing gear and construction plastics. The Hotspotting tool provides a qualitative framework for assessing

6 The municipal sector is normally considered to include households and businesses that consume similar products and generate similar wastes, such as retail, hospitality, offices, as well as institutions, such as universities and hospitals.

the relevance of the range of main sectors in the economy in terms of plastic pollution. This assessment can then be used as a rationale to structure a detailed analysis of different sectors, drawing on other specific tools and methodologies as required.

Tools generally use different archetypes to reflect differences in flows in different parts of the country (for example, urban compared to rural areas). Each archetype represents areas that have relatively homogenous characteristics in terms of plastic flows. The PPS tool, for example, identifies four archetypes: mega cities, medium cities & suburban, peri-urban & dense rural, and remote.

If possible, it is helpful to align the archetypes used to the types of statistical information routinely collected in a specific country. This reduces the need to collect lots of additional data. Islands, either as islands forming part of a territory or as independent Small Island Developing States (SIDS), are particularly important given the acute nature of plastic pollution impacts on island economies and the challenges in terms of economies of scale for implementing solutions. Some toolkits have been designed specifically for this context and/or have a demonstrated track record of being applied to islands (for example, the NAM tool [for the Indonesian archipelago] and the Plastic Drawdown tool [for the Greek islands, the Maldives, Barbados, and Grenada]).

Most of the tools discussed in this report are designed to be applied at the national level (for example, NAM, PPS, and Plastic Drawdown). However, others are global, regional, or municipal-level tools and have the flexibility to be used at the national level. The SPOT tool, for instance, uses municipal-level data to assess plastic flows but can be aggregated to provide national-level analysis. It has recently been used to estimate plastic flows by country globally (Cottom et al. 2023). The Global Plastics AI Policy tool (table C.1, row 6) was designed to allow an assessment of different plastic flows and policies at a global level in the context of the draft Plastic Treaty but could potentially be used to conduct a national assessment. Similarly, the Pathways tool was developed originally as part of the global Breaking the Plastics Wave study (2020) but has since been modified and enhanced to allow it to be used at the national level.

Geographic information system approaches can also be used to provide additional geographic granularity at the baseline stage, helping to identify geographic hotspots. The greater the level of granularity, the more data inputs are typically required. A GIS-based approach is particularly data hungry but can generate valuable outputs that allow geographic hotspots to be identified. The map-based outputs can also help communicate baseline findings. Tools such as the Hotspotting and SPOT incorporate a GIS-based approach.

Forecasting over time helps develop an understanding of how the problem and the impacts of potential interventions will change. Several tools use growth factors and other data to forecast plastic pollution and policy impacts over time (for example, NAM, PPS, and Plastic Drawdown). Other tools are based on a single year of assessment, providing data for one year for which data is available (for instance, the Hotspotting tool). These tools can provide

a detailed understanding of the baseline situation but they will need to be supplemented by other methods to allow future impacts to be understood.

Input data for the baseline assessment is likely to come from a range of sources, including waste management data (that is, waste generation, composition, and management practices) and data on levels of production and consumption of plastics and plastic-containing products. Clearly, there is always a trade-off between data needs and granularity of the analysis that is possible, but it is also important to keep in mind the level of data that is available for the context — applying a detailed model where little primary data is available will limit the value of the analysis outputs. Some tools are pre-populated with data for different types of countries or it is possible to use data from other similar contexts. For example, the NAM tool is pre-populated with World Bank data on demographics and waste generation by country and income group, and also Plasteax data on plastic flows. This allows an initial assessment to be conducted relatively quickly without extensive data collection and preparation. The Common Seas Plastic Drawdown tool is a 'rapid assessment' tool that aims to minimize the level of data inputs needed. Others require more detailed data to compile the baseline (for example, NAM and Hotspotting).

It is often necessary to collect primary data to allow sufficiently robust analysis. Key data points around plastic production and consumption, and waste generation can come from supplementary studies such as waste composition studies and waste arisings surveys. Data on spatial variation of plastic leakage can be obtained via conventional surveys and sampling techniques or approaches such as drone surveys, satellite imagery, or crowd citizen science (for example, OpenLitterMap, table C.1, row 22). Data on upstream elements need to be developed using appropriate tools (for example, the Product-Lifespan Toolkit, table B.1, row 2), based on data from UN Comtrade, or come from proprietary sources such as market research studies or Plasteax. A triangulation approach is often used to determine data points for a baseline plastic flow assessment, drawing upon several sources of data to determine an input value (for example comparing waste composition data with consumption data for specific items to develop an accurate input dataset).

This report identifies a selection of tools that have been specifically developed to undertake baseline analysis of plastic pollution issues. There is a wide range of other tools and methodologies available that can also help with this process. These tools and methodologies have not been detailed in this study as they are broader in scope, or have not been specifically developed for use by practitioners in different contexts. For example, the UN-HABITAT Waste Wise Cities tool (table C.1, row 27) has been used widely to assess municipal waste management systems at the city level. The Waste Wise Cities website also provides some useful data on waste generation and composition for a number of cities in different countries and hence is a useful source of data. There are also a number of methodologies and one-off studies that are helpful sources of information; however, these have not been detailed in this report because they have not been designed as tools to be applied in different contexts. A list of useful resources of this type can be found in appendix D.

The Plastic Pollution Assessment Methodologies Suitability Toolkit (PLAST, World Bank 2023) provides further information on the wide range of studies and related methodologies that can be used to assist with this element of the baselining process. PLAST (table C.1, row 25) is an interactive tool that allows users to define their specific needs and identify suitable modelling tools and methodologies. Additional information on these and other plastic pollution assessment methodologies can also be found in the Quick guide and review of existing plastic material flow and leakage methodologies (GIZ 2022, table C.1, row 24) and the Review of plastic footprint methodologies (IUCN 2019, table C.1, row 23).

Appendix B provides details of the key tools identified in this study as relevant for undertaking baseline analysis.

Understanding the Institutional, Governance, Legislative, and Stakeholder Aspects

Mapping of stakeholders and analyzing the existing legislation, policy, and governance landscape is essential to pinpoint any gaps and to identify context-appropriate solutions to be designed and implemented. All these dimensions have a key bearing on the design of a plan of action. Collaboration with stakeholders across the life cycle is necessary to help identify solutions, create buy-in, and establish the collaboration that is needed. New policies and legislation are likely to be needed to address particular problems and create an enabling environment for reducing plastic pollution (for instance, through banning avoidable single-use plastic products or creating incentives for increased circularity of plastic use). Clear governance arrangements, in terms of defined responsibilities and appropriate institutions, with the necessary resources, are needed to implement actions.

Identifying and mapping stakeholders provides the basis for engaging key organizations and institutions as part of an action plan. Proactively identifying and engaging the full range of interested stakeholders at an early stage is a critical element of action planning. Involving key stakeholders early maximizes the chances of positive buy-in to any plan of action and also provides opportunities for positive collaborations across the value chain. A thorough stakeholder engagement process, firstly, helps collect comprehensive information on the existing situation (for instance, in accessing useful data) and, secondly, creates a thorough understanding of the views, perspectives, and roles of key stakeholders. This allows context-appropriate and feasible solutions to be identified and implemented. The process is likely to require extensive desk study, research, and engagement with specialists and wider stakeholders. Stakeholder engagement typically comprises a process involving: stakeholder identification, stakeholder analysis (to identify levels of interest and influence), stakeholder

engagement planning (to plan mechanisms for engagement), and, finally, engagement activity, such as workshops, telephone interviews, and in-person discussions.[7]

As part of the stakeholder engagement process it is important to consider social aspects related to plastic pollution. For example, how are different individuals and community groups involved in the value chain? How are the living conditions of workers in the informal economy? How is plastic pollution affecting marginalized communities? Is there gender equity across the value chain? Understanding these different social dimensions provides a sound basis for implementing effective actions that improve the situation for all stakeholders, particularly vulnerable communities.

Governance is also a key consideration because it is important to know who is responsible for what to allow actions to be defined and implemented. It is important to identify the government departments, agencies, and other entities that have responsibility for different aspects of plastics across the life cycle. This is likely to include a range of different branches of government (for example, environment ministries, waste management authorities, environmental protection agencies, agencies responsible for marine protection, or trade ministries). Local governments are also likely to be central in terms of waste management service delivery and citizen engagement.

Existing markets, supply chains, and investment contexts need to be understood, particularly any current barriers to investments in potential solutions. For example, are there high start-up costs or entry barriers associated with circular plastic models, such as reuse and repair? Is investment finance available for businesses seeking to develop waste management and recycling capacity? Stakeholder engagement will provide some information on these aspects but some additional considerations will be required to identify whether there are some key business engagement challenges (or opportunities) that need to be addressed as part of any action plan.

GPML Digital Platform provides useful guidance and supporting information on stakeholder aspects and describes how to undertake a stakeholder mapping process as a part of a consultation. It also provides links to several stakeholder consultation case studies in the context of plastic pollution.

Understanding the existing policies and regulations with respect to plastics provides a basis for understanding what type of new instruments might be needed. Existing legislative arrangements need to be mapped and understood via investigation and desk study. This is often done alongside a stakeholder mapping and engagement process as the two are closely interlinked. Relevant legislation is likely to include current waste management regulations, trading standard controls, customs arrangements, international agreements, and so on.

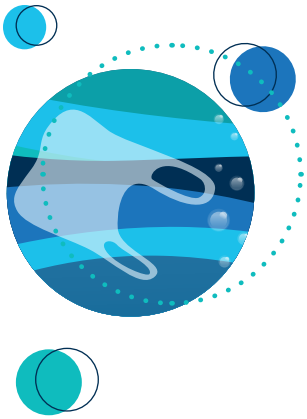
7 Stakeholders are likely to include polymer and chemical producers, plastic converters, brands/manufacturers, reuse service providers, retailers, governments, consumers, waste pickers, waste management companies and recycling companies (UNEP 2023a).

As well as reviewing the existing legislative context, it is important to understand the effectiveness of each relevant instrument and identify any areas that have not been successful or could be improved. For example, legislation to ban single-use plastic bags has been introduced in many countries. However, this has not always been successful (for example, because awareness and enforcement of the ban have been insufficient or the uptake of alternative products has created unintended negative impacts). The presence of a legislative instrument to address an issue does not necessarily mean that the problem has been solved.

The GPML Digital Platform provides guidance and supporting information on how to undertake a legislative and policy review at the national level. This includes a workbook that discusses legal frameworks in the context of plastic pollution and provides a structured approach for reviewing existing legislation. It draws upon the Plastics Legislation Explorer (table C.1, row 15), which is part of the UNEP Marine Litter and Plastic Pollution Legal Toolkit (table C.1, row 11). There are also several other online resources that are useful for assisting with this aspect of the baselining stage, such as the Global Plastic Laws Database, Plastic Pollution Coalition (table C.1, row 5); the Global Plastic Policy Reviews, University of Portsmouth (table C.1, row 16); and the Plastics Policy Inventory, Duke University (table C.1, row 18). Each of these resources can be searched by country and also by legislative type (for example, product bans) to provide an initial assessment of existing legislation and policies.

These resources also provide some qualitative information on policy effectiveness. For example, the Global Plastic Policy Reviews website provides qualitative assessments of identified legislative instruments, such as product bans and legislation to implement waste management services. The website provides a qualitative score for each instrument in terms of their effectiveness in 'contributing to reducing plastic pollution' and 'meeting own objectives'. It also describes the level of evidence available for assessing effectiveness. The Plastics Policy Inventory has a Plastics Policy Effectiveness Study Library that can be used to search for related published studies that assess the effectiveness of individual policies. Although these tools provide a basis for understanding the existing legislative and policy landscape, additional research at the country level is necessary to understand the details of how existing legislation operates in practice and its strengths and gaps. Discussions with key stakeholders and local experts are likely to be necessary to obtain this level of understanding, which is important to allow a feasible action plan to be developed.

Completed national action plans provide good illustrations of the typical scope and outputs of an institutional and legislative review (see appendix B). More examples of baseline studies can be found in the GMPL Digital Platform. The UNEP guidance document Designing a National Marine Litter Action Plan (2019, table C.1, row 8) also provides useful reference information and guidance.



4. Tools to Assess Potential Solutions and Develop an Action Plan (Step 2)

Step 2: Assess potential solutions and develop a specific plan of action, with targets.

2a. Identify priorities and goals as part of an overarching strategy

- What are the main sources and causes of plastic pollution that need to be tackled?
- What are the high-level goals which will guide the development of the action plan (for example reduce consumption of specific problematic products or reduce mismanaged plastic waste)?
- How will stakeholders be engaged to identify priorities and set goals?

Key tools: Hotspotting tool (module S1 – Actionable hotspots formulation)

Useful resources: GPML Digital Platform

2b. Compare different potential actions

- What different potential actions need to be assessed as part of the options analysis process? For example:
  - Banning specific problematic items (For example specific single use items that are commonly found in marine litter),
  - Applying economic incentives to reduce consumption (For example a fee on single use plastic bags),

- Improving services and infrastructure (For example improving waste management, developing recycling infrastructure, or implementing refill and reuse systems)
- Raising public awareness and promoting behavior change (For example communication campaigns and education initiatives)
- Partnering with business to develop circular plastics business models.

- What different metrics need to be used to compare actions? For example:
  - Plastic leakage
  - Environmental impacts (For example GHG emissions, and/or other lifecycle impacts).
  - Social impacts such as the effect on jobs and vulnerable communities
  - Financial costs (For example capital investment needs and operational costs)

Key tools: Hotspotting, NAM, PPS, Pathways, Plastic Drawdown, Plastic Substitution Tradeoff Estimator (PTSE)

Useful resources: Plastic Treaty Futures tool, Global Plastics AI Policy Tool

2c. Define an action plan and set appropriate targets

- Are the actions clear and deliverable?
- Are the targets specific, measurable, action-focused, relevant and time-bound?

Key tools: Hotspotting tool (module S1 – Actionable hotspots formulation)

Useful resources: GPML Digital Platform

There are several tools available to help with the process of assessing different potential solutions and developing a plan of action, including the Hotspotting tool, National Analysis and Modelling Tool (NAM), Plastic Policy Simulator (PPS), Plastic Drawdown, and Pathways. These tools have been developed specifically to allow different potential actions to be explored and compared, using a range of different criteria, such as plastic pollution reduction potentials, costs, and greenhouse gas (GHG) emissions reduction potentials. For example, these tools allow a practitioner to consider what would happen if consumption rates were reduced or if waste management flows were changed by recycling more materials, for instance. Comparing potential actions in this way provides a systematic, evidence-based basis for developing a strategy to tackle plastic pollution.

