ALLIANCE TO END PLASTIC WASTE

The Plastic Waste Management Framework

White paper by Roland Berger
for the Alliance to End Plastic Waste

Executive Summary

Plastic consumption has been steadily increasing globally, closely tracking the worldwide GDP growth rate. Approximately 460 million tonnes of plastics are introduced into the market each year, while about 360 million tonnes of plastic waste are generated annually. This surge in plastic waste poses a significant global environmental challenge, given that 70% of this waste remains uncollected, leaks into the environment, is dumped in landfills or openly burned.

In response to this challenge, there has been a substantial increase in global efforts to combat plastic waste. Both private and public entities have been actively coordinating their actions to address this issue.

A historic step in this endeavor occurred in March 2022, at the second session of the fifth UN Environment Assembly (UNEA-5) held in Nairobi, when 175 countries endorsed a resolution with the aim of putting an end to plastic pollution. The resolution set in motion a mulitilateral negotiating process to create an internationally binding agreement that encompasses the entire lifecycle of plastics, from design to collection, sorting and end-of-life treatment.

For this goal to become a reality, countries need to intensify their efforts in dealing with plastic waste. However, we must note that different countries have waste management systems at different stages of development and varying levels of resources. Therefore, they require different strategies that include enabling polices and consider their individual needs to improve their waste management efforts, in particular, their plastic recycling schemes.

Landfill, Bali, Indonesia

The Alliance to End Plastic Waste has pledged its support to the development of this global instrument. As part of its efforts to educate and inform key stakeholders, it has partnered with Roland Berger to design a conceptual framework that supports the improvement of plastic waste management systems. This framework defines contextually tailored enabling policies and levers to reduce plastic waste pollution and increase plastic circularity in an economically and environmentally sustainable manner. The Alliance hopes that this framework will serve as a guideline for governments to take stock of their own waste management systems and use the proposed policy levers to ensure the effectiveness of their downstream measures in dealing with plastic pollution.

The project, carried out in 2023, relies on Roland Berger's proprietary frameworks, databases, domain-specific knowledge, and expert know-how.

Category 1
UNDEVELOPED SYSTEMS

Countries in this category have no regulation or infrastructure, and the waste picker sector plays a crucial role. These countries can consider policies that focus on developing basic waste management legislation, building institutional capacity, and establishing comprehensive baseline data.

Category 2
INCIPIENT SYSTEMS

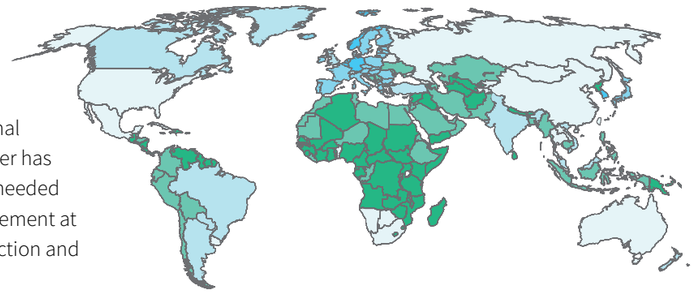
Countries in this category have basic waste regulation, but only a limited collection and end-of-life treatment infrastructure. These countries should consider prioritising policies that promote the development of basic collection and treatment infrastructure, including support for waste pickers.

Category 3
DEVELOPING SYSTEMS

Countries in this category have functional waste management systems, driven primarily by market-based mechanisms focused on value creation elements. Apart from securing funding for major infrastructure projects, these countries could consider pursuing policies that foster industry-wide commitment and support for recycling.

SIX DISTINCT CATEGORIES HAVE BEEN IDENTIFIED

For each of these categories, Roland Berger has analysed the characteristics in terms of stakeholders, infrastructure, legislation framework and operational models. Following this, Roland Berger has derived specific policies and levers needed for system and performance improvement at each stage of the plastic waste collection and recycling value chain.



Category 4
FUNCTIONAL, LARGELY UNREGULATED SYSTEMS

Countries in this category have functional waste management systems, yet their recycling rates have stabilised at around 20-25% due to limited regulatory pressure. Countries in this category could introduce policies focused on recycling targets, mandatory EPR and incentives for waste generators.

Category 5
ADVANCED SYSTEMS

Countries in this category are advanced and well-regulated, although they may still face challenges in specific areas or segments of the value chain. Complex waste management systems are firmly in place, supported by strong expertise and institutions. Countries in this category can focus on recyclability, separate collection at source, and rigorous enforcement of Extended Producer Responsibility (EPR).

Category 6
DEVELOPED PERFORMING SYSTEMS

Category 6 countries have the most advanced waste management systems. Their expertise and best practices can serve as "success story" examples. Still, they would benefit from policies that focus on promoting innovation (investment and adoption), the convenience of waste disposal options and work towards levelling the playing field for relevant stakeholders.

Key Highlights

1. As different countries have varying abilities to tackle the problem of plastic pollution, **tailored strategies that consider a country's national circumstances, infrastructure capacities and resources, are crucial to improving plastic waste management systems across the globe.**

2. Developed together with Roland Berger, this framework encompasses strategies and policy levers that countries can adopt, while also acknowledging countries' national contexts and plans.

The range of measures discussed in this framework, from overarching policies to specific infrastructure and operational enhancements, highlights the multifaceted approach needed to combat the problem of plastic waste.

3. Six distinct development categories have been identified based on country characteristics, namely, stakeholders, infrastructure, legislation framework and operational models.

Categories 1 ("Undeveloped Systems") and 2 ("Incipient Systems") have limited or lack waste management infrastructure and legislation. Categories 3 ("Developing Systems") and 4 ("Functional, Largely Unregulated Systems") have waste management infrastructure, market-based system and limited regulatory pressure. Categories 5 ("Advanced Systems") and 6 ("Developed Performing Systems") have both infrastructure and regulation frameworks, stream diversification and advanced policies and systems.

4. Case studies have been used to illustrate specific success factors and policies that can be leveraged in other geographies.

These factors include both infrastructural and systemic elements such as collection-sorting-treatment infrastructure, a comprehensive incentivising policy framework and the need for stakeholder engagement. Processes to mobilise capital and funding, capability building schemes and other forms of innovation serve as complementing enablers.

5. Waste pickers play an integral role in contributing to plastic waste reduction and circularity. This is particularly prominent in (but not limited to) Categories 1, 2 and 3.

Ultimately, policies to support, integrate and fund waste pickers' contributions and activities will go a long way in driving collection and by extension, plastic waste recycling rates. In addition, by ensuring that waste pickers have proper working and living conditions, and are fully integrated into the larger community, they will continue to make significant contributions to tackle the problem of plastic pollution.

6. Extended Producer Responsibility is one of the most effective policy instruments for increasing recycling rates.

Under EPR, the responsibility for achieving certain (well defined, typically gradually increasing) recycling rates lies with waste generators. The implementation of EPR systems requires an alignment across the entire value chain (brand owners, waste collectors, recyclers, municipalities and government/ regulators), thus developing an EPR framework should be a collaborative effort with industry, achieved through an iterative process. The typical implementation of EPR systems spans approximately 4-6 years.

7. The Deposit Refund System (DRS) is a policy tool commonly used for beverage packaging, and it has been successfully implemented in developed systems.

The primary focus is typically on non-alcoholic beverages and beer, with occasional inclusion of spirits. DRS systems include PET bottles and aluminium cans; some systems go further and also include other types of packaging like one-way glass and beverage cartons. Determining the appropriate deposit amount is key, as it strongly influences the return rates; the take-back strategy is also a critical factor.

8. There are caveats to how uniformly this framework can and should be applied.

We must remain sensitive to the fact that there are distinct factors that can affect how systems transition through categories and their overall evolution pathways. This system evolution framework is primarily built on empirical observations and analyses conducted at the individual system level, often corresponding to specific countries. In certain federal systems, individual system entities can be represented by states or provinces within these countries and may have full autonomy over environmental legislation, processes and timelines. Similarly, system evolution, stakeholder alignment and determination at a transnational level (e.g., global or regional, such as the European Union) can also act as catalysts to accelerate the timeline or allow states to leap-frog the evolutionary process.

9. The challenge, of course, lies in implementing, funding, and continuously monitoring and adapting these strategies.

1. Material Recovery Facility, Nairobi, Kenya

2. Waste collection service, Bali, Indonesia

3. Community waste collection, Argentina

4. Material Recovery Facility, Bali, Indonesia

The Plastic Waste Management Framework

TABLE OF CONTENTS

1. Plastic Waste: Global Context

Plastic Waste: Global Context

Of the ~360 million tonnes of plastic waste generated annually, approximately 50% consists of plastic packaging, 30% comes from construction, industry, and agricultural plastic waste, while the remaining waste includes from electronics and electrical waste (WEEE), textiles, and consumer products.

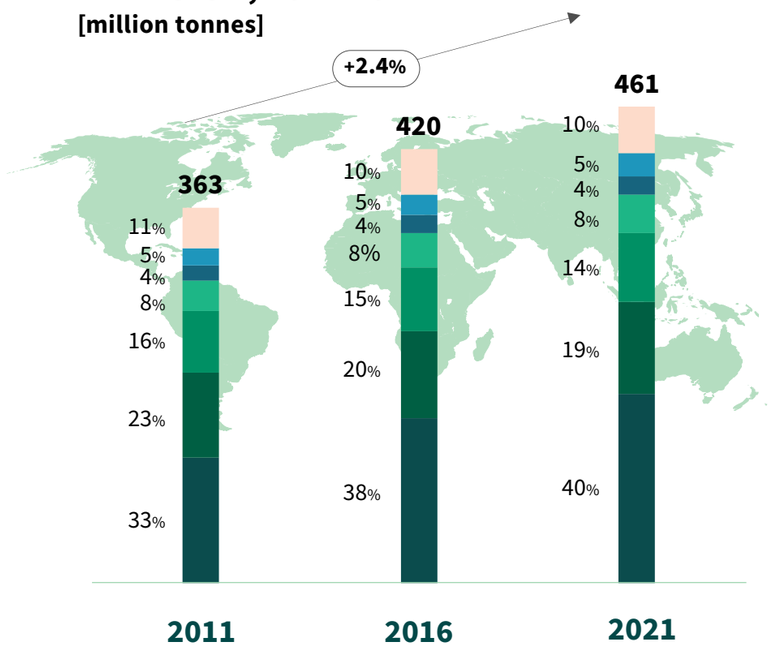
Plastic remains popular due to its convenience, lightweight, functionality, versatility in product design, utility in sterile environments, and its lower carbon footprint in comparison with other materials used for the same purposes.

Plastic consumption is expected to steadily increase, with economic and demographic growth as the primary drivers. Asia accounts for the largest share of plastics introduced to the market, approximately 40% (in 2021), with a compound annual growth rate (CAGR) of 5% between 2011 and 2021 (Diagram 1).

It is followed by North America and Europe, which account for 19% and 14% of the total plastics introduced to the market, respectively. Both regions are undergoing a reduction in the per unit weight of plastic packaging, resulting in lower volumes per capita introduced to the market over the past decade. However, a downside of this weight reduction is the increasing use of composites, which today are more difficult to recycle (design for recycling guidelines are addressing these challenges).

