



Auditing Plastic Waste: Research and Audit Benchmarks for Supreme Audit Institutions



INTOSAI
Working Group
on Environmental
Auditing

Foreword and Acknowledgements

Plastic is everywhere. It has many good attributes, but the plastic waste problem, especially related to single-use plastic, has rapidly become one of the key environmental concerns globally. The COVID-19 pandemic has further increased the amount of single-use plastic waste worldwide.

Particularly concerning is the plastic waste in oceans and other water bodies. At the same time, microplastics have become a recognised health concern. By controlling plastic waste, we can protect the environment as well as avoid health risks. This is a good example of the interlinked nature of the problems with plastic waste - but also their solutions.

The INTOSAI Working Group on Environmental Auditing (WGEA) adopted this topical issue into its Work Plan 2020-2022, and SAI India volunteered to lead the research project. This report provides a thorough study on the topic with practical examples on how to audit plastic waste. The publication also contributes to the follow-up and review of the United Nations Sustainable Development Goals (SDGs), and particularly Goal 12 on sustainable consumption and production.

We are very happy to publish the study just a couple of months after the United Nations Environmental Assembly decided to begin negotiations on a legally binding treaty to eliminate plastic waste.


We acknowledge contributions from researchers and attribute the material to its original source and author by providing a specific link in a footnote or in the paragraphs.

We also like to thank the Supreme Audit Institutions (SAIs) worldwide, especially the project sub-committee members: the SAIs of Afghanistan, Bulgaria, Cameroon, China, the Czech Republic, Ecuador, Egypt, Finland, Ghana, Indonesia, Iran, the Maldives, Nepal, Nigeria, Peru, the Philippines, Sri Lanka, Sudan, Tanzania, Thailand, Turkey, Ukraine, the United States of America and Zambia.

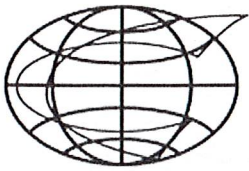
Special thanks to the INTOSAI WGEA and its Steering Committee members for their valuable help at various stages of the project.



Dr. Sami Yläoutinen
Auditor General of SAI Finland
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Annex-II

Quality Assurance Certificate of the Chair of the INTOSAI Working Group on Environmental Auditing

This is to certify that ***Auditing Plastic Waste: Research and Audit Criteria for Supreme Audit Institutions*** which is placed at level three of Quality Assurance as defined in the paper on “Quality Assurance on Public goods developed outside Due Process” approved by the INTOSAI Governing Board in November 2017 has been developed by following the Quality Assurance processes as detailed below:

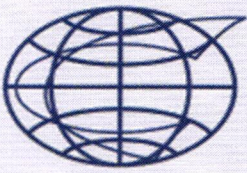
- i. The project proposal was developed by the team with consultation of INTOSAI WGEA Steering Committee Members;
- ii. The project was discussed during the 20th INTOSAI WGEA Assembly meeting held online in January 2021;
- iii. The project output draft was circulated among team members, Steering Committee members, and has gone through more than 30-day exposure (from 13 April to 16 May 2022) for comments and circulated among WGEA members via an online portal.

The product developed is consistent with relevant INTOSAI Principles and Standards. The structure of the product is in line with the drafting convention of non-IFPP documents.

The product is valid till 30 September 2028 and if it is not reviewed and updated by 30 September 2028 it will cease to be a public good of INTOSAI developed outside the Due Process.

Helsinki, 8 June 2022

Dr Sami Yläoutinen
Auditor General of the National Audit Office of Finland
Chair of the INTOSAI WGEA



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**Quality Assurance Certificate of the Chair of Knowledge Sharing and
Knowledge Services Committee (KSC)**

Based on the assurance provided by the Chair of the *INTOSAI Working Group on Environmental Auditing (WGEA)* and the assessment by the Goal Chair, it is certified that *Auditing Plastic Waste: Research and Audit Criteria for Supreme Audit Institutions* which is placed at level **3 (Three)** of Quality Assurance as defined in the paper on “Quality Assurance on Public goods developed outside Due Process” approved by the INTOSAI Governing Board in November 2017, has been developed by following the Quality Assurance processes as detailed in the Quality Assurance Certificate given by the Working Group Chair.

The product is valid till **30 September 2028** and if it is not reviewed and updated by **30 September 2028** it will cease to be a public good of INTOSAI developed outside the Due Process.

**Girish Chandra Murmu
Chair of Knowledge Sharing and
Knowledge Services Committee**

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List of Acronyms

SDG	Sustainable Development Goals
INTOSAI	International Organisation for Supreme Audit Institutions
WGEA	Working Group on Environmental Audit
EUROSAI WGEA	European Organisation of Supreme Audit Institutions - Working Group on Environmental Auditing
SCP	Sustainable Consumption and Production
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organisation
IUCN	International Union for Conservation of Nature
PVC	Poly Vinyl Chloride
ESM	Environmental Sound Management of Waste
EPR	Extended Producer Responsibility



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Executive Summary

The way in which societies use and care for natural resources fundamentally shapes the well-being of humanity, environment and the economy. In contemporary times, global consumption and production are major drivers of global economy.

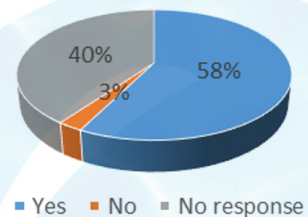
During the past four decades, extraction of primary materials has tripled which has led to severe environmental damage, depletion of natural resources and growing inequalities; both within and between countries. Every year, 4.8 to 12.7 million tonne (MT) plastic waste are dumped into our oceans causing severe damage to ecosystems, livelihoods and our health. Unsustainable consumption and production of plastic may further exacerbate the nature of plastic pollution. With increasing production and consumption of plastic, the issue of proper plastic waste management and abatement of pollution have become important governance issue for all countries around the globe.

A WGEA survey on management of plastic waste conducted in 2020 as a part of this research project showed that out of the 40 SAIs which responded, 58 percent of SAIs reported existence of legislations/regulations/policies/guidelines for plastic waste management in their country and 40 percent of SAIs also have conducted audit work specific to plastic waste management (Figure 1).

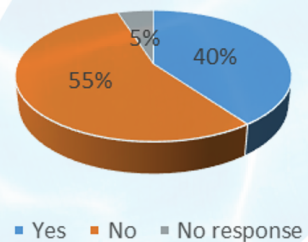
To respond to these challenges and limit it within the carrying capacity of the earth system, the adoption of sustainable patterns of consumption and production (SDG 12) is imperative. SDG 12 promotes sustainable consumption and production (SCP) patterns, which means using services and products that minimize the use of natural resources and the emissions of waste and pollutants as well as toxic materials over their

Figure 1: INTOSAI WGEA Survey results

Do any legislations/regulations/policies/guidelines exist for plastic waste management in your country?



Has your SAI conducted audit work specific to plastic waste management?



life cycle without jeopardizing the needs of future generations. Targets under SDG 12 cover a range of entry points required for promoting responsible consumption and production. This entails policies to improve resource efficiency, reduce waste and mainstream sustainability practices across all sectors of the economy.

Despite pervasive global pollution from plastic, there is only one indicator (14.1.1b) under Global Indicator Framework, specifically related to plastic debris density. Reliable monitoring and reporting of SDG indicators¹ presents unique challenges to governments and organizations in implementation of SDGs.

Major targets to achieve SDG 12 need urgent action to ensure that current material needs do not lead to the over extraction of resources and degradation of natural resources.

This research paper provides a critical overview of the key challenges specifically related to plastic waste affecting achievement of SDGs by undermining implementation of sustainable strategies and plastic waste policies as well as auditing their implementation. The contents of this paper are primarily based on available literature on this subject, ongoing efforts to mitigate pollution resulting from plastic waste as well as the auditing experiences of various SAIs. These information and case studies may aid the auditors in identifying the threats and associated implications of plastic waste so as to frame an opinion and make audit recommendations in improving the design or implementation of various policies and related instruments. While developing the research paper information/infographics from various reports/articles/publications available in public domain have been used to add value to the content of this paper. The terms plastic waste and plastic pollution have been used interchangeably in the document. The whole research paper is divided in to five chapters. At the end of each chapter there is an "Audit Desk" containing suggestive list of issues/concerns/questions which may be considered by auditors.

Plastic and Plastic Waste

Plastic waste is a subset of solid waste and classification of plastic waste varies across countries. From a broader perspective; plastic may be classified according to its behavior with respect to heating, structure, physical and chemical properties. First chapter provides an overview of the Plastic and plastic waste: definition and classifications, its sources and the current global scenario with respect to plastic waste.

Impact of Plastic Waste on Environment and Human Health

Plastic is one of the sought after product, but post use phases of plastic products have many adverse impacts on the environment (air, water and soil) and living beings. If left untreated, plastic waste interacts with the environment to release toxic additives or concentrates of additional toxic chemicals in the environment making them bio-

¹ There are 17 SDGs, comprising 169 targets, which are measurable against 247 unique indicators.

available again for direct or indirect human exposure. This chapter highlights various adverse impacts of plastic on soil, marine ecosystems, wildlife and human beings.

SDG 12 -Ensure Sustainable Consumption and Production Patterns and Plastic Waste

Massive production and consumption of plastic is not sustainable and contribute towards generation of plastic waste and pollution. Sustainable production and consumption of plastic and curbing the menace of plastic pollution requires a holistic approach and rethinking the way economic development is pursued. Achieving SDG 12 aid in curbing plastic waste generation and promotes achievement of other SDGs. This chapter attempts to establish interconnection of SDG 12 with plastic waste and other SDGs .

Circular Economy and Plastic Waste Management

This chapter provides an overview of Integrated Solid Waste Management (ISWM), its components and the ways in which it can be used to address the problem of plastic waste. It also discusses about the concept of circular economy and its significance in handling plastic waste. It also describes other methods for plastic waste management such as reusing, recycling including some latest technologies.

Overview of Governance Responses

This chapter provides an overview of instruments used by various Government agencies for handling plastic pollution by various countries; through a comparative perspective. This chapter also informs about a global plastic inventory of policies of various countries which can be used as an important source of information for audits on plastic related themes to assess adequacy and effectiveness of governance measures in their respective countries.

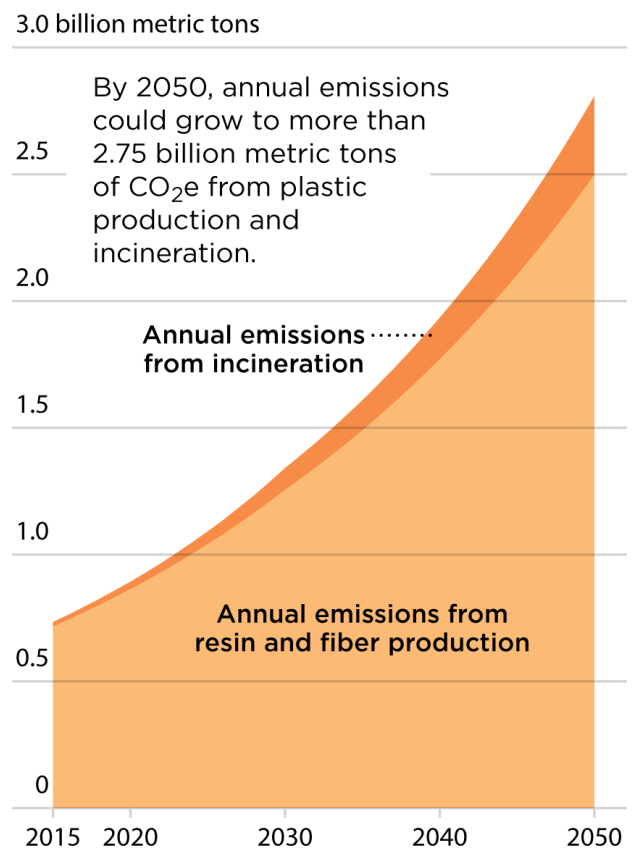


Introduction

A report by the United Nations in 2020 found that “the global material footprint grew from 73.2 billion metric tons (mt) in 2010 to 85.9 billion mt in 2017, involving increase by 17.4 per cent”.² Rising population, urbanization, modern lifestyle, human development and wellbeing are the biggest drivers of consumerism and economic growth in contemporary times. Unsustainable consumption and production patterns along with increasing waste and emissions has contributed to various environmental concerns. One such concern is the unsustainable consumption and production of plastic products and mismanagement of waste.

Plastic proliferation is one of the major cause of environmental pollution and also threatens the climate. If the production, disposal, and incineration of plastic continue on their present growth trajectory, by 2030, these global emissions could reach 1.34 gigatons per year. By 2050, plastic production and incineration could emit 2.8 gigatons of CO₂ per year Figure 2. Critically, these annual emissions will accumulate in the atmosphere over time. If growth in plastic production and incineration continue as predicted, cumulative greenhouse gas emissions by 2050 will be over 56 gigatons CO₂ emissions, or between 10-13 percent of the total remaining carbon budget,³ which points towards a global plastic waste crisis. In 2019, United Nations Environment Assembly (UNEA) also recognized plastic waste crisis as a serious and rapidly growing issue.⁴

Figure 2: Annual Plastic Emission to 2050



Source: Plastic & Climate- The Hidden Costs of a Plastic Planet <https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf>

Sustainable Consumption and Production (known as SCP) is about doing more and better with less. It is also about decoupling economic growth from

² The-Sustainable-Development-Goals-Report-2020.

³ Plastic and Climate, The Hidden Costs of Plastic Planet, CIEL.

⁴ The United Nations Environment Assembly is the world’s highest-level decision-making body on the environment. It addresses the critical environmental challenges facing the world today.

environmental degradation, increasing resource efficiency and promoting sustainable lifestyles. It also promotes strategies such as eco-efficiency, clean production, green procurement, etc. SDG 12 concerning SCP, underpins every other SDG. With the objective of significantly reducing manufacture and use of single-use plastic products by 2030, member states adopted a Ministerial Declaration titled 'Innovative Solutions for Environmental Challenges and Sustainable Consumption and Production' at the end of UNEA session (2019).⁵

Challenges related to disposal of plastic waste vary across countries. While developing countries face infrastructure deficiencies for sustainable production and post use disposal of plastic waste, many developed countries use high end technologies and policy initiatives for reuse and recycling of plastic waste. Transboundary movement of plastic waste is also used a source of revenue by many countries.

Currently there are limited methodologies to measure trade-offs between different impact categories - for example related to climate and ecosystem damage, undermining effective and informed decision-making to tackle the issue.⁶

As SAIs roles in achieving National Global Priorities⁷ is expanding, adoption of Agenda 2030 added a new dimension to include SDG audits. Unsustainable production and consumption of plastic products including plastic waste management has become a relevant field for audit. SAIs are urged to assist the national and local governments to improve the efforts and policies for promoting sustainable production and consumption in general. SAIs should conduct performance audits focused on plastic leakage due to systemic failures of linear economy and by recommending the need for a shift towards more **sustainable** and **circular** material flows.

⁵ SDG 12 - Initiatives to reduce the production and consumption of plastic By Larissa Copello de Souza, Zero Waste Europe.

⁶ Review of plastic footprint methodologies, Laying the foundation for the development of a standardised plastic footprint measurement tool, IUCN Julien Boucher, Carole Dubois, Anna Kounina, Philippe Puydarrieux.

⁷ INCOSAI XXIII Edition, Navigating the Journey: SAI Roles In Achieving National Global Priorities And Goals.

Plastic and Plastic Waste

1.1 Plastic

The term “plastic” is derived from the Greek word “plastikos”, meaning “fit for moulding”.⁸ According to the American Chemistry Council, plastic is a type of synthetic or man-made polymer; similar in many ways to natural resins found in trees and other plants.⁹ Different types of plastics are polyethylene terephthalate (PET), high-density polyethylene (HDPE), polyvinyl chloride (PVC), low-density polyethylene (LDPE), polypropylene (PP), and polystyrene (PS), “other”.¹⁰ Plastic can be broadly classified based on the following properties:

1. Behavior for heating
2. Structure
3. Physical and Chemical Properties

4. Type of Plastic Resin and identification codes
 5. Bioplastic
- Details are given in **Annexure I-V**.

Discovery of plastic in 1907 was a breakthrough worldwide.¹¹ Some of the main properties of plastics are light weight, hygienic plastic, durability, cost-effective, long-lasting, flexible and easy to transport and store. Plastic products are available all around us and used for variety of purposes ranging from household products, clothing, automobiles, electrical appliances, food industry to the health sector, aviation, and modern-day mobile phones. Plastic is major source material for production in many sectors. Various benefits of plastic are given in Table 1 below:

Table 1: Benefits of Plastics

Environmental Benefits	Social Benefits	Economic Benefits
<ul style="list-style-type: none"> ■ Packaging beverages in PET versus glass or metal reduces energy consumption and greenhouse gas emissions. ■ Use of lighter plastic composites in aircraft results in significant fuel cost savings as well as easier assembly. ■ In the automotive sector, the replacement of metal components by plastic composites that weigh less than 50 percent of the original contributes to significant energy savings. ■ Aluminum can also be replaced with plastic components that are lighter and also offer saving in cost. For example, the average plastic content of a light vehicle has increased to 110 kg or approximately 12 percent of its weight 	<ul style="list-style-type: none"> ■ Supply and storage of clean drinking water and plastics are installed in a range of diverse water control and distribution systems (e.g. sewerage, storm water, land drainage, and irrigation). ■ Plastic food packaging allows safe, time-dependent storage of fresh produce and other food, using temperature and atmosphere control inside the package (using gas-flush packaging and oxygen scavenger technology). ■ In addition, the quality of packaged foods (especially time-temperature history) can be monitored with low-cost indicator labels built into the packaging.¹² 	<ul style="list-style-type: none"> ■ Plastics have the advantage of a high strength-to-weight ratio, allowing minimal material usage (and low cost) in packaging design. ■ The ecological balance sheet of plastic packaging i.e. the total of the corresponding energy consumption for production, transport, and disposal and other effects on the environment, is often superior to that of competing materials. In addition, the plastic industry makes an important contribution to employment. ■ In 2012, the European plastic industry employed more than 1.4m people and earned revenues of €300 billion (or 390m USD), according to Plastics Europe.¹³

8 What are Plastic, Plastic Europe.

9 Lifecycle of a Plastic Product.

10 Identification and plastic type and classification of PET, HDPE, and PP using RGB method <https://iopscience.iop.org/article/10.1088/1757-899X/857/1/012015/pdf>.

11 Lifecycle of a Plastic Product.

12 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873019/>.

13 Valuing Plastic The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry.

This versatile nature of plastic has increased its global production and consumption manifold. Over 400 MT of plastic are produced every year.¹⁴ It is projected that between 2018 to 2030 and 2030 to 2050, the consumption of plastic worldwide is going to increase by 4.1 and 2.4 percent respectively.¹⁵ With the current rate, the plastic industry may account for 20 percent of the world's total oil consumption and 15 percent of the global annual carbon budget by 2050.¹⁶

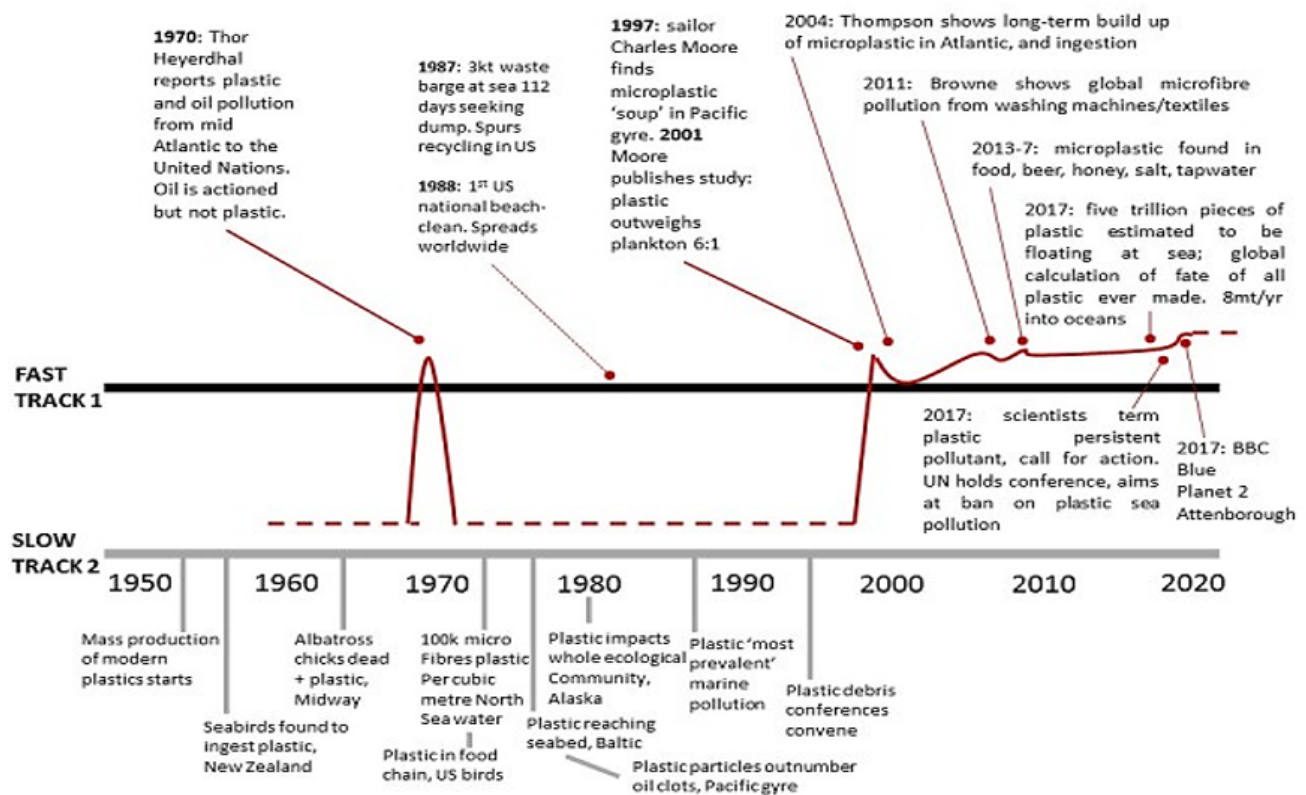
Despite enormous significance, plastic has a range of negative environmental and social impacts throughout its lifecycle. Production of plastic includes the use of chemicals which can potentially escape in the environment and harm local populations, customers, and workers, the aesthetic, health, economic and ecological impacts of plastic litter, and the consumption of

non-renewable petroleum products as an ingredient and fuel in manufacturing.¹⁷⁴ The amount of plastic waste is huge, spread all across the world and it is found in every part of the Globe. Therefore, it is realized that use of plastic in unsustainable manner outweigh its advantages and lead to its negative implications affecting environment and sustainability. Instead of boon, discovery of plastic has become a bane due to increased production and consumption, its durability and non-biodegradable characteristics. It is imperative that production and disposal of plastic is systematically managed and does not go out of control.