The process is typically undertaken iteratively and involves several steps: (1) Identifying priority areas and setting goals as part of an overarching strategy; (2) Conducting a detailed comparison of potential actions; and (3) Concluding with an agreed action plan with defined targets. This three-step process is intended to help structure the discussion of tools presented below. It is not intended as prescriptive guidance and should not be considered as a series of tasks that necessarily need to be done sequentially.

The tools identified in this report can be used to support this process, but it is also important to recognize that they are just a means to undertake an assessment of options in a systematic, evidence-based way. Importantly, the options analysis needs to be undertaken collaboratively. All key stakeholders need to be engaged to help develop a common understanding of the problem, explore potential solutions together, and build buy-in to the strategy.

Identifying Priorities and Goals as Part of an Overarching Strategy

The baseline analysis identifies the key sources, pathways, and causes of plastic pollution —or 'hotspots'—in the country and, therefore, provides a useful basis to discuss priority areas for action and identify overarching goals. For example, if a baseline analysis indicates that the escape of uncollected municipal waste into the environment is a key pathway for plastic pollution, then improving waste and resource management may be a key priority. If a baseline indicates that littering of certain types of single-use items is a key component of plastic pollution then actions to specifically tackle these items are likely to be a priority. The baseline modelling should also indicate what level of reduction may be possible and allow strategic targets to be established. The Hotspotting tool (module S1 – Actionable hotspots formulation) provides a framework that has been specifically developed to engage stakeholders to help identify key priority areas by considering 'hotspots'.

At this stage of the process, goals need to be defined in high-level terms as part of an overarching strategy—detailed analysis is required to understand what targets are realistically achievable in terms of quantitative reductions over time associated with specific actions. Examples of goals could include overall plastic pollution reductions or reduction in consumption and waste generation from specific groups of problematic items. The overall outcome of this activity should be a high-level strategy comprising a clear list of priority action areas to assess in detail and an overall goal (or goals) for reducing plastic pollution.

This stage is also an excellent opportunity to engage with stakeholders to build buy-in to the strategy and to develop joint ambition for action.

Comparing Various Potential Actions

There are several tools specifically designed to help with conducting a detailed, like-for-like comparison of the different specific actions, including the Hotspotting tool (table B.1, row 1), NAM (table B.1, row 4), PPS (table B.1, row 8), Plastic Drawdown (table B.1, row 7), and Pathways (table B.1, row 5). The actions that can be modelled by these tools vary in number and type, ranging from fairly high-level actions, such as 'increase recycling' to very specific ones, for example, implementing a ban on single-use plastic bags. For example, the PPS tool identifies 24 specific actions, categorized into five groups (taxes and fees, public financing, bans and standards, behavioral change, and governance). The Plastic Drawdown tool includes an initial 18 policies but can be adapted to allow additional policies to be added. The Hotspotting tool includes a library of 82 specific actions that can be assessed qualitatively or used as a basis for developing quantitative assessments by drawing on other tools and methods. Table 4.1 provides some examples of actions that various tools can be used to assess. Additional details of the actions modelled by each tool are presented in appendix B.

Normally, the process of comparing different specific actions commences with a short-listing process whereby different potential actions are considered in the context of the priorities identified in the overarching strategy (see section 4.1). This ensures that the detailed process of comparing options is conducted on the most appropriate types of actions available to meet the overarching goals.

Note that in assessing different potential actions, particularly regulatory actions, it is important to consider the details of the draft Plastic Treaty. Some regulations may be defined at the national level, while others may form part of the core obligations of the draft Plastic Treaty.

Table 4.1 Examples of actions used in selected tools, grouped by life cycle stage and by type of action

Life cycle stage*	Regulation and enforcement	Market incentive	Services and infrastructure	Communication and education	Private sector
Upstream (plastic production and conversion/ manufacturing)	• Production restrictions/ bans[1] • Mandatory product design requirements[1] • Reduction of plastic waste (e.g., plastic bag regulations)[2]	• Plastics excise tax[1]	• Substitution of plastics with alternative materials[1,2] • Design for reuse[3]	• Reduction of demand for single-use plastic products	• Reduction of plastic waste (e.g., reduction of headspace)[2] • Increased compliance with Operation Clean Sweep standards to address pellet leakage[3]
Midstream (plastic distribution and consumption)	• Plastic labelling[1]	• Deposit refund scheme[1]	• Reuse systems[1,2] • New delivery models[2]	• Consumer education campaigns[1]	
Downstream (plastic waste generation, disposal, and movement in the environment)	• Reduction in plastic waste imports[1]	• Household fees[1]	• Increase frequency of waste collection in areas prone to plastic leakage[3] • Improvement in on-the-go waste collection[4] • Introduce track-and-trace for fishing gear to enable lost gear to be recovered[4] • Increase share of treated wastewater[3,4]	• Reduce littering[3] • Clean beaches and/or polluted areas[3]	
Cross-cutting (affects more than one part of the life cycle)	• Extended Producer Responsibility[1] • Improvements in governance[1]		• Mechanical recycling[1] • Chemical recycling[1]		

Source: World Bank.

Note: Numbering refers to tool:

1. World Bank PPS tool

2. GPAP NAM tool

3. UNEP/IUCN Hotspotting tool

4. Common Seas Plastic Drawdown tool.

**Life cycle stage is based on the zero draft of the Plastic Treaty (annex X, p.69, UNEP 2023b).*

In assessing options, it is important to consider the trade-offs between various potential actions so that the benefits and impacts associated with change can be considered holistically. Comparing options is a complex process that requires careful consideration of a range of aspects including the financial costs and benefits of various solutions, the impacts of different solutions on various groups of stakeholders and communities, and the wider environmental and social impacts of a range of potential actions. Almost all potential solutions are likely to be associated with both positive and negative impacts, (for example, financial costs, GHG emissions associated with the production of alternative materials or impacts on particular communities or businesses). It is important to identify and assess these different impacts so that various options can be considered properly. For example, a specific intervention such as banning single-use plastic sachets or bags may significantly reduce plastics pollution; however, it also needs to be considered in terms of potential impacts, such as on poorer communities that rely on these items and on businesses that produce and distribute these products. Understanding potential impacts holistically enables informed policy making and also allows complementary measures to be implemented to address or alleviate negative consequences.

Analysis of impacts is often iterative in nature as actions are defined and then explored and assessed in more detail. Combinations of different actions also need to be evaluated to compare their combined effects. Furthermore, it is important to consider the effects of different actions over time, as they may have varying implementation timescales and some actions may need to precede others. For example, introducing a ban on specific single-use items will typically firstly require a communications campaign to raise awareness and encourage behavior change. Alternative products or delivery systems also need to be in place before the ban comes into full effect.

Assessing actions normally involves some form of options analysis that allows different potential solutions and combination of actions to be compared on a like-for-like basis, considering all relevant factors. The aspects that various tools enable practitioners to assess include:

- **Plastic leakage reduction potential** associated with different parts of the plastic flow (that is, managed plastic waste, mismanaged plastic waste, and plastic leakage into terrestrial, surface water, and marine environments as well as open burning of plastics).
- **Economic costs and benefits,** including capital and operational costs, and effects on jobs;
- **Environmental impacts**, including plastic pollution and GHG emissions; and
- **Social impacts**, including effects on disadvantaged or marginalized groups.

Various tools employ different sets of metrics to facilitate the comparison of options (see appendix B). Some tools focus on plastic flows, allowing analysis of how leakage from different parts of the system changes in response to varying actions. Other tools use a larger range of metrics to assess the impacts, including financial costs, environmental impacts, and social indicators.

By way of illustration, the PPS quantifies the impacts of alternative mixes of actions in terms of several different groups of metrics: environmental, social, fiscal, and financial. This allows the tool to be used to compare actions in terms of plastic waste management or leakage, overall systems costs and their distribution in terms of costs to householders, government budgets, and along various parts of the value chain (for example, converters, brands and retailers, recyclers and aggregators), direct employment, and GHG emissions. In this way, the tool allows the trade-off between potential groups of actions to tackle plastics pollution to be compared across a range of factors.

For example, the PPS tool was applied in Indonesia to compare three scenarios: one based on a continuation of existing policies, a second based on increasing collection and sorting of plastic waste through public subsidies, and a third scenario based on a combination of upstream policies to reduce plastic consumption and promote circular flows along with downstream measures to improve collection and recycling. The analysis illustrated how the three scenarios compared using the metrics above and indicated that the combination of upstream and downstream measures could potentially reduce plastic leakage by 70 percent, at a total system cost of US$2.1 billion per year. This scenario also had a much lower impact on fiscal budgets compared to a scenario focused solely on downstream measures. The combined policies scenario also reduced GHG emissions and increased employment (World Bank 2022).

The NAM and Pathways tools also allow actions to be compared in terms of a range of metrics: plastic leakage, costs, GHG emissions, jobs, revenues, and gender. Other tools allow users to assess various actions in terms of their potential to reduce plastic pollution in different parts of the plastic flow over time, but need to be supplemented by other methodologies or bespoke studies to consider the economic and social impacts and wider environmental impacts, such as GHG emissions. See appendix B for more details.

Life cycle assessment (LCA) is particularly important in the context of options assessments as it allows a holistic assessment of the different environmental impacts and trade-offs associated with various options. For example, replacing single-use plastics with alternative materials may be successful in reducing plastic consumption and waste, but it could also have unintended consequences by creating negative impacts associated with the production or consumption of other materials. For this reason, it is important to apply LCA concepts when considering solutions to understand the full impacts and benefits associated with all stages of the product life cycle. There are many generic LCA methodologies and tools and their application requires specialist work. Life cycle assessment has its limitations, so outputs need to be considered carefully, with full appreciation of the boundaries of the analysis and the uncertainties associated with the outputs. The UNEP Life Cycle Initiative provides some useful information sources on LCA.

In the context of plastic pollution, there is a specific tool that has been developed for this type of options assessment: the World Bank's Plastic Substitution Tradeoff Estimator (PSTE, table B.1, row 9)**.** The PSTE tool uses an LCA approach to allow comparisons of different plastic products and their potential alternatives. For example, the tool can be

used to assess the potential impacts and benefits associated with replacing single-use plastic beverage containers with refillable alternatives or replacing disposable diapers with reusable alternatives.

The PSTE tool allows ten different plastic products and their alternatives to be assessed: fishing nets, beverage bottles, beverage cups and food containers, shopping bags, disposable utensils, food wrappers, sachets, beverage cartons, clothing, and diapers. The tool provides quantitative outputs in terms of standard LCA indicators (for example, climate change, freshwater eutrophication, particulate matter, and so on). Where possible, impacts and benefits are monetized by conversion into external economic costs in US dollars using values available in literature. The tool also provides qualitative outputs for some impacts that cannot be quantitatively assessed (for example, litter).

The Hotspotting tool also provides a qualitative framework for assessing the potential for unintended consequences associated with alternative materials.

Defining an Action Plan and Setting Appropriate Targets

Once options have been assessed and compared on a like-for-like basis, a coherent strategy needs to be developed bringing together the prioritized options into a coherent, time-bound plan. Assessing and prioritizing potential solutions for inclusion in the action plan typically involves a stage of stakeholder engagement, often via a workshopping phase. The Hotspotting tool is one example of a tool that highlights how to use stakeholder engagement as part of the action-planning process.

A strategy needs some clearly identified targets that set an ambition for the actions and the plan and provide a basis for progress to be monitored. These targets should link to the specific solutions being implemented. Obligations under international, national, and regional agreements may also need to be considered and integrated into the strategic targets for the action plan. The Hotspotting tool and the GPML Digital Platform (table C.1, row 7) provide useful frameworks to facilitate stakeholder engagement in setting targets.

5. Tools to Determine Financial Needs (Step 3)

Step 3: Determine financial needs and investment plans for implementing the action plan.

- What are the investment and operational financing needs in different parts of the plastics value chain?
- What are the existing and potential sources of finance?
- Are there opportunities to unlock or de-risk investment?

Key tools: PlastInvest

Useful resources: Circularity Tracker, Diving Deep: Finance, Ocean Pollution and Coastal Resilience, Private Participation Infrastructure Database, Unlocking the Plastics Circular Economy: Case Studies on Investment

Identifying the need for, and sources of, finance for plastic action is a critical element for successful action plan implementation. An action plan will not be successful if its various components are not financially implementable as well as sustainable. Actions targeted at service and infrastructure improvements, such as improved waste management and recycling, are likely to require substantial capital investment and also need clear and sustainable sources of operational finance. Other interventions, such as regulatory interventions targeting specific avoidable or problematic plastics products, will have different requirements and impacts in terms of financing, but they will still require careful consideration. The needs in different parts of the plastics value chain need to be considered, as will existing and potential sources of finance, including public, commercial, international development, and philanthropic sources. Opportunities to unlock or de-risk investments and drive a transition to a more circular plastics economy also need to be explored.

Sources of finance are likely to include:[8]

- Government revenues
- Public-private partnerships
- Development finance
- Commercial bank finance
- Private finance
- Direct fees
- Extended Producer Responsibility (EPR)
- Revenues from recyclable materials.

The PlastInvest tool is the only tool identified by this review as directly relevant to this step of the action-planning process. The PlastInvest tool (table B.1, row 6), developed by World Bank and SystemIQ, allows analysis of the scale and the nature of investment needed. The tool enables the finance needs for different potential actions (for example, improving waste collection or implementing reuse systems) to be assessed quantitatively, using data outputs from the options assessment tools NAM or PPS. The tool's open access knowledge base also provides qualitative information on investment demand and supply, covering issues such as perceived risk and return potential.

There is also a range of other useful resources available that can help inform this step of the action-planning process. For example:

- Diving Deep: Finance, Ocean Pollution and Costal Resilience (table C.1, row 2), UNEP (2022);
- Financing Circular Economy – Insights for Practitioners (table C.1, row 3), GIZ (2022); and
- Investing to reduce plastic pollution in South & Southeast Asia: A Handbook for Action (table C.1, row 9), Circulate Capital (2019).