In 2021, at the global level, approximately 50% of total plastic waste was sent to landfills, 20% was littered or openly burned, and 20% was incinerated. 10% of plastic waste was recycled, with the recycling rate growing by 3% over the last decade (Diagram 2).

PLASTIC PUT-ON-MARKET BY REGION, 2011-2021
[million tonnes]



COMPOUND ANNUAL GROWTH RATE, 2011-2021

- 2% Other regions
- 3% Middle East & North Africa
- 3% Sub-Saharan Africa
- 2% South & Central America
- 1% European Union
- 1% North America
- 5% Asia

Diagram 1 - Source: OECD, Plastics Europe, Roland Berger

Material Recovery Facility, Vietnam

Open burning, littering, and landfilling are all end-of-life options with significant negative impacts on the environment and health. Therefore, they need to be addressed through diversion, reduction, circular solutions, and policies, which are the focus of this study.

Europe stands as the global leader in plastic waste recycling, with a recycling rate of approximately 15% in 2021. This percentage is expected to rise further as the European Union strengthens its regulatory efforts to combat pollution and waste, while setting ambitious targets for packaging and other waste categories such as WEEE and textiles.

In Asia, while rising living standards and improved waste handling infrastructure are evident, waste management development remains uneven. In 2021, 12% of plastic waste was recycled across the continent. Asia also has the largest share of ocean pollution.

In North America, roughly 75% of plastic waste is landfilled and 5% recycled. While the USA has historically faced less regulatory pressure in this regard, several states have recently taken steps to implement plastic waste policy frameworks.

Efforts to establish effective waste management systems are ongoing in Africa and South America. On these continents, waste management needs to become a strategic priority, akin to other essential utilities – this will help reduce plastic waste leakage and improve plastic circularity.

Plastic Waste: Global Context

PLASTIC WASTE END-OF-LIFE BY REGION, 2021
[million tonnes]

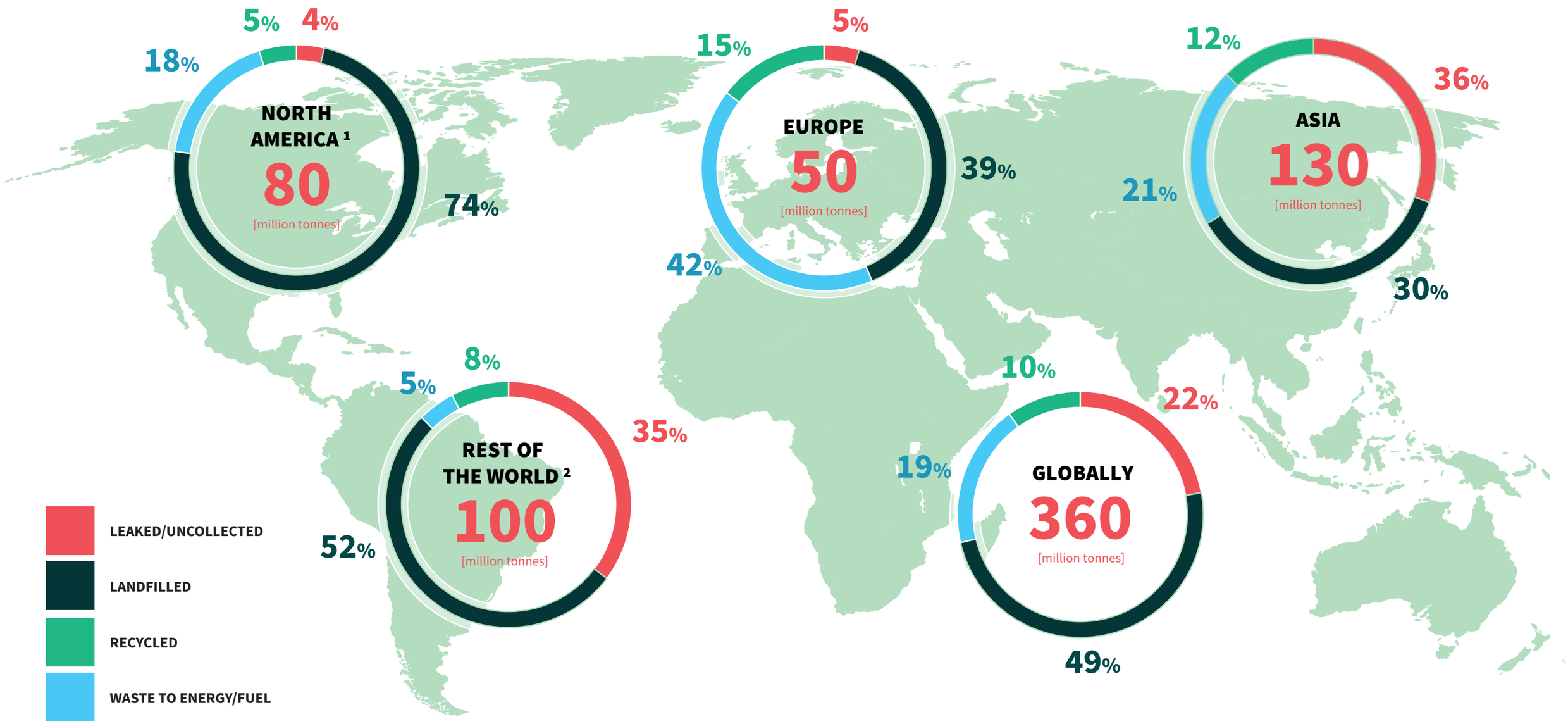


Diagram 2 - Source: OECD, Plastics Europe, StatsCan, US EPA, Roland Berger
1) United States and Canada 2) Africa, South and Central America, Middle East, Oceania, Non-EU Europe, Eurasia

2. The Plastic Waste Management Framework

The Plastic Waste Management Framework: General Introduction

The Plastic Waste Management Framework has been developed by drawing upon empirical observations and analyses of various systems worldwide, as they have evolved over time.

This framework serves a dual purpose. First, to provide a conceptual tool for understanding the distinct characteristics and outcomes of systems within diverse contexts and at different stages of maturity. Second, to outline the policy levers, actions, investments, and the complementary enablers required for each maturity category or stage.

The framework has been constructed around five key dimensions: collection, treatment, wider waste management legislation framework, specific plastic (waste) policy framework and enablers (which encompass factors such as the stakeholder ecosystem, awareness and communication efforts, and innovation).

All five dimensions must be addressed simultaneously during each maturity stage. The optimal combination of actions, investments, and policies defines the enabling policy framework for each specific maturity category.

The framework outlines six distinct maturity categories and assumes that, as these steps are implemented, they will help systems progress towards a higher level of maturity over time.

Drawing from empirical observations and analyses spanning the last 50 years, the framework also presents an estimated timeline for the evolution of systems and indicative performance metrics (utilising the widely accepted KPI of plastic waste recycling). These quantitative proxies, along with the specific timing of policies, actions and investments, should be interpreted within the broader context of the framework. Any deviations from these metrics or the timing of policies and actions will be assessed on a case-by-case basis for each individual system.

The six plastic recycling maturity categories identified are:

Category 1:
UNDEVELOPED SYSTEMS

Category 2:
INCIPIENT SYSTEMS

Category 3:
DEVELOPING SYSTEMS

Category 4:
FUNCTIONAL, LARGELY UNREGULATED SYSTEMS

Category 5:
ADVANCED SYSTEMS

Category 6:
DEVELOPED PERFORMING SYSTEMS

Plastic waste mismanagement represents one of the most important environmental challenges of the 21st century, affecting numerous ecosystems across the globe directly and indirectly.

The purpose of the study is to describe the characteristics of plastic waste management systems at various stages of their development, outline the stages in their evolution and the required policy framework and specific policy levers to drive such evolution.

The study also outlines a selection of specific examples and best practices for particular topics or policies. These examples illustrate the key success factors and the challenges faced during the implementation of different policy frameworks.

The Plastic Waste Management Framework

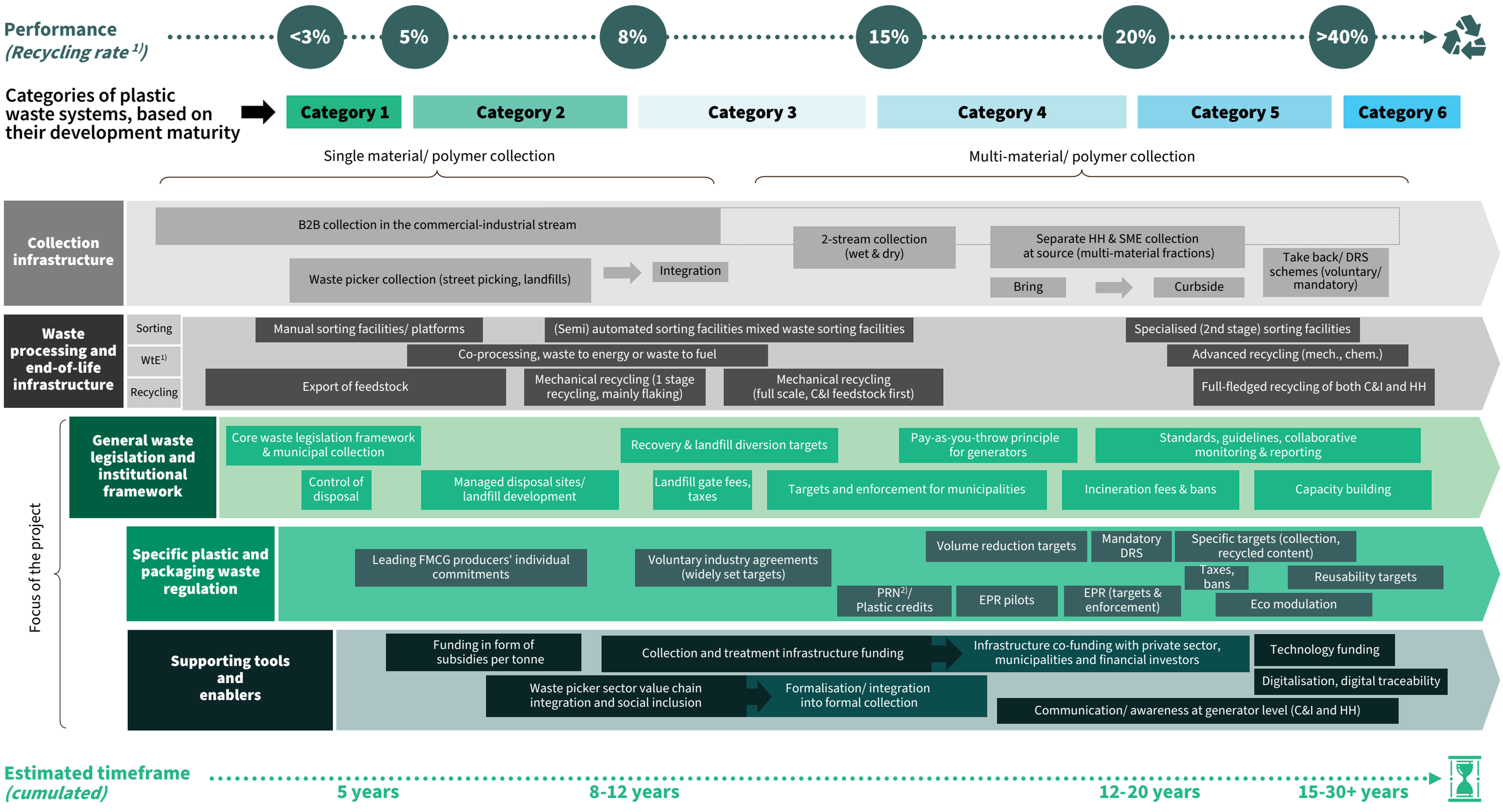


Diagram 3 - Source: Roland Berger

1) Indicative (total) plastic waste recycling rates, as % of plastic waste put on market/ generated per year. Recycling rate for different plastic waste categories, which are at times also highlighted in the report, can be different (e.g., plastic packaging recycling rates are typically higher than total plastic waste recycling rates)