1.2 Plastic Waste: The Problem

If we decide to give a name to the present age—in particular the last 30 years—we would surely call it the Plastic Age. The markets are flooded with colour-

Figure 3: From Plastic to Plastic Waste: Timeline



Source: Why We Suddenly Have A Plastics Crisis, <http://threeworlds.campaignstrategy.org/?p=1764>

14 Plastic Atlas (2019).

15 Consumption growth rate of selected materials worldwide from 2018-2050, Statista.

16 New Plastic Economy.

17 Valuing Plastic: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry.

ful plastic goods that were cheap, easy to maintain (Figure 3). It began to be considered as a dispensable commodity and a new term “use and throw” became a way of life. Plastic bags and bottles have become the most common items.¹⁸

The definition of waste varies across countries and generally revolves around the term “dispose”.¹⁹ Article 2.1 of the Basel Convention defines wastes as “substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law”.²⁰ Wastes are materials that are not prime products (that are products produced for the market) for which the generator has no further use in terms of his/her purpose of production, transformation or consumption, and of

which he/she wants to dispose of.²¹ As per the United States Environment Protection Agency (EPA) “solid waste” means any garbage or refuse sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and community activities.²² Different classifications of waste overlap, as shown in Figure 4. On similar grounds, Plastic waste can be defined as “the accumulation of discarded plastic objects (e.g: plastic bottles, plastic packaging material, and much more) in the earth’s environment that have adverse impacts on the environment”.²³

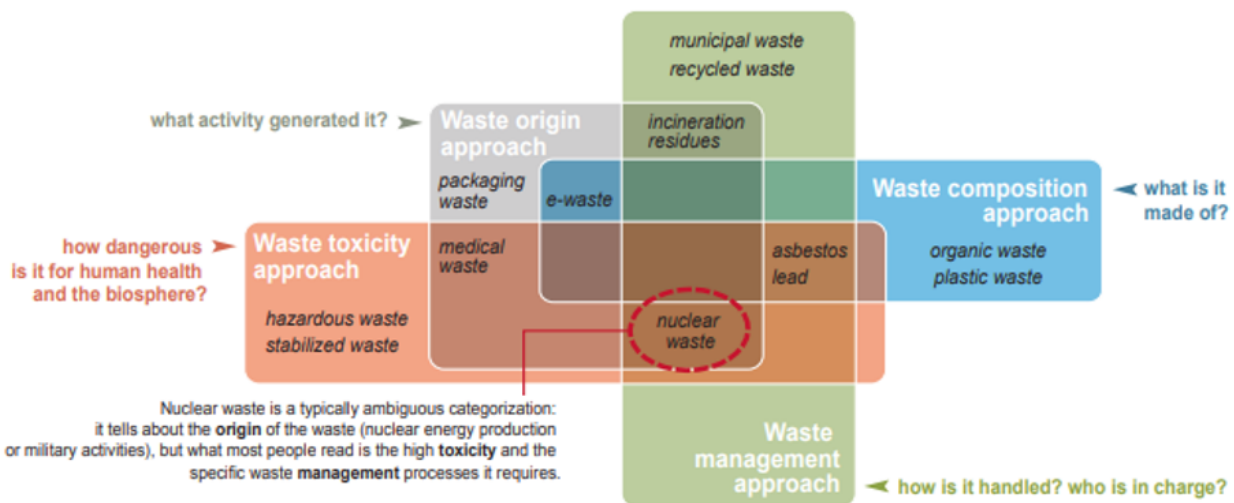
Categorization can help us understand plastic waste and identify its sources. However, most classifications

Figure 4: Overlapping definitions of waste Reference INTOSAI Guidance Audit of Management of Waste

About the difficulties of classifying waste (and counting it)

Different approaches and overlapping definitions

Statistical institutes of the world use various waste classifications, based on different approaches. This diversity is the major obstacle to data globalization and comparison.



Cartography by GRID-Arendal and Zoi Environment Network, www.grida.no

18 Plastic – A Boon Or A Bane?

19 INTOSAI WGEA: Auditing Waste Management.

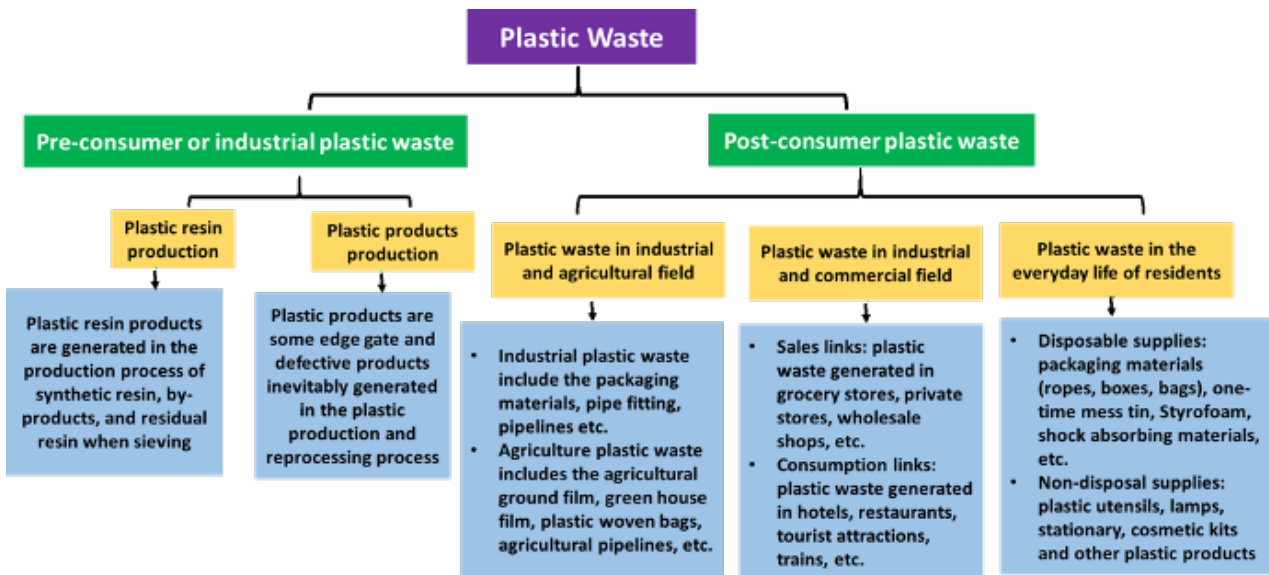
20 Basel convention.

21 Definition given by United Nations Statistics Division, cited in INTOSAI WGEA: Auditing Waste Managementf.

22 Criteria for the definition of solid waste and solid and hazardous waste exclusions, USEPA.

23 Plastic waste – everything you need to know, <https://cleanstreets.westminster.gov.uk/plastic-waste-complete-guide/#1>

Figure 5: Pre-consumer and postconsumer sources of plastic wastes



Source: Progresses in Polystyrene Biodegradation and Prospects for Solutions to Plastic Waste Pollution, <https://iopscience.iop.org/article/10.1088/1755-1315/150/1/012005/pdf>

have a purpose and waste is often categorized with a specific goal in mind. Plastic waste can be categorized based on its recycling potential and size. In oceans, plastic waste is often categorized into macro- (over 20mm diameter), meso- (5-20mm diameter), and micro- (under 5mm diameter) plastics.²⁴

1.3 Sources of Plastic Waste

Plastic pollution can arise at all stages during the life-cycle of plastic, from leakages during production and manufacturing, abrasion while products are in use to dumping or poor practices in handling wastes. Plastic waste has been categorized into pre-consumer plastic waste and post-consumer plastic waste.²⁵ Pre-consumer plastic waste, is generated during the manufacturing of virgin plastic from raw materials (oil, natural gas, salt, etc.) and the conversion of plastic into plastic products. Pre-consumer and Post-consumer generation of plastic waste are depicted below (Figure 5). Majority of plastic

waste comes from the post-consumer market. Post-consumer waste is found mainly in municipal solid waste (MSW), as well as in the following economic sectors: distribution and large industry, agriculture, construction and demolition, automotive, electronics, and electric.²⁶

1.4 Global Scenario of Plastic Waste

Growth in the amount of plastic production for various usages has led to significant increase in plastic waste generation due to their mismanagement. Plastic pollution is rapidly outpacing the efforts to stop it. Region-wise, the largest contributor to global domestic plastic waste in the year 2015 was Asia, generating 82 MT followed by Europe (31MT) and Northern America (29 MT), Latin America (including the Caribbean), and Africa each produced 19 MT of plastic waste while Oceania generated about 0.9 MT.²⁷ As per the study, Breaking the Plastic Wave (July 2020), at the present rate, the volume of plastic on the market will double, annual

²⁴ https://ec.europa.eu/environment/integration/research/newsalert/pdf/IR1_en.pdf.

²⁵ Progresses in Polystyrene Biodegradation and Prospects for Solutions to Plastic Waste Pollution- “Yang, S. S.; Brandon, A. M.; Xing, D. F.; Yang, J.; Pang, J. W.; Criddle, C. S.; Ren, N. Q.; Wu. Also described in “Baseline report on plastic waste”.

²⁶ Baseline report on plastic waste , United Nations Environment Programme (UNEP)(year 2020).

²⁷ Baseline report on plastic waste , United Nations Environment Programme (UNEP)(year 2020).

volume of plastic entering the ocean will almost triple and ocean plastic stocks will quadruple by 2040.²⁸

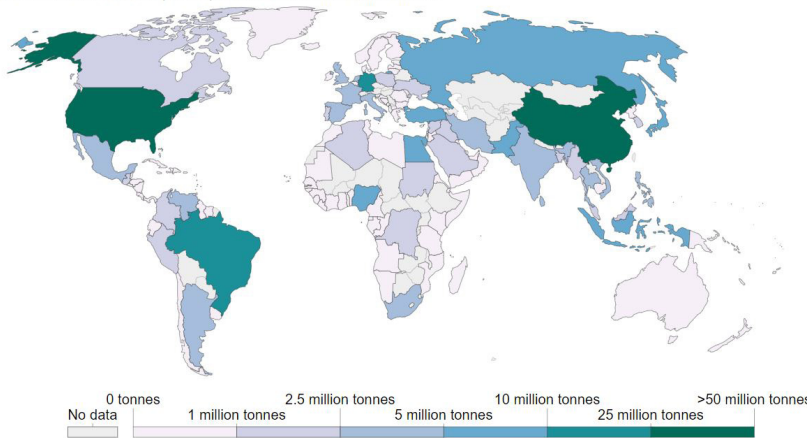
For the year 2010, status of total plastic waste generation by country is shown in Figure 6 below. The projected share of mismanaged plastic waste for the year 2025 is shown in Figure 7.²⁹ Country-wise actual position can be seen at the link: <https://ourworldindata.org/plastic-pollution>.

With increase in population, industrialization and urbanization; there has been growth in demand for plastic and plastic products. The gap between generation of plastic waste and measures for their effective management continue to persist, resulting in pollution and environmental degradation. While developing countries face infrastructure deficiencies for sustainable production and post use disposal of plastic waste, many developed countries use high end technologies and policy

Figure 6: Plastic waste generated by various countries

Plastic waste generation, 2010

Total plastic waste generation by country, measured in tonnes per year. This measures total plastic waste generation prior to management and therefore does not represent the quantity of plastic at risk of polluting waterways, rivers and the ocean environment. High-income countries typically have well-managed waste streams and therefore low levels of plastic pollution to external environments.



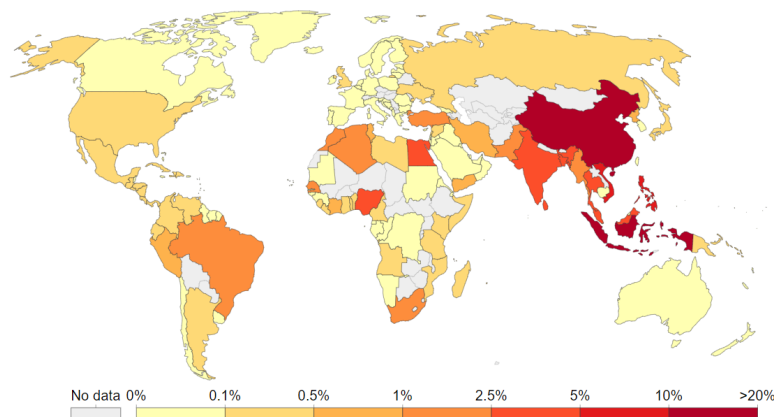
Source: OWID based on Jambeck et al. (2015) & World Bank

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Figure 7: Projected share of global mismanaged plastic waste in 2025

Projected share of global mismanaged plastic waste in 2025

Projected share of global mismanaged waste produced in 2025. This is measured as the total mismanaged waste by populations within 50km of the coastline, and therefore defined as high risk of entering the oceans. Mismanaged plastic waste is defined as "plastic that is either littered or inadequately disposed. Inadequately disposed waste is not formally managed and includes disposal in dumps or open, uncontrolled landfills, where it is not fully contained. Mismanaged waste could eventually enter the ocean via inland waterways, wastewater outflows, and transport by wind or tides."



Source: Jambeck et al. (2015)

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²⁸ Breaking the Plastic Wave (July 2020), released by the Pew Charitable Trusts and SYSTEMIQ is one of the most comprehensive and analytically robust studies on ocean plastic.

²⁹ <https://ourworldindata.org/plastic-pollution#total-plastic-waste-by-country>.

initiatives for reuse and recycling of plastic waste. A Case Study by State Audit Office of the Republic of N. Macedonia is given in Box 1.

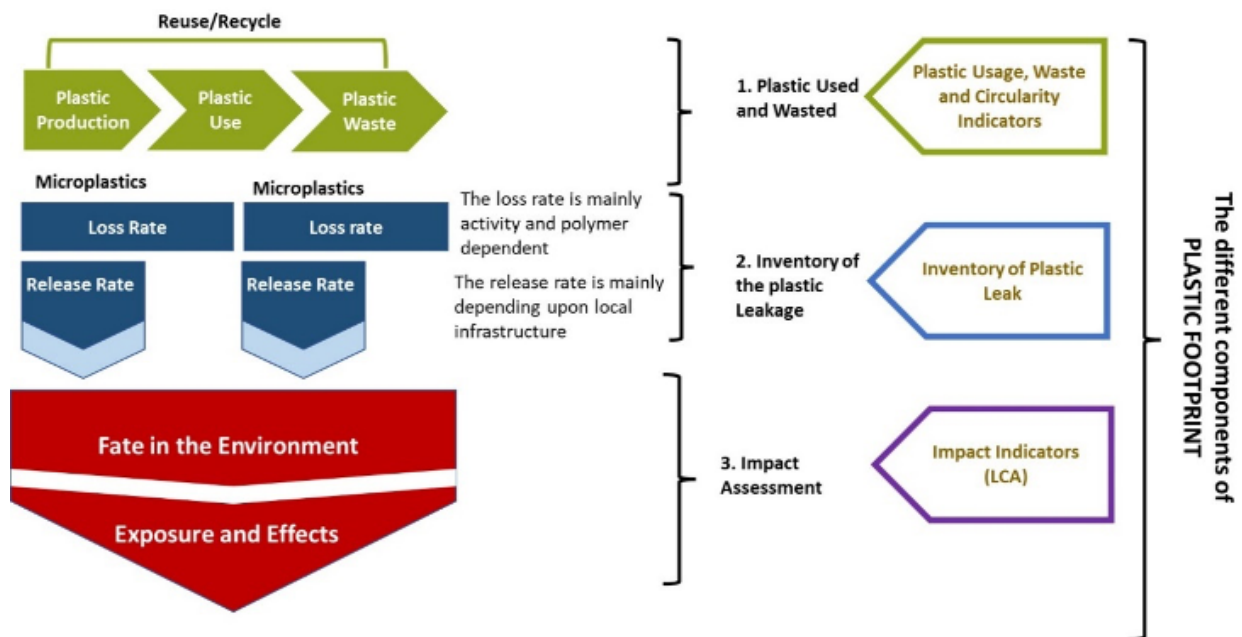


Audit Desk

For auditors, it is important to know about the status of plastic waste generated globally as well as in their respective countries to assess the adequacy and effectiveness of measures for their proper management. The auditors need to review if any assessment has been made about the quantum of plastic waste generated in their respective countries. They need to understand and examine if such assessment and projections about the amount of plastic waste has been made in a scientific manner considering various factors such as – population size, geographical size of the area, economic growth, increase in demand for consumer goods, changes in manufacturing methods etc. in their country and if so, is the mechanism of such projections follows standard methodology throughout the state.

There is no common methodology to either measure (through field studies) or assess (through modeling) plastic flow for a country. Auditors must equip themselves with the knowledge of plastic footprint methodologies capable of providing such information. Resolution No. 6 on marine plastic litter and microplastic adopted at the Fourth Session of the UN Environment Assembly (2019) highlighted the importance of a harmonized methodology to measure plastic flows and leakage along the value chain. National Guidance for Plastic Pollution Hotspotting and Shaping Action, Co-developed by the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN) provides a methodological framework and practical tools applicable at different geographical scales. The Guidance also goes one step beyond the quantification and qualification of plastic pollution. It also offers an effective interface between science-based assessments and policy (making). As illustrated in Figure 8, the notion of footprint may include three

Figure 8: Understanding Plastic Footprint. Ref-IUCN report of review of plastic footprint methodologies



What is included in the footprint/ 3 main modeling stages lead to 3 types of metrics: (1) plastic usage, waste and circularity indicators, (2) plastic leakage indicators, and (3) impact indicators

Source: Review of plastic footprint methodologies - Laying the foundation for the development of a standardised plastic footprint measurement tool by Julien Boucher, Carole Dubois, Anna Kounina, and Philippe Puydarrieux, <https://www.boell.de/sites/default/files/2019-11/Plastic%20Atlas%202019.pdf>

dimensions, leading to the following different types of metrics:

- The quantity of plastic used in a system (often referred to as the “source”). Here the plastic footprint is expressed in kilograms of plastic per year.
- The quantity of plastic emitted into the environment during production, transport, use, or end-of-life of a plastic product (often referred to as plastic leakage). Here the quantification of resource consumption as well as of the pollutants (i.e. the plastic itself and associated toxicants) emitted throughout the life cycle is referred to as “the inventory”.
- The impact, directly or indirectly generated by the pollutants emitted (or the leaked plastic) on human health or the environment. Impact assessment is a feature of the most advanced footprinting methodologies and requires the definition of one or multiple impact pathway- and Life Cycle Impact Assessment³⁰ (LCIA) methodologies. Impact assessment generally relies on three stages: fate,³¹ exposure³² and effect³³ assessments.

Auditors can examine whether appropriate methodology is being used for measuring the plastic problem. Detailed possible questions to be seen in audit are given in the Annexure-VII.

³⁰ Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product. Impact assessment generally consists in assessing fate, exposure and effect.

³¹ The environmental fate of a chemical describes the proportion of chemical that is transferred to the environment, and the length of time the chemical stays in the different environmental media.

³² Various species in an ecosystem can be exposed to chemicals through different uptake routes, such as inhalation of polluted air or ingestion of polluted water. For example, for human toxicity, exposure can be distinguished between direct intake (e.g. by breathing air and drinking water), indirect intake through bioconcentration processes in animal tissues (e.g. meat, milk and fish) and intake by dermal contact. The fate and exposure of chemicals are generally modelled with multimedia fate and exposure models.

³³ The effect of a chemical is determined by the sensitivity of a species to that chemical, among other factors, and is often derived from experimental toxicity data. For example, for human toxicity, it corresponds to the link between the quantity taken in via a given exposure route by a population to the adverse effects (or potential risk) generated by the chemical and the severity of disabilities caused by a disease in terms of affected life years.

Box-1 Case Study State Audit Office of the Republic of N. Macedonia

A performance audit on the topic “Efficient treatment and management of plastic waste” covering the period 2017 - 2019 was conducted and it was observed:

- Strategic, planning and program documents at central, local and regional level documents are not adopted and some are outdated posing challenges for setting up an Integrated Waste Management System.
- Lack of initiatives toward reusing plastic waste.
- Informal waste collection sector is not properly recognized in relevant legislation.
- Activities regarding management of plastic waste were neither sufficient nor efficient in prevention/reduction of plastic waste.
- Low level of awareness about plastic waste collection/segregation mechanisms signifying lack of implementation in educational/information tools.
- Measures are not providing incentives for plastic waste processing.
- Apathy from manufacturers towards measures to extend the life cycle of products.
- Inefficient collection and transportation of packaging waste (selected waste).
- Inconsistencies in implementation of measures based on “polluter pays” principle.
- Absence of regulatory mechanism in respect of collective packaging waste handlers regarding collection and utilization of realized revenue.
- The amount of collected fees paid to the treasury account or to the collective packaging waste handlers is insignificant, indicating insufficient funding for encouraging activities for collection, transport, processing and disposal of packaging waste.
- Inefficient data collection system in respect of issued permits (export of plastic waste), collected, processed and deposited plastic waste.
- Insufficient monitoring mechanism for waste management at national and local level and the supervisory activities by competent institutions.

2. Impact of Plastic Waste on Environment and Human Health

During the past 50 years, global production of plastic has reached 400 MT a year³⁴ alongside this massive plastic production came increased pollution as well. The whole lifecycle of plastic from production to disposal has severe environmental and health implications. Plastic production begins as a fossil fuel, and greenhouse gases are emitted at each stage of the plastic lifecycle. There are serious risk of both; post consumer plastic waste and pre-consumer or industrial plastic waste generated during the manufacturing of virgin plastic from raw materials (oil, natural gas, salt, etc.) and the conversion of plastic into plastic products returning back to the environment and causing long-term contamination of soil, air and water. The scope and magnitude of such problems are more visible in low-income countries as they lack sufficient resources to mitigate the harmful effects of plastic waste. Various impact of plastic and plastic waste are discussed in the following paragraphs.