Circulate Initiative's Circularity Tracker provides information on investments that have been made on plastics circularity. This database (table C.1, row 1) can be searched by country and, therefore, can provide useful contextual information. The World Bank's Private Participation Infrastructure Database (table C.1, row 14) provides information on investments that have been made in downstream actions, specifically waste collection, treatment, and disposal infrastructure.

There are also several examples of financing plans developed by the Global Plastic Action Partnership (GPAP) that can serve as useful sources of inspiration and information on this issue, such as:

- Unlocking the Plastics Circular Economy: Case Studies on Investment (table C.1, row 21), GPAP (2022);
- Financing System Change to Radically Reduce Plastic Pollution in Indonesia (table C.1, row 4), GPAP (2020); and

8 Ellen McArthur Foundation 2018; GIZ 2022.

- NPAP Ghana Financing Roadmap (table C.1, row 13), GPAP (2022).

The GPML also provides numerous case studies and financing-related resources on its Digital Platform (table C.1, row 7).

6. Tools to Implement Actions and Monitor Impacts (Step 4)

Step 4: Implement actions and monitor and evaluate impact.

- What institutional structures and governance arrangements are needed to successfully implement the action plan?
- Is there clear accountability for delivering each component of the action plan?
- How will the necessary enabling environment for the action plan be created using appropriate policies and investment?
- How will monitoring and evaluation of the action plan be conducted?
- Is there a clear process for periodically reviewing and up-dating the action plan?

Key tools Hotspotting tool, Plastic Drawdown

Useful resources GPML's Digital Platform, Marine Litter and Plastic Pollution Legal Toolkit, Plastic Smart Guides for Cities

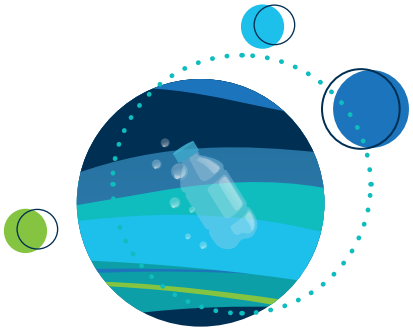
Effective implementation of an action plan requires institutional and governance arrangements that ensure ownership and accountability. It is important, therefore, to establish the necessary institutional structures and define clear responsibilities for overseeing a plan and implementing its identified components, including planning, operations, financing, and regulation. In many contexts, institutions and clear governance arrangements are either absent or, even where they are established, the capacity to deliver on their responsibilities is often too low. For instance, insufficient resources to enforce regulations relating to product bans or littering often results in the legislation being ineffective.

There are two tools that can assist with the monitoring and evaluation elements of the implementation phase: the Hotspotting and Plastic Drawdown tools. However, there are currently no specific tools available that can assist with other elements of the implementation step, such as policy design or institutional development. Often, putting the plan into action is the most challenging step, as it requires mobiliziling resources, drafting appropriate legislation, and ensuring effective enforcement. The development of additional tools to assist with implementation would maximize the effectiveness and success of action plans to tackle plastics pollution. For example, the World Bank is developing the Extended Producer Responsibility (EPR) Implementation Readiness Assessment Tool (IRAT) to help governments assess readiness for implementation of EPR.

However, there are several key sources of information and case studies to assist in implementation of action plans. GPML Digital Platform provides numerous case study examples of successful action plans and provide examples of monitoring and evaluation (M&E) approaches. Existing action plans also highlight potential national governance arrangements for plastic pollution. For example, the World Bank's *Towards a Multisectoral Action Plan for Sustainable Plastics Management In Bangladesh* (2021) sets out an integrated approach for tackling plastic pollution over the short, medium, and long terms. Resources available to support each key element of the implementation stage are discussed below.

The necessary enabling environment to implement an action plan needs to be created with evidence-based policies and legislation. One key aspect of implementing an action plan is likely to include implementing new legislation and regulatory frameworks. The UNEP Marine Litter and Plastic Pollution Legal Toolkit (table C.1, row 11) is a key resource for developing and implementing legislation in the context of plastic pollution. See section 3.2 for other resources that provide useful case studies on legislative and policy frameworks.

Establishing a clear M&E framework is essential to track the implementation of an action plan against the targets (defined in step 2), providing a basis for continual improvement. The M&E framework and its indicators depend on the specific targets set during the action-planning process. The Hotspotting Tool can be used to develop approiopriate Key Performance Indicators as part on an M&E framework. For some indicators, it may be necessary to apply the tools used in the baselining process to reassess progress achieved in terms of reduction of plastic pollution leakage or consumption of specific items. The Plastic Drawdown tool has been specifically developed to undertake M&E of action plan implementation. Collection of primary data may also be necessary through, for example, waste composition studies or surveys. The M&E process also serves as a basis for reevaluating and refining the overall strategy, if appropriate. Some of the tools used in step 2 (assessing potential solutions) may be useful to help review the mix of policies and actions being applied. In terms of wider guidance, the WWF's Plastic Smart Cities Framework (table C.1, row 12) provides a basis for developing an M&E framework for action plan implementation.



7. Conclusions

Considerations for Selecting Tools and Resources

Various factors need to be considered in developing an approach and selecting tools for planning action to tackle plastic pollution, depending upon capacities, timescales, and local contexts and priorities. In this chapter, the focus is on the key considerations in terms of four fundamental questions:

Action-planning stage

What stage of the action planning process is the government seeking to conduct?

Technical capacity and data availability

What level of technical capacity is available to conduct the process and what data is available?

Key factors

What are the priorities in terms of:

- Material scope and granularity?
- Sectors and sources covered?
- Metrics for comparing potential solutions?

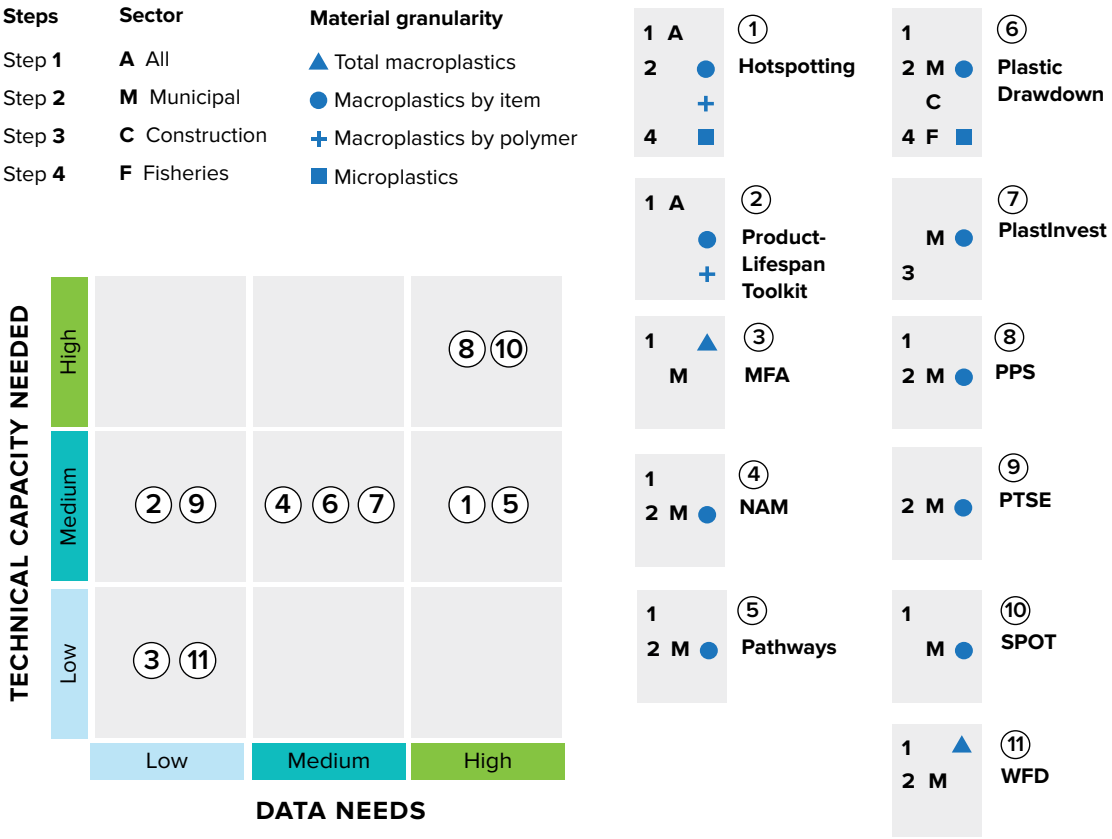
Additional considerations

What other factors need to be considered, including:

- Life cycle stages?
- Temporal factors/ forecasting capability?
- Geographic granularity and scope?
- Archetypes?

Each of these key aspects is discussed in the following sections. Figure 7.1 illustrates each of the selected tools in terms of their key characteristics: action planning step, technical capacity needed, data needs, sectors covered, and material scope. Please note that the factors described are presented in qualitative terms and for illustrative purposes. Appendix B provides more information on each tool.

Figure 7.1 Schematic illustration of the characteristics of key selected tools



Action Planning Stage

There is no single tool currently available that covers all four of the action planning steps outlined in chapter 2, so it is necessary to apply more than one tool or methodology to conduct the full action-planning process. Many of the available tools focus on the baselining stage of the action planning process (step 1). If the intention is to conduct an assessment of different potential actions, then it will be important to identify a tool that is suitable for this activity (step 2). There is currently one tool—PlastInvest (table B.1, row 6)—available for conducting an assessment of financing needs (step 3), and, similarly, two tools that have been developed to enable monitoring and evaluation (The Hotspotting tool, Table B.1, row 1 and Plastic Drawdown, table B.1, row 7). Figure 7.1 illustrates which tools can be utilized at each step of the action planning process.

Technical Capacity and Data Availability

The capacity and data available to undertake action planning (for example, data collection, project coordination, analysis, and decision making) will determine the approach to be used in developing a plan. There are three key issues to consider here: first, is the tool open source? Second, what level of technical capacity and expertise is needed to use the tool? Third, what data is needed to apply the tool? Careful consideration needs to be given to how the overall action process will be delivered, who will deliver it, and the tools and methods that will be needed at each stage. For instance, is the intention to commission an external expert to conduct the whole process or will it be divided into different steps to be conducted by various staff and/or external organizations? Are there existing studies that have been conducted or work being conducted by partners that can form elements of the action-planning process (for example, waste composition analyses or policy work on specific items)? The Hotspotting tool (table B.1, row 1) provides some further guidance on planning the overall process, particularly steps 1 and 2 (available in the appendixes of the Hotspotting guidance (UNEP 2020)).

Some tools are potentially accessible and usable by government staff or their partners (for example, the Hotspotting tool is publicly available and is accompanied by training modules meant to assist technical personnel in learning how to apply the various modules). However, it is necessary to build capacity and invest in training in order to use these tools.

Other tools require experts to be commissioned to undertake the necessary analysis, particularly if the tool is not publicly available or requires specialist expertise. Several of the tools detailed below have been developed by organizations that have the capacity to undertake detailed studies on behalf of national governments (for example, GPAP, UNEP, IUCN, and Common Seas). Clearly, this provides benefits in terms of being able to access the expertise of the developers themselves who know the strengths and weaknesses of the tool, know how to overcome any limitations, and also have access to relevant data that can be used in the absence of locally available information.

Tools vary in terms of the technical expertise needed to use them and the data needed to apply them. Several tools are open source, Excel-based tools that have been designed for use by a practitioner familiar with the issues of plastics pollution and mass flow modelling (for example, Hotspotting, Material Flow Analysis (MFA, table B.1, row 3), and Product-Lifespan (table B.1, row 2) tools). Others require some specialist expertise to operate, such as the Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) tool (table B.1, row 10), which is based in R and geographic information system (GIS) software.

Data needs also vary considerably between tools. Some have been designed to be used with limited data. For example, the Common Seas' Plastic Drawdown tool is a 'rapid assessment' tool that aims to minimize the level of data inputs needed. Similarly, the MFA tool has been designed to be reliant upon a limited input dataset. Others require much more detailed data to compile the baseline. For example, the SPOT tool requires municipal-level data to develop a baseline. Figure 7.1 provides a simple, qualitative indication of the level of technical expertise and the data needed to operate each tool.

Other Key Factors to Consider

Material scope and granularity. The granularity of analysis needed in terms of types of plastics and plastic products needs to be considered. Are there specific items or products that are of concern in a specific country (for example, disposable plastic sachets or multi-laminate plastic products)? If so, then it is important to apply the tools that allow this level of granularity to be assessed so that the costs and benefits of focused policies and interventions can be analyzed. Some tools focus solely on macroplastics, while some allow analysis of various polymers (for example, PET, HDPE, PVC, and PP). Others consider items (for example, single-use plastic bags and single-use bottles) and/or groups of products (for example, rigid plastics and flexible plastic packaging). Some tools also consider primary microplastic pollution (that is, particles of less than 5 mm in size, such as particulates from tire wear). None of the tools identified in this report consider secondary microplastics (that is, microplastics released from the degradation of macroplastics in the environment). There are some studies that assess secondary microplastics, but the scientific understanding of these process is nascent; consequently, this aspect is not typically integrated into the types of tools discussed in this report.

Scope. Different economic sectors are relevant in different countries. Plastic consumed and plastic waste generated by municipal sources are important to consider in all contexts. Municipal waste generally includes the majority of macroplastic items which comprise marine litter (Lau et al. 2020). However, other key economic sectors have an important bearing on the process and the tools that need to be used for action planning and vary by country (for example, tourism, agriculture, fisheries and aquaculture, primary plastic production, and so on). Some tools focus solely on plastic waste from municipal sources (such as households and commercial and institutional establishments). Other tools have the capacity to assess other types and sources of plastic waste such as from agriculture, fisheries, and construction. The Plastics Drawdown tool, for example, includes an assessment of abandoned or lost fishing gear (also known as 'ghost gear') and plastics used in the construction sector. The Hotspotting tool includes a specific module to allow a wide range of different industrial use sectors to be considered and assessed (for example, packaging, automotive and transportation, construction, textiles, and tourism).