The Plastic Waste Management Framework

PLASTIC RECYCLING MATURITY CATEGORIES
GLOBAL OVERVIEW[1]

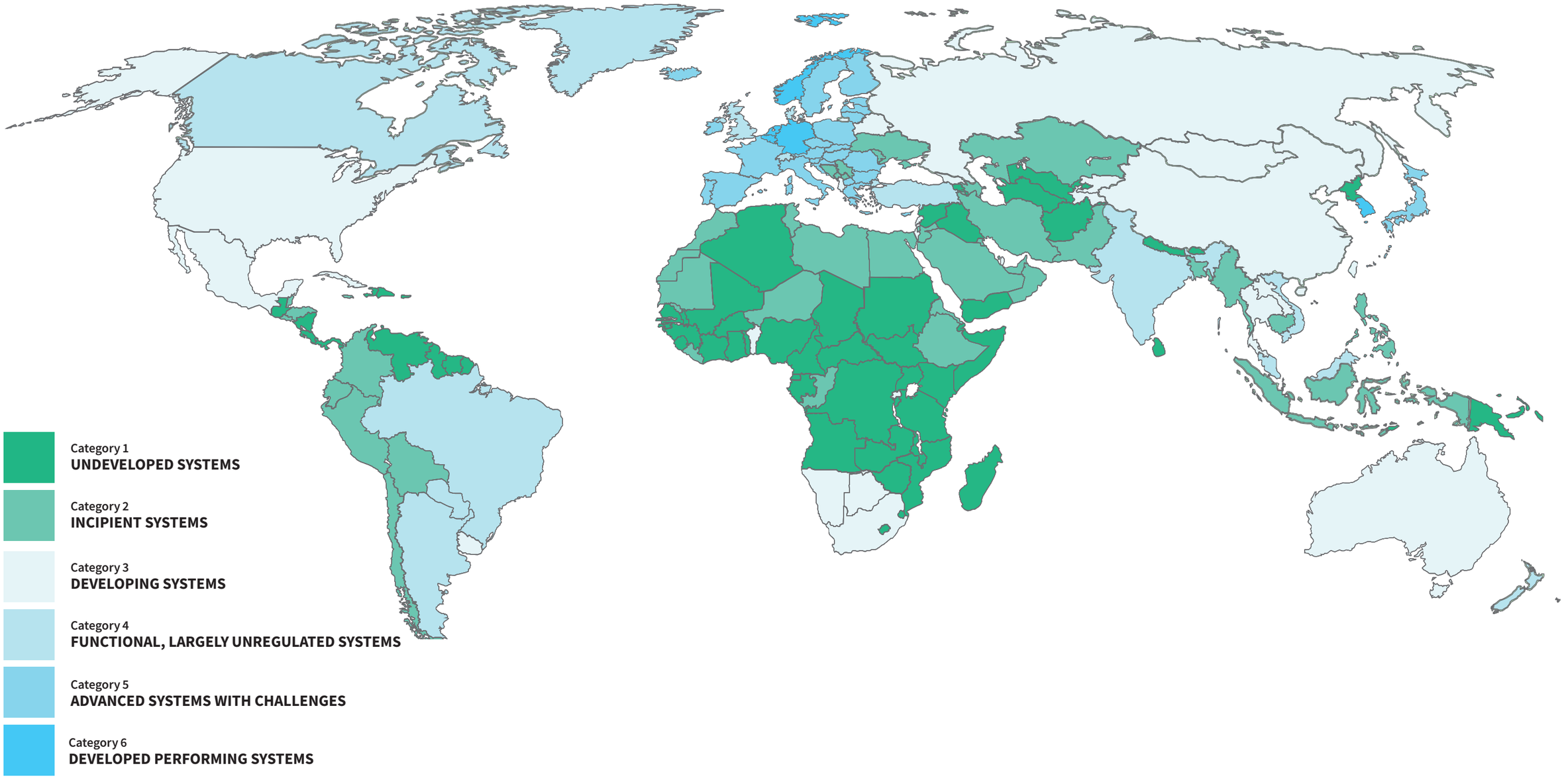


Diagram 4 - Source: World Bank, Roland Berger
1) Individual country level data provided in appendix

The Plastic Waste Management Framework

Category 1
UNDEVELOPED SYSTEMS

This category encompasses countries that either lack or have very basic waste management systems. These countries often lack essential utilities such as clean water, sewage systems, and power, and grapple with security and safety issues. Many of these countries are relatively small and located in regions across Africa, Asia, and various islands. However, some larger nations like Nigeria and Kenya also fall into this category. These countries are expected to experience significant demographic growth, greater economic development and by extension, an increase in plastic consumption per capita. With a proper waste management policy framework and investment, they stand to benefit from significant reduction in plastic waste and its associated environmental impact.

Category 2
INCIPIENT SYSTEMS

The waste management systems in this category are typically found in undeveloped or emerging economies which have prioritised waste management in their strategic roadmaps. In these systems, high-value plastic waste, such as PET and HDPE bottles, is collected and either recycled locally or exported. As such, they are able to achieve recycling rates of up to 30-40% for these polymers (but under 5% for total plastic waste). These countries hold significant potential for reducing plastic waste through “quick wins” because they already have the basic legislative framework and infrastructure in place, making it feasible to achieve total plastic waste recycling rates of 5-8% in the mid- term.

Category 3
DEVELOPING SYSTEMS

This category is widespread globally and encompasses countries ranging from emerging economies to highly developed countries. These systems are characterised by a lack of regulations and mandatory targets. Recycling rates within these systems are primarily influenced by market-based mechanisms along the value chain. These countries, home to some of the world’s largest populations, are major contributors to plastic waste. They also have the potential to significantly increase their recycling volumes if they are developing both a comprehensive policy framework and the required collection-sorting-recycling infrastructure for plastic waste.

Category 4
FUNCTIONAL, LARGELY UNREGULATED SYSTEMS

Countries in this category are generally developing or advanced economies which typically have a relatively developed waste infrastructure and some related policies in place. However, they have less effective or strict enforcement mechanisms, which are often the result of limited policy intervention.

Despite the absence of a comprehensive regulated waste management system, they have managed to achieve average plastic waste recycling rates of around 15-20%, primarily due to market-driven mechanisms. However, any further increase in these recycling rates would be difficult without stricter policies, because any marginal increases would stem from addressing the lower-value waste streams, which are not economically attractive in a market-only based policy framework. Such systems can have a significant contribution to the increase of the global recycling rate due to their size and future growth prospects, coupled with the already existing infrastructure and stakeholder awareness on the matter.

Category 5
ADVANCED SYSTEMS WITH CHALLENGES

Many European countries belong to this category, together with selected countries in Eastern Asia. These nations have established advanced waste management systems and implemented comprehensive policy frameworks, being able to reach overall plastic waste recycling rates in the range of 20% to 30% (with higher rates for plastic bottles and rigid packaging). However, these systems have substantial room for improvement as they have the potential to at least double their plastic waste recycling rates. This can be achieved through specific policies and incentives targeting plastic waste streams that are not currently (fully) addressed, along with increasing incentives for the stakeholders involved. Rigorous enforcement of their policy frameworks, at all levels, combined with the adoption of innovation and technology along the entire value chain, are essential. Countries with such systems possess the potential to significantly boost global recycling rates, thanks to their overall size and untapped opportunities, especially in plastic waste categories like non-packaging and flexible packaging.

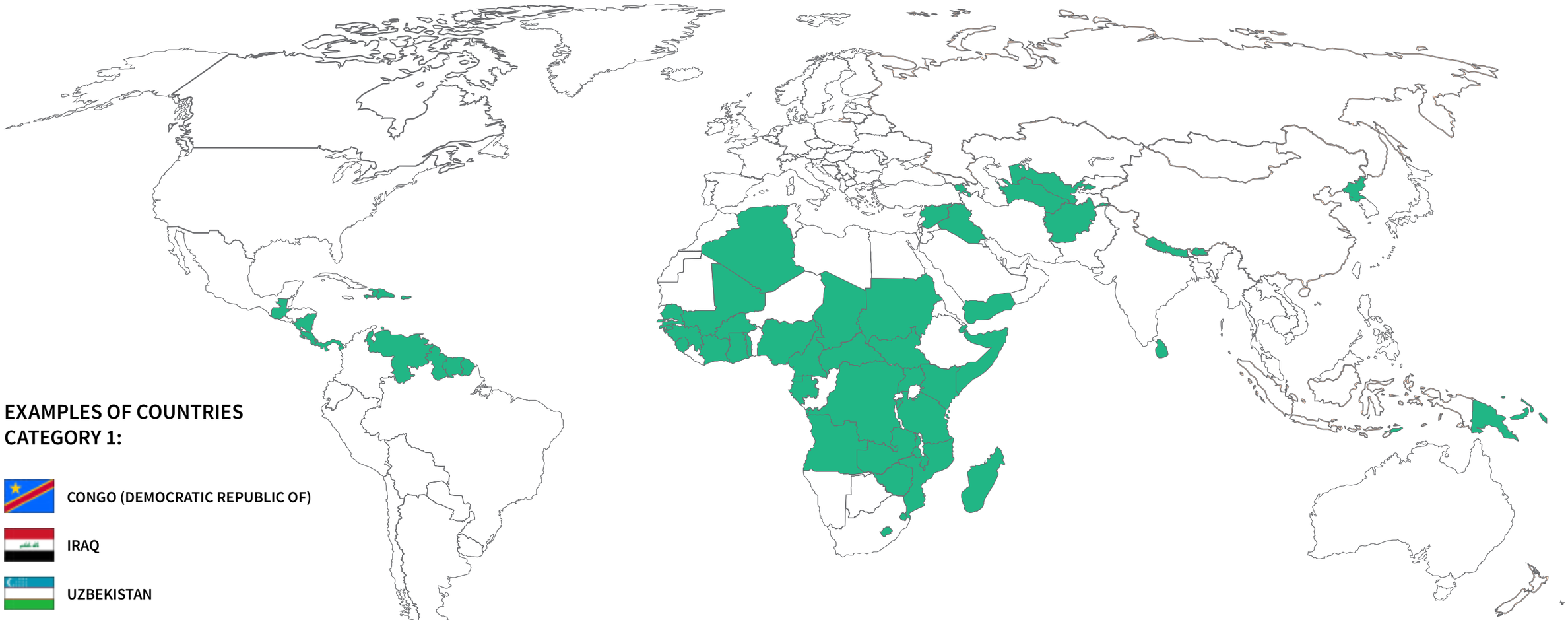
Category 6
DEVELOPED PERFORMING SYSTEMS

This category consists of a select group of best practice waste management systems in developed economies (including Belgium, Germany, Netherlands, Norway and South Korea). Their success in waste management is attributed to a comprehensive policy framework which creates the right incentives for all plastic waste streams and stakeholders participating in the value chain. Infrastructure in these countries is also well-developed, and well-distributed across the territory, optimally covering the plastic waste volumes generated with proper treatment solutions. Policies are enforced strictly and consistently, at all levels of authority, and there is a high level of awareness and education on the matter across all categories of waste generators (households, businesses, institutions). Due to these characteristics, such well-performing systems can achieve high plastic waste recycling rates beyond 40%. Some specific plastic waste categories or streams even achieve recycling rates surpassing 90%, thus reaching full circularity, with minimal environmental impact.