2.1 Air Contamination

Around ninety-nine percent of plastic is derived from fossil fuels.³⁵ According to researchers, almost 40 percent of the world's waste gets burned. Toxic chemicals such as dioxins, furans, mercury and polychlorinated biphenyls (better known as BCPs) are released into the atmosphere when plastics are burned, posing harm to plants as well as human and animal health. Polyethylene, the most discarded synthetic polymer, is used in shopping bags and

is the highest emitter of methane, and ethylene.³⁶ It is also asserted that greenhouse gas emissions from the plastic lifecycle threaten the ability of the global community to keep global temperature rise below 1.5°C and the impacts of climate change. It is estimated that, with contemporary trends, these emissions could reach 1.34 gigatons per year by 2030—equivalent to the emissions released by more than 295 new 500-megawatt coal-fired power plants. By 2050, the accumulation of these greenhouse gas emissions from plastic could reach over 56 gigatons.³⁷

2.2 Water Pollution

Marine Pollution

Marine pollution due to plastic waste poses a big threat to coastal areas, mangroves, marine wildlife, fisheries, and coral reefs. Untreated and mismanaged plastic waste finds its way to the oceans through rivers, storm water drains, and plastic litter on coasts and maritime activities such as aquaculture, fishing, and shipping end up into the oceans. Untreated/mismanaged plastic waste material degrades slowly and thus remains drifting in oceans for years for decades and form entire islands of plastic debris known as plastic gyres.³⁸ About 73.9 million pounds (33,500 mt) of plastic waste is spread through the world's gyres. As plastic degrades slowly into microplastic, it releases toxic chemicals such as phthalates, flame retardants and Bisphenol A in water which poses serious threats to the marine ecosystem. Ingestion

³⁴ Plastic Atlas 2019 2nd Edition.pdf (boell.de).

³⁵ Centre for International Environmental Law: Fossil Fuels and Plastic.

³⁶ Double trouble: plastic found to emit potent greenhouse gases.

³⁷ Plastic and Climate Executive Summary.

³⁸ Tips for dealing with waste at sea by Emily Penn.

of such chemicals has harmful effects on marine wildlife. Plastic may also transport other hazardous waste, such as POPs, with long-term effects on the environment. Many animals face entanglement, ingestion, and obstruction due to plastic waste debris which has serious implications for their existence.

Surface and Ground Water Contamination

Untreated and mismanaged plastic waste leads its way to landfills. Harmful chemicals from untreated plastic waste in landfills may leach through the soil into the nearby water bodies like lakes and wetlands having harmful effects on the water quality and the entire ecosystem. Contaminated water may also damage the wetlands and their ability to support healthy ecosystems and controlling flood. Harmful chemicals may also enter into the food chain through fish and shellfish, and accumulate when consumed by other animals. Contaminated groundwater also poses great health risk, as it is often used for drinking, bathing and recreation, as well as in agricultural and industrial activities.³⁹

2.3 Soil Contamination

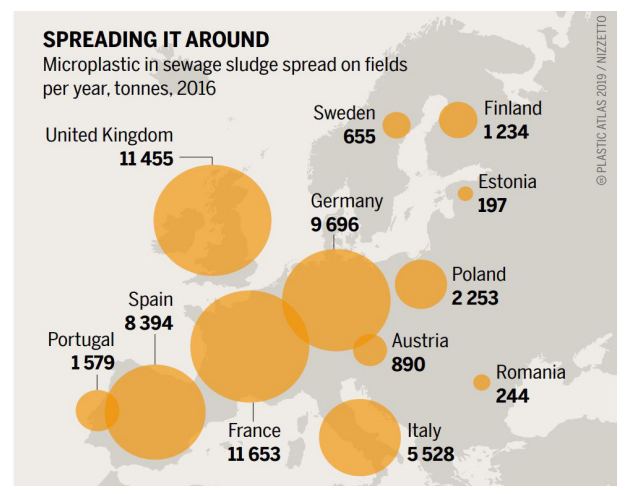
Many researchers warn that terrestrial microplastic pollution is much higher than marine microplastic pollution – estimated at four to twenty three times higher, depending on the environment.⁴⁰ Dumping of plastic on land or landfilling plastic leads to their degradation. It slowly disintegrates into microplastic and nanoplastic, which releases chemicals into the soil. These plastics also change the structure of the soil as well as the habitat of living organisms that are important for maintaining soil fertility.⁴¹ A case study on “Audit on policies and funds related to the recycling of mulch films” conducted by SAI China is given in Box-2-Case Study. Worldwide, microplastic is also spread on the soil through the application of sewage sludge as fertilizer. Figure 9 gives a glimpse of

the quantity of microplastic in sewage sludge spread on fields per year (in tonnes) in the year 2016. The sludge also contains microfibers from textiles, personal care products and degradants of consumer products.⁴² Household compost and organic fertilizers used in the soil are another significant source of plastic into the soil. These microplastic can remain in the soil for several years due to low light and oxygen conditions. They also transfer toxic chemicals to harvested crops and grazing animals.⁴³ Earthworms and other insects and worms in the agricultural soil can further transfer the chemicals to other areas of soil through the food web.

2.4 Effect on Human Health

Humans are exposed to a large variety of toxic chemicals found in plastic products through inhalation, ingestion, and direct skin contact all along the plastic lifecycle, as shown in Figure 10. In certain circumstances,

Figure 9: Micro plastic particles that sewage-treatment plants cannot separate out are sprayed onto fields with the residual sludge commonly used as a fertilizer



Source: Plastic Atlas- Facts and figures about the world of synthetic polymers published by Heinrich Böll Foundation, Berlin, Germany, and Break Free From Plastic, <https://www.boell.de/sites/default/files/2019-11/Plastic%20Atlas%202019.pdf>

39 INTOSAI WGEA Guidance on Audit of Management of Waste.

40 Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) and their Berlin colleagues: An underestimated threat: Land based pollution with Microplastics.

41 Plastic Atlas (2019).

42 The Hidden Cost of Plastic Planet (2019)

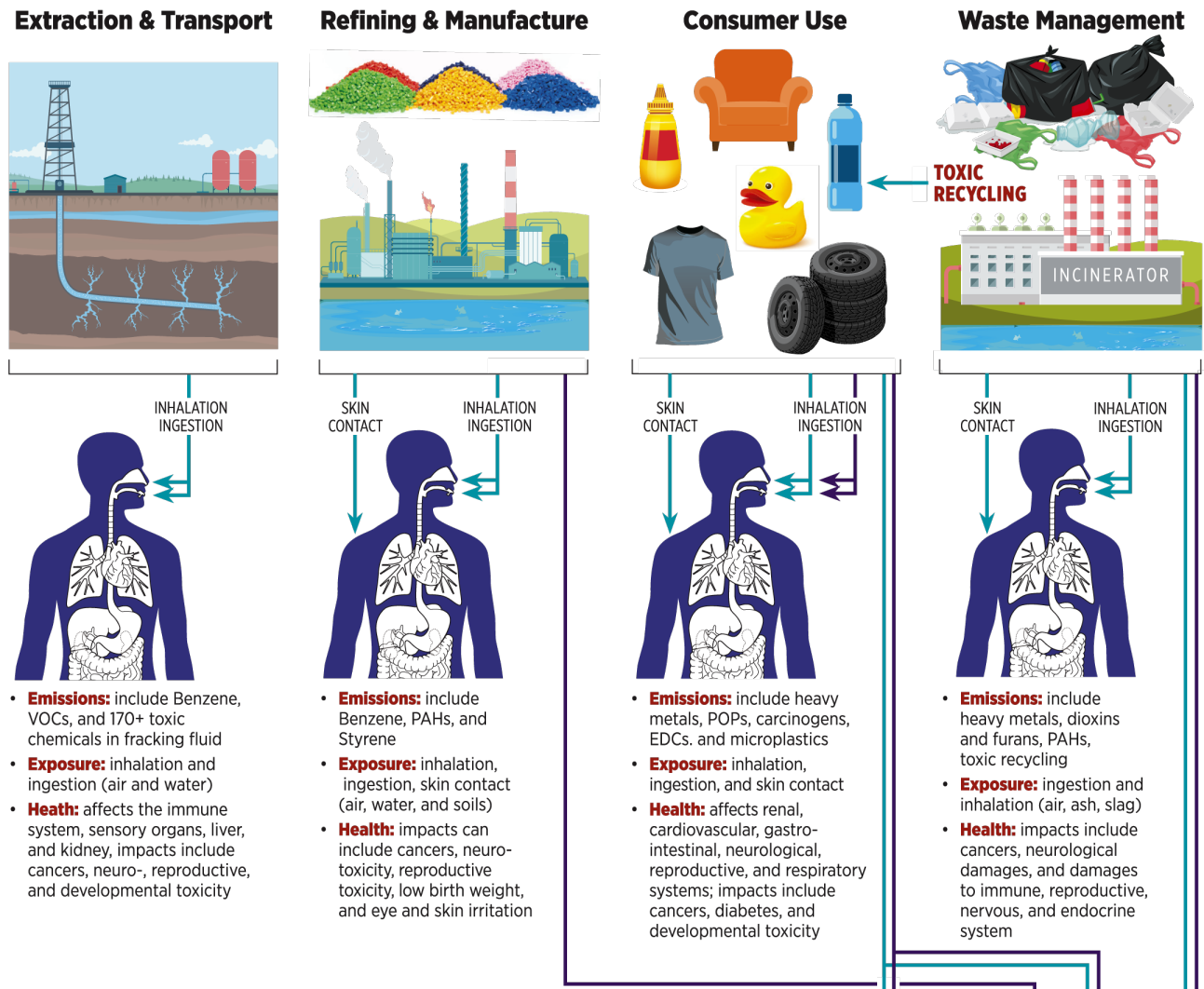
43 The Hidden Cost of Plastic Planet (2019)

Figure 10: Impact of plastic waste on human health

Plastic & Health: The Hidden Costs of a Plastic Planet

Humans are exposed to a large variety of toxic chemicals and microplastics through inhalation, ingestion, and direct skin contact, all along the plastic lifecycle.

DIRECT EXPOSURE



ENVIRONMENTAL EXPOSURE

- Microplastics and toxic additives:** including POPs, EDCs, carcinogens, and heavy metals
- Exposure:** inhalation and ingestion (air, water, and food chain)
- Health:** affects cardiovascular, renal, gastrointestinal, neurological, reproductive, and respiratory systems, impacts include cancers, diabetes, neuro-, reproductive, and developmental toxicity

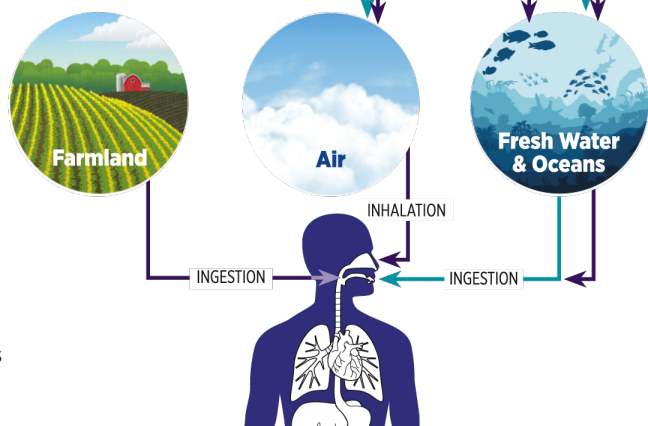
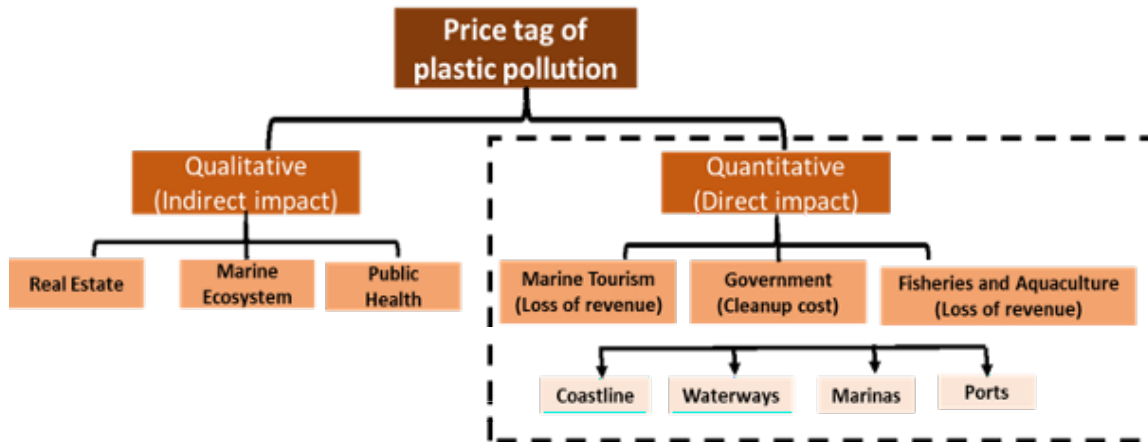


Figure 11: Impact of marine plastic pollution on six socio economic areas



Source: The price tag of plastic pollution An economic assessment of river plastic, <https://www2.deloitte.com/content/dam/Deloitte/my/Documents/risk/my-risk-sdg14-the-price-tag-of-plastic-pollution.pdf>

microplastic can bioaccumulate⁴⁴ and biomagnify⁴⁵ over time, especially in sea foods, as predators eat prey. Consumption of such contaminated food can be harmful to human health. Short-term health impacts due to this kind of exposure include rashes, headaches, coughing etc. while long-term impacts include depression, asthma, etc. Inhaling harmful gases produced by burning plastic waste irritates the eyes and nose, coughing, headache, dizziness, and sometimes these gases can even cause unconsciousness. Burning PVC material (generally used in construction, food packaging, or toys) releases Dioxin⁴⁶ which is carcinogenically responsible for Endocrine Disruption causing neurological disorders, declining sperm count, and infertility and have a particularly negative impact on women.⁴⁶ Phthalates used as plasticizers are common additives in cosmetic products and can increase the risk of recurrent pregnancy loss in women.⁴⁷ Such pregnancy losses, or birth defects in pregnancies carried to term, can lead to social consequences for mothers who may be blamed or abused for these negative outcomes.⁴⁸

2.5 Social and Economic Impacts

Social costs due to plastic waste includes a potential reduction in the recreational and aesthetic values of the marine environment. Land-origin plastic costs the global economy up to 19 billion USD every year, according to new research. Asian countries account for 82 percent of global plastic waste coming from the land, with the economic impact of marine plastic pollution from these countries constituting 86 percent of the global costs estimated.⁴⁹

The economic impact of plastic waste is immense. As per the United Nations Environment Programme (UNEP) estimates, the economic costs (eg. revenue losses to fisheries, aquaculture, and marine tourism industries) associated with ocean-based consumer plastic pollution alone amount to 13 billion USD every year.⁵¹ Related economic costs also include those linked to clean-up operations and litter removal (Figure 11).

Many countries often depend on fishing or coastal

44 Bioaccumulation is the gradual accumulation of substances, such as pesticides or other chemicals, in an organism. Bioaccumulation occurs when an organism absorbs a substance at a rate faster than that at which the substance is lost or eliminated by catabolism and excretion.

45 Biomagnification, also known as bioamplification or biological magnification, is any concentration of a toxin, such as pesticides, in the tissues of tolerant organisms at successively higher levels in a food chain.

46 Murphy L and others, 'Exposure to Bisphenol A and Diabetes Risk in Mexican Women' (2019) 26 Environmental Science and Pollution Research 26332.

47 Ibid.

48 Lakhani M, 'Wasting Women—The Biopolitics of Waste and Women' [2007] Agenda: Empowering Women for Gender Equity 93.

49 <https://www.consultancy.uk/news/23051/land-origin-plastic-costs-economy-19-billion-every-year>.

50 No time to waste.

tourism, which makes them more vulnerable to the economic consequences of ocean plastic pollution.⁵¹ This adds up to the economic impacts in the form of cleaning expenses and loss of tourism revenue. Plastic waste damages the fishing equipment of fishermen. They suffer further loss of revenue from less fish being caught, and the fact that the ones caught are often of poorer quality, due to plastic waste.⁵² Communities that depend on coral reef-related tourism face difficulties due to damage caused to coral reefs by plastic waste. Adverse health effects on cattle due to consumption of plastic waste have dire economic consequences for farmers, especially in low-income or developing countries. Such kind of economic degradation further impacts the social lifestyle, livelihood opportunities and wellbeing of these people leading to unemployment, poverty, and other social problems.



Audit Desk

Growing use of plastic and mismanaged plastic waste have many harmful effects on the environment. The materiality⁵³ and the probability⁵⁴ of the damage caused by plastic and mismanaged plastic waste is an area of concern for Auditors. They need to assess the impact of environmental, social, and economic risks

associated with plastic and plastic waste. Auditors may examine if any assessment of risk from plastic and plastic waste to the environment and human health has been made by the concerned government entities and responsible stakeholders.

Auditors may further assess actions, if any, that has been initiated to tackle these risks and what kind of methodology and considerations have been taken into account while assessing the risks from plastic waste to the environment. Auditors must take due diligence of guidelines/ standards for monitoring of plastic pollution in marine water, air, surface water, soil, etc. which have been issued by plastic waste monitoring bodies in their countries. It is also needful for auditors to examine if regular monitoring is conducted as per these guidelines/ standards by monitoring agencies and action has been taken management of plastic waste as per monitoring reports. A few possible audit questions related to impacts of plastic and mismanaged during the audit of plastic waste are detailed in the Annexure-VII.

51 Plastic the problem and its impact.

52 No time to waste.

53 Inherent dangers of plastic waste.

54 Follows from the management of waste.

Box-2 Case Study: The National Audit Office of the People's Republic of China (CNAO)

Audit objectives

- To determine whether the competent authorities, agricultural material producers and operators could demonstrate that they were adequately implementing the laws and policies in the collection, disposal and reuse of mulch films.
- To reveal the unclear accountability of the above entities in pollution prevention and control and in the practice of recovery.
- To reveal the insufficient capacity of recycling processing sites for obsolete mulch films, and the unsatisfactory recycling rate.
- To reveal the lack of financial, taxation, energy and other preferential policies, and inadequate market guidance, which together affect the collection, disposal and reuse of mulch films.

Scope of audit

- The audit on the recycling of mulch films covered 8 provinces with large film-mulched areas.

Criteria of audit

- Soil Contamination Prevention and Control Law of the People's Republic of China, Regulations on Pesticide Administration, and Polyethylene Blown Mulch Film for Agricultural Uses (China national standard GB 13735-2017), etc.

Audit findings

- The implementation of the new standards of mulch film is not in place. The production, sales and use of ultra-thin mulch film still exist due to the lack of effective promotion measures and regulatory means. The audited areas has low rate of mechanical recycling of obsolete mulch films.
- The reuse of obsolete mulch films in the audited areas is not high, and some provinces do not even carry out mulch films recycling. The few recycling sites have insufficient capacity, causing a dilemma in which most of the collected mulch films could neither be reproduced nor stored, some counties even have to discard, landfill or burn the recovered films, posing potential eco-system hazards.

Audit recommendations

- Relevant authorities should introduce a mulch film recycling system as early as possible, in order to clarify the responsibilities of the regulatory authorities in relation to production, sales and consumption.
- Strengthen supervision and assessment, promote the enforcement of the new China national standard for thickened mulch films.
- Include the elimination of ultra-thin mulch films and pollution caused by mulch films in the scope of law enforcement.
- Improve the supporting policies for recycling, address both problems and their causes.
- Effectively increase the recycling rate of obsolete mulch films, and reduce farmland pollution.

Box-3 Case Study: Supreme Audit Court of Iran (SAC)

Supreme Audit Court of Iran (SAC) has used the pathology model in environmental auditing in the process of conducting audit of plastic waste management.

SAC in this method examined the pathology of the mechanisms governing the ecosystem (policies and laws at the macro level) in a small range, and finally based on the findings and results of the audit offered recommendations for improving its environmental status.

Pathology requires a systematic approach to the whole process and its purpose is to identify the nature and type of the problems that have arisen and need to be solved. In this model, damage is anything that interferes with the system in achieving its goal, or whatever that hinders the achievement of the goal.

Pathology is the first step to get things done legally, prevent breaches of obligations and also deal with problems. It includes four stages of

- recognizing the nature and mechanisms,
- identifying harmful signs,
- rooting out the causes and factors of damage,
- finding solutions to deal with damage.

Conclusion

Based on performance and compliance audits conducted in relation to plastic waste during the last few years, SAI underlined the significance of constructive and promising measures in the field of waste management such as submission of a bill to reduce plastic bags (2019) for approval by the Islamic Consultative Assembly, building up a committee to reduce plastic consumption in the Environmental Protection Organization, increasing public culture regarding the nature and damages of plastic waste and, consequently, the activities of the public and their participation in plastic waste management.

In addition, in order to increase the awareness of auditors, the Supreme Audit Court had compiled a book on waste audit and also by translating the experiences of other SAIs, tries to participate in training courses and conferences, share experiences with other peers and improve its status.