Metrics used to compare actions. All tools discussed in this report provide outputs in terms of a set of metrics related to plastic flows. This typically includes quantitative information on several key parts of the flow: mismanaged plastic waste, plastic waste management, and plastic waste leakage, with the latter often divided into different metrics for leakage pathways. These are key metrics for the baselining process (step 1) and are also important in terms of allowing the effects of various actions to be compared (step 2). However, some tools also provide outputs of other metrics, particularly where they are used to compare actions (for example, operational and capital costs of various solutions or impacts on livelihoods). The Plastic Policy Simulator (PPS, table B.1, row 8) and National Analysis and Modelling (NAM, table B.1, row 4) tools, for example, provide outputs on costs and livelihoods. It is important to carefully consider the output metrics to ensure that they align with country priorities and allow for an appropriate comparison of options under step 2. Clearly, tools that do not provide the necessary outputs can be supplemented with additional studies to assess other important metrics.

Additional Considerations

The previous sections in this chapter outline the key considerations for selecting tools for each step in the action planning process, summarized in figure 7.1. However, several other issues should be considered when selecting appropriate tools:

- **Life cycle stages:** Some models focus on analyzing plastic waste generated at the end-of-life and others on the upstream components of the life cycle (that is, production, manufacturing, and consumption stages). Which tool to select depends on data availability and the priorities within a country. For example, mismanagement of plastic waste may be a key priority to address, in which case a tool that enables a detailed understanding of this part of the life cycle would be useful.

- **Forecasting capability:** Some form of forecasting impacts over time is essential for action planning. Understanding how the problem and the impacts of potential interventions will evolve over time allows for the prioritization of appropriate actions. Some tools are based on a single year of assessment, providing data for one year for which data is available. These tools provide a detailed understanding of the baseline situation, but they need to be supplemented by other methods to allow future impacts to be understood. Other tools use growth factors and other data to forecast plastic pollution and policy impacts over time (for example, NAM).

- **Geographic granularity:** Is it important to capture the differences in regions and areas, such as large cities, secondary cities, rural areas, and remote areas. The geographical scope of different tools varies: some are designed to be applied at the national level, but others are global, regional, or municipal-level tools. Some tools also use GIS methods to collect and process data on plastic pollution. The greater the level of granularity, the more data inputs are typically required. A GIS-based approach is particularly data hungry. Most toolkits use different archetypes to assess plastic pollution issues so differences in various parts of the country can be captured and assessed. It is best to align the archetypes used to the types of statistical information routinely collected in a specific country so as to reduce the need to collect lots of additional data.

- **Islands**: Either as islands forming part of a territory or as independent Small Island Developing States (SIDS), islands are particularly important given the acute nature of plastic pollution impacts on island economies and the challenges in terms of economies of scale for implementing solutions. Some tools have been designed specifically for this context and/or have demonstrated track records of being applied to islands (for example, the GPAP NAM was used for the Indonesian archipelago and the Common Seas Plastic Drawdown tool for the Greek islands, the Maldives, Barbados, and Grenada).

- **Engaging stakeholders forms a key element throughout the action-planning process.** With respect to tools, the analysis process serves to engage stakeholders in the process by involving them in the data collection, analysis, and action prioritization process. Some of the tools considered in this report have characteristics that lend themselves well to this

type of engagement as they have clear steps for stakeholder involvement (for instance, GPML Workflow tool [table C.1, row 7] and the Hotspotting tool) and/or have easily accessible outputs that can be used to communicate analysis to stakeholders (for example, Drawdown and PPS).

- **Considering where tools have been implemented to date can help identify whether a tool is appropriate for a specific context.** Firstly, tools that have been tried and tested represent a ready and presumably reliable resource to support action planning. However, there are numerous tools under development so it is important not to disregard new tools. Newer tools may have refined the process and also provide a unique approach that addresses some of the challenges and limitations encountered by other tools and methods. Secondly, tools that have been previously applied in similar contexts are likely to have access to data that are more relevant and also to have been tailored to particular contexts. In this sense, it is useful to consider where tools have been applied to date.

Future Considerations

This report presents a review of tools and related resources available to support action planning to tackle plastic pollution. The information presented in this report is intended to be helpful, rather than to provide prescriptive guidance. It does not include an exhaustive list of tools, and it is important to note that new tools are being developed and existing tools are being evolved and improved. This report should, thus, be viewed as a starting point for practitioners and decision makers to understand the types and ranges of available tools and to select those that are appropriate and suitable for their needs and explore those in more detail. Readers will also find the GPML Digital Platform (table C.1, row 7) a useful general resource for the steps needed and for providing supporting information sources.

It is Important to reiterate that there Is no one-size-fits-all process to undertaking action planning. Similarly, no single tool supports the whole of the action-planning process. All tools have certain limitations, making it important to apply various tools and resources at different stages. It is also possible to use a particular tool in conjunction with supplementary approaches (for example, conducting waste composition analysis, separate cost analysis, or combining the detailed baseline assessment outputs from one model with a separate approach for assessing different actions and policy options).

This review has identified a number of factors that could further improve the tools and resources that are available:

- **More tools and resources are needed to assist with steps 3 (assessing investment needs) and 4 (implementing actions and monitoring impacts),** in contrast to steps 1 and 2 where several tools and examples of methods and completed studies already exist. More work is needed to develop the resources and tools that could help decision makers and practitioners assess and identify sources of financing and implement and monitor actions. Note that the World Bank and Systemiq are developing the PlastInvest tool, which will

help users assess financing needs for plastic pollution interventions. A tool to help assess readiness for Extended Producer Responsibility (EPR), the EPR Implementation Readiness Assessment Tool (IRAT), is also soon to be released by the World Bank.

- **Readily available and accurate input data are needed to deploy tools effectively.** Analysis conducted by the GPML Community of Practice on Monitoring and Modeling Methodology Harmonization (Global Partnership on Plastics Pollution and Marine Litter 2023) found significant discrepancies and variation in data inputs used in different studies, particularly in terms of data on plastic waste composition and waste generation rates. Divergence was as much as 60 percent in some cases, and some of the key datasets used in conducting studies are becoming increasingly out of date. Work needs to be ongoing in terms of collecting, sharing, and harmonizing the data needed to conduct robust analyses (for example, plastic waste composition and generation, plastic production and consumption data, and so on). An inventory and repository of existing data sources could be particularly useful in helping initial assessment work to be conducted at the country level.

- **Harmonizing data inputs and outputs, including typologies and definitions, helps maximize the value of existing data and studies and allows experiences and learnings to be shared.** Another GPML Community of Practice study (Global Partnership on Plastics Pollution and Marine Litter 2024) highlights the differences and inconsistencies in the ways that different terms are applied. For example, the terms 'mismanaged', 'unmanaged', and 'improperly disposed waste' are used differently across various tools, leading to confusion and a lack of comparability. Harmonizing these terms would ensure that outputs are communicated clearly and would also help with the interoperability of tools. This would be particularly useful when several tools are used together as part of an action-planning process. The work of the GPML in developing its knowledge platform and the efforts of the three GPML-convened Communities of Practice are key here:

    1. Monitoring and Modeling Methodology Harmonization;
    2. Harmonization of approaches for informing and enabling action on plastic pollution and marine litter; and
    3. Data harmonization.

- **More information is needed on the effectiveness/impacts of various actions for tackling plastic pollution.** The tools designed for step 2 (assessing potential actions) require robust data on the impacts and interactions of different actions. Some resources do provide some information on the effectiveness of different policy interventions (for example, the Plastics Policy Effectiveness Study Library and the Global Plastic Policy Reviews, table C.1, row 16) but much more detailed, quantitative and harmonized information is needed to allow the potential impact of different policies to be analyzed and compared as part of an action planning process.

- **Tools need to be developed to allow assessment of the wider impacts of the plastic life cycle.** Existing tools assess plastic leakage, and many also quantify associated positive and negative impacts, and such as financial costs and greenhouse gas (GHG) emissions. However, there is limited consideration of the wider human health and ecosystem impacts

associated with the release of — and exposure to — plastic polymers and additives at all stages of the plastic life cycle. For example, it is important to assess the impacts of potentially harmful polymers and additives during the production, distribution, and use of plastic products. The movement and impacts of primary and secondary microplastics also need to be better understood and considered, and tools are needed to allow these impacts to be quantified and potential interventions assessed. Furthermore, the potential options and efficacy of tackling legacy plastics (that is, those already released into the environment) also needs to be considered as part of future tool development.

- **Tools would benefit from incorporating some additional metrics to capture wider issues associated with plastic pollution action planning** including the impact of different actions on vulnerable communities, livelihoods, and levels of plastic circularity achieved by different actions.

- **It is essential to build capacity and technical expertise** among practitioners, both in national governments, particularly in low- and middle-income countries, and among the organizations supporting governments on these issues. An active community of practitioners will drive innovations and effectiveness in this space.

- **Tools are likely to be needed to allow assessment of the wider impacts of plastics across the life cycle.** The focus of the key tools featured in this report is primarily on plastic pollution (that is, leakage of plastics into the environment). However, there are wider potential impacts associated with the plastic life cycle such as exposure to chemicals and polymers of concern during the production or use phases, an issue that has been explicitly identified in the draft Plastic Treaty. Work is needed to better understand these wider impacts and to develop the tools necessary to allow evidence-based decision on actions that could mitigate them.

Maintaining a diversity of tools is likely to be an important factor in ensuring that there is a range of options for practitioners, recognizing that different contexts require different analyses and have different needs. A lively sector of innovative developers and practitioners should provide — and continue to enhance — the range and quality of resources available. These resources will be essential in the coming years to help make effective, evidence-based decisions in tackling plastic pollution.

The global details of the draft Plastic Treaty, which is currently being negotiated, will influence how these tools are utilized. It is intended that this report will be updated as negotiations progress and the specific obligations of the treaty, particularly concerning action planning, become clearer.

Appendix A. Methodology to Review Relevant Tools to Develop Plastic Management Strategies

This appendix outlines the systematic review process undertaken to (1) identify, (2) screen, and (3) review relevant tools for this report.

1. **Identify** potential tools for inclusion based on three main sources:
   - An online search was conducted using combinations of various search terms. The search was kept relatively narrow to focus results on tools and toolkits rather than the much wider literature on plastics and plastic pollution. Academic studies were excluded unless it was clear that they included a tool element. The search terms included plastic, management, tool, toolkit, pollution, action planning, assessment, and life cycle.
   - Two online knowledge portals relevant to the subject matter: GPML Digital Platform (table C.1, row 7) and Plastiverse (table C.1, row 19); and
   - Project partners (UNEP, GPAP, IUCN, and WWF) were consulted to provide information on tools that they considered relevant and in scope.

   Results of this identification process were recorded in a spreadsheet, detailing the name of the item, its type (tool, method/study, guidance, or other), the developer or owner, and the URL.

2. **Screen.** Resources identified in step 1 were screened to identify tools for detailed review. Items were included if:
   - Its main focus is plastic management;
   - It is a tool that can be used to conduct bespoke assessment work, as opposed to a written method or one-off study; and
   - It could be used to conduct one or more parts of the action-planning process at the national level, without significant adjustment or enhancement.

3. **Review.** Tools identified for inclusion were reviewed in detail using online information and, where possible, information provided by the developer or owner. Details of these tools are provided in appendix B. The fields populated during the detailed review were:
   - Name of tool
   - Developer or owner
   - Type of tool
   - Date of development/launch
   - Action planning step(s) (see chapter 2)
   - Technical capacity needed (Low, medium, or high)
   - Life cycle stages (Upstream or downstream)
   - Data requirements (Low, medium, or high)
   - Sectors covered
   - Examples of implementation to date
   - Material granularity
   - Assessment of different actions.

Appendix B. Selection of Tools Available for Plastic Pollution Action Planning

This appendix presents details of a selection of tools that have been designed to undertake one or more of the action planning steps at the national level, with limited adjustment or supplementary analysis. A summary of key tool characteristics is presented in table B.1. Further details of each of the selected tools are presented in the remainder of appendix B (in alphabetical order, according to the shortened name used to describe each tool). See appendix C for summary of other resources identified that are available to support these steps. Please note that this is not an exhaustive list of tools and resources.

Table B.1 Summary of key characteristics for selected tools

No.	Tool	Action Planning Step				Technical capacity needed	Data needs	Open source?	Material granularity	Scope (sources/ sectors)	Types of metrics
		1	2	3	4						
1.	National Guidance for Plastic Pollution Hotspotting and Shaping Action (Hotspotting tool)	YY	YY	N	Y	Medium	High	Yes	Microplastics Macroplastics by polymer Macroplastics by groups of items	Adaptable to all industrial sectors	• Plastic production and consumption • Plastic waste generation, Plastic waste management • Mismanaged plastic waste • Plastic waste leakage
2.	Product-Lifespan Toolkit	YY	N	N	N	Medium	Low	Yes	Macroplastics by polymer Macroplastics by groups of items	Adaptable to all industrial sectors	• Plastic consumption • Plastic waste generation
3.	Toolkit for Material Flow Analysis (MFA tool)	YY	N	N	N	Low	Low	Yes	Macroplastics – total	Municipal sources	• Plastic waste management • Mismanaged plastic waste • Plastic waste leakage

No.	Tool	Action Planning Step				Technical capacity needed	Data needs	Open source?	Material granularity	Scope (sources/ sectors)	Types of metrics
		1	2	3	4						
4.	National Analysis and Modelling Tool (NAM)	Y	YY	N	N	Medium	Medium	No	Macroplastics by groups of items	Municipal sources	• Plastic consumption • Plastic waste generation, imports and exports • Plastic waste management • Mismanaged plastic waste • Plastic leakage • OPEX • CAPEX • Jobs • GHG • Gender • livelihoods supported • Circularity
5.	Breaking the Plastic Wave Pathways Tool (Pathways)	YY	YY	N	N	Medium	High	Yes	Macroplastics by groups of items	Municipal sources	• Plastic waste generation, imports and exports • Plastic waste management • Mismanaged plastic waste • Plastic leakage • OPEX • CAPEX • Jobs • GHG
6.	PlastInvest	N	N	YY	N	Medium	Medium	No	Macroplastics – selected packaging types	Municipal sources	• OPEX • CAPEX • Jobs • GHG
7.	Plastic Drawdown	YY	YY	N	Y	Medium	Medium	No	Macroplastics by groups of items Microplastics	Municipal sources Fisheries Construction	• Plastic waste generation, imports and exports • Plastic waste management • Mismanaged plastic waste • Plastic leakage

No.	Tool	Action Planning Step				Technical capacity needed	Data needs	Open source?	Material granularity	Scope (sources/ sectors)	Types of metrics
		1	2	3	4						
8.	Plastics Policy Simulator (PPS)	Y	YY	N	N	High	High	No	Macroplastics by items	Municipal sources	• Plastic waste generation, imports and exports • Plastic waste management • Mismanaged plastic waste • Plastic leakage • OPEX • CAPEX • Jobs • GHG
9.	Plastic Substitution Tradeoff Estimator (PSTE)	N	Y	N	N	Medium	Low	No	Macroplastics by items	Municipal sources	• Life cycle indicators
10.	Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) model	YY	N	N	N	High	High	No	Macroplastics by items	Municipal sources	• Plastic waste generation, imports and exports • Plastic waste management • Mismanaged plastic waste • Plastic waste leakage
11.	Waste Flow Diagram	YY	Y	N	N	Low	Low	Yes	Macroplastics - total	Municipal	• Plastic waste management • Mismanaged plastic waste • Plastic waste leakage

Key:
Action planning step:
YY = Tool developed specifically for this step and can be applied with limited modification/adjustment.
Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken).
N = Tool is not suitable for this step of the action planning process.