Material Recovery Facility, Brazil

The Plastic Waste Management Framework

CATEGORY 1 - UNDERDEVELOPED SYSTEMS



EXAMPLES OF COUNTRIES CATEGORY 1:

- CONGO (DEMOCRATIC REPUBLIC OF)
- IRAQ
- UZBEKISTAN
- GUYANA
- KENYA
- TANZANIA (UNITED REPUBLIC OF)

CONTEXT

Plastic waste management systems in Category 1 have no regulation or infrastructure in place, and the waste picker sector plays a crucial role.

POLICIES AND LEVERS

Category 1 countries could consider policies that focus on developing basic waste management legislation, building institutional capacity, and establishing a comprehensive data baseline.

Diagram 5 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 1: CONTEXT

Plastic waste recycling rate
The overall plastic waste recycling rate is (significantly) under 5%, with plastic packaging waste recycling rate up to 7-8%. This means that most of the recycling efforts are focused on plastic packaging. For other types of packaging, recycling rates are similar or even lower. Uncollected and/ or littered and landfilling plastic waste rates are very high, typically beyond 90%.

Collection infrastructure
Systems in this category experience uncontrolled waste disposal and have limited and/or lack municipal solid waste collection systems. If collection systems do exist, they are limited to urban areas, sometimes even excluding parts of these cities. In cases where curbside collection exists, it is single stream collection (no source separation), with irregular and infrequent pickups. Moreover, there is very limited or no infrastructure for the separate collection of packaging and recyclables at the source within the commercial and industrial stream.

Waste processing and end-of-life infrastructure
The infrastructure for waste treatment does not exist or is insufficient to meet waste treatment needs. In some instances, there may be limited incineration (waste-to-energy) or small-scale waste-to-fuel or co-processing capacities. Plastic recycling capacities are very rare. In general, waste, including plastics and other packaging materials, is disposed of in an uncontrolled manner (dumpsites/ unmanaged landfills), resulting in littering and open burning, with high CO2 emissions. In the absence of treatment infrastructure, the small plastic volumes collected are typically exported.

General waste legislation and institutional framework
Systems in this maturity category have limited or dysfunctional waste and environmental legislation. Even when limited waste legislation exists, instruments for enforcement are often lacking and institutions, enforcement bodies and penalties are absent. Expertise in waste management is severely limited at all levels, whether in government, other public sector stakeholders, or the private sector. This lack of expertise is a major obstacle to progress, despite funding being often available.

Specific plastic and packaging waste regulation
Typically, there are no specific targets set for plastic and packaging waste, and specific regulations are often lacking. In cases where regulations do exist, they may be ineffective and poorly enforced. Sometimes, regulations may be simply copied from other geographies, without meaningful implementation.

Waste Pickers
Waste pickers play a crucial role in collecting a significant portion of waste, including street-picking, small and medium enterprises and household picking, and landfill picking of rigid plastic packaging such as PET and HDPE, which have higher value. Despite their essential contribution to waste collection, waste pickers are often outlawed; the main arguments against their activities revolve around perceived negative impacts on public safety.

CATEGORY 1: POLICIES AND LEVERS

Collection infrastructure
Developing the collection infrastructure is key for this category. Expanding the coverage of curbside waste collection for the population and supporting the waste picker sector are expected to make a significant difference. Driving the separate collection of packaging waste (including plastic) is crucial. The collected waste could be exported until local treatment infrastructure becomes available.

Waste processing and end-of-life infrastructure
The development of treatment infrastructure could commence by introducing controlled disposal methods and establishing managed landfills. Quick progress in waste sorting can be achieved by setting up manual sorting platforms or facilities, next to the newly developed managed disposal sites. Investment in more sophisticated municipal waste material recovery facilities would have significant impact. These facilities can also be co-located in landfills or waste-to-energy sites to maximise their effectiveness.

Implementing small scale pilot waste-to-energy, waste-to-fuel or co-processing (refuse-derived fuel) projects near major metropolitan areas could yield significant results. Additionally, small scale first-stage recycling infrastructure, such as flaking, should be piloted, albeit with limited capacity initially due to the lack of feedstock. Alternatively, feedstock can be imported from nearby countries if necessary.

General waste legislation and institutional framework
Systems falling within this category will benefit from waste management within their national policy frameworks as well as comprehensive institutional frameworks. Such institutional frameworks could include, among other elements, regulatory bodies, monitoring and reporting entities, as well as a certifying organisation.

Countries can kickstart this process by developing basic legislation that define the roles and responsibilities of stakeholders along the waste management value chain, establish basic targets for diverting waste from landfills and create corresponding incentives, such as taxes or bans, to encourage compliance. Effective enforcement mechanisms ensure adherence to these regulations.

Specific plastic and packaging waste regulation
It is too early to establish mandatory targets for specific materials or packaging at this stage, considering the limited collection and treatment infrastructure in these countries. Typically, individual companies – often large FMCG producers, packaging manufacturers, and plastic producers – take the lead, via individual company commitments and initiatives (often in the form of support for waste picker activities). Furthermore, the early adoption of design-for-recycling guidelines by large (international) FMCG producers creates prerequisites for treatment in later stages.

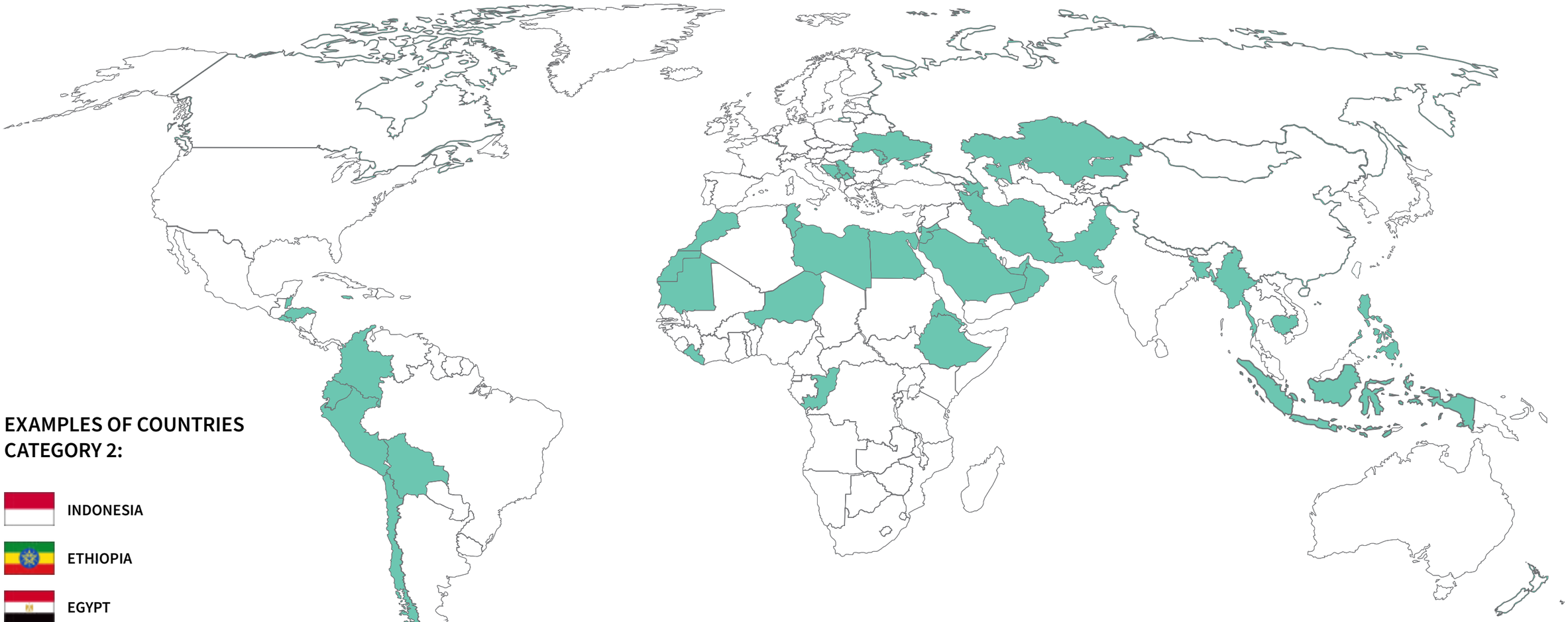
Supporting tools and enablers
A fundamental prerequisite is establishing a data baseline, which includes measurements of waste volumes (both generated and existing in nature), waste composition, a comprehensive understanding of waste flows across various streams, identification of key (potential) actors in the value chain, and an assessment of mid-term treatment needs.

Funding efforts that provide incentives and subsidies for existing collectors and sorters, including those in the waste picker sector, B2B collectors, and basic waste sorting platforms are helpful as are an initial plan and roadmap to address infrastructure investment requirements.

Capacity development focused on enhancing institutional capacities and building fundamental expertise in the field is also beneficial.

The Plastic Waste Management Framework

CATEGORY 2 - INCIPIENT SYSTEMS



EXAMPLES OF COUNTRIES CATEGORY 2:

- INDONESIA
- ETHIOPIA
- EGYPT
- BANGLADESH
- PHILIPPINES
- SAUDI ARABIA

CONTEXT

Systems in Category 2 have basic waste regulation frameworks, but only limited levels of collection and treatment infrastructure.

POLICIES AND LEVERS

Policies for Category 2 countries that prioritises the development of basic collection and treatment infrastructure, including support for waste pickers will help to further develop waste management.

Diagram 6 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 2: CONTEXT

Plastic waste recycling rate
Overall plastic waste recycling rates are around 5%, primarily driven by the efforts and performance in plastic packaging recycling. Specifically, plastic packaging rates typically range between 8% and 10% (comparable to other packaging materials' recycling rate).