SDG 12 - Ensure Sustainable Consumption and Production Patterns and Plastic Waste

The diverse negative impacts of plastic on sustainability clearly demonstrate that the world has to deal with a tough and persistent problem. The 2030 Agenda for sustainable development is an ambitious plan of action for all countries to achieve the 17 SDGs. The “Vision” of Agenda 2030 entails a world in which consumption, production patterns and use of all natural resources ranging from air to land, rivers, lakes and aquifers to oceans and seas are sustainable. The agenda seeks to benefit all people and does not leave anyone behind, calling for the participation of all to contribute towards its implementation. It requires a collaborative partnership among all stakeholders to support the achievement of the SDGs. However,

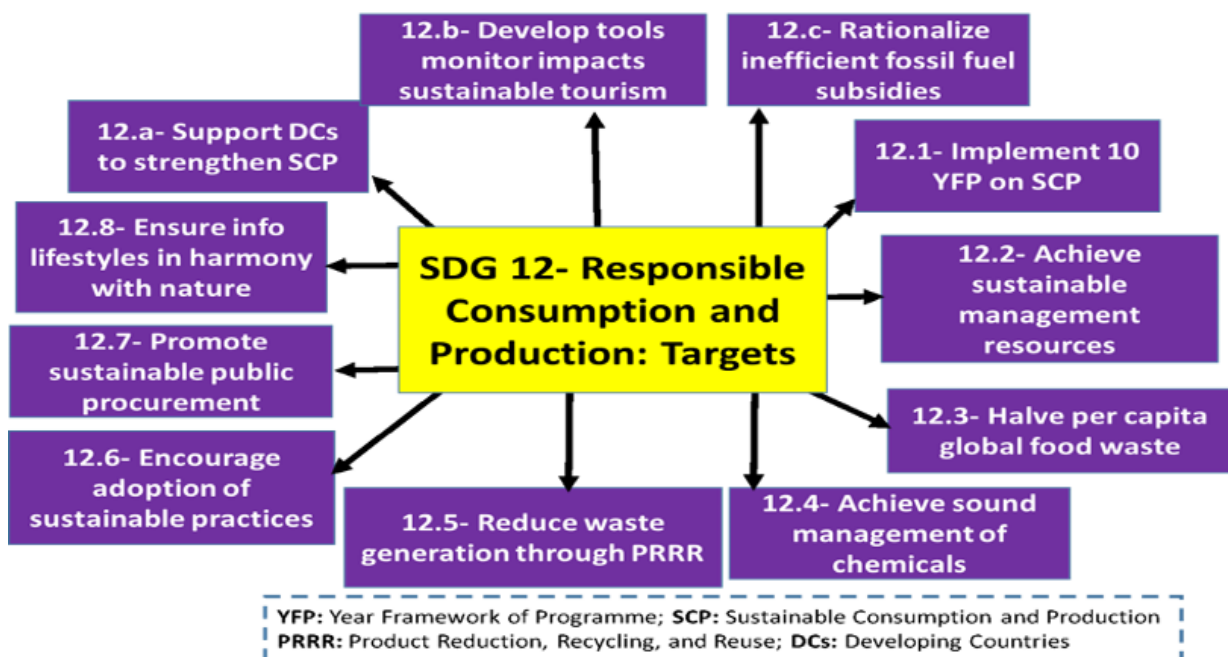
plastic pollution is not represented as a main theme in any of the 17 SDGs despite the omnipresence of plastic and plastic waste in contemporary life.

3.1 Sustainable Development Goal (SDG) 12 and Plastic Waste

SDG 12 aim to ensure sustainable consumption and production patterns, champions this theme and believes in sustainable lifestyles by increasing resource efficiency and reducing environmental degradation, as depicted in Figure 12 below.

Integrating environmental sustainability with economic growth and welfare by decoupling environ-

Figure 12: Targets of SDG 12





The SDG12 is also closely interlinked with many other Agenda 2030 goals and targets. UNEP believes that advancing toward sustainable consumption and production through circularity will enable to advance over 50 of the 169 SDG targets that are all dependent on more sustainable consumption and production patterns.

mental degradation from economic growth and doing more with less is one of the major challenges faced globally. Resource decoupling and impact decoupling are needed to promote sustainable consumption and production patterns and to make the transition towards a greener and more socially inclusive global economy. It also entails respecting the biophysical boundaries of the planet and to reduce current global consumption rates in order to fit with the biophysical capacity to produce ecosystem services and benefits.

Of the total amount of plastic produced since the 1950's, only 9 percent has actually been recycled globally, with the rest being burned, landfilled or left polluting our environment.⁵⁵ In fact, the recycling systems in place have not kept pace with the excessive consumption. The pattern of consumption of plastic products is presently linear, mostly meant for short term usage and not designed for recycling. To curb the problem of increasing plastic waste, there is need to promote sustainable consumption of plastic especially the plastic products which are meant for single use, low value disposable plastic. Lesser and sustainable

consumption will ultimately lead to generation of sustainable amount of plastic waste.

Though SDG 12 on Sustainable Consumption and Production (SCP) is a stand-alone goal, it should be seen as an enabler for the implementation of a range of other SDGs and many of their targets.⁵⁶ SDG 12 by its cross cutting nature, addresses inter-linkages and adopts a holistic approach, taking into account the economic, social and environmental aspects of sustainable development in a balanced and integrated manner.⁵⁷ However, there is least data availability, least funding and appears to be awarded low priority from Member States in their Voluntary National Reviews and SDG prioritisation processes.⁵⁸

3.2 Plastic Waste and Other SDG

Plastic pollution has impact on all other SDGs as depicted in Table 2. Absence of sufficient indicators for measuring the progress towards plastic waste management poses great challenge to authorities responsible for making public policies, monitoring and curbing the issue.

⁵⁵ Gaia/CAG/BFFP (2019).

⁵⁶ Global Environment Outlook-6 Measuring Progress towards achievement of environment dimension of SDGs and Progress report on the 10-year Framework of Programmes on Sustainable Consumption and Production Patterns : note / by the Secretary-General.

⁵⁷ Goal 12—Ensuring Sustainable Consumption and Production Patterns: An Essential Requirement for Sustainable Development.

⁵⁸ Global Environment Outlook-6 Measuring Progress towards achievement of environment dimension of SDGs.

Table 2: Challenges Posed by Mismatched Plastic Waste on all of the SDGs



SDG 1: No Poverty

- Negative impacts on ecosystem services and on communities.
- Economic impacts (negative impacts on tourism and fisheries).
- Plastic waste may enter waterways causing flooding.⁵⁹
- Well managed plastic industry can provide job opportunities, income and better livelihood to many people.



SDG 2: Zero Hunger

- Hygienic food packaging by plastic, helps keeping food and drink safe and fresh, plus reduces amount of food waste. However, microplastics can impact fisheries (decreasing income) and pollute seafood that people depend on for sustenance. Presence of (micro)plastic in food packaging, agricultural soils, fruits and vegetables posing potential risks to human health through ingestion and limit supply of healthy food and food security



SDG 3: Good Health and Well Being

- Medical plastics are traditionally single use to reduce cross-contamination and the spread of disease. Reducing the amount of waste through effective sterilisation processes whilst still preserving the benefits of plastics is a challenge for the industry.
- The health care industry generates large amounts of contaminated waste that cannot be treated as part of the standard waste stream. incineration is the standard method for Medical waste Managing contaminated waste to recover the material or embodied energy requires improved processes and development
- Presence of (micro) plastic in humans and fetus via ingestion, inhalation, and dermal exposure of microplastic in packed food products, foodstuff, and air.⁶⁰



SDG 4: Quality Education

- Students located in fence line communities (next to extraction / refinery/ production/ waste burning/ incinerator locations) are more susceptible to adverse health impacts, compounding education disparities.⁶¹

⁵⁹ Davidson J, Myers D and Chakraborty M, No Time to Waste: Poverty and the Global Environment (Oxfam Publishing 1992)

⁶⁰ Human Rights Council, 'Report of the Special Rapporteur on the Implications for Human Rights of the Environmentally Sound Management and Disposal of Hazardous Substances and Wastes' (United Nations General Assembly 2016).

⁶¹ Bullard R, 'Comments of Dr. Robert D. Bullard on EPA's Proposed Updates to Refinery Emissions Standards' (Dr. Robert Bullard Father of Environmental Justice, 9 August 2014) /, accessed 18 November 2020.



SDG 5: Gender Equality

- Waste picking is thought to be a woman's job at some locations, making them more exposed to waste and sanitation issues.⁶²



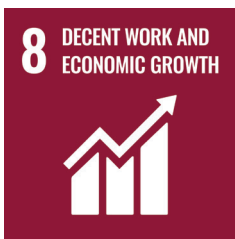
SDG 6: Clean Water Sanitation

- Plastic can pollute water sources, aggregate contaminants and clog /disrupt sanitation infrastructure.



SDG 7: Affordable and Clean Energy

- Incineration of (micro)plastic waste used in waste-to-energy systems contributes to greenhouse gas emissions, release of atmospheric pollution, and is unsustainable. Subsidies drive plastic production and fossil fuel extraction via highly polluting extractive methods that would not be commercially feasible without this use. It also possibly hinders the development of cleaner energies.



SDG 8: Decent Employment and Economic Growth

- Employment opportunities along the production (extraction to use) of plastic, can present health risks to workers from exposure to toxics. The development of circular economies and recycling/ collection infrastructures could create more jobs, which is yet develop appropriately.



SDG 9: Industry, Innovation and Infrastructure

- Subsidies, financing, and investments from businesses drive plastic production and fossil fuel extraction via highly polluting extractive methods that would not be commercially feasible without these incentives. It possibly hinders the development of cleaner energies.
- Innovation is required for sustainable bio-based alternatives to fossil fuel-based plastic to help contributing to a circular economy

⁶² Lynn H, Rech S and Samwel-Mantingh M, 'Plastic, Gender and the Environment. Findings of a Literature Study on the Lifecycle of Plastic and Its Impacts on Women and Men, from Production to Litter.



SDG:10 Reduced Inequalities

- Exports of plastic waste from developed to developing countries have been considered waste pollution transfer.⁶³
- Petrochemical and waste management facilities, such as incinerators and landfills, are disproportionately built in low-income and heavily minority communities, further deepening social disparities with environmental degradation, health costs, and wasted public investments.⁶⁴



SDG 11: Sustainable Cities and Communities

- The commodification of a public resource (water) by the plastic industry, hinders the development of local infrastructure by becoming the de facto replacement of potable water, which can lead to local authorities abdicating their responsibility to provide it.⁶⁵ Indiscriminate disposal of plastic in countries with inadequate waste management systems is choking critical urban infrastructure



SDG 12: Responsible consumption and Production

- Plastic, from extraction and material sourcing, to production and waste disposal, can be a problematic industry, in some cases commodifying natural resources for profit (bottled water), and hindering the development of public infrastructure.⁶⁶ Besides the cost of mismanaged plastic waste is immensely huge and unsustainable.



SDG 13: Climate Action

- Greenhouse gases are emitted at every step of the plastic life cycle, which drives climate change

⁶³ Indonesia Returning 57 Containers of Developed Worlds Waste' (AP NEWS, 9 July 2019), accessed 18 November 2020.

⁶⁴ Lerner S, Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States.

⁶⁵ Pacheco-Vega R, 'Agua Embotellada En México: De La Privatización Del Suministro a La Mercantilización de Los Recursos Hídricos' (2015) 22Espiral (Guadalaj.) 221.

⁶⁶ Pacheco-Vega R, '(Re)Theorizing the Politics of Bottled Water: Water Insecurity in the Context of Weak Regulatory Regimes' (2019) 11 Water 658.



SDG 14: Life Below Water

- Plastic pollution threatens marine wildlife



SDG 15: Life on Land

- Mismanagement of (micro) plastic waste causes widespread terrestrial pollution of (micro) plastic in landfills, urban and rural areas, protected areas, and agricultural soils. Over 50% of all microplastic remain on land, and comprise nearly all (95%) of global annual plastic waste output.⁶⁷



SDG 16: Peace Justice and Strong Institutions

- Differential exposure of vulnerable communities to health hazards due to plastic threatens strong institutions by undermining justice and promoting instability through protests and water insecurity.



SDG 17: Partnerships for the Goals

- Increasing menace of plastic waste presents an opportunity to create equitable and fair collaboration opportunities to address the problems posed by plastic pollution. An international instrument that addresses the whole plastic cycle at the global scale may help mitigate the issue and strengthen the voices from impacted countries.⁶⁸

⁶⁷ Jambeck JR and others, 'Plastic Waste Inputs from Land into the Ocean' (2015) 347 Science 768 Possible Sources' (2018) 612 Science of The Total Environment 422.

⁶⁸ Toward an International Legally Binding Agreement on Plastic and Plastic Pollution' (CIEL, 2017), < >, accessed 8 April 2021.

3.3 Data Challenges related to Plastic Waste

Some of the major targets of “SDG 12- Ensure sustainable consumption and production patterns” include the targets specifically based on waste, which invariably include plastic waste also. These are:

- By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment (SDG target- 12.4)
- By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse (SDG target- 12.5).

An analysis of the indicators in the Global SDG Indicators Database⁶⁹ reveals that for 4 of the 17 goals, less than half of 194 countries or areas have internationally comparable data. There is not enough data to assess progress on management and generation of waste and hazardous waste (SDG target 12.4), recycling (SDG target 12.5), corporate sustainability reporting (SDG target 12.6), and research and promotion of sustainable lifestyles (SDG 12.8, 12.a). Country-level data deficits are also significant in areas related to sustainable production and consumption (Goal 12) and climate action (Goal 13). Even countries with available data have only a small number of observations over time, making it difficult for policymakers to monitor progress and identify trends.⁷⁰



Audit desk

SAIs and their auditors have an important and direct role to play in the implementation of Agenda 2030 and SDGs. They can support good governance by ensuring accountability and transparency of government

“Despite our best efforts to identify data for the SDGs, several indicator and data gaps persist at the international level. Governments and the international community must increase investments in SDG data and monitoring systems and build strong data partnerships to support informed SDG decisions and strategies.”

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through objective, rigorous and practical analysis of how programs, laws, regulations and sustainability targets are managed, implemented and monitored nationally and internationally. Just as a whole-of-government approach that fosters policy coherence requires the governments to employ different ways of thinking and managing, SAIs and auditor’s need to think differently in developing approaches to audit the SDGs. The SDGs targets and indicator framework are also especially well-suited for SAIs to perform audits because they provide a source of clear criteria on a wide range of topics.⁷¹

It is important for auditors to check if stakeholder departments/agencies/Government entities are working together in coordination to meet targets under SDG 12 and if there is a monitoring mechanism in existence, to evaluate the intermediate outcomes of the activities towards meeting targets set under SDG 12.5 with respect to reduction in Plastic waste generation. Auditors have to ensure if adequate measures have been taken by the stakeholders to substantially reduce waste generation by 2030 through prevention, reduction, recycling and reuse. For this,

⁶⁹ SDGs indicator database.

⁷⁰ The-Sustainable-Development-Goals-Report-2020.

⁷¹ https://www.environmental-auditing.org/media/113691/21h-wgea_sdgs_18-sep-2019.pdf.

auditors may examine about the adoption of relevant national indicators under SDG 12.5 to achieve the set targets for reduction in Plastic Waste generation and ensure that they confirm to international indicators, if any given by United Nations and the targets that have been set for reduction in Plastic Waste generation under SDG 12.5. Auditors should examine that suitable mapping of all the stakeholders has been done and duties and responsibilities assigned to each stakeholder institution for management of plastic waste. Data plays a very important part in deriving

conclusions during audits. Auditors may examine if the data constituting national indicators are being correctly evaluated using a uniform methodology, to assess the progress made under SDG 12.5 and mapping of National Recycling Rate in relation to plastic waste generation. The Voluntary National Report (VNR) information has to be in line with the actual ground conditions.

Illustrative Questions as Audit Guidance are provided in the Annexure-VII.

Box-4 Case Study: Accountability State Authority (ASA), Arab Republic of Egypt

The Accountability State Authority (ASA) of Arab Republic of Egypt conducted an audit to evaluate the performance of the Egyptian Environmental Affairs Agency with regard to its process of plastic waste management operations in 2019 and recommended to:

- Strengthen legislation encouraging recycling.
- Encourage plastics recycling to become a recognized activity to develop the sector performance.
- Improve performance of Waste Management Regulatory Authority.
- Increase training courses for workers in this field to improve their skill.
- Oblige packaging manufacturers to put a label on the plastic packing material to facilitate the sorting process.

Government Actions:

- In June 2019 Government announced banning plastic bags usage & disposable plastic tableware in Marsa Allam & Hurghada cities:
- An "Environment" initiative was taken by the Government to raise awareness of reducing the consumption of plastic bags.

4. Circular Economy and Plastic Waste Management

4.1 The Concept of Circular Economy

The concept of waste management is alone becoming insufficient for solving waste problems. Waste volumes can be looked upon as a resource and concept of resource management is becoming important.

The **circular economy** is a restorative and regenerative by design. This means materials constantly flow around a “closed loop” system, rather than being used once and then discarded. In the case of plastic waste, this means simultaneously keeping the value of plastics in the economy, without leakage into the natural environment. This can be achieved via long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling and upcycling. The ultimate aim is to minimise the amount of resources consumed, and waste generated, by our economic activities. Circular

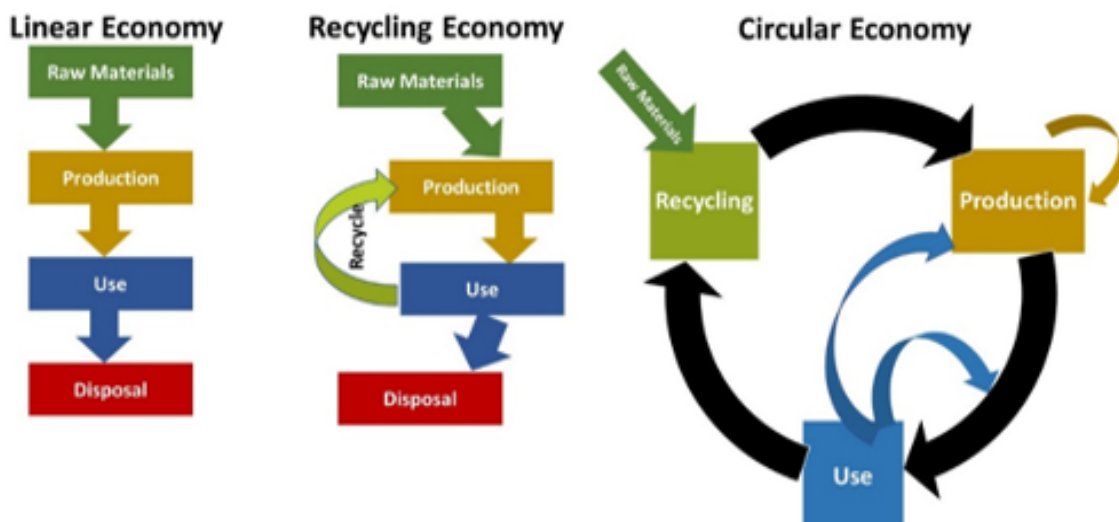
“Society needs to stop thinking of plastic as ‘waste,’ but as a renewable resource that needs to be disposed of correctly”.

Creating a circular economy for plastics

economy approaches are also contributing to the implementation of the Paris Agreement and climate related targets, as well as the biodiversity targets.

In contrast, the linear economy a “take, make, dispose” model of production, as illustrated in Figure 13.⁷² Circular economy is market economy, new

Figure 13: From linear economy to circular economy



Source: Linear, recycling and circular economies. Adapted by ISF from Netherlands Government-wide Programme for a Circular Economy, <https://theconversation.com/the-planned-national-waste-policy-wont-deliver-a-truly-circular-economy-103908>

72 MOOC: Auditing Waste Management, NAO Estonia.

values should be introduced and therefore regulation needed besides markets. For example, oil is a very easy item to trade, while plastic waste is not. Therefore, circular economy needs to be made as efficient as the market economy because the outcome is better. A circular economy for plastic is necessary to limit consumption of plastic while ensuring that the plastic used is appropriately managed throughout its lifecycle.

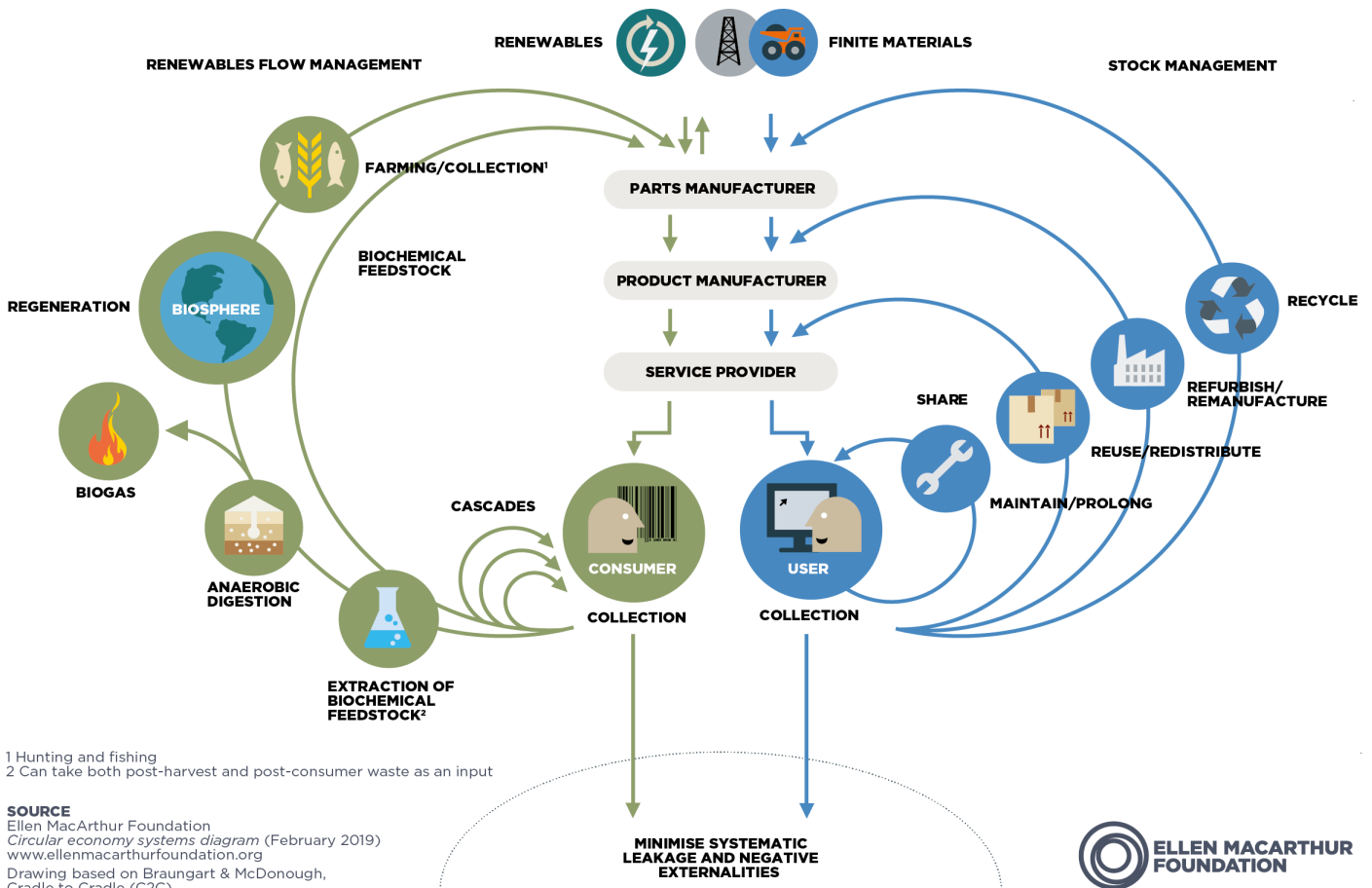
4.1.1 Concept of Circularity for Plastic Waste

The concept of circularity was acknowledged during 4th United Nations Environment Assembly held in 2019 as one of the approaches to move forward towards sustainable consumption and production. The plastics value chain has raised significant attention, as countries see the opportunity of addressing the plastic problem through circularity.