Technical capacity needed:
Low = Open source and suitable for someone with some subject knowledge to apply.
Medium = Open or closed source and suitable for someone with good subject knowledge to apply.
High = Closed source and suitable for a specialist only.

Data needs:
Low = Specifically designed with minimal data needs required.
Medium = Moderate data needs and/or preloaded with selected generic data.
High = Large dataset inputs needed (e.g., GIS data points required at high level of granularity).

Note: CAPEX = capital expenses, GHG = greenhouse gas, N/A = not applicable, OPEX = operating expenses.

Name	National Guidance for Plastic Pollution Hotspotting and Shaping Action (Hotspotting Tool)					
Organization	UNEP, IUCN, EA, Quantis, Life Cycle Initiative					
Publication Date	2020					
URL	https://plastichotspotting.lifecycleinitiative.org/					
Summary	The 'National Guidance for Plastic Pollution Hotspotting and Shaping Action' aims to provide a structure for the methods of identifying plastic leakage 'hotspots', finding their impacts along the entire plastic value chain, and then prioritizing actions once these hotspots are identified. The Guidance takes a holistic approach, covering major types of plastic polymers and products, as well as their leakage and impacts along the full value chain. The Guidance is action-oriented and supports users with a reproducible workflow, with a set of tools and templates for data collection, analysis, diagnosis, planning, and implementation.					
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: YY Step 3 – Investment needs: N Step 4 – Implementation and M&E: Y					
Tool characteristics						
Open source?	Yes					
Tool format/platform	The toolkit comprises several different tools, ranging from Excel-based to Python-based.					
Geographic scope	National (but adaptable to sub-national and local)					
Archetypes	User defined archetypes are recommended.					
Scope (sectors/sources)	Methodology adaptable to cover a wide range of industrial use sectors.					
Material scope	Microplastics and macroplastics Specific categories used: Polymer, Application, Sector, Waste Management, Geographic area/GIS					
Life cycle stage	Upstream, midstream, and downstream					
Forecasting capability	No					
Scenario modelling capability?	No					
Interventions	6 groups of interventions covering a large library of specific interventions across the value chain, including sustainable production, sustainable consumption lifestyles, waste collection systems, waste infrastructure, plastic recycling, and clean-up solutions. The methodology links the interventions to instruments – the actions needed to enable the intervention (e.g., specific regulations, financing, etc.)					
Stakeholder engagement capabilities	The overall methodology includes a strong emphasis on stakeholder engagement and the toolkit has a module specifically focused on action planning through engaging stakeholders (module S1 – actionable hotspots formulation).					
Application						
Technical capacity required	Medium – The toolkit is supported by tutorials that show the user how to conduct the different modules. However, considerable investment of time is required to understand and apply the toolkit. Technical specialists are likely to need to be commissioned to conduct various elements of the methodology. Tutorials and videos are available online.					
Level of data input needed	High – The toolkit comprises 6 technical and 3 strategic modules, each of which requires different types and levels of data inputs.					
Interoperability	High – The toolkit is adaptable, so can be structured to link with other studies and metrics.					
Applications to-date	8 pilots by UNEP and IUCN	8 Asia reports done for the World Bank	Latin America and Caribbean work ongoing	Mexico	Portugal Plastic Pact	Colombia
Metrics	Plastic production	Plastic consumption	Plastic cowaste generation, imports, and exports	Plastic waste management	Mismanaged plastic waste	Plastic waste leakage

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: EA = Earth Action, GIS = geographic information system, IUCN = International Union for Conservation of Nature, M&E = monitoring and evaluation, UNEP = United Nations Environment Programme.

Name	Product-Lifespan Toolkit
Organization	Basel Convention and UNITAR
Publication Date	2023
URL	https://www.basel.int/Countries/NationalReporting/Toolkitsforwasteinventory/tabid/9043/Default.aspx
Summary	The Product-Lifespan Toolkit comprises Excel-based tools that allow users to generate estimates of the quantities of different types of plastic product and polymer placed on market (POM) and generated as waste. The POM data is generated using HS Code data and the waste generated data is generated using assumptions about typically lifespans for different products.
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: N Step 3 – Investment needs: N Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	Yes
Tool format/platform	Excel
Geographic scope	National
Archetypes	N/A
Scope (sectors/sources)	All ISIC sectors
Material scope	Macroplastics by polymer Macroplastics by items *Note:* Outputs based on HS codes can be interrogated down to product and polymer-specific levels.
Life cycle stage	Upstream
Forecasting capability	No *Note:* Estimates can be generated for any historic year for which HS code data is available. Tool does not project forward.
Scenario modelling capability?	No
Interventions	N/A
Stakeholder engagement capabilities	N/A
Application	
Technical capacity required	Medium – Tool comprises two Excel sheets that require data inputs and some manipulation to operate.
Level of data input needed	Low – Data inputs available from UN Comtrade.
Interoperability	High – As the data outputs are relatively granular, they can be used as inputs for a number of other tools that could then be used to conduct additional analysis.
Applications to-date	Not known
Metrics	Plastic consumption Plastic waste generation

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: HS = Harmonized system, ISIC = International Standard Industrial Classification, M&E = monitoring and evaluation, N/A = not applicable.

Name	Toolkit for developing an inventory of plastic waste using the Material Flow Analysis methodology (MFA tool)
Organization	Basel, Stockholm and Rotterdam Convention Secretariat and Resource Futures
Publication Date	2021
URL	https://www.basel.int/Countries/NationalReporting/Toolkitsforwasteinventory/tabid/9043/Default.aspx
Summary	The toolkit consists of the inventory methodology for plastic waste and an associated Excel tool for data entry and computation of the inventory results. The methodology uses an MFA approach. The MFA allows: (1) the mapping of flows of plastic waste arising from sources of generation (e.g., householders and businesses), through the formal and informal waste management systems, and to its disposal or recovery, or leakage into the environment, (2) the assessment of the degree of 'leakage' of waste plastics from the waste management system. Understanding the points at which leakage occurs is critical for allowing targeted interventions to tackle plastic pollution.
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: N Step 3 – Investment needs: N Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	Yes
Tool format/platform	Excel
Geographic scope	National
Archetypes	Mega: Large, metropolitan urban areas Medium: smaller urban areas Small: Small towns and rural areas
Scope (sectors/sources)	Municipal sources
Material scope	Total macroplastic waste
Life cycle stage	Downstream
Forecasting capability	No
Scenario modelling capability?	No
Interventions	N/A
Stakeholder engagement capabilities	N/A
Application	
Technical capacity required	Low – Tool is open source and designed to be used by someone with some Excel skills and knowledge of the subject.
Level of data input needed	Low – Data inputs limited to waste flow modelling aspects.
Interoperability	Medium – Outputs offer some compatibility with other tools and approaches due to mass flow framework used.
Applications to-date	Ghana
Metrics	Plastic waste generation, imports, and exports Plastic waste management Mismanaged plastic waste Plastic waste leakage

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: HS = Harmonized system, M&E = monitoring and evaluation, MFA = material flow analysis, N/A = not applicable.

Name	National Analysis and Modelling Tool (NAM)			
Organization	Global Plastic Action Partnership, World Economic Forum, Systemiq			
Publication Date	2019			
URL	https://www.globalplasticaction.org/tools			
Summary	GPAP, with the support of Systemiq, developed an online analytics tool called the National Analysis and Modelling (NAM) Tool, which allows countries to establish a practical, science-based roadmap to accelerate their transition to a circular, low-carbon emissions plastic system. The tool is based on the Breaking the Plastic Wave methodology and compatible with UNEP's hot-spotting analysis. It is designed to guide national teams through the data input and analytics process to quantify the economic, environmental, and social implications of different plastic pollution pathways for the country. The rigorous, data-based approach serves as a critical foundation for aligning and rallying diverse stakeholders behind a national action roadmap to address plastic pollution.			
Action planning steps	Step 1 – Baselining: YY Step 2 – Options analysis: YY Step 3 – Investment needs: N Step 4 – Implementation and M&E: N			
Tool characteristics				
Open source?	No			
Tool format/platform	Online			
Geographic scope	National, state, and city			
Archetypes	Urban and rural			
Scope (sectors/sources)	Municipal sources			
Material scope and granularity	Macroplastics by item group: Flexible monomaterials, bottles, other rigid monomaterials, multilayer or multimaterial plastics, other household goods			
Life cycle stage	Midstream and downstream			
Forecasting capability	Yes, up to 2040			
Scenario modelling capability?	Yes			
Actions	10 actions: Reduction of plastic waste, reuse, new delivery models, substitution with alternative materials, packaging design, trade control, collection and sorting infrastructure, recycling capacity, disposal capacity, and dumpsite recovery/open burning reduction.			
Stakeholder engagement capabilities	Visual outputs facilitate useful dialogue with key stakeholders.			
Application				
Technical capacity required	Medium – Deployed by GPAP-trained practitioners/consultants with local teams to carry out data collection and stakeholder engagement to guarantee full knowledge of the territory, context, and facility discussions for feedback and approval.			
Level of data input needed	Medium – Preloaded with World Bank, Plasteax, and Breaking the Plastic Wave data.			
Interoperability	High – Aligns with Hotspotting tool			
Applications to-date	Cambodia Colombia Costa Rica Ecuador	Ghana Nigeria Pakistan Panama	Peru Philippines Vietnam Mexico City	Maharashtra State (India)
Metrics	Plastic consumption Plastic waste generation, imports, and exports	Plastic waste management Mismanaged plastic waste	Plastic waste leakage OPEX CAPEX Jobs	GHG Gender Livelihoods supported Circularity score

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Note: CAPEX = capital expenses, GHG = greenhouse gas, GPAP = Global Plastic Action Partnership, M&E = monitoring and evaluation, OPEX = operating expenses, UNEP = United Nations Environment Programme.

Name	The Breaking the Plastic Waves Pathways Tool (Pathways)	
Organization	The Pew Charitable Trusts and the University of Oxford	
Publication Date	2020	
URL	https://www.pewtrusts.org/ar/research-and-analysis/fact-sheets/2022/09/a-new-tool-can-help-address-ocean-plastic-pollution#:%7E:text=The%20Breaking%20the%20Plastic%20Wave%20Pathways%20Tool%20(%E2%80%9CPathways%E2%80%9D),polluting%20the%20land%20or%20water. https://www.ouce.ox.ac.uk/research/pathways/	
Summary	The Pathways tool is a data-driven coupled ordinary differential equation (ODE) model, that models the flows of plastics through a system. An ODE modelling framework was chosen because the output of such a model takes the form of flows (derivatives) and stocks (integrals), while also ensuring mass balance of the system. The model is dynamic, in the sense that it estimates the stocks and flows over time, accounts for quantitative changes in these stocks and flows, and captures feedbacks and flow constraints in the system. The Pathways tool also estimates the mitigation potential and system-level effects of different strategies aimed at minimizing plastic pollution, and offers the ability to optimize based on a 'trade-off' of objectives.	
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: YY Step 3 – Investment needs: N Step 4 – Implementation and M&E: N	
Tool characteristics		
Open source?	Yes	
Tool format/platform	MatLab	
Geographic scope	City, national, regional and global.	
Archetypes	Urban and rural for each income group (World Bank categories).	
Scope (sectors/sources)	Municipal	
Material scope	Macroplastics by groups of items. Full adaptable. South Africa model used: rigid monomaterial, flexible monomaterial, multilayer/multimaterial.	
Life cycle stage	Midstream and downstream	
Forecasting capability	Yes	
Scenario modelling capability?	Yes	
Interventions	Four main strategies or 'levers': reduce demand, increase collection, increase recycling, and improve disposal.	
Stakeholder engagement capabilities	N/A	
Application		
Technical capacity required	Medium – Tool is open source but is operated in Matlab so requires some expertise to operate.	
Level of data input needed	High	
Interoperability	Medium – Mass flow is similar to other tools as it is derived from Breaking the Plastic Wave.	
Applications to-date	South Africa (national) Pune, India (city-level)	
Metrics	Plastic waste generation, imports, and exports Plastic waste management Mismanaged plastic waste Plastic waste leakage	OPEX CAPEX Jobs GHG emissions

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: CAPEX = capital expenses, GHG = greenhouse gas, M&E = monitoring and evaluation, N/A = not applicable, ODE = ordinary differential equation, OPEX = operating expenses.