Collection infrastructure
Uncontrolled waste disposal is highly prevalent and there is limited curbside single-stream collection of municipal solid waste from households and small to medium-sized enterprises. Collection is predominantly focused on urban areas, leaving certain regions without access to such basic "utility" services.

Managed disposal sites and landfills are scarce, with limited capacity, and they typically do not meet basic environmental or health and safety standards (such as avoidance of leakage into soil, limited access of people and animals). Open burning of waste, with significant CO_2 and methane emissions, is the most frequent end-of-life method in such instances, presenting one of the most pressing environmental challenges that should be addressed.

Moreover, there is limited infrastructure for separate collection of recyclables at source in the commercial and industrial sector, with a small number of enterprises prioritising this matter (typically as part of their global inhouse environmental policies).

Waste processing and end-of-life infrastructure
Treatment infrastructure capacities are rather scarce and small-scale (given the high level of expertise and investment required), resulting in a high incidence of waste being leaked in nature, openly burned or landfilled (in non-ecological landfills). Typically, there are a few small-scale functional incineration (waste-to-energy), waste-to-fuel, co-processing and/or mechanical recycling facilities, close to larger cities. However, they are generally insufficient to process the higher volume of collected waste; consequently, sorted plastic waste is frequently exported.

Specific waste legislation and institutional framework
The plastic and packaging waste regulations in these countries need improvement. Frequently, targets are set at ambitious levels, without a clear roadmap for achieving them. While there may be some basic regulations in place, they often include misaligned incentives throughout the value chain. These regulations fail to establish the necessary conditions or incentives to boost recycling rates and, at times, exhibit biases or advantages favouring specific segments of the value chain that wield greater influence or power at the government level. For example, this can be seen in cases where municipal-owned collectors monopolise waste ownership.

Specific plastic and packaging waste regulation
Typically, there are no specific targets set for plastic and packaging waste, and specific regulations are often lacking. In cases where regulations do exist, they may be ineffective and poorly enforced. Sometimes, regulations may be simply copied from other geographies, without meaningful implementation.

Waste Pickers
The waste picker sector is a key contributor, being responsible for most of the waste collection, including street-picking, small and medium-sized enterprise picking, household picking, and landfill picking. Despite their significant contributions, waste pickers are often operating in a legal grey area and lack formal recognition from authorities. The organisations within this sector are typically informal, leading to substandard working conditions, inefficiencies, and low income levels for the pickers.

CATEGORY 2: POLICIES AND LEVERS

Collection infrastructure
Collection infrastructure should address several key aspects.

Firstly, support for waste pickers. This can be done by securing funding for their equipment, providing incentives, and conducting training.

Secondly, provide 100% curbside waste collection in both urban and semi-urban areas, for at least single-stream waste. This will help drive the infrastructure development for separate source collection systems for recyclables (including plastic waste) within the commercial and industrial sector and should be made mandatory for all businesses.

Lastly, pilot programs for the separate collection of recyclable plastics at the household level should be initiated, through designated collection points, starting in more affluent urban districts. This will go some way in fostering sustainable habits and awareness among the citizenry.

Waste processing and end-of-life infrastructure
Investment in managed landfills will ensure that a significant portion of waste volumes will be handled efficiently through controlled disposal. For sorting, investments in material recovery facilities is recommended to ensure that primary urban areas are covered with at least one such facility. For end-of-life treatment infrastructure, the expansion of first-stage recycling infrastructure, like flaking, gradually starting to phase out incineration, waste-to-fuel or co-processing as the main and/or preferred end-of-life methods could be considered.

General waste legislation and institutional framework
A focus on consolidating their general waste legislation, to ensure complete alignment among stakeholders. This includes addressing issues such as waste picker rights, defining municipal responsibilities and ownership of waste, and establishing disposal obligations for various generators, including businesses in commerce, industry and households. Enforcement measures would include key incentive mechanisms, such as landfill diversion targets and minimum landfill taxation thresholds.

Specific plastic and packaging waste regulation
Initiating voluntary recycling targets for specific materials and packaging, including plastic, is a first step in developing specific plastics- and packaging-related frameworks. At this stage, such targets are typically set up on a voluntarily basis by alliances comprising of prominent FMCG producers and converters and packaging producers. These targets are typically related to a single material or polymer.

The early adoption of design-for-recycling guidelines by large (international) FMCG producers creates prerequisites for end-of-life treatment in later stages. Authorities can encourage and support these voluntary commitments made by specific company alliances or associations through co-financing, grants, or fiscal incentives. This collaborative approach helps establish the necessary foundations for waste treatment in later stages.

Supporting tools and enablers
The transition from short-term financial incentivisation for key actors in the value chain, such as subsidies for waste pickers and sorters, to mid-term solutions can include investing in assets to enhance collection efficiency, such as fleet improvements, compacting and basic mixed waste sorting infrastructure.

Professionalising and organising the work of waste pickers including ways to increase waste pickers' productivity and efficiency; ensure fair compensation and/or commercial terms in relation with offtakes (collection companies, traders, recyclers); foster social inclusion of waste pickers and their families within the waste management value chain; and provide avenues for them to engage with the broader community.

The Plastic Waste Management Framework

CATEGORY 3 - DEVELOPING SYSTEMS

EXAMPLES OF COUNTRIES CATEGORY 3:

- MEXICO
- THAILAND
- RWANDA
- AUSTRALIA
- CHINA
- URUGUAY

CONTEXT

Systems in Category 3 are functional, driven primarily by market-based mechanisms focused on value creation elements.

POLICIES AND LEVERS

Policies for Category 3 countries focus on securing funding for major infrastructure projects and fostering industry-wide commitment and support to develop.

Diagram 7 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 3: CONTEXT

Plastic waste recycling rate
Typically, the overall plastic waste recycling rate for systems in this category is up to 10%. This is driven mainly by the recycling rate of plastic packaging, which can be up to ~15% (the recycling rate for packaging in general can reach 20-30%, with rates for fiber-based packaging and metal packaging higher than for plastic packaging).

Collection infrastructure
Collection infrastructure in these countries is developing. It encompasses most waste generators, both in urban and rural areas. Only a limited portion of waste is disposed of without proper control. The commercial and industrial waste stream is typically effectively covered, with separate collection at source. This is the result of regulatory disposal obligations and market-driven incentives.

In selected urban areas, a two-stream collection system (curbside or via collection points, or a mix of these) is partially implemented for household waste. However, it is important to note that the waste picker sector still has the largest contribution to collection activities for the household and small and medium enterprises waste streams.

Waste processing and end-of-life infrastructure
In general, the processing and end-of-life treatment infrastructure in these systems is sufficient to manage the (relatively small) volumes of waste collected. This infrastructure typically includes sorting plants (both manual and automated) and incineration capacities (waste-to-energy or waste-to-fuel), which handle a substantial portion of the overall waste volumes recovered or diverted from landfills.

Furthermore, the recycling infrastructure encompasses both first-stage and second-stage processes, primarily focusing on plastic volumes from the commercial and industrial waste stream, and high-value plastic packaging, such as PET and HDPE, from the household stream.

General waste legislation and institutional framework
The waste frameworks in this category are typically established during the earlier stages of system development. Due to a reluctance to introduce further regulations and a preference for market-based mechanisms, these regulatory frameworks tend to remain unchanged over extended periods of time.

Expertise in the field is accessible within both the public and private sectors and has a positive impact. However, system performance improvements (measured by plastic waste leakage reduction and recycling rate increases) remain relatively small in the absence of significant structural regulatory changes.

Specific plastic and packaging waste regulation
Industry-wide voluntary commitments are emerging and are contributing to higher recycling rates. However, due to their non-binding and non-enforceable nature, these commitments often fall short of achieving their targets. In many cases, a significant number of stakeholders do not adhere to these voluntary commitments resulting in a phenomenon called "free-riding". This limits the overall system performance and frustrates active private sector players who bear the system burdens (and costs). Therefore, in the long-term, such systems tend to have a rather stagnating or even decreasing performance, in the absence of stricter and mandatory regulations.

Market-based credit or certificate trading platforms, such as credit systems or PRNs (Producer Responsibility Obligation Note), are operational in various markets (e.g. UK, US), where they can be effective for high-value materials and have a lower sorting cost (e.g., PET, HDPE). However, these platforms face limitations when dealing with materials that have limited economic value or are more difficult to sort and/or collect separately at source, especially in the absence of regulatory intervention (e.g., food plastic packaging, flexibles).

Waste Pickers
The waste picker sector is well-organised and highly productive in these systems (where they are not outlawed). The waste pickers also contribute to post-consumer collection activities. Waste picker associations play a crucial role in enhancing both their productivity and their social integration within the sector.

CATEGORY 3: POLICIES AND LEVERS

Specific plastic and packaging waste regulation
Regulation for plastic and packaging waste encourages industry-wide voluntary commitments to achieve specific recycling and recovery targets for the system to further develop. Typically, these initiatives will be spearheaded by a few large multinational companies, with smaller companies benefiting from their efforts ("free-riding"). Policies aimed at supporting and incentivising such initiatives could include tax incentives and deductions, as well as the promotion of market-based credit and certificate trading schemes (e.g., PRN). These schemes ensure that polluters, including plastic producers and brand owners, voluntarily fund collection and recycling activities.

While recycling targets and obligations remain non-mandatory, it is advisable to initiate public-private sector consultations and design frameworks to transition these voluntary commitments into mandatory obligations.

Supporting tools and enablers
Access to funding that prioritises long-term investments in infrastructure using typical financial market instruments such as loans and grants is crucial for stakeholder and players with expertise in waste management.

It is also essential to integrate the contribution of the waste picker sector into the collection and sorting infrastructure landscape, harmonising their activities with those of professional waste collectors; efforts to improve working conditions and promote social inclusion should continue.

Collection infrastructure
Apply an enforced obligation for separate source collection for recyclable plastics within the commercial and industrial waste stream. This can be to all companies generating a minimum threshold volume of waste. Explore a concerted effort to expand the separate source collection of recyclable plastics at the household level, at least in urban areas, where plastic waste volume is high can be achieved by establishing collection points for plastic waste and plastic packaging waste. A minimum improvement would be implementing a two-stream (recyclables separated from organic stream) curbside collection system. It is also important to professionalise waste collection activities, including investments in fleet and bin infrastructure, to increase collection productivity and effectiveness.

Waste processing and end-of-life infrastructure
Providing funding for end-of-life treatment infrastructure is crucial for the systems in this category, to generate demand pull for the collected waste.

Installing adequate sorting capacity in all urban and semi-urban areas, so that collected waste is handled effectively. For mechanical recycling, it is essential to ensure sufficient capacity for both first and, increasingly, second-stage recycling processes. This will enhance value creation throughout the entire collection-sorting-recycling value chain.

Additionally, at this stage, it is vital to develop ecological landfills and other end-of-life treatment infrastructure, including composting and biogas facilities, to comprehensively address all waste management requirements.