A circularity in plastic waste life-cycle is necessary in order to keep the added value in products for as long as possible and eliminate as much as possible waste generation. The concept of circularity in plastic is presented in Figure 14.

The incorporation of secondary raw materials, i.e., recycled plastics, in the products is a way of avoiding the use of virgin raw materials with benefits in terms of energy consumption, imports of fossil fuels, environmental protection and GHG emissions. The use of virgin raw materials for products of a very short lifecycle such as single use items, might be seen as a clear example of inefficient use of resources and contrary to the circular economy principles where the value of products, materials and resources is maintained in the economy for as long as possible and the generation of waste is minimised.

Figure 14: The concept of circularity in plastic



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

4.1.2 How Plastic Circularity Can be Improved?

The circular economy is based on the following three principles:

- Reduce plastic waste and pollution through product design.
- Retain resources and products in use.
- Regenerate and preserve natural systems.

Plastic circularity strategy proposes measures aiming to improve recyclability, collection, sorting, recycling and recycled content of plastic products. The circularity in plastics can be achieved through following options.⁷³

Redesign and Innovation

Designing plastic products to enhance longevity, reusability, recycling, and waste prevention by incorporating after use, asset recovery, and waste and pollution prevention from the onset. This means adopting a life-cycle approach including cleaner production; discouraging single- and other avoidable plastic use as well as designing products for appropriate lifetimes, extended use, and for ease of separation, repair, upgrade, and recycling; eliminating toxic substances; and preventing the release of microplastic into the environment by redesigning products.

Plastic from Alternative Feedstock⁷⁴

Producing plastic from alternative feedstock including bio-based sources such as sugarcane, oils, and cellulose as well as from greenhouse gas, sewage sludge, food waste, and naturally occurring biopolymers.

Designing for Recyclability

Today, producers of plastic and packaging have little or no incentive to consider recycling or reuse

when they design products, but end-of-life needs to be front of mind throughout product development processes. Plastics are made from a range of molecular chains called polymers, which perform a wide variety of properties and can be highly customised to meet each manufacturer's specific requirements. This diversity complicates the recycling process.

Closing the Loop with Chemical Recycling

Unlike mechanical recycling, which is inevitably constrained by contamination and complications arising from material separation, chemical recycling is a process by which the material is stripped down to its original chemical building blocks, so that they can be built back up again into new products. The exciting opportunity for chemical recycling is that waste plastic can be used to make food-grade PET – not just from plastic bottles, but also waste recovered from oceans and even polyester textiles. For a long time, chemical recycling has often remained in the margins of public discourse about plastic waste (mostly due to a lack of investment and infrastructure), but it is currently the focus of intense innovation.

Extended Producer Responsibility Schemes

Extended Producer Responsibility (EPR) is a policy approach under which producers are given significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals.⁷⁵

Reporting of Recycling Data

Production statistics for recycled plastics are largely unknown. Reliable data is crucial to measure the progress towards attaining its plastic packaging waste recycling targets.

⁷³ <https://www.sustainability.com/thinking/creating-a-circular-economy-for-plastics/>

⁷⁴ <https://www.thegef.org/sites/default/files/publications/PLASTIC%20for%20posting.pdf>

⁷⁵ <https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm>

Develop Robust Information Platforms

Such platforms provide data on the composition of plastic products, track the movement of plastic resources within the economy, support cross-value chain dialogue and the exchange of knowledge, and build on experiences gained through existing global institutional networks.

Policy Instruments

Implementing economic, policy, and regulatory measures such as direct surcharges, taxes, extended producer responsibility, mandatory requirements and standards for circular/eco-design, and a ban on certain plastic types

4.1.3 Barriers to Achieving a Circular Economy in the Plastic and Other Economic Sectors⁷⁶

- Being locked into a linear plastic production infrastructure makes it costly to change
- High up-front investment costs and risks when changing to the circular model
- Complex international production and consumption supply chains
- Lack of support for scaling up circular models, especially for small and medium-sized enterprises
- Difficulties in business-to-business cooperation, including transactions costs
- Resistance to change among product manufacturers, which could be due to a lack of knowledge
- Uncompetitive circular products because subsidies encourage the linear production and use model
- Inadequate knowledge and capacity for implementation
- Limited consideration of plastic in key legislation

- Unfavorable regulations and lack of standards
- Inadequate monitoring and reporting on plastic data, especially in developing countries
- Lack of consumer awareness or enthusiasm and reluctance to accept recycled products.

Overcoming these barriers will require significant policy and regulatory support to foster innovation, increase the competitiveness of the circular model and create a demand-pull for circular plastic products. It will also require working with the private sector to catalyze changes as well as with the public to encourage changes in societal behavior and create consumer demand for circular products.

4.2 Technologies That Can Help Reduce Plastic Pollution

Governments policies drive innovation in the private sector and innovation can also influence public policy for tackling the problem of plastic pollution. Some technologies are mentioned here intended to (1) prevent plastic from leaking into waterways or (2) improve the ability to recapture and collect existing plastic pollution.

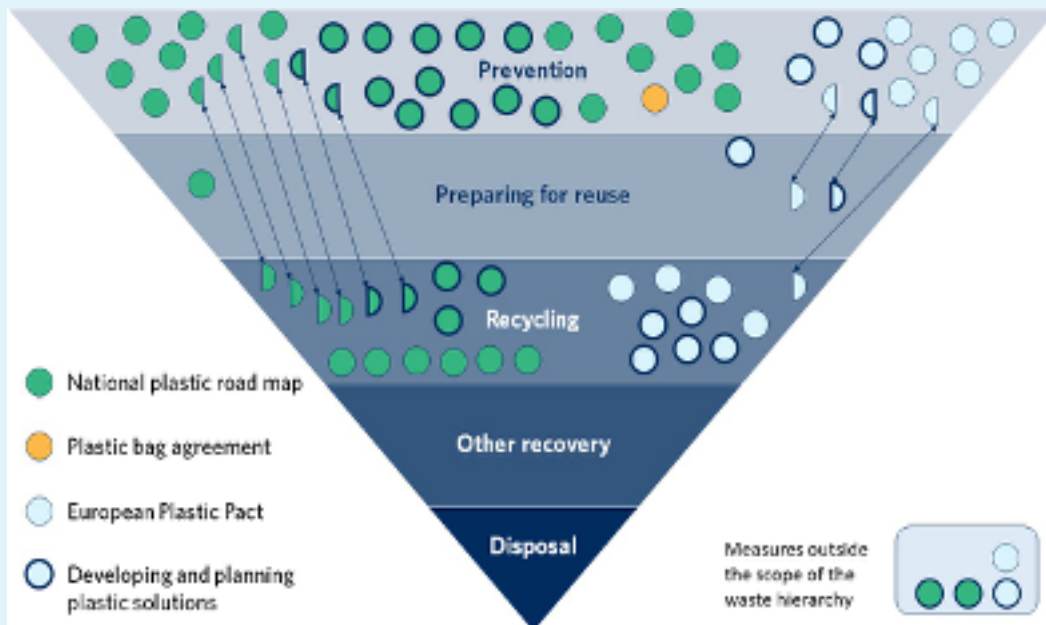
The technologies that collect existing plastic pollution from waterways, include large-scale booms, smaller robotics aimed, and technology that seeks to track and identify plastic pollution to aid in manual collection.

Technologies aimed at preventing plastic leakage through greywater disposal, primarily in residential water systems are two laundry balls and a washing machine filter are designed to trap microfibers generated from washing synthetic fabrics in domestic laundry systems and prevent them from entering wastewater. Similarly, "showerloop" technology filters and reuses greywater in the home; while this technology is primarily designed to reduce water

⁷⁶ <https://www.thegef.org/sites/default/files/publications/PLASTIC%20for%20posting.pdf>

Box-5 Case Study: National Audit Office of Finland (NAOF)

The National Audit Office of Finland (NAOF) reviewed the actions taken by the government to reduce the problems of plastic waste with the Fragmentation, Overlap, Duplication and Gap Analysis method (FODG), developed by GAO and TCU Brazil.



Source: <https://www.vtv.fi/en/good-governance-articles/how-to-analyse-overlaps-and-fragmentation-in-public-administration/>

Three governmental plastic programs viz; The National Plastic Roadmap (2018), European Plastic Pact (2020) and Plastic Bag Agreement (2016) were analyzed to identify potential cases of FODG-problems. The objective was to identify whether these three programs and their objectives overlap or duplicate, or whether the functions have been fragmented. It was concluded that:

- The measures and targets in these three plastic programs were sufficient. However, they overlapped in many respects and, on the other hand, they also completely ignored the lowest levels of the plastic waste hierarchy.
- There was a clear need of coordinating these operations as well as monitoring of the work related to plastic waste.
- The duplication of objectives was not in itself detrimental to the activities, if the objectives can be promoted by recognizing this duplication with other organizations involved in the activities. However, this required closer co-operation with what had been done in many areas of the plastic roadmap.
- Many actors continued to contribute to the goals alone, although more coordinated cooperation would be beneficial. This fragmentation of the responsible parties had also led to gaps in implementation, as some of the implementers of the plastic roadmap had dropped out of operation.
- It is possible that implementation and monitoring of objectives would have been more effective if the activity had been allocated funding at an early stage.

consumption, a secondary benefit is preventing the leakage of microplastic, such as those from cosmetics, into the environment.

Several other innovations target macroplastic leakage and remove macroplastic from stormwater and wastewater before entering waterways. One invention, Clever-Volume, is a monitoring technology that allows authorities to certify the volume of trash in shipping containers, preventing improper disposal and fraud.⁷⁷ The majority of inventions found focus on collecting macroplastic from rivers and oceans. Some of the technological options are discussed below in detail. The Ocean Cleanup System, a large boom system designed to clean up the Great Pacific Garbage Patch (Figure 15).

A large device called the Holy Turtle deployed off the coast of Honduras is 1,000-foot long floating unit towed by two marine vessels which capture floating waste, while large vent holes act to protect wildlife (Figure 16).

A related macroplastic collection technique involves the use of a “bubble barrier” rather than traditional nets or filters to guide trash to the edge of rivers or waterways for easy collection (Figure 17).

Another invention, the Floating Robot for Eliminating Debris (FRED), shown in Figure 18 is an ongoing efforts to improve the technology to collect plastic down to the size of a few millimetres. There are other technologies also which include a remotely operated vehicle that uses infrared light to detect, photograph and remove microplastic from the environment and a magnetic liquid that combines oil and magnetite powder to bind to and remove microplastic. Other smaller projects include aquatic drones, boats, and buckets aimed at more localized collections of macroplastic from harbours and waterways. These designs range from simple, nondiscerning collection technologies, to more

Figure 15: Ocean Cleanup system



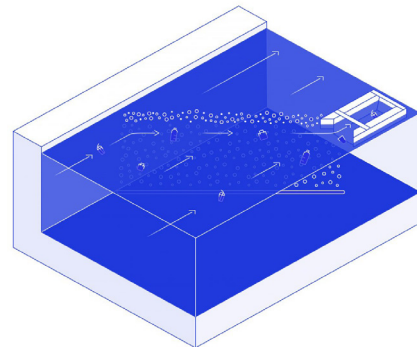
Source: The Ocean clean up, <https://theoceancleanup.com/milestones/system-002/>

Figure 16: Holy Turtle



Source: <https://www.adweek.com/brand-marketing/soda-stream-created-a-new-device-the-holy-turtle-to-remove-plastic-in-the-oceans/>

Figure 17: Bubble Barrier



Source: A smart solution to plastic pollution, <https://thegreatbubblebarrier.com/>

Figure 18: FRED



Source: Solar-powered, semi-autonomous Floating Robot For Eliminating Debris (FRED) that cleans oceans, <https://ubuntu.com/solutions/clear-blue-sea>

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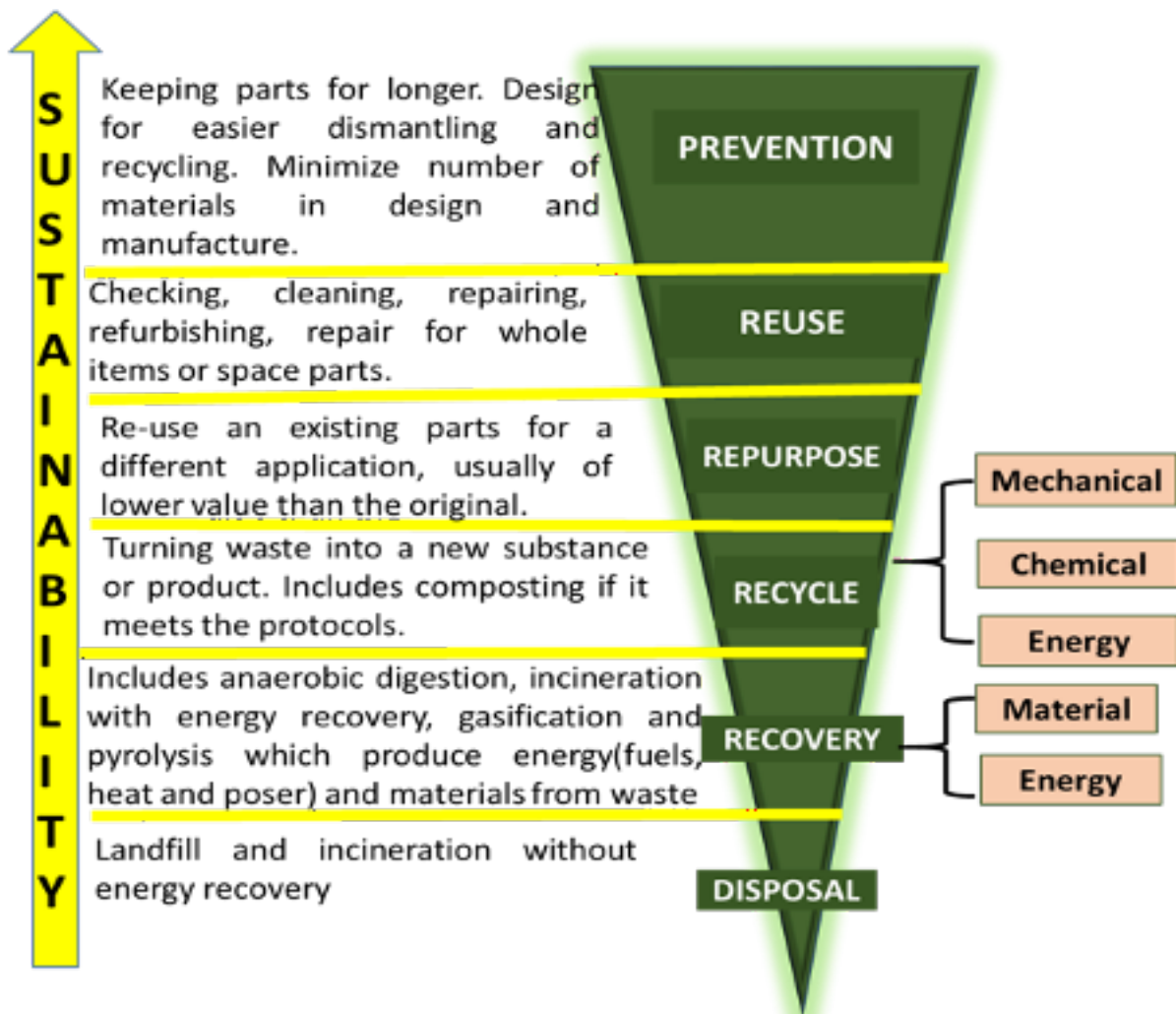
advanced features, including sonar technology and sensors.⁷⁸

4.3 Approaches for Waste Management

Incineration and landfills are the most frequently used modes of plastic waste disposal. This is mainly practised through government policies in low income and developing countries which do not have sufficient infrastructure to dispose plastic waste. Like solid waste, integrated waste management is equally significant in management of plastic waste.

The concept of Integrated Waste Management (IWM) involves carefully evaluating local needs and conditions to determine the most suitable options for all aspects of waste management. This process involves prevention, reduction, reuse, recycling, recovery and disposal as IWM hierarchy steps. Figure 19 shows the IWM hierarchy indicating Prevention as the most preferred option and Disposal as the least preferred option.

Figure 19: Integrated Waste Management hierarchy



Source: Waste management hierarchy, <https://baxcompany.com/insights/circularity-of-polymer-composites/waste-management-hierarchy/>

Box-6 Case Study: United States Government Accountability Office (GAO)

GAO was asked to review federal efforts that advance recycling in the United States. The performance audit was conducted from August 2019 to December 2020. The GAO examined (1) cross-cutting challenges affecting recycling in the United States, (2) actions that selected federal agencies had taken that advance recycling, and (3) actions Environment Protection Agency(EPA) had taken to plan and coordinate national efforts to advance recycling.

Based on GAO analysis of stakeholder views, five cross-cutting challenges affect the U.S. recycling system: (1) contamination of recyclables; (2) low collection of recyclables; (3) limited market demand for recyclables; (4) low profitability for operating recycling programs; and (5) limited information to support decision making about recycling.

Conclusion

- EPA has not taken steps to implement Resource Conservation and Recovery Act (RCRA) requirements to conduct studies and develop recommendations for administrative and legislative action about either existing policies or Extended Producer Responsibility (EPR) requirements.
- EPA's draft national strategy does not align with desirable characteristics for effective national strategies.
- Commerce has taken actions to advance recycling, in part by supporting export markets for U.S. recyclables. However, Commerce has not taken action to stimulate the development of domestic markets for recyclables, as we recommended in 2006.
- Moreover, according to EPA officials, recent changes to the Basel Convention might further reduce export markets for plastic recyclables.

Recommendation

To develop an implementation plan:

- For conducting a study and developing recommendations for administrative or legislative or eliminating such incentives and disincentives, upon the reuse, recycling and conservation of materials.
- Regarding the necessity and method of imposing disposal or other charges on packaging, containers, vehicles, and other manufactured goods to reflect the cost of final disposal, the value of recoverable components of the items, and any social costs associated with non-recycling or uncontrolled disposal.
- To incorporate desirable characteristics for effective national strategies, including (1) identifying the resources and investments needed, and balancing the risk reductions with costs, (2) clarifying the roles and responsibilities of participating entities, and (3) articulating how it will implement the strategy and integrate new activities into existing programs and activities.

4.3.1 Components of IWM

Prevention

Prevention is the most efficient way of dealing with plastic waste. Unwanted waste is controlled by efficient use of technology in designing and manufacturing of products and packaging with minimal requirement of resources. The society is encouraged to reduce the consumption of plastic products to a minimal level. Lesser consumption may result in lesser production as well as lesser generation of waste. Governments should implement policies having information and outreach instruments for creating awareness among common people to influence them towards adopting a life style requiring minimal plastic for their needs.

Figure 20 shows a few simple initiatives, which may result in significant reduction of plastic waste through prevention.

Reuse

The “product reuse” is using the product again after repair or refurbishment. Reusing plastic is preferable to recycling as it is a more energy efficient option. A plastic product can be reused multiple times in variety of feasible manners without replacing it immediately with a new plastic product. Re-fillable containers for food and drink fluids are an obvious alternative to plastic containers that are thrown away after only one use.

Figure 20: Few initiative’s for reduction of plastic use at source



Source: <https://ecobnb.com/blog/2018/07/plastic-pollution-seas/>

Repurpose and Upcycling

Upcycling involves additional uses for many plastic goods whose primary lives have come to an end. It can be defined as “a process that can be repeated in perpetuity of returning materials back to a pliable, usable form without degradation to their latent value—moving resources back up the supply chain”.⁷⁹ Upcycling, reduces the amount of waste that is produced and ultimately takes longer time to go into the ground as waste. It will reduce the overall demand on the Earth’s resources and provide an alternative to their plastic equivalents (Figure 21).

Figure 21: Upcycling of plastic products



Source: <https://earth5r.org/plastic-and-what-to-do-with-it/>

Recycling

Recycling operations usually involves the reprocessing of waste into products, materials or substances. Resources are saved by recovering material benefits from the waste. One of the basic requirements for effective recycling is public awareness in separation of the plastic waste material at the household stage. Efficient collection and separation of waste plastic will lead for enhanced recycling efficiencies. There are three main types of recycling for plastic waste mechanical, energy and chemical⁸⁰ (Figure 22).

Disposal

In 2018 in USA, about 146.1 MT of municipal solid waste (MSW) were landfilled of which 18.5 percent was plastic⁸¹ (Figure 23). Normally, plastic waste is disposed in landfills. The landfills with bottom liner to prevent leakage of liquid underground and proper ventilation passage for naturally emerging harmful gases like methane, can become a safe disposal site for plastic waste. Many landfills have ways to vent it into the air.⁸² Others have ways to capture it and sell it to produce electricity, heat, pipeline-quality gas or vehicle fuel.