Name	PlastInvest
Organization	World Bank and Systemiq
Publication Date	2024
URL	https://plastinvest.global/accounts/login/?next=/
Summary	PlastInvest is a tool for governments, providing quantitative and qualitative insights into the investments needed to deliver national action plans for reducing plastic waste and pollution.
Action planning step	Step 1 – Baselining: N Step 2 – Options analysis: N Step 3 – Investment needs: YY Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	No
Tool format/platform	Web-based (Python/Django framework)
Geographic scope	Per country/region (defined by data input)
Archetypes	Archetypes combined per country/region
Scope (sectors/sources)	Municipal sources. The tool provides quantitative demand information for Public Sector (Collection, Sortation, Incineration, Engineered Landfills) and Private Sector (Reduction & Reuse, Substitution, Recycling). Qualitative supply information (Government Funding, Development Capital, Philanthropic Capital, Early-stage Private Finance, Late-stage Private Finance; Derisking Instruments)
Material scope	Combined Plastic Packaging and substitutes (Paper, Bio, Compostables, Glass, Metal)
Life cycle stage	Downstream/end-of-use
Temporal/Forecasting capability	Comparison of "Business as Usual" and "System Change" scenarios. Scenario data import usually for 2020-2040, results displayed for 2026-2040.
Scenario modelling capability?	Scenarios as defined in World Bank's Plastic Policy Simulator (PPS) or GPAP's National Analysis and Modeling (NAM) Tool. Limited capacity to model Finance Demand per Sector ("Experimentation Mode")
Interventions	Implicit intervention assumptions as defined in PPS or NAM
Stakeholder engagement capabilities	Scenarios, quantitative and qualitative insights, and Sector Scenarios ("Experimentation Mode") can be shared via direct links with stakeholders who have been granted access.
Application	
Technical capacity required	Medium (user-friendly interface, access to PPS or NAM scenario data required for quantitative insights, knowledge base easily explorable without data input, based on open-source solutions)
Level of data input needed	Medium (Knowledge Base usable without data input, quick import of NAM and PPS datasets for quantitative insights, greater effort required for new country/region scenarios via PPS/NAM)
Interoperability	Designed to work with both PPS and NAM data export, no standardized data format but designed to be extensible with open source tools.
Applications to-date	Can be easily applied to derive insights from existing NAM and PPS scenarios.
Metrics	Overview of Plastic Fate Indicators per scenario (Reduction, Substitution, Recycling, Disposal & Export, Mismanagement), Impact Indicators per scenario and sector (Mass Flow, GHG, Jobs), Finance Indicators per scenario, sector, year (Demand, Capex, Opex).

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: M&E = monitoring and evaluation, N/A = not applicable.

Name	Plastic Drawdown	
Organization	Common Seas	
Publication Date	2019	
URL	https://commonseas.com/uploads/Plastic-Drawdown-academic-paper-2.pdf	
Summary	Plastic Drawdown is a rapid, affordable, and user-friendly tool that helps decision makers create ambitious policies to tackle plastic pollution. It has been developed in consultation with over 20 country governments and exists to help them understand their country's unique plastic waste flows and choose the most effective portfolio of policies to tackle ocean pollution.	
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: YY Step 3 – Investment needs: N Step 4 – Implementation and M&E: Y	
Tool characteristics		
Open source?	No	
Tool format/platform	Excel and Google Looker Studio	
Geographic scope	National	
Archetypes	Urban and rural	
Scope (sectors/sources)	Municipal, fisheries, and construction	
Material scope	Macroplastics by item, including construction and fisheries plastics Microplastics (tire and brake wear, pellets and microfibers) Note: 24 macroplastic products focusing on items commonly found in marine litter plus 4 types of microplastic.	
Life cycle stage	Midstream and downstream	
Forecasting capability	Yes	
Scenario modelling capability?	Yes	
Interventions	18 actions including bans, taxes, EPR, waste management, waste water, and actions to tackle fishing gear and microplastics.	
Stakeholder engagement capabilities	Tool integrates with Google Looker Studio to enable stakeholders to explore outputs.	
Application		
Technical capacity required	Medium – Tool is operated in Excel but requires some familiarity with the concepts of flow modelling and policy analysis to operate.	
Level of data input needed	Medium – Tool designed to allow 'rapid assessment' of plastic pollution so data inputs have been minimized.	
Interoperability	Medium – Outputs offer some compatibility with other tools and approaches due similar framework, inputs, and outputs.	
Applications to-date	Barbados The Gambia Greece Grenada	Indonesia The Maldives United Kingdom
Metrics	Plastic waste generation, imports, and exports Plastic waste management Mismanaged plastic waste Plastic leakage	

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Note: EPR = Extended Producer Responsibility, M&E = monitoring and evaluation.

Name	Plastics Policy Simulator (PPS)		
Organization	World Bank		
Publication Date	2022		
URL	https://www.worldbank.org/en/topic/environment/publication/pathways-out-of-plastic-pollution		
Summary	The PPS is the first technology-financial model for policy makers to estimate how firms and households will react to various plastic policy instruments and what the costs, revenues, and other impacts of these policies will be before laws are passed or public money is spent. It supports governments, industry, and civil society in search of mutually agreeable policy reforms to enhance plastic circularity and reduce plastic pollution.		
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: YY Step 3 – Investment needs: N Step 4 – Implementation and M&E: N		
Tool characteristics			
Open source?	No		
Tool format/platform	Excel		
Geographic scope	National		
Archetypes	Defined by user		
Scope (sectors/sources)	Municipal		
Material scope	Macroplastics by groups of items. 20 products in 5 groups: bottles (water bottles, other food-grade bottles, non-food grade bottles); other monomaterials (pots tubs and trays, takeaway food containers, disposable utensils, beverage cups and lids, B2B packaging, household goods, other rigid packaging); flexible monomaterials (carrier bags, films, B2B flexibles); multimaterial/multilayer (sachets, multilayer flexibles, laminated paper and alum, household goods, diapers, hygiene products), and cigarette butts.		
Life cycle stage	Midstream and downstream		
Forecasting capability	Yes		
Scenario modelling capability?	Yes		
Interventions	24 actions: Taxes and fees (mandatory modulated EPR fees, virgin plastic excise tax on all packaging, plastic excise tax on all packaging, plastic excise tax on individual products, carbon tax, deposit return schemes, landfill tax, household fees) Public financing (alternative materials, reuse systems, formal collection, informal collection, sorting facilities and operations, mechanical recycling, chemical recycling, landfill facilities and operations, incinerators, refuse-derived fuel) Bans and standards (plastic labelling, product restrictions/bans, mandatory product design requirements, target reduction in plastic waste imports) Behavior change (consumer education campaigns) Governance (improvements in governance system)		
Stakeholder engagement capabilities	N/A		
Application			
Technical capacity required	High – PPS is a sophisticated tool which considers a range of different dimensions including plastic product and waste flows, total system costs (including fiscal costs and private sector resources mobilized), the effect on different stakeholder groups and the interactions between 20 different policies over time.		
Level of data input needed	High – The model requires data (or estimates of) volumes of plastic materials and plastic products that go through each segment of the system, as well as the annual capital expenditures, operational expenditures of plastic management options, and transaction costs, in addition to market prices and revenues after taxes and subsidies. Default values are available for different types of countries and can be adjusted by users.		
Interoperability	Medium – Mass flow is similar to other tools as it is derived from Breaking the Plastic Wave.		
Comment	The tool provides a range of outputs so is largely compatible with the inputs and outputs of other models and frameworks.		
Applications to-date	Indonesia Ghana The Philippines.		
Metrics	Plastic waste generation, imports, and exports Plastic waste management	Mismanaged plastic waste Plastic leakage OPEX	CAPEX Jobs GHG

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: B2B = business-to-business, CAPEX = capital expenses, GHG = greenhouse gas, M&E = monitoring and evaluation, N/A = not applicable, OPEX = operating expenses, PPS = Plastic Policy Simulator.

Name	The Plastic Substitution Tradeoff Estimator (PSTE)
Organization	World Bank
Publication Date	2022
URL	https://www.worldbank.org/en/topic/environment/publication/pathways-out-of-plastic-pollution
Summary	The PSTE can be used to consider the potential benefits and impacts of switching from one of 10 plastic products to alternative products (e.g., switching from a single-use LDPE plastic bag to reusable alternatives made of multi-use LDPE, jute, cotton, or paper). It does this by using a life cycle assessment methodology to estimate the different environmental costs and benefits of different product options (e.g., climate change, acidification, etc.). Where data is available, it uses 'environmental pricing' to monetize these effects so that a like-for-like comparison can be made across different impacts types.
Action planning step	Step 1 – Baselining: N Step 2 – Options analysis: Y Step 3 – Investment needs: N Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	No
Tool format/platform	Excel
Geographic scope	National
Archetypes	N/A
Scope (sectors/sources)	Specific consumer products and fishing nets
Material scope	Selected macroplastic products across 10 categories: fishing nets, beverage bottles, beverage cups and food containers, shopping bags, disposable utensils, food wrappers, sachets, beverage cartons, clothing, and diapers.
Life cycle stage	Upstream, midstream, and downstream
Forecasting capability	No
Scenario modelling capability?	Yes – The tool allows comparison of the impacts and benefits of a plastic product against a range of alternative products.
Interventions	10 identified products can be assessed against up to 4 alternatives.
Stakeholder engagement capabilities	N/A
Application	
Technical capacity required	Medium
Level of data input needed	Low Note: The tool is able to provide default values with minimal input from the user, such as region, income level, area, population, and percentage of population living in rural areas. Tailored data will provide more accurate results.
Interoperability	Medium – The tool provides valuable outputs that can be used to supplement analysis conducting using other tools.
Comment	The tool provides valuable outputs for supporting analytical work by other tools. For example, informing the potential for using alternative materials to tackle plastic pollution.
Applications to-date	Ghana The Philippines.
Metrics	Life cycle indicators: GHG emissions, environment costs, photochemical ozone, particulate matter, human toxicity, acidification, eutrophication, freshwater ecotoxicity, land use, and water use.

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: LDPE = Low-density polyethylene, GHG = greenhouse gas, M&E = monitoring and evaluation, N/A = not applicable, PSTE = Plastic Substitution Tradeoff Estimator.

Name	Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) Model
Organization	University of Leeds
Publication Date	2019
URL	https://plasticpollution.leeds.ac.uk/toolkits/spot/
Summary	The SPOT model is a fully integrated GIS-based model for highlighting hotspots of plastic pollution across the world. The model has been applied on a global scale (Cottom et al. 2023) but can also be applied at higher resolution over any region with dedicated data inputs for enhanced reliability. SPOT uses measured municipal-scale activity data and socioeconomic variables to predict data for locations where reliable data have not been obtained using quantile regression random forest machine learning. These predicted data are used to populate a random probabilistic MFA model (Monte Carlo) which maps the flow of plastic waste across the planet, from the moment it is generated through the complex and diverse global systems. The model estimates plastic waste emissions from five system components in 60,000 municipalities worldwide.
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: N Step 3 – Investment needs: N Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	No
Tool format/platform	R
Geographic scope	Municipal to global
Archetypes	Municipal-level, based on socio-economic indicators
Scope (sectors/sources)	Municipal
Material scope	Macroplastics by groups of items: flexible and rigid plastic items
Life cycle stage	Downstream
Temporal/Forecasting capability	No
Scenario modelling capability?	No
Interventions	N/A
Stakeholder engagement capabilities	N/A
Application	
Technical capacity required	High – Tool operates in R with GIS inputs required.
Level of data input needed	High – Spatial and municipal data required.
Interoperability	Medium – Outputs are compatible with SDG 11.6.1 (Sustainable communities and cities) and provide granular outputs on plastic waste generation and leakage which can be used as inputs for other tools.
Applications to-date	Global study
Metrics	Plastic waste generation, imports, and exports Plastic waste management Mismanaged plastic waste Plastic waste leakage

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Note: GIS = geographic information system, M&E = monitoring and evaluation, MFA = material flow analysis, N/A = not applicable, SDG = Sustainable Development Goal, SPOT = Spatio-temporal quantification of Plastic pollution Origins and Transportation.

Name	Waste Flow Diagram (WFD)
Organization	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, University of Leeds, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Wasteaware, and David Newby Associates (DNA)
Publication Date	2020
URL	https://wfd.rwm.global/
Summary	The Waste Flow Diagram (WFD) is an open-source toolkit that enables a rapid assessment of a city's municipal solid waste (MSW) flows. It maps and visualizes the materials flows within a municipal solid waste management (MSWM) system, and quantifies the amounts, sources and fates of plastic leakage into the environment. Various scenarios may be run to assess how changes to the MSWM system may affect the system and the levels of plastic pollution in the environment. The data collected and results generated through WFD applications are reported and can be made openly accessible on the WFD Portal. The portal also provides a range of supporting training resources and case studies.
Action planning step	Step 1 – Baselining: YY Step 2 – Options analysis: Y Step 3 – Investment needs: N Step 4 – Implementation and M&E: N
Tool characteristics	
Open source?	Yes
Tool format/platform	Originally Excel-based. Now with on-line portal to share data, data can either be entered using the Excel tool and uploaded or can be entered direct via the on-line portal.
Geographic scope	Originally developed for city-level but can be applied to any scale, provided that it is clearly defined
Archetypes	N/A
Scope (sectors/sources)	Municipal
Material scope	Total waste plastics (and other main waste fractions of municipal solid waste)
Life cycle stage	Downstream
Temporal/Forecasting capability	Yes (using scenarios functionality)
Scenario modelling capability?	Yes
Interventions	The tool can be used to assess the impact of changes to the municipal solid waste management system.
Stakeholder engagement capabilities	The overall methodology includes a strong emphasis on stakeholder engagement and the toolkit has a module specifically focused on action planning through engaging stakeholders (module S1 – actionable hotspots formulation).
Application	
Technical capacity required	Low – Tool is open source and designed to be used by someone with some Excel skills (or use of on-line data entry forms) and knowledge of the subject. The portal has a range of training resources available to help users apply the tool.
Level of data input needed	Low – Data inputs limited to waste flow modelling aspects.
Interoperability	High – Outputs offer some compatibility with other tools and approaches due to mass flow framework used. On-line portal has Application Programming Interface (API) accessible via digital key to act as interoperability data source. On-line system designed to be able to use Waste Wise Cities Tool (WaCT) online data portal as data source via the API.
Applications to-date	150+ cities in 23 countries including Albania, Bangladesh, Brazil, Cambodia, China, Democratic Republic of the Congo, Dominican Republic, Ethiopia, Ghana, India, Indonesia, Kenya, Lebanon, Malaysia, Mexico, Montenegro, Morocco, Nepal, Pakistan, Philippines, Tanzania, Viet Nam and Zimbabwe.
Metrics	Plastic waste management Mismanaged plastic waste Plastic waste leakage Carbon emissions estimation from openly burnt plastic

Key: Y = Tool that is applicable to this step but it is not the tool's prime purpose or some adjustment or additional analysis will be needed (e.g., scope is not national level or toolkit only allows some components of the step to be undertaken), YY = Tool developed specifically for this step and can be applied with limited modification/adjustment, N = Tool is not suitable for this step of the action planning process.