General waste legislation and institutional framework
Establish specific targets and obligations for complementary stakeholders within the value chain. These stakeholders include municipalities and counties, who should be responsible for landfill diversion, public space management (location of curbside bins, collection points etc.), and waste ownership. In addition, residential builders should adhere to spacing and building requirements for waste disposal and collection infrastructure.

Enforce the implementation of the "pay-as-you-throw" principle at the household level to incentivise proper disposal practices and promote separate collection at the source.

Policy Deep-Dive: Waste Picker Integration

Approximately 22 million individuals worldwide engage in waste picking, an informal occupation within the waste management sector.

More than

20 M

of informal waste sector workers worldwide

Up to

80%

waste pickers in developing countries represent huge communities of tens of thousands in each metropolitan area

More than

10 K

waste pickers per city in certain countries (e.g., Brazil, India, Nigeria, Mexico, South Africa)

Diagram 8 - Source: PREVENT Waste Alliance, International Labour Organization, World Bank, Roland Berger

In some countries, such as Brazil, India, Nigeria, Mexico, and South Africa, as much as 80% of plastic collection relies on the informal sector. In developing countries, waste pickers form large communities, often including tens of thousands in each metropolitan area.

Waste pickers usually collect valuable waste materials, either from the streets or uncontrolled landfill sites, and sell these materials to collection firms, both small and large, to sustain their livelihoods. They commonly focus on collecting PET and HDPE rigid plastics due to their manageable weight and high demand for recycling; these polymers constitute roughly half of plastic waste in many regions.

However, it is important to note that waste pickers often work in challenging conditions, dealing with unhygienic environments (including odours and toxic substances), pollution, hazards like broken glass, and unsafe situations due to high crime rates.

The waste picker sector is gaining recognition and a stronger voice, thanks to organisations such as the International Alliance of Waste Pickers and Women in Informal Employment: Globalizing and Organising . These efforts are shedding light on the significant and indispensable role that waste pickers play in waste management and recycling.
Waste pickers play a crucial role in diverting waste from landfills. They usually have a high level of productivity, collecting over 25% more material per year compared to formalised collectors or employees. The materials they collect are generally of better quality and are less contaminated than those collected through single-stream municipal collection systems.

Waste pickers play a key role in communities facing challenges such as high crime rates and unemployment. They contribute to stabilising these communities by providing essential waste management services and sources of income.

In Category 1 systems, raising awareness about the value of specific materials or polymers and offering variable support or subsidies based on the volume of collected materials can enhance the income and productivity of waste pickers.
These pickers require protective equipment for their health and hygiene, such as masks, gloves, clothing, and shoes, along with safety support through a 24/7 hotline.

Furthermore, registering waste pickers to secure their basic rights, providing daily essentials like meals and water, and occasionally offering support packages to their families (including basic groceries, school supplies, and clothing) can significantly improve their overall well-being.

In Category 2 systems, waste pickers would benefit from low-cost equipment (e.g., carriages/ bicycles, simple balers), and assistance in negotiating fair remuneration and commercial terms with offtakes (such as collection companies, traders, recyclers). Education and training on health and hygiene can make a big difference, as can access to facilities like showers and clean clothing. Training in relevant skills, integration into the local community, and the provision of social support for waste pickers and their families can have a meaningful contribution at this stage.

In Category 3 systems, various tools can be employed to enhance waste pickers' income and productivity. These tools include market-making, such as support for aggregating volumes of materials; digitalisation initiatives like route optimisation and on-demand pick-up services (like 'uberization'); the provision of storage facilities for materials; and incentives to expand the range of materials they collect.

Transitioning from landfills to street picking, and possibly moving towards protected environments like semi-automated sorting plants, can significantly enhance waste pickers' overall health and well-being.

Integrated community programs for waste pickers and their families also play a crucial role in helping them integrate with society at large. These programs should include educational opportunities for children, community, and employment options for family members. Entrepreneurship programs, including startup financing

Informal Waste Reclaimer, Johannesburg, South Africa

(e.g., for recycling ventures), and participative governance that allows waste pickers to have a voice within formal local community authorities, can also be highly impactful.

Waste pickers play an integral role in contributing to plastic waste reduction and circularity. This is particularly prominent in (but not limited to) Categories 1, 2 and 3. Ultimately, policies to support, integrate and fund waste pickers' contributions and activities will go a long way in driving collection and by extension, plastic waste recycling rates. In addition, by ensuring that waste pickers enjoy proper working and living conditions, and are fully integrated into the larger community, they will continue to make significant contributions to tackle the problem of plastic pollution.

Case Study: Enhancing Waste Picker Productivity and Data Transparency

Brazil has made substantial progress regarding plastic waste management in the recent years. A key driver of this progress has been the successful integration of the waste picker sector into the waste collection process, supported by technological innovation.

The digitalisation of this process has played a key role in enhancing the productivity and efficiency of waste pickers. It has also brought about a significant increase in transparency in terms of waste volumes, flow, and the economic aspects of the entire collection and sorting value chain. Several digital platforms have been developed in Brazil by the private sector, in collaboration with local NGOs representing the waste picker community. These platforms enable digital tracking and reporting of the amounts collected by waste pickers. This innovation has been widely embraced, with thousands of waste collection hubs and centers adopting these online platforms. This has led to a substantial improvement in transparency regarding the volumes of plastic waste collected and delivered by waste pickers, with nearly 100,000 waste pickers subscribing to these apps. Furthermore, this platform has facilitated the implementation of various support mechanisms for waste pickers, including training and personalised incentives. A flexible subsidy structure for waste collection has been introduced, tailored to regional differences, ensuring a constant income for waste pickers. The platform also enabled the creation of mobile applications that connect waste generators, whether they are businesses or households, with waste pickers, allowing for on-demand waste pickup services.

WASTE PICKER SECTOR IN INDIA KEY FACTS:

2-4 M	~100 €	> 95%
Estimated number of waste pickers	Per month is the average income for household of waste pickers	Unaffiliated/unorganised waste pickers

Diagram 9 - Source: International Alliance of Waste Pickers

SUCCESSFUL WASTE PICKERS INTEGRATION AND COMMUNITY SUPPORT

India has a functional collection system, strongly supported by the effective integration of the waste picker sector. It relies on millions of waste pickers to collect, sort and recycle its waste. Multiple cooperatives are supporting their integration in society. Waste picker integration in India rests on three building blocks.

Legislative Framework:
In 2016, an updated legal framework formalised the sector. It established formal rights for waste pickers, encompassing the right to access waste, a designated space for sorting, participation in door-to-door waste collection, access to training, and entitlements such as scholarships for their children and low-interest credit.

Social Entitlement:
A government body was established under the Ministry of Social Justice Programs, aimed at eradicating manual scavenging (defined as "worst surviving symbol of untouchability"). Key benefits include a five-day training program for improved livelihoods, three to six months of recycling training, access to low-interest credit, provisions for health, safety, and the enrolment of waste pickers in a national health insurance scheme.

Sector Affiliation:
The network of waste picker organisations, cooperatives, self-help groups, and government bodies across India has also played a significant role. These entities were established to champion the rights and needs of waste pickers, offering sector representation and support.

The benefits of the successful pickers integration are two-fold.

On one hand, there are tangible advantages for the waste picker sector, such as financial inclusion, a better working environment (including improved health and safety measures, better sorting facilities, and basic social support), and reduced marginalisation.

On the other hand, the industry as a whole has experienced gains, including enhanced plastic collection and recycling along the waste value chain, resulting in improved material quality.

The Plastic Waste Management Framework

CATEGORY 4 - FUNCTIONAL, LARGELY UNREGULATED SYSTEMS

EXAMPLES OF COUNTRIES CATEGORY 4:

- ARGENTINA
- MALAYSIA
- VIETNAM
- INDIA
- BRAZIL
- TURKEY

CONTEXT

Category 4 systems are functional, but their recycling rates have stabilised at around 20-25% given the limited regulatory pressures.

POLICIES AND LEVERS

Policies in category 4 countries should be focused on recycling targets, mandatory EPR and incentives for waste generators

Diagram 10 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 4: CONTEXT

Plastic waste recycling rate
Typically, the plastic waste recycling rates in such systems reach 12-15%, while the plastic packaging recycling rates range from 20% to 25%. (For packaging in general, the recycling rate can reach up to 40%, with higher rates observed for fiber-based packaging and metals.)

Collection infrastructure
Collection infrastructure is well-developed, providing general waste collection services to most of the population. Separate collection of (plastic) packaging is typically mandatory in the commercial and industrial sector, with funding usually covered entirely through B2B contracts by the waste generators themselves. In urban areas, separate collection systems for households are widespread and can be organised in two streams (dry and wet) or multiple streams. The waste collection is facilitated through a network of collection points based on the 'bring' principle or through curbside collection.

Waste processing and end-of-life infrastructure
There is ample processing and end-of-life treatment infrastructure in place to handle the volumes of waste collected. This includes both manual and automated sorting plants, which are tailored to the specific needs of each area or city. In addition, the recycling infrastructure is well-established, encompassing both first-stage and second-stage processes. This infrastructure primarily focuses on handling plastic volumes from the commercial and industrial stream and high-value plastics packaging (PET and HDPE) from the household stream.

General waste legislation and institutional framework
Countries falling within this category typically have somewhat functional (although limited) waste regulation frameworks in place, which include basic legislation that define the rules of engagement, roles of various actors, and other parameters. However, they often lack specific mandatory targets and incentives. In these countries, the waste management sector generally operates within the framework of market-based mechanisms, relying on demand and supply principles.

Specific plastic and packaging waste regulation
Industry-wide voluntary commitments for plastic and packaging waste regulation are prevalent and play a significant role in improving recycling performance. These commitments involve (co)-financing infrastructure investments in collection, sorting, and recycling. In some cases, they also contribute to operational expenses, with municipalities typically covering a larger share than that which is covered by waste generators.

Under these commitments, companies or industry associations declare, monitor, and report recycling targets on a voluntary basis, without being held accountable to authorities; there are no penalties for failing to meet these targets. However, even when targets are achieved, they tend to be at the industry, segment, company, or regional levels, and are not sufficient to achieve a robust overall performance at system or country levels. This results in an unequal distribution of efforts and financial responsibilities between companies and industries with commitments, and those who do not participate ("free-riders").

Waste Pickers
In certain countries with less dense curbside collection and sorting infrastructure, the waste picker sector remains a significant contributor to the collection of waste volumes. However, in these countries, waste pickers typically operate within a more formal framework. They are either employed by waste collection companies or work independently. In the latter instance, they are registered and fulfill their tax and social contribution obligations, enjoying all the rights that come with the formalisation of their profession and status. Waste picker associations play a crucial role in such environments, advocating for the protection of waste pickers' interests and striving to improve their working and social conditions.

CATEGORY 4: POLICIES AND LEVERS

Collection infrastructure
Consider the mandatory enforcement of separate collection for recyclable (plastic) waste in both the commercial and industrial, and household streams. This can be achieved through collection points or, at a minimum, two-stream curbside collection systems.