Audit desk

Information on plastic waste management approaches would provide the auditors with the necessary information about various mechanism and approaches used to handle plastic waste. Their role can be significant in raising technology neutrality and analysing the impact of policies and approaches put in place by the Government for plastic waste prevention, reduction, reuse, recycle and recovery. They may examine if there exist any action plan for reduction of plastic waste and whether modalities for disposal of plastic waste are being finalised by Municipal Authorities/ Urban Local Bodies. Auditors may further assess if there exists a mechanism for efficient collection the plastic waste from households, shops, industries etc. and any action has been taken by the government towards consumer information and education to promote plastic waste minimization and specifically reduction, reuse and recycling ? While conducting audit of plastic waste related issues, auditors may also explore availability, extent of use of advance technological options in such programmes. Alternatively challenges if any, faced by

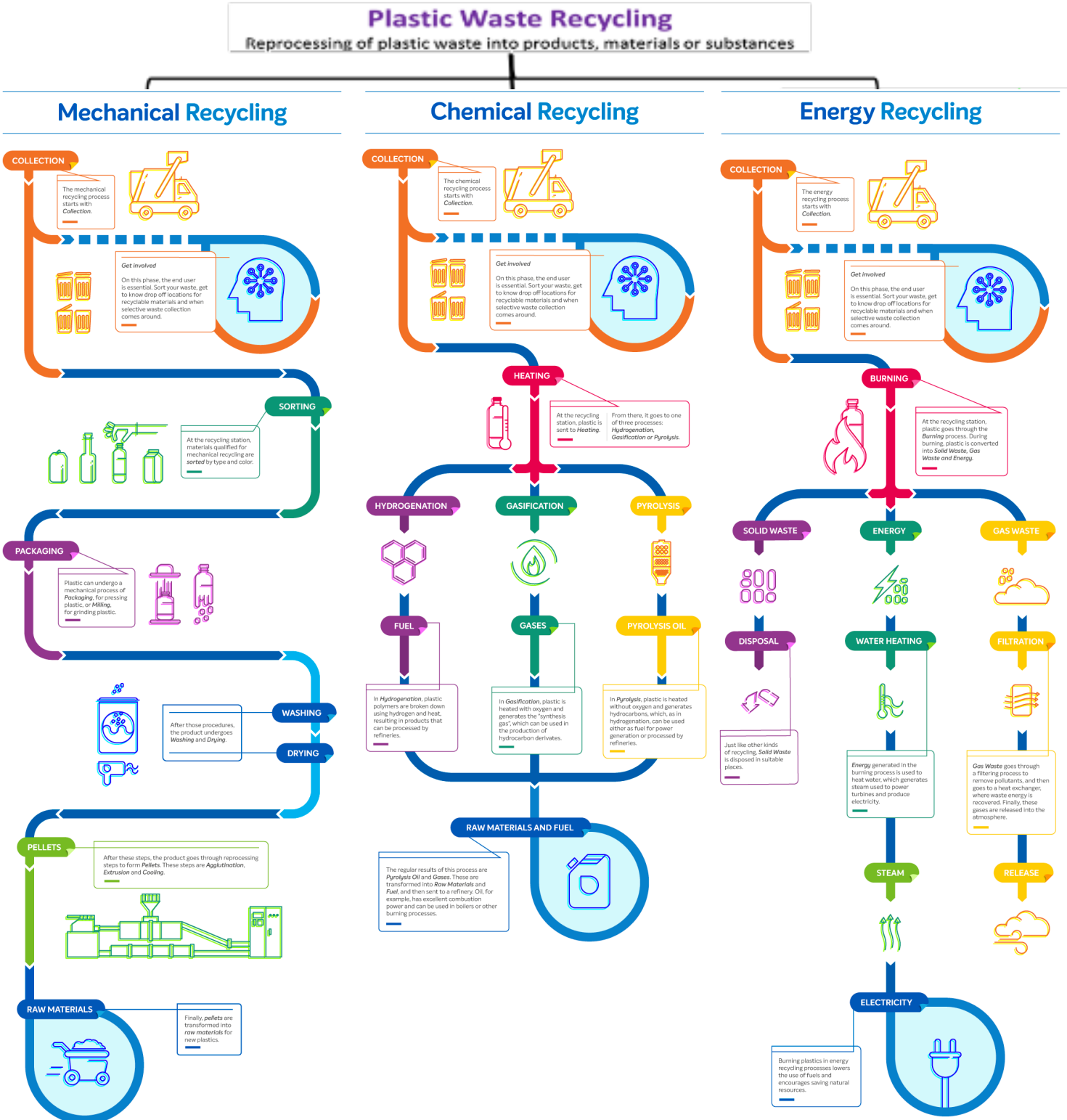
⁷⁹ <https://intercongreen.com/2010/02/17/recycling-vs-upcycling-what-is-the-difference/>

⁸⁰ <https://bluevisionbraskem.com/en/intelligence/mechanical-energy-or-chemical-the-different-types-of-recycling-work/>

⁸¹ National Overview: Facts and Figures on Materials, Wastes and Recycling, USEPA.

⁸² hings You Might Not Know About Landfills.

Figure 22: Some methods of recycling Plastic Waste



Source: <https://bluevisionbraskem.com/en/intelligence/mechanical-energy-or-chemical-the-different-types-of-recycling-work/>

Box-7 Case Study: Supreme Audit Office of Poland (SAI)

The Supreme Audit Office of Poland examined how the Polish state deals with plastic waste management. The audit encompassed two ministries (Ministry of Climate and Ministry of Development), five marshal offices and 15 municipal offices. The period covered was 2017-2019. Auditors also verified activities in previous and subsequent years, if they were related to the implementation of waste management tasks. Audit noticed the following:

- The ministries were not fully informed on the issue, as the data reporting system did not allow to identify the actual amount of plastic waste being produced, or to determine a comprehensive, final method of its management.
- No actions are taken at the central and local level to inform the society on how to prevent waste production.
- Actions were insufficient to reduce the generation of plastic waste, ensure its proper management and rapid implementation of the circular economy model in Poland.
- Slow pace of works to amend the waste management system.
- As regards the system of extended producer responsibility for packaging products, the Ministry did not have detailed information on the market reality concerning the production of packaging and packet products, as well as the possibilities of their recycling.
- The vast majority of actions defined in the Roadmap for Transformation towards a circular economy were conceptual and most of the tasks planned in the Task Map were still in the preparation stage.
- Many municipalities in the provinces had not achieved the required level of recycling and preparation for reuse of municipal waste in the years 2019-2020 using the 2018 management method.
- Looking at the issue from the perspective of companies marketing packaging and prepacked products, including plastics, very high risk that the restrictive recycling levels for packaging waste might not be achieved in the future.

Recycling of packaging products in 2016-2018 state-wide

- In majority of province marshals audited, there were no appropriate legal solutions to verify the calculation of the recycling fees paid for 2018 and 2019. Moreover, the present regulations make it difficult for marshal offices to review the public education campaigns conducted by the obliged entrepreneurs, to control the spending of related funds, and to vindicate the payments declared by the entrepreneurs to finance the campaigns.
- The analyses showed that most audited municipalities applied other, less desirable methods of plastic waste management than recycling and preparation for re-use.

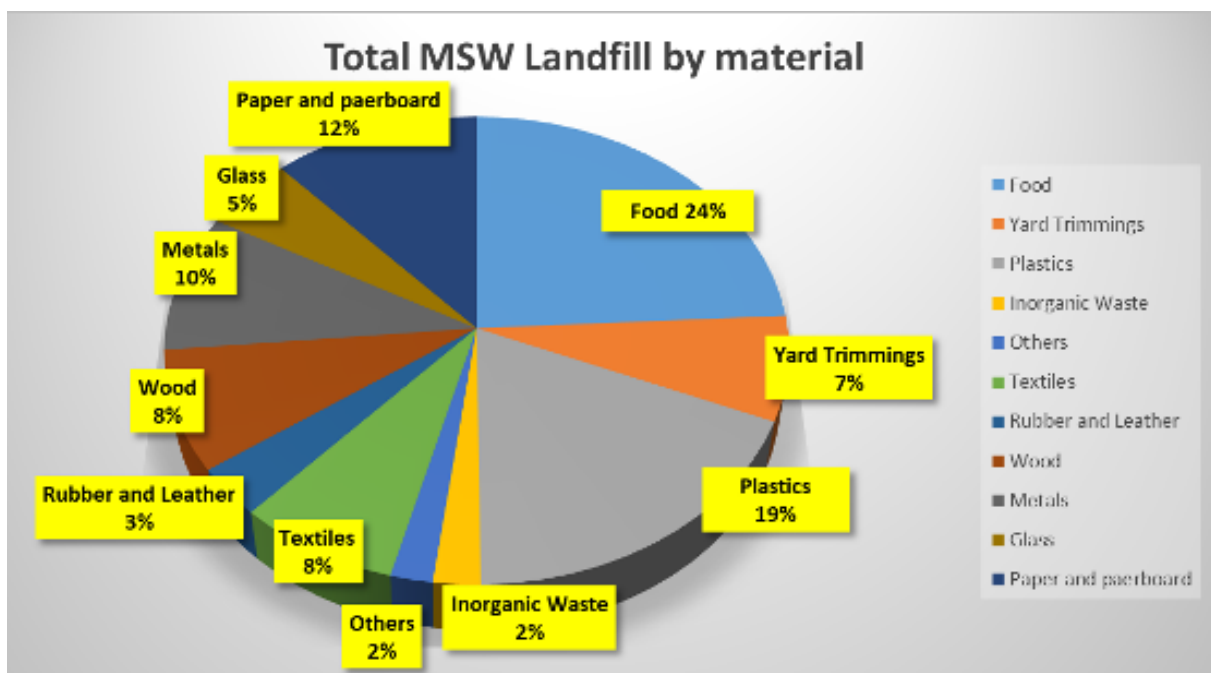
Recommendations

- To accelerate the implementation of solutions that will direct the waste management system in Poland towards a circular economy model, in particular through the:
 1. adoption of standards for eco-design of plastic packaging,
 2. improved effectiveness of the selective collection of municipal waste, including plastic waste, and management of the system in accordance with the binding hierarchy,
 3. developed system of extended producer’s responsibility that will cover the real costs of waste collection and management (including plastic waste),
 4. to design and implement the deposit system for packaging.
- To amend the provisions to enable province marshals to collect debt from entrepreneurs who introduce prepacked products to the market and fail to financially contribute to public educational campaigns or who pay amounts lower than due.
- Ministries to closely cooperate to implement the circular economy model in Poland as soon as possible, with particular emphasis on plastic waste management.

governments in adopting such solutions may also be examined. Information regarding availability of technological options also aid in framing recommendations with useful alternatives.

Audit Questions pertaining to adopting of circularity of Plastic Waste are detailed in the Annexure-VII.

Figure 23: Total MSW disposed in a landfill by material (in percent) in USA



Source: National Overview: Facts and Figures on Materials, Wastes and Recycling, <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials>

5. Overview of Governance Responses

The perils of plastic pollution have mobilized governments, business corporations and local communities to combat its proliferation in the environment. In 2022, United Nations Environment Assembly adopted a resolution on ending plastic pollution and forging an internationally binding agreement by 2024. Governments across the globe have an important role to solve the problem of plastic waste, by virtue of their core regulatory powers. Social, technological and institutional amendments like nationwide phasing out of single-use plastic, resolutions by businesses and corporations to reduce their plastic footprint, initiatives by non-profit organizations to clean up beaches and ocean, behavioural changes in public to reduce consumption and littering of single-use plastic have raised hope of positive changes in the recent past. The announcement of plastic pollution as a worldwide crisis by the United Nations in 2017 has made several businesses establishments to adjust their corporate strategies and prepare for an accelerated transition to a circular economy.⁸³ Moreover, inclusion of plastic waste under Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal in 2019 which was ratified by more than 180 countries has promised improved regulation of plastic waste trade.

Lack of globally binding standards to mitigate plastic pollution has been identified as a key gap in the international governance of plastic.⁸⁴ The plastic

legislation is a recent phenomenon and most of the legislations either focusing specific items or under implementation and not much on comprehensive policies regarding plastic pollution is available. Two reports conducted on similar topic in recent years are referred for drawing conclusions in the chapter: (1) Legal Limits on Single-Use Plastic and Microplastic: A Global Review of National Laws and Regulations conducted by UNEP and World Resources Institute (WRI) in 2018 and (2) 20 years of Government responses to the Global Plastic Pollution Problem by Nicholas Institute, Duke University.

The general approach of the governments is to introduce policies which manage the proper disposal of solid waste in their area. In general, these policies are also applicable to plastic waste, and have a significant effect on plastic pollution.

5.1 Types of Policy Instruments

The three broad categories of instruments used by governments specifically to address the plastic pollution problem are regulatory, economic and information instruments:⁸⁵

Regulatory Instruments include developing of plans to address plastic problem, capturing plastic post leakage- Use of technology and mechanical interventions to capture litter, waste stewardship practices to minimize plastic leakage, including “extended producer responsibility”

⁸³ Challenges and strategies for effective plastic waste management during and post COVID-19 pandemic.

⁸⁴ The assessment of governance strategies for reducing plastic pollution that was presented to the third meeting of UNEA in 2017.

⁸⁵ 20-Years-of-Government-Responses-to-the-Global-Plastic-Pollution-Problem

Box-8 Case Study: Federal Board of Supreme Audit-The Republic of Iraq

Specialized performance assessment and audit on the government policy on waste management. The initial study conducted by the specialized audit teams during the strategic planning phase to identify how the departments concerned-ministry of reconstruction, ministry of housing, ministry of municipalities and public works, ministry of health and environment, Baghdad Municipality- deal with the solid waste, namely, plastic waste revealed that the waste management is deteriorating as a result of poor application of environmental limitations and requirements by the relevant authorities and it was observed:

- 1 Waste sorting plants were inoperative.
- 2 Delay in completion of waste sorting plants.
- 3 Lack of planning by municipal authorities for waste sorting and recycling, or for reusing waste generated at source.
- 4 Lack of coordination among stakeholders: Despite constitution of a committee to consider the investment offers for generating energy from waste, no progress was observed.
- 5 The treatment of waste and plastic waste is below the level laid down in the environmental limitations beside poor capacities to deal with the waste pile.
- 6 Waste management suffers from insufficient specialized vehicles and staff comparing with the street lengths and population density, which adversely affect the regular workflow such as waste removal, collection and transfer.
- 7 Poor coordination among the agencies concerned in terms of putting the regulations of solid waste management and sorting at the source into place including activation of the penal regulations on the offenders of waste management.
- 8 Environmental and awareness-raising media failed to generate awareness among public regarding handling of municipal wastes and how wastes are separated at source.

(EPR) and developing new or improve existing processes or products, regulatory bans are the preferred tool of local governments. Prohibitive regulatory instruments include Limiting plastic to prescribe a maximum amount, quantity, or number of plastic material in the life cycle, fully or partially prohibiting a specific type of plastic at any stage(s) in the life cycle or prohibiting irresponsible handling of plastic to prohibit poor waste stewardship practices.

Economic instruments consisting of subsidies (incentives), cash for return (incentives), tax

break (incentives) disincentive (fee, tax, levy or duty). Studies of economic instruments to incentivize increased recycling of plastic beverage containers by providing cash for return of the used containers, have consistently shown significant effects over a small sample size largely in the European Union and North America.

Information instruments include research, data collection, data reporting, or record keeping, education or outreach, labels or placards.

Regardless of the choice of instrument (regulatory or economic) key factors to effectiveness of such instruments include:

- 1 Setting the fee high enough for economic instruments to affect behaviour and in some cases adjusting it upwards over time to counteract the rebound effect;
- 2 Focusing on provision of inexpensive reusable alternatives; and
- 3 Emphasizing public awareness and acceptance of the policy to enhance compliance, through coupling regulatory and economic instruments with information instruments.

5.2 Growth of Policy Documents

Prior to 2000, a number of multilateral environmental agreements were agreed that are applicable to the plastic pollution problem, but only maritime sources were directly addressed⁸⁶ (Figure 24). After 2000, there has been growth in number of non-binding

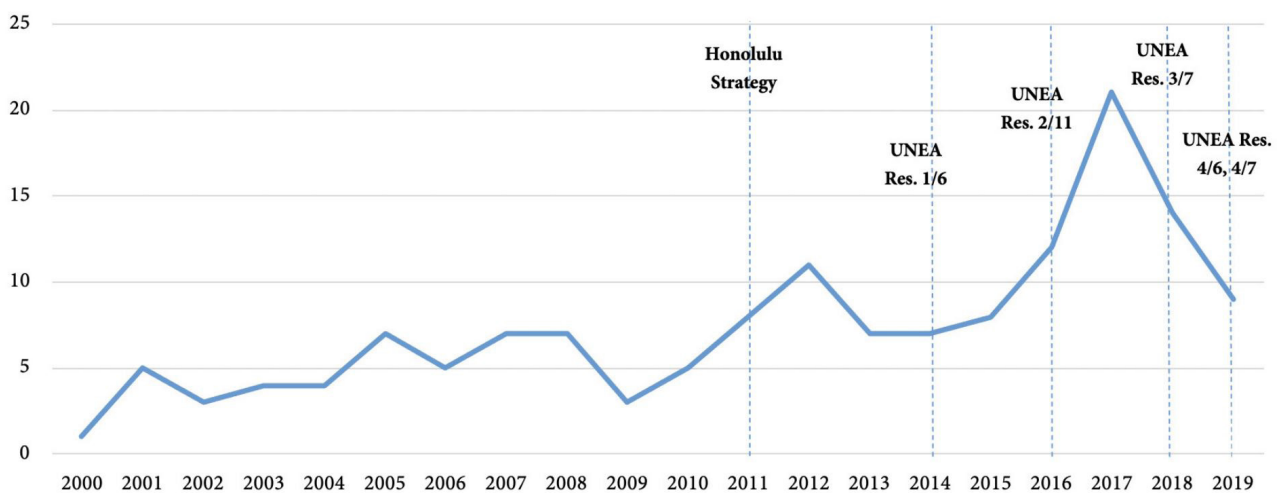
international policies covering land-based sources and increasingly more specific terms such as “marine plastic litter and micro plastic.” Subsequent to plans to address maritime sources of plastic pollution, a number of regional action plans recommend comprehensive national responses to reduce land-based sources of plastic pollution.

Beginning with the 2011 Honolulu Strategy and other key global policies (Annexure-VI) and a series of United Nations Environment Assembly (UNEA) Resolutions, there is an overall trend of increased public policies at national levels.

5.3 Broad Trends in Policy Instruments Used Globally

- Regulatory instruments are the most commonly used instrument in the policies of sub-Saharan Africa, Europe, North America, Latin America and Caribbean and South Asia to ban various forms of plastic packaging, proscribing various behaviors to handle plastic and dispose of plastic

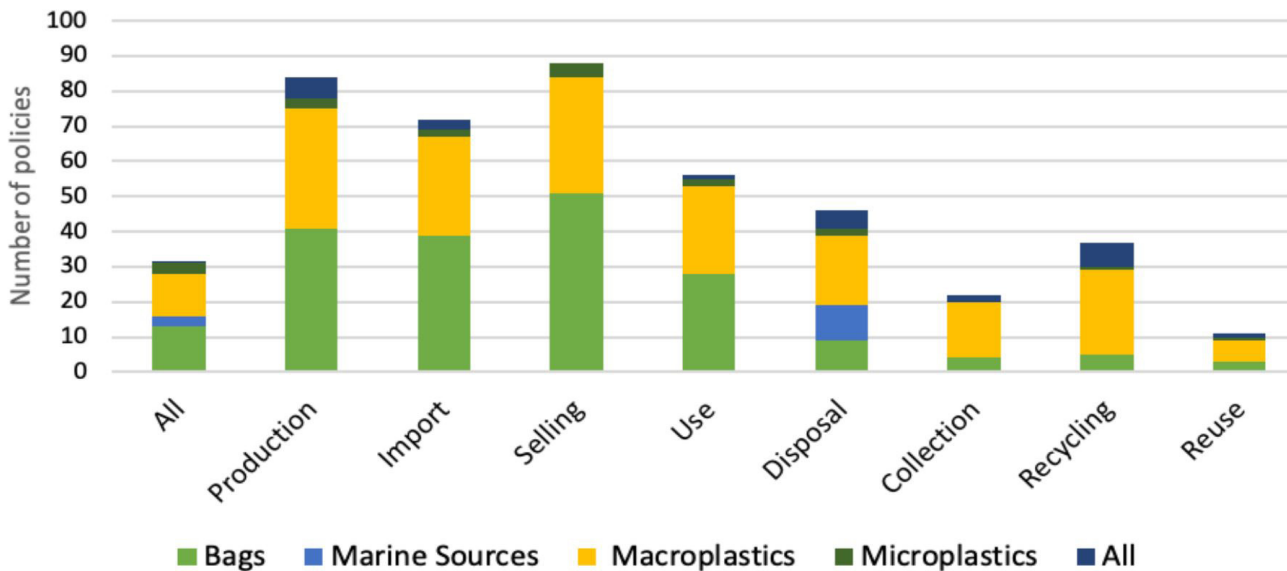
Figure 24: Number of National Plastic Policy Documents and Key Global Policies (until July 2019)



Source: 20 Years of Government Responses to the Global Plastic Pollution Problem- The Plastics Policy Inventory by Rachel Karasik, Tibor Vegh, Zoie Diana, Janet Bering, Juan Caldas, Amy Pickle, Daniel Rittschof, and John Virdin, https://nicholasinstitute.duke.edu/sites/default/files/publications/20-Years-of-Government-Responses-to-the-Global-Plastic-Pollution-Problem-New_1.pdf

⁸⁶ Efforts related to abandoned, lost or otherwise discarded fishing gear have continued, with FAO releasing Voluntary Guidelines on the Marking of Fishing Gear in April 2019 (<http://www.fao.org/3/ca3546t/ca3546t.pdf>).

Figure 25: Number of National Policy Documents Containing Instruments That Address a Given Stage of Life Cycle



Source: 20 Years of Government Responses to the Global Plastic Pollution Problem- The Plastics Policy Inventory by Rachel Karasik, Tibor Vegh, Zoie Diana, Janet Bering, Juan Caldas, Amy Pickle, Daniel Rittschof, and John Viridin, https://nicholasinstitute.duke.edu/sites/default/files/publications/20-Years-of-Government-Responses-to-the-Global-Plastic-Pollution-Problem-New_1.pdf

waste frequently targeted to the point of sale (Figure 25). To prevent marine plastic pollution, the most commonly used instrument⁸⁷ is a ban on disposal of plastic waste at sea. This is often accompanied by information requirements for ships to clearly mark the procedures and to record garbage disposal which illustrates national governments using standard instruments to comply with their commitments in the MARPOL treaty.⁸⁸ National government responses⁸⁹ towards microplastic pollutants are a relatively recent phenomenon and are largely confined to Europe and North America.

A mix of instruments are used to address pollution from various types of single-use plastic products in policies of East Asia and the Pacific countries.

Economic instruments: Australia provided an example with the introduction of a cash for return scheme for

beverage containers (2011) generally (including plastic bottles), aiming to enhance producer responsibility and complement existing solid waste management and recycling. In European region, policies in several cases included cash for return instruments, or in some cases (e.g., Macedonia 2015), fees for packaging waste to cover costs of management.

In Europe the responsibility of plastic product producers is frequently emphasized in the instruments, e.g., in the United Kingdom (2007 and 2012) and Austria (2014) in policies targeting packaging.