Appendix C. Other Resources for Plastic Pollution Action Planning

This appendix summarizes a selection of other resources mentioned in this report that may be useful to support in assessing and planning actions to tackle plastic pollution.

Table C.1 Summary of other resources mentioned in this report

No.	Resource	Organization	Action planning step			
			1	2	3	4
1.	Circularity Tracker (online)	Circulate Initiative			X	
2.	Diving Deep: Finance, Ocean Pollution and Costal Resilience (2022)	UNEP			X	
3.	Financing Circular Economy – Insights for Practitioners (2022)	GIZ			X	
4.	Financing System Change to Radically Reduce Plastic Pollution in Indonesia (2020)	GPAP			X	
5.	Global Plastic Laws Database (online)	Plastic Pollution Coalition	X			
6.	Global Plastics AI Policy Tool (2023)	Benioff Ocean Science Laboratory at University of California Santa Barbara and Eric and Wendy Schmidt Center for Data Science & Environment at University of California Berkeley	X			
7.	Global Partnership on Plastic Pollution and Marine Litter Digital Platform (online)	GPML	X	X	X	X
8.	Designing a National Marine Litter Action Plan (2019)	UNEP	X	X	X	X
9.	Investing to reduce plastic pollution in South & Southeast Asia: A Handbook for Action (2019)	Circulate Capital			X	
10.	Life Cycle Initiative (online)	UNEP		X		
11.	Marine Litter and Plastic Pollution Legal Toolkit (online)	UNEP	X			X
12.	Plastic Smart Cities Framework (online)	WWF	X			X
13.	NPAP Ghana Financing Roadmap (2022)	GPAP			X	
14.	Private Participation Infrastructure Database (online)	World Bank Group			X	

No.	Resource	Organization	Action planning step			
15.	Plastics Legislation Explorer (online)	UNEP	X			
16.	Global Plastic Policy Reviews (online)	University of Portsmouth	X			
17.	Plastics Policy Effectiveness Study Library (online)	Duke University	X			
18.	Plastics Policy Inventory (online)	Duke University	X			
19.	Plastiverse Tools Database (online)	Plastiverse	X	X	X	X
20.	Plasteax (online)	EA	X			
21.	Unlocking the Plastics Circular Economy: Case Studies on Investment (2022)	GPAP			X	
22.	OpenLitterMap (online)		X			
23.	Review of plastic footprint methodologies (online)	IUCN	X			
24.	Quick guide and review of existing plastic material flow and leakage methodologies (2022)	GIZ	X			
25.	Plastic Pollution Assessment Methodologies Suitability Toolkit (PLAST) 2023	World Bank, University of Leeds, IUCN, DNA and Deltares	X			
26.	Waste Wise Tool (2021)	UN-HABITAT	X			

Note: This is not an exhaustive list of resources. Many more resources can be found at the website https://datahub.gpmarinelitter.org/.

AI = artificial intelligence, DNA = David Newby Associates, EA = Earth Action, GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, GPAP = Global Plastic Action Partnership, GPML = Global Partnership on Plastics Pollution and Marine Litter, IUCN = International Union for Conservation of Nature, NPAP = National Plastic Action Partnership, UNEP = United Nations Environment Programme, WWF = World Wide Fund For Nature.

Appendix D. Additional Tools and Resources Identified in This Review

This appendix provides a list of other tools and resources that have been identified through the tool review process. They may be useful to support in assessing and planning actions to tackle plastic pollution.

Table D.1 Summary of additional tools and resources identified in this review

No.	Title	Author/Owner/Developer	Publication Year
TOOLS			
1.	A Tool for Evaluating Environmental Sustainability of Plastic Waste Reduction Innovations	University of Michigan	2022
2.	CounterMeasure	UNEP, Asian Institute of Technology	2019
3.	Plastic Calculator	Earth Day	Not known
4.	Plastic Lifecycle Assessment Calculator for the Environment and Society (PLACES)	The Circulate Initiative	Not known
5.	Plastic Management Index	Back to Blue Initiative, Economist Impact and The Nippon Foundation	2021
6.	Plastic Pollution Calculator	International Solid Waste Association, University of Leeds	2018
7.	Plastic Scan	IUCN/EA	2018
8.	Plastic Waste Management Tool	University of Hull	Not known
9.	PlasTICK	Common Seas	2023
10.	Plastics Treaty Futures Tool	Systemiq	2023
GUIDANCE			
11.	African Marine Litter Monitoring Manual, 2nd Edition	Barnardo, T., D. Marlin, A.J. Ribbink, and L. Pichegru (Eds.). 2023. *African Marine Litter Monitoring Manual.* 2nd Edition. Gqeberha, South Africa, African Marine Waste Network, Sustainable Seas Trust.	2020

No.	Title	Author/Owner/Developer	Publication Year
12.	BFFP Global Plastics Treaty: Advocacy Toolkit	Break Free From Plastic	2022
13.	Business Toolkit	Surfers Against Sewage	Not known
14.	Developing a Training Toolkit for Practitioners on Plastic Waste in India	Adelphi	2021
15.	Dive Against Debris Survey Toolkit: A Survey of Underwater Marine Debris For Scuba Divers	Project AWARE Foundation	2015
16.	Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean	GESAMP	2019
17.	Guidelines on Survey and Monitoring of Marine Litter	UNEP/IOC	2009
18.	Health & Toxics Digital Toolkit	Break Free from Plastic	Not known
19.	Legal and Policy Guidance on Addressing Marine Litter in the Philippines	UNEP	2021
20.	Marine Debris Action Planner (MDAP)	Larsen Haarr, Marthe, Levi Westerveld, Joan Fabres, Kriss Rokkan Iversen, Kjersti Eline Tønnessen Busch. 2019. "A novel GIS-based tool for predicting coastal litter accumulation and optimising coastal cleanup actions." *Marine Pollution Bulletin,* 139: 117-126.	2017
21.	Marine Debris Monitoring Toolkit for Educators	NOAA Marine Debris Program and the Office of National Marine Sanctuaries	
22.	Marine litter legislation: A toolkit for policymakers	UNEP	2016
23.	Mobilizing Health Care to Prevent Plastic Pollution: A Plastics Toolkit for Hospitals	Health Care Without Harm	2019
24.	Ocean Plastics Mapping Toolkit	The Incubation Network	2022
25.	Plastic Pollution Primer and Action Toolkit	International Centre for the Study of the Preservation and Restoration of Cultural Property	2018
26.	Plastic Reduction Toolkit – Made for Merchandise	Onetide	2022
27.	Plastic Tide Turners Challenge Badge Toolkit	Tide Turners	Not known
28.	Plastic Waste Leakage Assessment: Training Manual	Climate Centre for Cities, NIUA in association with National Productivity Council, UNEP	2022
29.	Plastic Waste Reduction Toolkit	Futouris	Not known

No.	Title	Author/Owner/Developer	Publication Year
30.	Plastics Clever Schools: Primary Teachers Toolkit	Common Seas	Not known
31.	Plastics Toolbox	A Rocha International	Not known
32.	Plastics Toolbox: Business, Human Rights, and the Environment	SEA Circular	2021
33.	Self-Assessment Tool Basel Convention – Plastic Waste	World Customs Organization Organisation mondiale des douanes (WCOOMD)	2022
34.	Toolkit for plastic waste-free cruising	IUCN, Norad, and Searious Business	2020
35.	Toolkit for plastic waste-free tours	IUCN, Norad, and Searious Business	2020
36.	Toolkit: Plastic Waste Management	Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India	2021
37.	WasteAid Toolkit	WasteAid	2017
38.	Zero Avoidable Packaging for Construction Toolkit	Alliance for Sustainable Building Products	Not known
METHOD/STUDY			
39.	A European threshold value and assessment method for macro litter on coastlines	European Union	2020
40.	A field-based assessment of anthropogenic macrolitter loads and emission rates of three German tributaries	Schöneich-Argent, Rosanna Isabel, Kirsten Dau, Holger Freund. 2020. "Wasting the North Sea? – A field-based assessment of anthropogenic macrolitter loads and emission rates of three German tributaries." *Environmental Pollution,* 263, Part B.	2020
41.	A methodology to characterize riverine macroplastic emission into the ocean	van Emmerik Tim, Kieu-Le Thuy-Chung, Loozen Michelle, van Oeveren Kees, Strady Emilie, Bui Xuan-Thanh, Egger Matthias, Gasperi Johnny, Lebreton Laurent, Nguyen Phuoc-Dan, Schwarz Anna, Slat Boyan, Tassin Bruno. 2018. "A Methodology to Characterize Riverine Macroplastic Emission Into the Ocean." *Frontiers in Marine Science,* 5.	2018
42.	A Public Database for Microplastics in the Environment	Čerkasova, Natalja, Kristina Enders, Robin Lenz, Sonja Oberbeckmann, Josef Brandt, Dieter Fischer, Franziska Fischer, Matthias Labrenz, and Gerald Schernewski. 2023. "A Public Database for Microplastics in the Environment" *Microplastics* 2, 1: 132-146.	2022

No.	Title	Author/Owner/Developer	Publication Year
43.	APLASTIC-Q: Machine learning for aquatic plastic litter detection, classification and quantification	Wolf, Mattis, Katelijn van den Berg, Shungudzemwoyo P. Garaba, Nina Gnann, Klaus Sattler, Frederic Stahl, and Oliver Zielinski. 2020. "Machine learning for aquatic plastic litter detection, classification and quantification (APLASTIC-Q)." *Environmental Research Letters,* 15, 11.	2020
44.	Assessment of the plastic inputs from the Seine Basin to the sea using statistical and field approaches	Tramoy, Romain, Gasperi Johnny, Dris Rachid, Colasse Laurent, Fisson Cédric, Sananes Sarah, Rocher Vincent, Tassin Bruno. 2019. "Assessment of the Plastic Inputs From the Seine Basin to the Sea Using Statistical and Field Approaches." *Frontiers in Marine Science,* 6.	2019
45.	Baseline and power analysis for the assessment of beach litter reductions in the European OSPAR region	Schulz, Marcus, Dennis J.J. Walvoort, Jon Barry, David M. Fleet, Willem M.G.M. van Loon. 2019. "Baseline and power analyses for the assessment of beach litter reductions in the European OSPAR region." *Environmental Pollution,* 248, 555-564.	2019
46.	Baseline estimation of plastic discharges from land-based sources via rivers and coastlines	World Bank 2021. *Plastic Waste Discharges from Rivers and Coastlines in Indonesia*. Marine Plastics Series, East Asia and Pacific Region. Washington, DC.	2021
47.	Closing the Mediterranean Marine Floating Plastic Mass Budget: Inverse Modelling of Sources and Sinks	Kaandorp, Mikael L. A., Henk A. Dijkstra, and Erik van Sebille. 2020. "Closing the Mediterranean Marine Floating Plastic Mass Budget: Inverse Modeling of Sources and Sinks." *Environmental Science & Technology, 54*, 19: 11980-11989.	2020
48.	Export of plastic debris by rivers into the sea	Schmidt, Christian, Tobias Krauth, and Stephan Wagner. 2017. "Export of Plastic Debris by Rivers into the Sea." *Environmental Science & Technology, 51,* 21: 12246-12253.	2017
49.	From Land to Sea – Model for the Documentation of Land-Sourced Plastic Litter	Consultic/BKV	2016
50.	Full Circle - PET Collection, Landfill and Environmental Leakage Rates in Southeast Asia	GA Circular	2019
51.	Global Plastic Pollution Survey	CSIRO	2018
52.	High-Resolution Mapping of Japanese Microplastic and Macroplastic Emissions from the Land into the Sea	Nihei, Yasuo, Takushi Yoshida, Tomoya Kataoka, and Riku Ogata. 2020. "High-Resolution Mapping of Japanese Microplastic and Macroplastic Emissions from the Land into the Sea" *Water,* 12, 4: 951.	2020

No.	Title	Author/Owner/Developer	Publication Year
53.	Identifying Sources of Marine Litter	European Commission	2016
54.	Major sources and monthly variations in the release of land-derived marine debris from the Greater Jakarta area, Indonesia	Cordova, M.R. and I.S. Nurhati. 2019. "Major sources and monthly variations in the release of land-derived marine debris from the Greater Jakarta area, Indonesia." *Scientific Reports* 9, 18730.	2019
55.	Market Study for Malaysia: Plastics Circularity Opportunities and Barriers	World Bank Group 2021. *Market Study for Malaysia: Plastics Circularity Opportunities and Barriers.* Marine Plastics Series, East Asia and Pacific Region. Washington DC.	2022
56.	OSPAR Litter Analyst - standard method and software for statistical analysis of beach litter data in the OSPAR region	Schulz, Marcus, Willem van Loon, David M. Fleet, Paul Baggelaar, Eit van der Meulen. 2017. "OSPAR standard method and software for statistical analysis of beach litter data." *Marine Pollution Bulletin,* 122, 1–2: 166-175.	2014-2018
57.	Plastics-to-Oceans (P2O) model	Lau, Winnie W.Y., *et al. 2020*. "Evaluating scenarios toward zero plastic pollution." *Science,* 369, 1455-1461.	2020
58.	Plastic Leak Project	Quantis/EA	2019
59.	Plastic waste inputs from land into the ocean (and subsequent adaptions)	Jenna R. Jambeck *et al. 2015*. "Plastic waste inputs from land into the ocean." *Science,* 347, 768 -771.	2015, 2020
60.	Plastic Waste Management in Rwanda, an Ex-post Policy Analysis	World Bank	2022
61.	Polymer-Specific Modeling of the Environmental Emissions of Seven Commodity Plastics As Macro- and Microplastics	Delphine Kawecki and Bernd Nowack. 2019. "Polymer-Specific Modeling of the Environmental Emissions of Seven Commodity Plastics As Macro- and Microplastics." *Environmental Science & Technology, 53,* 16: 9664-9676.	2019
62.	Radically Reducing Plastic Pollution in Indonesia: A Multistakeholder Action Plan National Plastic Action Partnership	GPAP	2020
63.	Rapid assessment of floating macroplastic transport in the Rhine	Vriend Paul, Caroline van Calcar, Merel Kooi, Harm Landman, Remco Pikaar, Tim van Emmerik. 2020. "Rapid Assessment of Floating Macroplastic Transport in the Rhine." *Frontiers in Marine Science,* 7.	2020
64.	Reproducible pipelines and readiness levels in plastic monitoring	NILU	2023
65.	RIVER PLASTIC EMISSIONS TO THE WORLD'S OCEANS	The Ocean Cleanup	2021