Define and enforce clear obligations for the collection of commercial and industrial waste, for both large enterprises and small and medium enterprises, across all sectors, including segments like food services and hotels, which generate substantial amounts of (plastic) waste.

Look into developing infrastructure for separate collection at the source. Ideally, this infrastructure should allow for multi-fraction separation. A two-stream collection approach is recommended only if the sorting infrastructure is well-established and has adequate coverage.

Waste processing and end-of-life infrastructure
Ensure adequate end-of life treatment infrastructure, with a comprehensive geographic coverage for all types of waste. It is essential to increase the quality of sorting output, as this is a prerequisite for achieving high-quality recycling. This can be achieved with improved sorting automation and sorting facilities in most urban areas.

Develop sufficient first-stage and increasingly, second-stage recycling infrastructure to drive greater value creation across the entire collection-sorting-recycling value chain.

Prioritise the development of recycling infrastructure over incineration (waste-to-energy) capacities and push for the expansion of ecological landfilling, composting, and other end-of-life treatment capacities.

General waste legislation and institutional framework
Complement general landfill diversion and waste reduction targets with mandatory waste volume reduction and recycling targets for various waste types (packaging, WEEE, textiles etc.)

Specific plastic and packaging waste regulation
Pilot producer responsibility schemes that includes local authorities, the private sector and the public over 2-3 years and eventually implement it with full-fledged enforcement measures, such as reporting, monitoring, penalties for non-compliance, and rigorous control mechanisms.

Such a transition aims to make the effort more comprehensive and marketwide, reducing free-riders. It also ensures that necessary funding is acquired to develop collection, sorting, and recycling infrastructure required for a substantial increase in recycling rates, going beyond the "low hanging fruit" (i.e., easier-to-recycle materials like PET and HDPE).

In addition, introducing a pay-as-you-throw policy is essential to raise awareness and create incentives for waste reduction and separation at source at the generator or disposal levels. To complement the EPR scheme, launch pilot programs for voluntary or regional deposit-return or take-back schemes for specific packaging types (e.g., beverage packaging) or specific waste types (e.g., WEEE, batteries, tires). These programs offer monetary incentives to end-consumers, encouraging their active participation in collection activities.

Supporting tools and enablers
A public-private partnership mechanism is crucial for systems to secure the necessary financing for significant infrastructure investments along the entire value chain.

Efforts to effectively communicate to all parties in the waste management value chain including generators (both businesses and households), collectors (both specialised material collectors and municipal collectors), municipalities, authorities, sorters, and recyclers is another key enabler.

Developing Awareness Through School Programmes and Education

Limited public awareness on proper waste disposal practices, including source separation, is common in nascent systems. This often leads to improperly separated waste, even when infrastructure for source separation is available.

One noteworthy example is the implementation of school programs in Malaysia, aimed at fostering selective waste collection and recycling among younger generations. These programs have been developed in collaboration with brand owners, local governments (e.g., City Councils), and various NGOs.

These initiatives encompassed a range of activities, including school visits, interactive presentations, and Q&A sessions to actively involve schoolchildren. They also featured collection events and waste-picking activities, alongside support for the establishment of sustainable recycling systems within schools.

These programs successfully engaged over a million students across more than 1,500 schools nationwide. A key component in their success was the use of gamification, which involved organising "collecting recyclables competitions" in schools throughout the country. These initiatives encouraged innovative and creative approaches to repurposing plastic waste materials.

Moreover, these programs expanded the network of collection partners and collection points, resulting in a significant increase in the amount of plastic packaging collected.
The impact of these programs is profound and enduring, as they involve the broader community and educate young consumers about the importance of recycling and its role in establishing a circular economy.

1

2

3

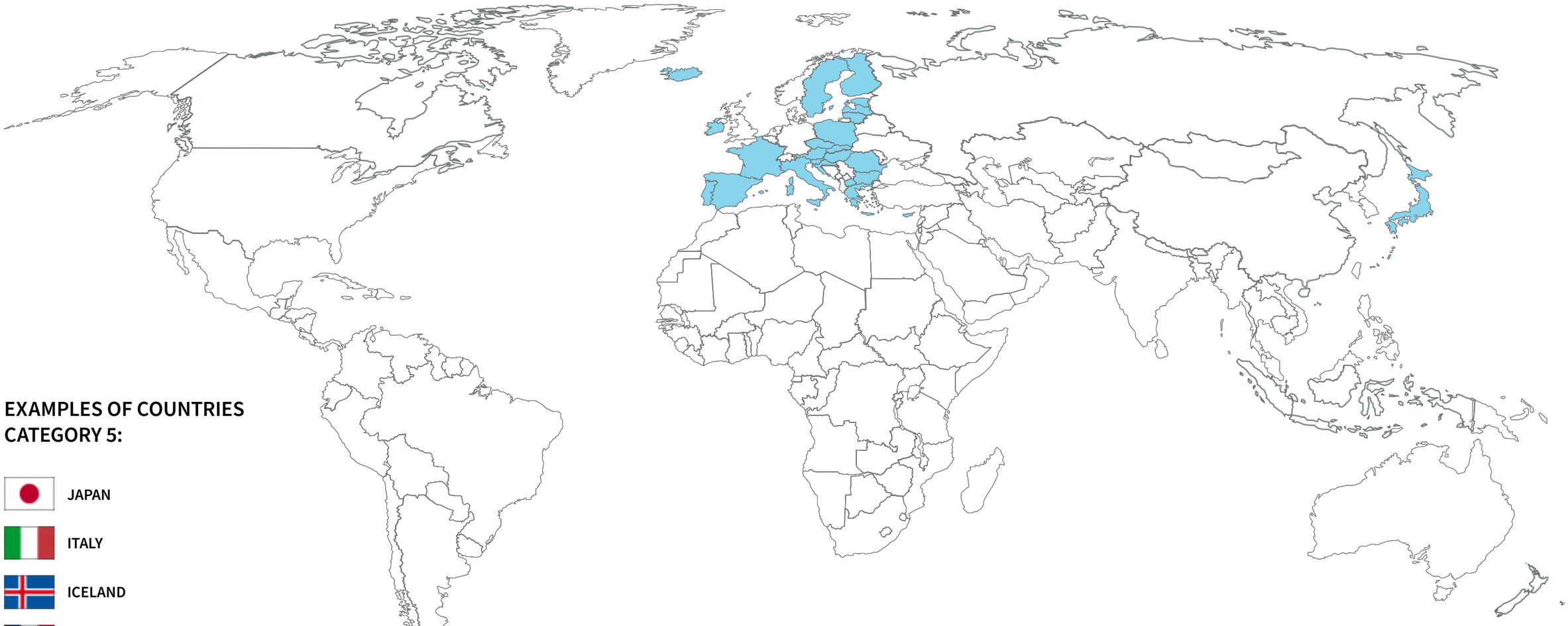
1. Changemakers, Sundarbans, India

2. Changemakers, Bethune, India

3. Ocean Stewards, Indonesia

The Plastic Waste Management Framework

CATEGORY 5 - ADVANCED SYSTEMS WITH CHALLENGES



EXAMPLES OF COUNTRIES CATEGORY 5:

- JAPAN
- ITALY
- ICELAND
- FRANCE
- POLAND
- NORTH MACEDONIA

CONTEXT

Systems in Category 5 are advanced and well-regulated, although they still face challenges in specific areas or segments of the value chain. A complex waste framework is firmly in place, supported by strong expertise and institutions.

POLICIES AND LEVERS

Beneficial policies in Category 5 countries include those that promote recyclability, separate collection at source, and rigorous enforcement of Extended Producer Responsibility.

Diagram 11 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 5: CONTEXT

Plastic waste recycling rate
The recycling rate for plastic waste in such systems ranges from 20% to 40%, whilst the plastic packaging recycling rates achieved are up to 40-50% (even higher for other types of packaging, such as cardboard, glass or metal).

Collection infrastructure
Waste collection infrastructure is well-developed, providing the entire population access to general waste collection services. Separate collection of (plastic) packaging in the commercial and industrial sector is mandatory, with clearly defined obligations. Curbside separate collection for households (at a minimum, two streams, for dry and wet waste, preferably multi-stream) is also in place and covers the vast majority of the population. Curbside collection is often also complemented by a network of collection points for all recyclable materials (e.g., textiles, WEEE, mattresses, but also for plastic packaging or plastic in other waste streams).

Waste processing and end-of-life infrastructure
The end-of-life treatment infrastructure is well-established and equipped to effectively handle the collected volumes. Sorting of plastics is organised in two stages: the first stage involves sorting for the municipal stream, or the commingled/ recyclables stream and the second stage includes sorting plants, specialised in sorting of plastics in more granular outputs (e.g. by polymer). The recycling infrastructure includes both mechanical and chemical/ advanced recycling processes, handling both commercial and industrial and household plastic waste. Additionally, other treatment capacities (e.g. co-processing, waste-to-energy, composting) are well-developed and contribute to the overall high recycling and recovery rates of plastic and other municipal waste types.

General waste legislation and institutional framework
These countries have established complex and comprehensive waste frameworks. These frameworks have been firmly integrated into their environmental and economic development legislation to maximise enforcement efficiency. Mandatory volume reduction and recycling targets are defined for all waste categories, including plastics, and apply to all relevant stakeholders, such as producers, retailers, municipalities, waste management entities, and waste generators. Enforcement mechanisms and institutions have been developed and are continuously improved.

Recycling targets are defined for specific waste categories (e.g., packaging, WEEE) and at the material level (plastic, paper and board, glass, metal packaging, etc.), with gradual increases over time. EPR is implemented, with penalties for free-riding, failure to achieve targets, misreporting, and similar violations.

A key challenge faced by systems at this stage is enforcement. All public actors and authorities involved in certification, control, and monitoring must have the necessary tools and resources to enforce EPR legislation, whereas value chain actors must have sufficient positive and negative incentives to comply with the regulations.

Specific plastic and packaging waste regulation
In situations where there are no specific, granular targets (such as collection goals for certain plastic waste categories or requirements for recycled content), countries can reach a certain level of success by prioritising cost-efficient recycling methods for particular polymers. For instance, they may exhibit good recycling rates for certain plastics like PET, especially in the form of bottles, HDPE, and LDPE sourced from the commercial and industrial stream. However, they may face substantial challenges when dealing with other types of plastics, such as flexibles, particularly from household streams, and PP, especially in food packaging applications.

Waste Pickers
In mature waste management systems, the waste picker sector typically plays a rather limited role, as these systems rely on a well-developed collection and sorting infrastructure. Waste pickers are generally well integrated into the collection systems in a formalised manner.

CATEGORY 5: POLICIES AND LEVERS

Collection infrastructure
Enforce mandatory, separate, multi-fraction collection of recyclable waste (including plastics) across all streams and generators, such as small and medium enterprises, hotel, restaurant, and catering establishments, and rural households. Enforcement can be achieved through a system of incentives and penalties applicable to municipalities, waste generators, and actors in the waste value chain.