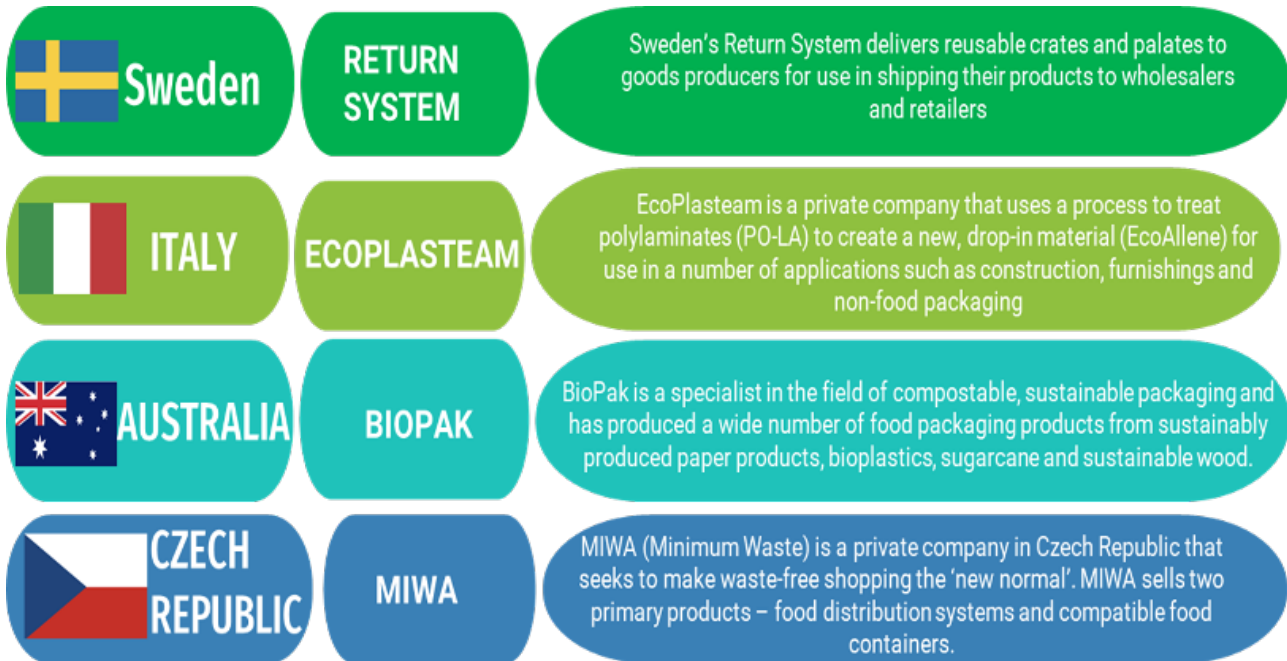
Information instruments: In North America, policies include amendments which focus on information instruments to conduct research and collect data on land-based sources of plastic pollution, including providing reporting on findings to the legislature in order to guide future policy responses.

⁸⁷ Government of the Solomon Islands (2001), Government of Malta (2004) and US (2000).

⁸⁸ 20-Years-of-Government-Responses-to-the-Global-Plastic-Pollution-Problem.

⁸⁹ 20-Years-of-Government-Responses-to-the-Global-Plastic-Pollution-Problem.

Figure 26: Best practices for plastic waste management



Source: SAI India and <https://sealive.eu/project-news-case-studies-on-circular-plastics/>

Some of the best practices adopted by different countries are depicted in Figure 26.

Figure 26: Best practices for plastic waste management
Source: SAI India and <https://sealive.eu/project-news-case-studies-on-circular-plastics/>

5.4 Challenges for Plastic Waste Management

5.4.1 Transboundary Movement of Plastic Waste

To deal with the growing amount of plastic waste, the processing costs (trash and recycled) and to avoid environmental impacts – many countries often resort to the option of shipping the waste to other countries.⁹⁰ The Secretariat of the Basel Convention provides information on hazardous wastes that are exported, however, green-listed (non-hazardous) waste is not subject to notification, and therefore not included in the published waste statistics. It poses

challenge for countries to control the plastic waste transported from one country to another.

Many of the importing countries do not have sufficient enforcement and technological parlance to treat the imported plastic waste. Many waste importing countries report high waste mismanagement rates. About 5 percent to 20 percent of imported plastic scrap in the emerging economies in the Global South has no market value.⁹¹ Hence, the imported plastic waste results in ocean, air, and land pollution.

Such trade has negative effects on legal trade and the corresponding economic transactions. Besides exposing populations to toxic substances, illegal waste trade and handling is also associated with economic issues such as tax fraud and money laundering.⁹²

⁹⁰ https://www.environmental-auditing.org/media/5375/wgea-waste-managemen_e.pdf

⁹¹ https://live.staticflickr.com/65535/47763857571_d1a701f81d_o.jpg.

⁹² Understanding the Impacts of Transboundary Waste Shipment Policies: The Case of Plastic and Electronic Waste, Keshav Parajuly 1,2,* and Colin Fitzpatrick 2.

Box-9 Case Study: The National Audit Office of the People's Republic of China (CNAO)

Objective

To investigate the implementation of China's ban on imported solid waste, and the impact of the use of imported waste plastics on the environment, with a focus on the illegal transfer of import licenses for solid waste and final disposition of the imported waste plastics.

Audit findings and audit methods applied

- 1 Illegal transfer of import licenses for solid waste.
 - Some companies import waste plastics in violation of the regulated quota and the requisite provisions.
 - Some unqualified companies cooperate with qualified companies to apply for import licenses in the name of the latter, and make profits through direct reselling upon actual import of the waste plastic violating regulations of the Administrative Measures for the Import of Solid Waste.
- 2 Disposition of the imported waste plastics.
 - Some companies use waste plastics as raw materials to produce packaging against regulations violating the regulations of the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China and other authorities.

Basel Convention has been amended during Basel Conference of the Parties held in May 2019, to include plastic waste in a legally-binding framework. The core principle of the "Plastic Amendment" to the Basel Convention is to increase the regulation of plastic waste shipments through regular standardized customs checks on procedures and paper work related to plastic shipments. The amendment also includes the principles of environmental sound management of waste (ESM). However, if the principles of ESM and proximity are not implemented, the amendment could likely result in increased illegal disposal of plastics in source regions, along with illegal imports in destination regions thus there is risk of increased illegal disposal in the event of improper implementation of the Basel Convention amendment on plastic waste trade.

There is Risk of re-routing of illegal trade to new and more vulnerable countries following upcoming bans on plastic waste imports.⁹³ A Case Study for Audit on the imported solid waste (waste plastics) conducted by The National Audit Office of the People's Republic of China (CNAO) is given in Box 8 Case Study.

Recent studies have demonstrated how plastic-derived chemicals (e.g. plastic additives) leach from plastics into the environment. Two provisional amendment proposals to the Basel, Rotterdam and Stockholm Conventions envisage to limit the persistent organic pollutants content (POPs) in plastics to 50 or 100ppm. In a 2018 review,⁹⁴ the United Nations Environment Programme (UNEP) registered that over 60 countries had introduced bans and levies to limit the production of single-use plastic items. As the use of those items

⁹³ <https://www.interpol.int/en/News-and-Events/News/2020/INTERPOL-report-alerts-to-sharp-rise-in-plastic-waste-crime>.

⁹⁴ United Nations Environment Programme (UNEP), "SINGLE-USE PLASTICS: A Roadmap for Sustainability," 2018.

is made illegal, illegal businesses trafficking plastic items may emerge thus posing risk of new criminal activities related to banned plastic items.

5.4.2 Single Use Plastic

Single-use plastic bags and Styrofoam products are widely used because they are strong, cheap and hygienic ways to transport goods. Plastic groceries bags consume less energy and water to produce and generate less solid waste than paper bags, taking up less space in landfills. However, these are perceived as the most problematic single-use plastic, given their easily observable presence in the environment.⁹⁵ Plastic packaging generates significant negative externalities, conservatively valued by UNEP at 40 billion USD and expected to increase with strong volume growth in a business-as-usual scenario.

Finally, the future costs of removing all single-use plastic accumulating in the environment is estimated as higher than the costs of preventing littering today.

5.4.3 Formalizing Informal Waste Collection

In many poor countries, waste pickers divert a significant amount of waste back into productive uses. Waste pickers are often a vulnerable demographic and are typically women, children, the elderly, the unemployed, or migrants. They generally work in unhealthy conditions, lack social security or health insurance, are subject to fluctuations in the price of recyclable materials, lack educational and training opportunities, and face strong social stigma.

Waste collection, associated transportation and technology is often the costliest step in waste management. Formalizing informal waste pickers could lead to improved waste collection and recycling.

5.4.4 COVID-19 Pandemic and Plastic Waste

Outbreak of the coronavirus has overshooted the demand for plastic worldwide. The plastic made personal protective equipment (PPE) and masks have played a very crucial roles in protecting people during the COVID-19 pandemic (Figure 27). Majority of personal protective equipment (PPE) is made up of paper, textile materials (clothing, cotton) and plastic. While paper and textile are biodegradable, plastic-based PPE persist indefinitely if not properly disposed.⁹⁶ From face shields, gloves, PPE kits, food takeaway, to bubble wrap for online purchasing have seen an increase in demand in every corner of the world. Because most of it can't be recycled, the amount of waste has increased.⁹⁷ The management of wastes generated by single use plastic is a concerning side effect of the COVID-19 epidemic worldwide.⁹⁸ One study on environmental footprints of the global plastic wastes generated during COVID-19 reported the plastic garbage has been generated at a pace of 1.6 MT per day since the pandemic began.⁹⁹ Globally, 3.4 billion single-use facemasks/face shields are discarded every day as a result of the COVID-19 outbreak. As per projection, global plastic packaging industry increased at a compound annual growth rate of 5.5 percent from USD 909.2 billion in 2019 to USD 1012.6 billion by 2021, owing to pandemic preparedness.¹⁰⁰



Audit desk

Auditors should assess whether adequate and effective regulatory framework exists for management of plastic waste. There must be sufficient provisions for levy of a penalty for violation of laws in law/rules/guideline for plastic waste management. Auditors may examine the rules framed for management of plastic waste and comment on their compliance, monitoring mechanism etc. Checking the

95 https://wedocs.unep.org/bitstream/handle/20.500.11822/25496/singleUsePlastic_sustainability.pdf.

96 <https://www.tandfonline.com/doi/full/10.1080/15567036.2020.1869869>.

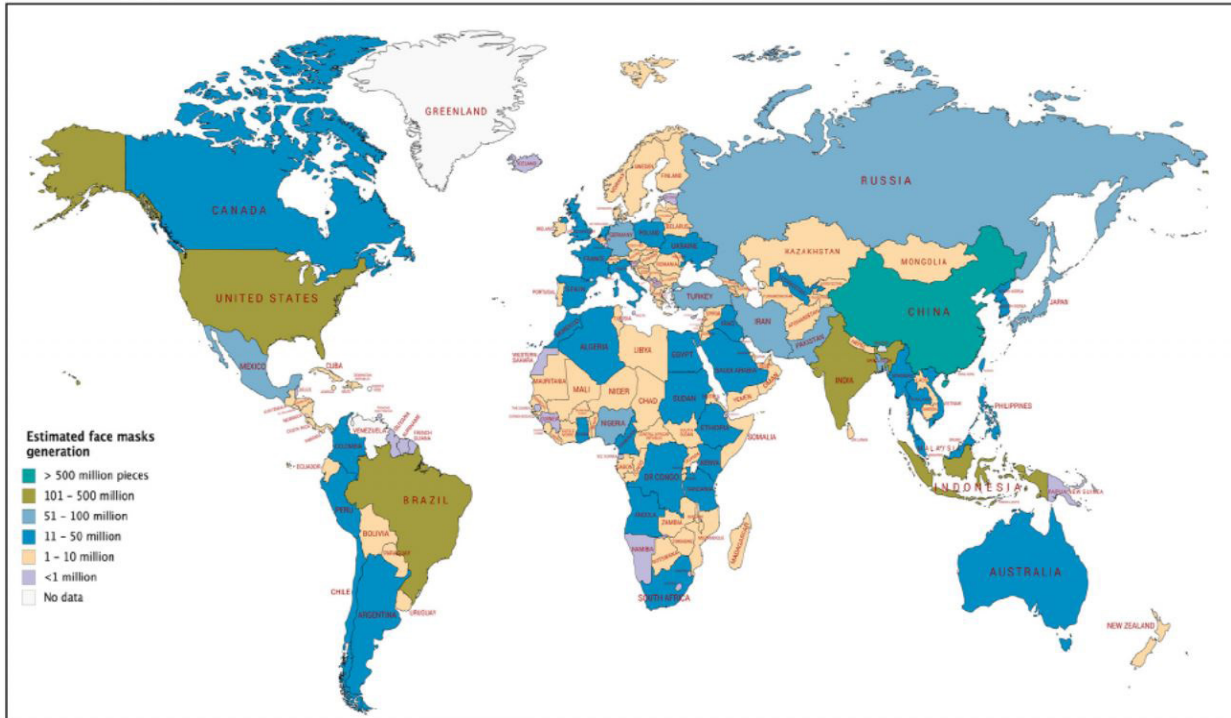
97 <https://www.reuters.com/investigates/special-report/health-coronavirus-plastic-recycling/>.

98 <https://pubmed.ncbi.nlm.nih.gov/33655084/>.

99 <https://www.sciencedirect.com/science/article/pii/S2405844021004485>.

100 <https://science.sciencemag.org/content/369/6509/1314>

Figure 27: The global share of face masks discarded after COVID pandemic



Source: COVID pollution: impact of COVID-19 pandemic on global plastic waste footprint, https://www.researchgate.net/publication/349486463_COVID_pollution_impact_of_COVID-19_pandemic_on_global_plastic_waste_footprint/figures?lo=1

adequacy/quality of infrastructure created for management of plastic waste is another way for auditors to ensure that plastic waste infrastructure is being utilized economically, efficiently and effectively to tackle the problems. SAls may examine effectiveness/presence of regulations/guidelines in their respective countries leading to systematic consideration of waste pickers in waste management cycle. Whether an effective impact assessment mechanism for plastic waste management exists? Has the Government/ entity/ external agency conducted any evaluation/ review of the effectiveness of its plastic waste management strategy/ policy? If so, have they identified the strength and weakness of the strategy/ policy and modified it after taking into account the findings and suggestions from such studies? Have they assessed impact on environment and health caused by improper waste management?. Auditors may need to assess whether policies regarding transboundary movement of plastic waste have considered risks of illegal trade, banned plastic and enforcement mechanism is sufficient to curb plastic waste menace.

In A Nutshell

Governments around the world are increasingly awake to the scale of plastic pollution. More than 60 countries have introduced bans and levies to curb single-use plastic waste. Plastic bags and, to a certain extent, foamed plastic products like Styrofoam have been the main focus of government action so far. This is understandable. These plastic products are often the most visible forms of plastic pollution. It is estimated that one to 5 trillion plastic bags are consumed worldwide each year. Five trillion is almost 10 million plastic bags per minute. If tied together, all these plastic bags could be wrapped around the world seven times every hour.

UNEP (2018)

Conclusion

Adoption of Agenda 2030 has added a new dimension requiring SAI work to include SDG audits. Shifting SAI activities from “accountability for process” to “accountability for performance,” is becoming more important for improving accountability and efficiency in public governance. Growing emphasis are laid on the ideas related to circular economy, integrated waste management including recycling practices and stringent regulations for abatement of pollution caused by plastic. This subject has also emerged as a very relevant field of study by SAIs around the world in terms of sustainable production and consumption of plastic, its mismanagement, plastic waste and pollution caused by plastic.

Our efforts in preparing this document on SDG 12-Responsible Consumption and Production – Focus on Plastic Waste have led us to conclude that unprecedented rate of production and consumption of plastic for economic and social progress has resulted in depletion of natural resources and adverse impact on environment, reaching a critical stage. With increasing demand and production of plastic, the extent of plastic waste and resulting menace has increased globally indicating unsustainable management of this valuable product. Plastic waste poses serious environmental, social, economic and health threats and its harmful effects on terrestrial and marine ecosystems have also become major concerns globally.

Though regulatory instruments are the most preferred instruments, no substantial change is observed between the quantum of mismanaged plastic waste in the year 2010 and 2025. There is a clear upward trend in the number of public policy responses to

the plastic pollution problem over the last decade, at global, regional and national levels yet the risk remains seriously high. It is therefore imperative for the Governments to review their policies towards management of plastic waste. SAIs can examine the efficiency and effectiveness of measures taken by Governments in the respective countries.

A holistic, transformative and circular economy approach covering the entire value chain from production of plastic to plastic waste management is needed to address the problem of mismanaged plastic waste in a comprehensive manner. This envisages the concepts of producing less, consuming less, adopting environmentally friendly techniques for recycling, upcycling, imposing legal instruments and proper disposal of waste that already exists to prevent contamination or leakages. Urgent actions are therefore required to be taken through involvement of numerous stakeholders in society including citizens, governments, community organizations, businesses, and manufacturers. Policy solutions, increased awareness and improved design and disposal processes, among others, can minimize the impact of plastic waste on society.

Annexure

I. Classification of Plastic Based on Behavior with Respect to Heating

Characteristics	Thermoplastic		Thermosetting	
Definition	Softens on heating and then harden again on cooling		never softens once they have been moulded	
Properties	Melts before passing to gaseous state No change in chemical composition due to heating Glossy and brittle Good resistance to creep May swell or dissolve when come in contact with certain solvents		Soluble in alcohol and certain organic solvents Undergo irreversible chemical process Durable strong and hard Available in a variety of beautiful colours Mainly used in engineering application of plastic	
	Pros	Cons	Pros	Cons
	Aesthetically -superior finishes	More expansive than thermostat	More resistant to high temperatures	Non - recyclable
	High impact resistance	Can melt if heated	Highly flexible design	Surface finish is more difficult comparably
	Remoulding/reshaping capabilities		Thick to thin wall capabilities	Cannot be remoulded or reshaped
	Chemically resistant		High levels of dimensional stability	
	Highly recyclable		Cost effective as compared to thermoplastic	
	Eco-friendly manufacturing			
	Hard crystalline or rubbery surface options			
Examples	Polyethylene, polypropylene, polystyrene, Acrylics, Teflon, Polycarbonate, Nylon, Acrylonitrile butadiene styrene		Epoxies, Polyurethane, Unsaturated polyesters. Phenolics, Silicones	












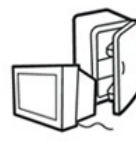


II. Structure Based Classification of Plastic

Characteristics	Homogenous plastic	Heterogeneous plastic
Definition	Composed only of hydrocarbon atoms and exhibit a homogenous structure	Composed of the chain containing carbon, hydrogen, oxygen, nitrogen and other elements and exhibit a heterogeneous structure
Examples	Polyethylene, Polypropylene, Polystyrene	Polytetrafluoroethylene, Polyamides or nylons, Polyvinylchloride, Acrylonitrile butadiene styrene

III. Physical and Chemical Properties Based Classification of Plastic

Characteristics	Rigid Plastic	Semi rigid plastic	Soft Plastic	Elastomers
Definition	Have high modulus of elasticity and retain their shape under exterior stresses applied at normal or moderately increased temperatures.	Have a medium modulus of elasticity the elongation under pressure completely disappears, when pressure is removed.	Have low modulus of elasticity and the elongation under pressure disappears slowly, when the pressure is removed.	Have low modulus of elasticity. Deform considerably under load at room temperature and return to original shape when the load is released.
Examples	HDPE tubes, PP cups, PET Pallets	LDPE films, flexible ducts, PVC sheets	Children's toys, rattles, fishing baits	Polyisoprene, Polybutadiene, Polyisobutylene

IV. Type of Resin and Identification Codes

 PETE	 HDPE	 PVC	 LDPE	 PP	 PS	 OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyactic fibers, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps	trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars	toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	an example of one type is a polycarbonate used for CD production and baby feeding bottles
						

Source: Plastic Coding System Guide For Resin Types, <https://polychem-usa.com/plastic-coding-system/>

V. Bioplastic

According to European Bioplastic a plastic material is defined as a bioplastic if it is either **bio-based**¹⁰¹, **biodegradable**¹⁰², or **features both** properties. The prefix “Bio” can effectively refer to either the biological origin of the plastic (“bio sourced”) or its end of life (“bio-degradable”). Bio-plastic or bio-based plastic are plastic made from renewable biological resources - most often vegetable - which are either biodegradable or not. Bioplastic are not just one single substance, they comprise of a whole family of materials with differing properties and applications.¹⁰³

VI. Key International Policies that Address Plastic Pollution

Based on the volume of text related to plastic pollution, and/or the presence of clear targets or commitments to address the problem, following fourteen policy documents could be labelled as “key international policies to address plastic pollution”,

- 1 2010: Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Tenth Meeting (UNEP/CBD/COP/DEC/X/2) “The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets”
- 2 2011: The Honolulu Strategy - A Global Framework for Prevention and Management of Marine Debris
- 3 2011: Resolution MEPC.201(62) Amendments to the Annex of the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973 “Revised MARPOL Annex V”
- 4 2012: UNGA Resolution A/Res/66/288 “The Future We Want”
- 5 2014: UNEP/CMS/Resolution 11.30 Eleventh Meeting of the Conference of the Parties to the Convention on Migratory Species - Management of Marine Debris
- 6 2014: UNEA/Resolution 1/6 “Marine Plastic Debris and Microplastic”
- 7 2015: UNGA Resolution A/Res/70/1 “Transforming Our World: The 2030 Agenda for Sustainable Development”
- 8 2016: CBD/COP/DEC/XIII/10 “Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity - Addressing Impacts of Marine Debris and Anthropogenic Underwater Noise on Marine and Coastal Biodiversity”
- 9 2016: UNEA Resolution 2/11 “Marine Plastic Litter and Microplastic”
- 10 2017: Thirteenth meeting of the Conference of the Parties to the Basel Convention - BC-13/11: Technical assistance; Work Programme 2018-2019
- 11 2018: UNEA Resolution 3/7 “Marine Litter and Microplastic”
- 12 2019: UNEA Resolution 4/6 “Marine Plastic Litter and Microplastic”
- 13 2019: UNEA Resolution 4/9 “Addressing Single-Use Plastic Products Pollution”
- 14 2019: BC-14/13 Fourteenth Meeting of the Conference of the Parties to the Basel Convention - Further actions to address plastic waste under the Basel Convention

¹⁰¹ The term ‘bio-based’ means that the material or product is (partly) derived from biomass (plants). Biomass used for bioplastic stems from e.g. corn, sugarcane, or cellulose.