No.	Title	Author/Owner/Developer	Publication Year
66.	River plastic emissions to the world's oceans	Lebreton, Laurent C.M., Joost van der Zwet, Jan-Willem Damsteeg, Boyan Slat, Anthony Andrady, and Julia Reisser. 2017. "River plastic emissions to the world's oceans." *Nature Communications,* 8, 15611.	2017
67.	Riverine Litter Observation network and data analysis	RIMMEL, RiLON, JRC	2016-2017
68.	Simple model estimates of input of marine plastic into the sea, from land-based sources, fisheries and remote sources (via ocean).	Turrell, W.R. 2020. "Estimating a regional budget of marine plastic litter in order to advise on marine management measures." *Marine Pollution Bulletin,* 150.	2020
69.	Technology Options for Plastic Waste in Island Contexts (TOPIC) Toolbox	World Bank	2022
70.	The effect of tidal fluctuation on the accumulation of plastic debris in the Wonorejo River Estuary, Surabaya, Indonesia	Kurniawan, Setyo Budi and Muhammad Fauzul Imron. 2019. "The effect of tidal fluctuation on the accumulation of plastic debris in the Wonorejo River Estuary, Surabaya, Indonesia." *Environmental Technology & Innovation,* 15.	2019
71.	The Plastic Waste Management Framework	Alliance to End Plastic Waste	2023
72.	Toward a National Single-use Plastics Roadmap in Vietnam	World Bank	2022
OTHER RESOURCES			
73.	Global Plastics Watch	Minderoo Foundation	Not known
74.	Analyzing city litter data	Litterati	Not known
75.	Marine Plastic Footprint	IUCN/EA	2020
76.	Plastic Pollution Prevention and Collection Technology Inventory	Duke University Nicholas Institute for Energy, Environment and Sustainability	2022
77.	Plastic Recovery Insight and Steering Model (PRISM)	Alliance to End Plastic Waste/IBM Consulting	2020
78.	Plastic Tracker	The Ocean Cleanup	Not known
79.	Plastic Health Map	Minderoo Foundation	Not known
80.	Preventing Plastic Pollution	The Rivers Trust	Not known

Note: BFFP = Break Free from Plastic, CSIRO = Commonwealth Scientific and Industrial Research Organisation, EA = Earth Action, GESAMP = Group of Experts on the Scientific Aspects of Marine Environmental Protection, GPAP = Global Plastic Action Partnership, IOC = Intergovernmental Oceanographic Commission, IUCN = International Union for Conservation of Nature, JRC = Joint Research Centre (European Commission), NIUA = National Institute of Urban Affairs, NOAA = National Oceanic and Atmospheric Administration, OSPAR = Oslo and Paris Conventions, RiLON = Riverine Litter Observation Network, RIMMEL = RIverine and Marine floating macro litter Monitoring and Modelling of Environmental Loading, UNEP = United Nations Environment Programme, WCOOMD = World Customs Organization Organisation mondiale des douanes.

Appendix E. National Planning Aspects of the Plastics Treaty

Introduction

At the 5th United Nations Environmental Assembly (UNEA) in March 2022, nations adopted a resolution to develop an International Legally Binding Instrument (ILBI) on Plastics Pollution ('Plastics Treaty') (UNEP 2022). The first Intergovernmental Negotiating Committee (INC) meeting was convened in Uruguay in November 2023. Subsequent INC meetings took place in Paris in June 2023, in Nairobi in November 2023, and in Ottawa in April 2024. It was the intention of the original resolution that work to develop the Plastics Treaty would be completed by the end of 2024. At the time of writing, a fifth INC meeting is scheduled for November 2024 in Busan. The Plastics Treaty is currently in Revised Draft form (UNEP 2023b).

This appendix identifies and briefly discusses the key aspects of the current Revised Draft of the Plastics Treaty that are relevant to planning action at national level. It is intended that this appendix will be updated when the draft Plastics Treaty has been redrafted or finalized.

The content of the Plastics Treaty is still to be finalized and the Revised Draft includes many different, wide-ranging options on the majority of aspects of the Plastics Treaty. Discussions at the 4th INC in Ottawa revealed significant divergence between parties on key aspects of the Plastics Treaty, including its overall scope and the specific arrangements for its implementation at global and national levels (IISD 2024). As such, it is not possible to provide a detailed or definitive description of the key aspects of the Plastics Treaty as it relates to action planning activities. However, there are several key issues that are particularly relevant. It will be important to keep consider how these issues develop as the PlasticsTreaty is finalized as they will define the requirements for Action Planning.

Key National Planning Aspects of the Plastics Treaty

- **The precise scope of the Plastics Treaty in terms of the plastics lifecycle is still under discussion.** The scope is defined in Part 1, Section 5 of the Revised Draft. It sets out a variety of options for text that defines the scope. Many of the options refer to the lifecycle of plastics, from plastics production to the disposal of plastics. However, a number of delegations at the negotiations in Ottawa proposed that the Treaty focus on the waste management phase only and excludes the production stages of the lifecycle (IISD 2024). The issues of scope could have an implication for planning action at national level as the specific obligations of the Treaty could potentially relate to all stages of the life cycle or just a subset. This could affect the scope of any action planning activity, particularly

the baselining and options assessment steps (noting that, irrespective of the scope defined in the final Plastics Treaty, governments should be able to expand the scope to other phases where it is considered necessary and important).

- **The specific requirements of the Plastics Treaty in terms of National Plans are a key component of the current Revised Draft and have been a key issue discussed at negotiations to-date.** Clearly, the specific provisions set out in the finalized Plastics Treaty will have a direct implication for the scope and process used to conduct national planning activities. However, the specific requirements are still very much under discussion as part of the negotiations. The current Revised Draft leaves open the question as to whether it will include a requirement for parties to prepare National Plans, National Action Plans (NAP), or National Implementation Plans (NIP). See IUCN, CIEL, and WCEL (2023) for a more detailed discussion of the difference between NAPs and NIPs.

  National plans are referred to in various parts of the Revised Treaty, and Part IV that is specifically focused on National Plans. Part IV includes a number of proposed clauses that set out different National Plan requirements for parties to the Plastics Treaty. The options included in the Revised Draft range between two main types of approach:

  - A requirement that parties set out in a National Plan how the obligations of the Plastics Treaty would be delivered (text option OP0 in Part IV). This would mean that the requirement to prepare a National Plan would be in addition to the main obligations of the Treaty and would describe how an individual country would deliver upon the obligations, taking account of local circumstances and capacities. The optional text in this part of the Revised Draft sets out a list of areas that would potentially be covered and included in National Plans. The areas listed cover many different aspects of the plastics lifecycle and potential interventions to reduce plastics pollution (for example, product design and performance, Extended Producer Responsibility, waste management, just transition, information exchange, and so on). The areas listed align to the action planning approach and the capabilities of the key tools described in this report.

  - A requirement that Parties "develop and implement a nationally determined action plan that best fits its national circumstances to meet the objectives of this instrument" (text option OP1 in Part IV). This can be considered to represent a more voluntary approach to action planning, with the intended outcomes defined at the national level rather than at the global level.

  The Revised Draft also sets out, under Part IV, potential requirements for implementation (Section 2), reporting on progress (Section 3), and periodic assessment and monitoring of progress of implementation (Section 4). A country conducting National Planning activities should take into account the requirements set out in these sections. But at this stage, the requirements are very uncertain and are defined at such a level that it is not possible to say what the specific requirements are likely to be.

  In terms of the specific provisions relating to action planning, the approach and tools described in this report broadly support all of the potential approaches set out as options in the current Revised Draft. None of the Revised Draft text options are prescriptive in the sense that they would affect how a country would go about action planning, although it is possible that more detailed requirements may be included in the finalized Plastics Treaty.

As highlighted in this report, there are few tools and resources available to support implementation, reporting, assessment and monitoring (Step 4 of the action planning process set out in this report). More efforts are needed to develop these resources, particularly if there will be specific obligations set out on these aspects in the finalized Plastics Treaty.

- **Financing arrangements form a key part of the Revised Draft of the Plastics Treaty.** Part III of the Revised Draft presents potential options for the financing mechanisms and resources that could be used to support implementation of the Treaty. The issues covered by the draft text options include:

    - Potential sources of finance, including domestic, bilateral, multi-lateral, private sector and voluntary funding.

    - The potential for "developed country Parties ...[to] provide new and additional funding to enable developing countries and Parties with economies in transition to meet the agreed full incremental costs of implementation measures".

    - The specific needs and special circumstances of Parties, such as small island developing states or least developed countries.

Action planning activities will need to take account of the provisions in the Plastics Treaty with respect to financing. This is Step 3 of the action planning process described in the report. There are relatively few tools and resources available to support this step so it will be important for greater capacity and tools to be developed to allow countries to identify financing needs and develop financing plans as part of their action planning activities, depending on the specific provisions of the finalized Plastics Treaty.

Conclusion and Next Steps

Review of the current Revised Draft of the Plastics Treaty indicates that there are likely to be a number of key provisions that relate to National Planning activities but the specifics are very much still under discussion. Clearly, it will be important for national governments to contribute to, and take account of, the specific requirements of the Plastics Treaty as it relates to national planning activities. The Plastics Treaty will provide the key context for taking action at the national level.

It is important to recognize that many countries are planning and implementing actions to tackle plastics pollution, even though the Plastics Treaty is in draft form. As such, whilst the provisions of the Plastics Treaty are important, and are expected to provide the context and some specific provisions relevant to national planning, it does not prevent countries from progressing their own action planning activities and applying an action planning approach that is appropriate for their needs, priorities and context. The preamble to the current Revised Draft of the Plastics Treaty recognizes that "each country is best positioned to understand its own national circumstances... related to addressing plastics pollution...".

INC5 is scheduled for November 2024 in Busan, Republic of Korea. Two ad hoc intersessional open-ended expert groups were established at INC4 to progress work on some critical issues:

- Expert Group 1: Financing sources and mechanisms
- Expert Group 2: Criteria and non-criteria based approaches regarding plastic products and chemicals of concern in plastic products, and product design focusing on recyclability and reusability of plastic products.

These groups will present their work on these issues for consideration by the INC at INC5. The ambition of the resolution adopted by UNEA in 2022 was that the Plastics Treaty be finalized by the end of 2024.

References

Circulate Capital. 2024. "Plastics Circularity Investment Tracker." Accessed 14 June 2024. https://circularitytracker.thecirculateinitiative.org.

Cottom, J.W., E. Cook, and C.A. Velis. 2023. A local-to-global emissions inventory of macroplastic pollution. https://www.researchsquare.com/article/rs-3376960/v1.

Ellen McArthur Foundation. 2018. *Financing the Circular Economy: Capturing the Opportunity.* https://www.ellenmacarthurfoundation.org/financing-the-circular-economy-capturing-the-opportunity.

GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution). 2019. *Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean.* http://www.gesamp.org/publications/guidelines-for-the-monitoring-and-assessment-of-plastic-litter-in-the-ocean.

GPML (Global Partnership on Plastics Pollution and Marine Litter). 2023. CoP on Monitoring and Modeling Methodology Harmonization – Different Models and Monitoring Methodology Results Compilation.

GPML (Global Partnership on Plastics Pollution and Marine Litter). 2024. CoP on Monitoring and Modeling Methodology Harmonization – Updates on terminologies comparison of different methodologies.

IISD (International Institute for Sustainable Development). 2024. *Summary of the Fourth Session of the Intergovernmental Negotiating Committee to Develop an International Legally Binding Instrument on Plastic Pollution: 23-29 April 2024.* Earth Negotiations Bulletin, Vol 36, No. 27. https://enb.iisd.org/plastic-pollution-marine-environment-negotiating-committee-inc4-summary#brief-analysis-inc-4

IUCN, CIEL, and WCEL. 2023. *National Implementation and National Action Plans: Key Elements to Consider in the Context of a Treaty to End Plastic Waste.* https://www.ciel.org/wp-content/uploads/2023/08/National-Implementation-Plans-and-National-Action-Plans-Key-Elements-to-Consider-in-the-Context-of-a-Treaty-to-End-Plastic-Pollution_August-2023.pdf.

Lau, Winnie W.Y., *et al. 2020.* "Evaluating scenarios toward zero plastic pollution." *Science,* 369, 1455-1461. DOI:10.1126/science.aba9475.

OECD (Organisation for Economic Co-operation and Development). 2022. *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*. Paris: OECD Publishing. https://doi.org/10.1787/de747aef-en.

UNEP (United Nations Environment Programme). 2020. *National guidance for plastic pollution hotspotting and shaping action – Introduction to the methodology.* Boucher, J., M. Zgola, X. Liao, A. Kounina, G. Billard, P. Paruta, A. Bouchet. Nairobi: UNEP. https://www.unep.org/resources/report/national-guidance-plastic-pollution-hotspotting-and-shaping-action.

UNEP (United Nations Environment Programme). 2022. UNEA Resolution 5/14 entitled "End plastic pollution: Towards an international legally binding instrument", Dakar. https://www.unep.org/inc-plastic-pollution.

UNEP (United Nations Environment Programme). 2023a. *Turning off the Tap: How the world can end plastic pollution and create a circular economy.* Topic Sheet: Think Global – Act Local, NOW. Nairobi: UNEP. https://www.unep.org/resources/turning-off-tap-end-plastic-pollution-create-circular-economy.

UNEP (United Nations Environment Programme). 2023b. *Zero draft text of the international legally binding instrument on plastic pollution, including in the marine environment.* UNEP/PP/INC.3/4. Nairobi: UNEP. https://wedocs.unep.org/bitstream/handle/20.500.11822/43239/ZERODRAFT.pdf.

World Bank. 2021. *Towards a Multisectoral Action Plan for Sustainable Plastics Management in Bangladesh.* Washington, DC: The World Bank. https://thedocs.worldbank.org/en/doc/42712a1018d536bb86c35018b9600c53-0310062021/towards-a-multisectoral-action-plan-for-sustainable-plastic-management-in-bangladesh.

World Bank. 2022. *Where Is the Value in the Chain? Pathways out of Plastic Pollution.* Washington, DC: The World Bank. https://hdl.handle.net/10986/37285.

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