¹⁰² A biodegradable material is one that can be decomposed under the action of microorganisms (bacteria, fungi, algae, earth-worms, etc.) and give water (H₂O), carbon dioxide (CO₂) and/or methane (CH₄), and by-products (residues, new biomass).

¹⁰³ <https://www.google.com/search?q=plastic+waste+background+report&oq=plastic+waste+background+report&aqs=chrome..69i57.6257j0j15&sourceid=chrome&ie=UTF-8>

VII Possible Audit Questions for Conducting Audit of Plastic Waste

Chapter - I Plastic and Plastic Waste

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether the Central/Provincial government has clearly defined "Plastic Waste" in concrete terms in legislation and regulations?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
If so, are the definitions comparably in uniformity with the use of definitions of "Plastic Waste" in other countries/ International accords?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether, projections regarding quantity of plastic waste to be generated in future has been made by the Central/Provincial regulatory authorities?	<ul style="list-style-type: none"> Surveys, Notifications Legislative waste rules and regulations 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether the Central/Provincial regulatory authorities have made an assessment of quantity of plastic waste that is generated in the country/province?	<ul style="list-style-type: none"> Surveys, Notifications Legislative waste rules and regulations 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether the Central/Provincial regulatory authorities have been uniform and consistent with the methodologies and parameters taken into account, to calculate the quantum of plastic waste generated in the country/province?	<ul style="list-style-type: none"> Surveys, Notifications Legislative waste rules and regulations 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
<p>If so, were the methodologies and parameters used for calculating plastic waste in the country/province, effective, efficient and economical?</p>	<ul style="list-style-type: none"> ▪ Surveys, Notifications ▪ Legislative waste rules and regulations 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ▪ Analysis of Documents. ▪ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Whether, the Central/Provincial regulatory authorities have devised any mechanism to assess the capability for handling the plastic waste generated in the country/province?</p>	<ul style="list-style-type: none"> ▪ Surveys, Notifications ▪ Legislative waste rules and regulations 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ▪ Analysis of Documents. ▪ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Whether, the Central/Provincial regulatory authorities have devised any mechanism to assess the capability for handling the plastic waste predicted to be generated in the near future in the country/province?</p>	<ul style="list-style-type: none"> ▪ Surveys, Notifications ▪ Legislative waste rules and regulations 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ▪ Analysis of Documents. ▪ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Whether, the capability to handle the plastic waste in present as well as future scenario, is deficient. If so, what steps have been taken by the Central/Provincial regulatory authorities to gap the deficiencies?</p>	<ul style="list-style-type: none"> ▪ Surveys, Notifications ▪ Legislative waste rules and regulations 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ▪ Analysis of Documents. ▪ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>

Chapter - II

Impacts of Plastic and Plastic Waste on Environment and Human Health

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether the Central/Provincial regulatory authorities have issued any guidelines for monitoring of plastic pollution in surface, water, soil and air?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
What are the methods and components that are being used by the monitoring authorities to monitor plastic pollution on surface, water, soil and air and efficiency in compilation, reporting of such data for mitigation?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether the Central/Provincial regulatory authorities have issued any policies/guidelines to assess the risk arising from plastic waste towards environment and human health?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
If, so has any risk assessment of plastic waste towards environment and human health been done. What Methodology used and what are the components taken into account while assessing the risks from plastic waste to environment and human health?	<ul style="list-style-type: none"> Legislative waste rules and regulations International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	Concerned files/ Audit requisitionmemo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
<p>If so what action has been initiated to tackle these risks? Whether the actions were effective?</p>	<ul style="list-style-type: none"> ■ Legislative waste rules and regulations ■ International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>If so, has the regulatory authorities been complying those guidelines to monitor plastic pollution?</p>	<ul style="list-style-type: none"> ■ Legislative waste rules and regulations ■ International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Are the national practices relating to plastic waste management in compliance with the international obligations and commitments to which the region or country has agreed?</p>	<ul style="list-style-type: none"> ■ Legislative waste rules and regulations ■ International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL). 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Do the relevant authorities comply with the international commitments? Are all plastic waste activities and liabilities accurately accounted for in international cooperation?</p>	<ul style="list-style-type: none"> ■ International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL) ■ Framework Convention for the Protection of the Marine Environment of the Caspian Sea (2003) ■ Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, 1972) 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>

Chapter - III

SDG12 - Ensure Sustainable Consumption and Production Patterns and Plastic Waste

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether Governments policy/approach towards Plastic Waste consider SDG 12 as main driver?	<ul style="list-style-type: none"> ■ Policy Documents <ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	Schemes Programmes Score cards/ Performance sheets	Analysis of Information
Whether the Central/Provincial regulatory authorities have devised any national Indicators under SDG 12 for monitoring and achieving of the SDG targets related to tackling of risks associated with Plastic Waste?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	Concerned files Through scrutiny of the concerned files and through audit Requisitions and queries.
Whether adequate measures have been taken to substantially reduce waste generation through prevention, reduction, recycling and reuse, by 2030?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	Through scrutiny of the concerned files and through audit Requisitions and queries.
Whether key areas have been identified by the Government in order to meet the SDG-12.5 targets with respect to reduction in Plastic Waste generation?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	Concerned files Through scrutiny of the concerned files and through audit Requisitions and queries.

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
<p>If so, whether these SDG national Indicators are in consonance with the international SDG indicators?</p>	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
<p>Whether the Central/Provincial authorities have made any guidelines/policies to achieve the targets under SDG 12.5, which are related to plastic waste?</p>	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
<p>If so, whether the responsible authorities have implemented the guidelines/policies economically, efficiently and effectively?</p>	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<p>Concerned files/ Audit requisitionmemo/ Assessment reports</p>	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
<p>If so, what programme/schemes have been initiated under this?</p>	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
<p>Whether stakeholders mapping have been carried out by the Government to assign the duties and responsibilities to each stakeholder institution for management of plastic waste?</p>	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether there is proper co-ordination among stakeholder institutions to meet the targets set under SDG 12.5 for reduction plastic waste generation?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
Whether responsibility has been assigned to agencies for ongoing data collection w.r.t plastic waste generation?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
If so, whether the responsible agencies are correctly evaluating such data?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
Whether plastic waste management data is comprehensive and reliable?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
Whether responsibility has been assigned to agencies for ongoing data collection w.r.t National recycling rate, tons of material recycled?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
If so, whether the responsible agencies are correctly evaluating such data?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
Whether responsibility has been assigned to agencies for ongoing data collection w.r.t plastic debris density, as per the national indicators of SDG 14.1?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
If so, whether the responsible agencies are correctly evaluating such data?	<ul style="list-style-type: none"> ■ Target indicator mapping done by responsible authorities ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
Whether the country has made any commitments w.r.t plastic waste under SDGs 12 through their Voluntary National Report (VNR)?	<ul style="list-style-type: none"> ■ Voluntary National Report of concerned countries ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>
If so, what actions have been taken by the agencies to achieve them?	<ul style="list-style-type: none"> ■ Voluntary National Report of concerned countries ■ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development 	<ul style="list-style-type: none"> ■ Interviews ■ Concerned files ■ Reply to audit queries 	<p>Concerned files</p> <p>Through scrutiny of the concerned files and through audit Requisitions and queries.</p>

Chapter - IV

Approaches for Tackling Mismatched Plastic Waste

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether the Central/Provincial regulatory authorities have information on the quality and quantity of plastic waste generated?	Surveys, Notifications Legislative waste rules and regulations	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether circularity concept is adopted by government for managing plastic waste?	Declared commitments by authorities on National International platforms	Minutes, Declaration statements, Action taken notes by ministries	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
If so, what are the commitments/Plan of Action as defined in regulatory framework? What are the components for achieving circularity?	Declared commitments by authorities on National International platforms	Minutes, Declaration statements, Action taken notes by ministries	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
If no, are there any policy measures and initiatives undertaken by the Central/Provincial regulatory authorities to accelerate the transition toward circularity and what are such initiatives?	Planning Documents/ Road maps / Review	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether the process of collection, treatment and disposal of post consumer plastic waste efficient, effective and economical in the respective countries.? What are the efforts undertaken by the Central/Provincial regulatory and monitoring authorities to ensure this?	Action Plan targets/ Task reports/ Expenditure statements / Contract Documents entered into with stakeholders / Service level Agreements	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.
Whether any targets set for recycling of contents across all major end-use applications?	Action Plan targets/ Task reports/ Expenditure statements / Contract Documents entered into with stakeholders / Service level Agreements	Concerned files/ Audit requisition memo/ Assessment reports	Interviews <ul style="list-style-type: none"> Analysis of Documents. Through scrutiny of the concerned files and through audit Requisitions.

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether any Mandate “design for recycling” standards for plastics, especially for packaging?	Documents specifying/ setting such documents. Best Practices	Internet / Media / concerned Files	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Whether any policies exist(s) to encourage increase in recycling capacities (mechanical and chemical)?	Policy Documents / National Targets / Internationally accepted universal targets / Best Practices	Internet / Media / concerned Files	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Whether existing policies provide for Implement industry-specific requirements to increase waste collection rates. Is there any monitoring mechanism for collection such data to reflect progress in such events?	Policy Documents / National Targets / Internationally accepted universal targets / Best Practices	Internet / Media / concerned Files	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
What approaches adopted by authorities to improve waste/waste plastics management for reduce, reuse and recycling?	Approach Papers / Guidelines / Awareness documents	Policy documents / concerned files/ Awareness media	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Whether existing policies are effective in restricting disposal of waste plastics in landfills and phase-out non-essential plastic items?	Policy Documents / National Targets / Internationally accepted universal targets / Best Practices	Internet / Media / concerned Files	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
What are the efforts to cover upstream measures such as source reduction at production and consumption level, and downstream measures such as collection, transportation, treatment and disposal, and recycling and recovery?	Approach paper for adoption of circularity measures / Road map/pronouncements / Policy documents deifying targets / Commitments etc.;	Documents / files/ media/ white papers/ Guidelines/ Awareness media	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Do countries follow EPR scheme and do they have regulatory and funding framework for this policy?	EPR scheme documents / implementation plan / Action Plan / Responsibility details for producers	Concerned files / correspondences/ Notifications	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
If so, what action has been initiated for implementing EPR?	EPR scheme documents / implementation plan / Action Plan / Responsibility details for producers	Concerned files / correspondences/ Notifications	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
What is the method used and what are the components taken into account while implementing EPR?	EPR scheme documents / implementation plan / Action Plan / Responsibility details for producers	Concerned files / correspondences/ Notifications	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.

Chapter - V Overview of Governance Responses

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
<p>Whether the Central/ Provincial Governments have a comprehensive waste policy specifically for Plastic Waste which deals economically efficiently and effectively with various stages of plastic waste management. Are these policies, regulations, etc. implemented efficiently and effectively?</p> <p>Whether the plastic waste management policies effectively targeting prevention, reduction, recycling, recovery and disposal of plastic waste which are consistent with the plastic policies of other countries and International Conventions/Agreements?</p>	<p>Existing /Proposed Plastic waste management Rules</p> <p>Targets /Methods /Penal provisions provided</p> <p>Disposal guidelines</p> <p>Implementation Plan. Responsible Agencies/ Stakeholders documents. International conventions of Basel, Rotterdam, Stockholm Conventions & The International Convention for the Prevention of Pollution from Ships (MARPOL)</p> <p>Framework Convention for the Protection of the Marine Environment of the Caspian Sea (2003)</p> <p>Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, 1972)</p>	<p>Concerned files / commitment documents / National Reviews</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Are plastic waste policies by Central/Provincial authorities reflected, specified and put in concrete terms in legislation and regulations?</p> <p>Are there any gaps or inconsistencies in the waste legislation?</p>	<p>Independent assessments of various implementation schemes, Research papers, Studies, Audits</p>	<p>Reports, Surveys, concerned files, documents</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
<p>Whether the Central/Provincial Government rules and regulations with respect to Plastic Waste are being efficiently, effectively and economically complied with by the government, departments, ministries, relevant agencies and enforcement authorities.</p> <p>Whether an efficient work distribution of responsibilities has been done regarding the monitoring and supervisory responsibilities? If so are the responsibilities of different authorities clear?</p>	<p>Rules framed by Municipal Corporations w.r.t plastic waste management, Standard guidelines for management of plastic waste in the country, Good practices</p>	<p>Reports, Surveys, concerned files, documents</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Is there a formal capacity building process with plastic waste-related subjects involving research and education institutions?</p> <p>Is the structure of plastic waste management system appropriate for solving challenges that waste entails?</p> <p>Do the responsible agencies have the necessary instruments for fulfilling their obligations related to the priorities in the plastic waste management? Are there measures for raising awareness about plastic waste-related issues?</p>	<p>Public awareness campaigns, Promotion of alternatives by regulatory authorities. Mandate of the agencies/entities responsible for. Implementation of policy/ laws/ rules/ guidelines/ bye law/regulations/ strategy</p>	<p>Reports, Surveys, concerned files, documents</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Whether the measures adopted have sufficient controls for comparison/ quantification of effects of instruments for determining effectiveness?</p>	<p>Policy Documents, Legislative Framework, Policy Instruments</p>	<p>Reports, Surveys, concerned files, documents</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>
<p>Whether the Central/Provincial regulatory authorities have performed any analysis for comparison of effectiveness among the various instruments?</p>	<p>Policy Documents, Legislative Framework, Policy Instruments</p>	<p>Reports, Surveys, concerned files, documents</p>	<p>Interviews</p> <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files <p>and through audit Requisitions.</p>

Main Audit Questions and Sub-questions	Audit Criteria	Sources of Audit Evidence	Audit Method
Whether any study conducted/policy implemented to examine effectiveness aiming to address/monitor/measure microplastics pollution from plastic waste?	Basel convention, legislative rules and regulations for microplastics by respective countries	Reports, Surveys, concerned files, documents	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Whether any impact assessment regarding policy initiatives undertaken? Whether such exercise study the impact where reduction in plastic waste is for short term or elimination of plastic pollution in long term?	Study documents, Policy Documents, Legislative Framework, Policy Instruments	Reports, Surveys, concerned files, documents	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Whether such assessment or any study conducted consider the contributing factors and constraints regarding implementation of policy initiatives for identifying unobserved factors for comparison of consumption rate prior to and post implementation of policy/initiative?	Study documents, Independent review studies, Policy Documents, Legislative Framework, Policy Instruments	Reports, Surveys, concerned files, documents	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
Are there cases of waste import from other countries and waste trafficking? What are government policies, regulations and framework for addressing this issue?	Basel convention, legally binding agreements with other countries governing transboundary movements of plastic waste, Bilateral Agreements Between countries,	Reports, Surveys, concerned files, documents	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.
How regulatory authorities monitoring transboundary movement of plastic waste	Basel convention, legally binding agreements with other countries governing transboundary movements of plastic waste, Bilateral Agreements Between countries,	Reports, Surveys, concerned files, documents	Interviews <ul style="list-style-type: none"> ■ Analysis of Documents. ■ Through scrutiny of the concerned files and through audit Requisitions.

Glossary

Bioaccumulation	Bioaccumulation is the gradual accumulation of substances, such as pesticides or other chemicals, in an organism
Biodegradation	Biodegradation is defined as the biologically catalysed reduction in complexity of chemical compounds
Biosolids	Biosolids are solid organic matter recovered from a sewage treatment process and used as fertilizer.
Bisphenol A	Bisphenol A (BPA) is an organic synthetic compound. It is used to make polycarbonate, a hard, clear plastic, which is used in many consumer products.
Carcinogenic	A carcinogen is any substance, radionuclide, or radiation that promotes carcinogenesis, the formation of cancer.
Dioxin	Dioxins and dioxin-like compounds are a group of chemical compounds that are persistent environmental pollutants.
Greenhouse gases	A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect.
Greywater	Greywater refers to domestic wastewater generated in households or office buildings from streams without fecal contamination
Hydrocarbon	A hydrocarbon is an organic chemical compound composed exclusively of hydrogen and carbon atoms. Hydrocarbons are naturally-occurring compounds and form the basis of crude oil, natural gas, coal, and other important energy sources.
Incineration	Incineration is a waste treatment process that involves the combustion of substances contained in waste materials. It is commonly referred to as waste-to-energy facilities.
Landfill	A landfill site, also known as a tip, dump, rubbish dump, garbage dump, or dumping ground, is a site for the disposal of waste materials.
Material Footprint	“Material footprint” refers to the total amount of raw materials extracted to meet final consumption demands
Macroplastic	Plastic debris with size greater than 5 mm

Microbeads	Microbeads are manufactured solid plastic particles of less than one millimetre in their largest dimension
Microfiber	Microfiber is synthetic fiber, having a diameter of less than ten micrometers.
Microplastic	Microplastic are small plastic pieces less than five millimetres long which can be harmful to our ocean and aquatic life.
Nanoplastic	Nanoplastic are particles resulting from the degradation of plastic objects. ▪ Nanoplastic exhibit a colloidal behaviour within size ranging from 1 to 1×m.
Polyethylene	Polyethylene or polythene is the most common plastic in use today. It is a polymer, primarily used for packaging.
Polymer	A polymer is a substance or material consisting of very large molecules, or macromolecules, composed of many repeating subunits.
Plasticizers	A plasticizer is a substance that is added to a material to make it softer and more flexible, to increase its plasticity, to decrease its viscosity, or to decrease friction during its handling in manufacture.
Pthalate	Phthalates are a group of chemicals used to make plastic more durable. They are mainly used as plasticizers, i.e., substances added to plastic to increase their flexibility, transparency, durability, and longevity.
Slow Fashion	Slow fashion, is a concept describing the opposite to fast fashion and part of the "slow movement", which advocates for manufacturing in respect to people, environment and animals.
Sludge	Sludge is a semi-solid slurry that can be produced from a range of industrial processes, from water treatment, wastewater treatment or on-site sanitation systems.
Sustainable	Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs.



GOAL 12: RESPONSIBLE CONSUMPTION AND PRODUCTION

BY: MARGREET DE HEER



WE MUST MAKE SURE THE **PRODUCTION PROCESS** FROM MANUFACTURER TO CONSUMER DOES NO HARM TO NATURE NOR HUMANITY AND GENERATES AS LITTLE WASTE AS POSSIBLE!

COMPANIES MUST BE **OPEN** AND **RESPONSIBLE** ABOUT THEIR PRACTICES.

WE MUST HAVE **INTERNATIONAL AGREEMENTS** FOR THE HANDLING OF HARMFUL CHEMICALS.

PROTECTING WATER. AIR & SOIL

WE MUST PREVENT FOOD WASTE!

SALE

SECOND-HAND GOODS

AND KEEP THE PUBLIC **INFORMED** AND **EDUCATED!**



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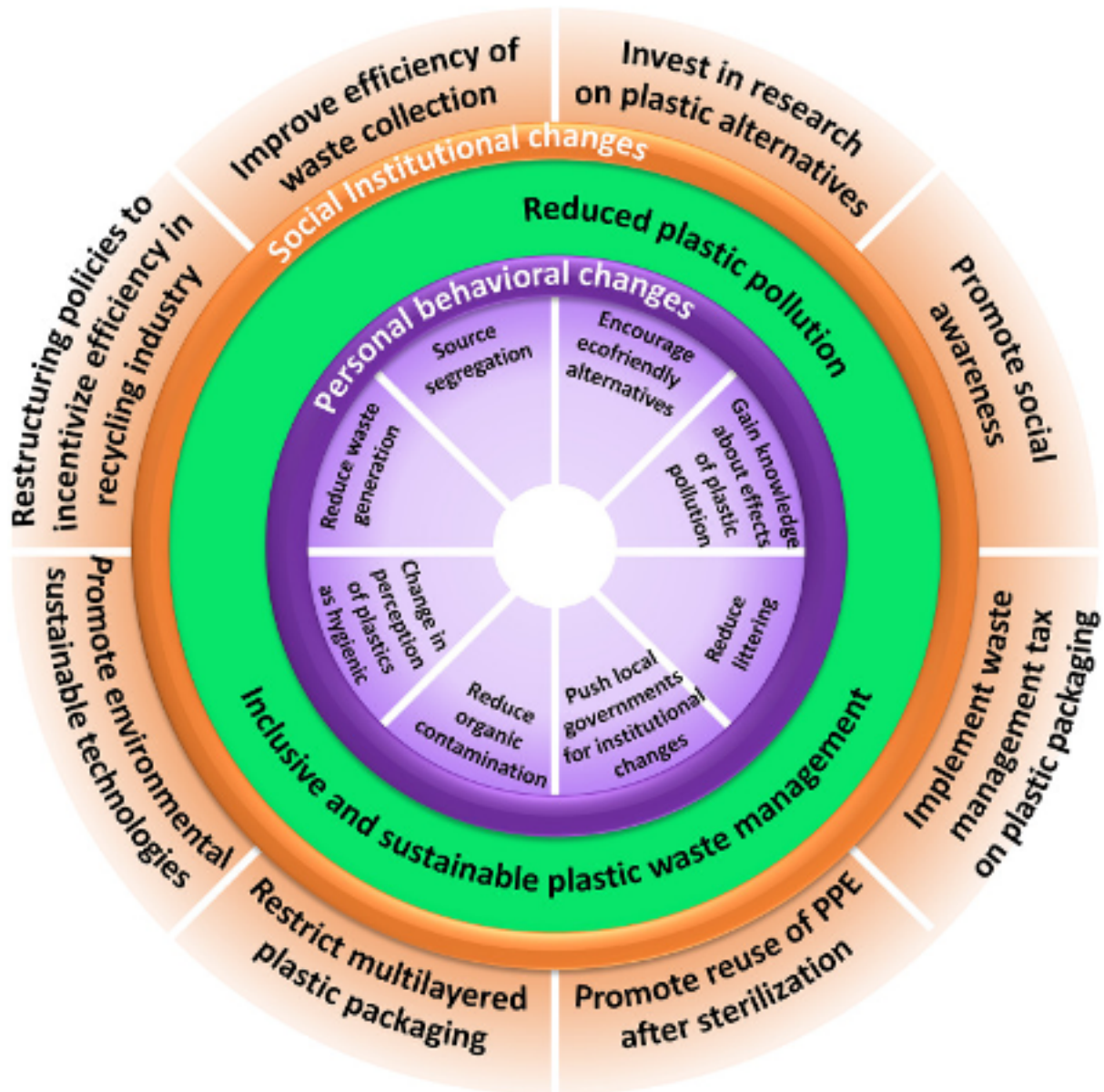
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Illustration depicting an approach to reduce plastic pollution and to bring more inclusive and sustainable plastic waste management.



Source: NCBI



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