Complement curbside collection with a network of collection points to address categories of waste that are typically generated outside the home and are commonly littered (e.g., pouches and sachets, bottles under 0.3 l).

Waste processing and end-of-life infrastructure
Encourage investments in advanced local end-of-life treatment infrastructure, while ensuring adequate density for comprehensive geographic coverage across all types of waste. Sorting is balanced between geographic coverage and sorting capacity utilisation.

Strike a healthy balance between mechanical and chemical recycling and promote the recycling of all plastic types from all waste streams. Focus on ensuring high-quality feedstock availability. Apply policies that discourage landfilling and incineration (through measures such as bans or taxes).

General waste legislation and institutional framework
Define a clear path towards achieving full circularity, by setting progressively more ambitious targets for all waste types and defining obligations for all stakeholders involved. Enforcing the EPR system includes allocating both human and financial resources to monitor, control, and penalise non-compliant actors.

Specific plastic and packaging waste regulation
Incorporate ambitious recycling targets that go beyond market-based interests. It is essential to introduce specific, detailed targets to cover all types of plastics and waste streams. This could include, for instance, setting recyclability/ design for recycling guidelines as a basis for the EPR fee pricing framework, defining ambitious separate source collection targets, and establishing recycled content targets for packaging materials.

It is crucial to enforce recyclability and design for recycling guidelines. This can be achieved through eco-modulation principles to ensure fair treatment and incentives for recyclable and non-recyclable plastics. Several measures have been proven to complement the EPR system well and substantially improve recycling rates. These measures include policies to limit or completely ban non-recyclable plastics and policies that promote mandatory deposit-return or take-back schemes for specific types of packaging (e.g., beverage containers) and certain waste categories (e.g., WEEE, batteries, tires).

Supporting tools and enablers
Capacity building and education are key. This involves developing expertise at the institutional and authority levels through training, exchanges, and the sharing of best practices with high-performing systems (Category 6). It is important to integrate waste management and circular economy principles at various levels of education, including schools and colleges.

Policy Deep-Dive: Extended Producer Responsibility

Extended Producer Responsibility is one of the most effective policy instruments for increasing recycling rates.

Under EPR, the responsibility for achieving certain (well defined, typically gradually increasing) recycling rates lies with waste generators, and in particular, consumer goods producers. The financial contributions paid by the generators are collected by Producer Responsibility Organisations (PROs). PROs then allocate these resources as subsidies or gate fees to various stakeholders along the physical collection-sorting-recycling value chain of recyclable waste, focusing on areas where it is necessary to cover the circularity gaps.

When EPR systems are implemented, recycling rates for packaging and items like WEEE, tires, and batteries can be increased by up to 15-25 percentage points over a 10–15-year period.

More and more countries have effectively implemented EPR systems. By the end of 2020, more than 40 countries had operational EPR systems, while an additional 20+ were planning its adoption. Furthermore, as of 2023, six U.S. states, including California, Colorado, Maine, Oregon, New Jersey, and Washington, have also implemented EPR or similar packaging laws.

The implementation of EPR systems requires an alignment across the entire value chain (brand owners, waste collectors, recyclers, municipalities and government/ regulators). Developing an EPR framework should be a collaborative effort with industry, achieved through an iterative process. The typical implementation of EPR systems spans approximately 4-6 years and comprises three distinct phases.

The initial phase, spanning 1-2 years, focuses on achieving transparency regarding the “as-is” state. It begins with discussions with industry stakeholders, the formation of joint working groups, a holistic market analysis, and alignment on the existing status quo.

The subsequent phase, also taking 1-2 years, involves defining the “to-be” state. During this phase, stakeholders collectively establish specific objectives, develop the EPR framework (including legislation, institutional structures, infrastructure, and financing mechanisms), conduct a macro-level impact analysis, and agree upon an implementation roadmap.

The final stage, spanning 2-3 years, focuses on implementation and optimisation. Activities in this phase include launching the PRO(s), conducting initial pilot programs, then gradually scaling up EPR operationalisation, increasing recycling and waste reduction targets incrementally and enforcing compliance with EPR regulations.

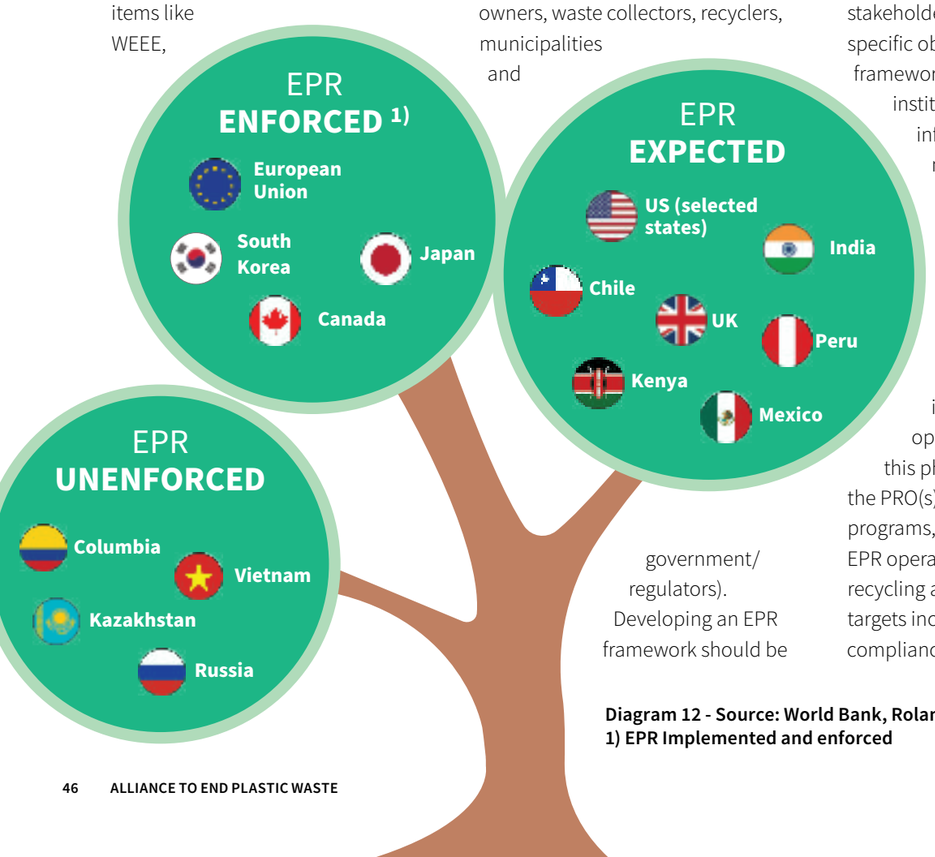
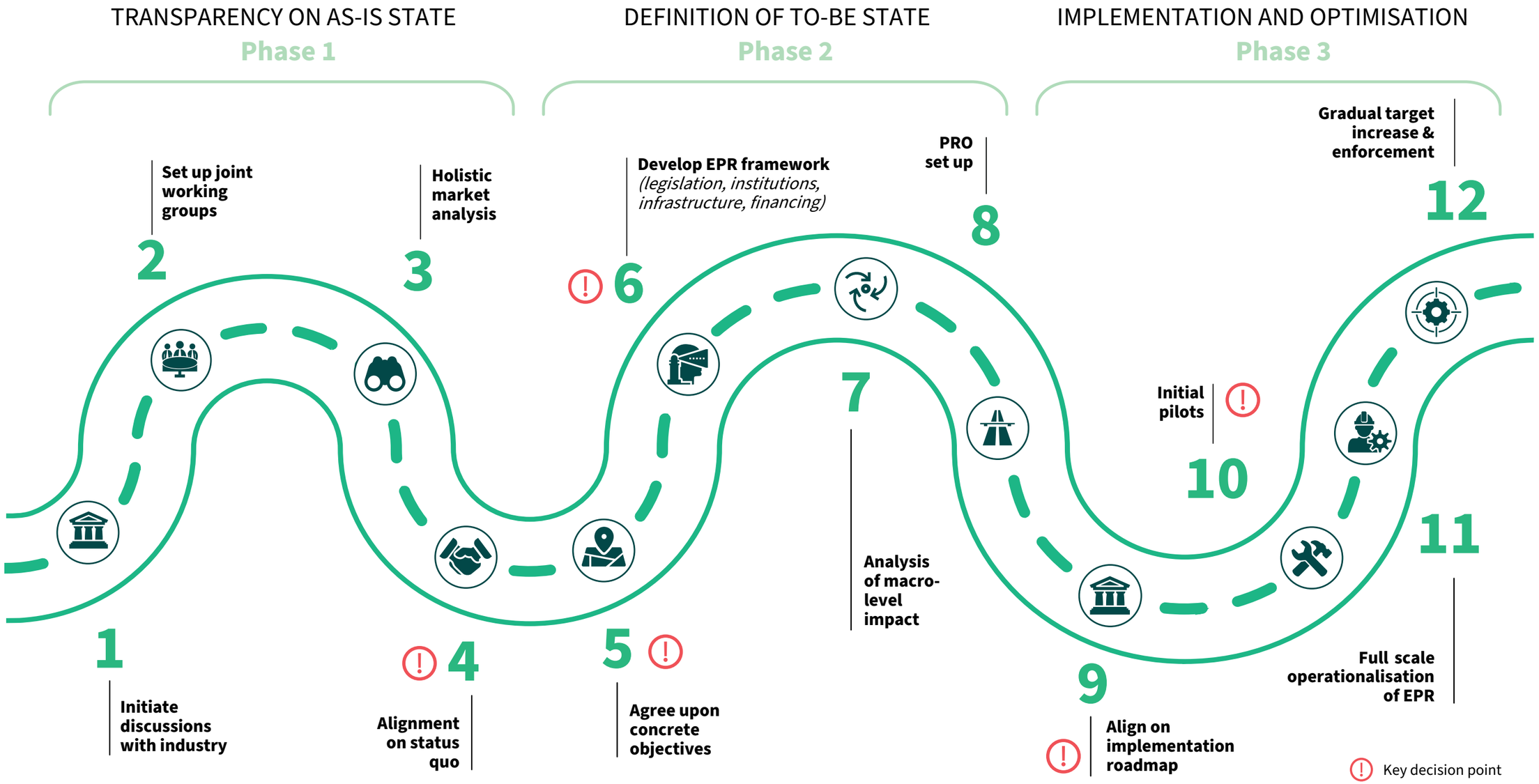


Diagram 12 - Source: World Bank, Roland Berger
1) EPR Implemented and enforced

Policy Deep-Dive: Extended Producer Responsibility

PATHWAY TO SUCCESSFULLY IMPLEMENTING AN EPR SYSTEM AND INDICATIVE TIMELINE



NOT ALL STEPS ARE REQUIRED - LEAP-FROGGING POSSIBLE

Diagram 13 - Source: Roland Berger

The Plastic Waste Management Framework

CATEGORY 6 - DEVELOPED PERFORMING SYSTEMS

EXAMPLES OF COUNTRIES CATEGORY 6:

- BELGIUM
- KOREA (REPUBLIC OF)
- NORWAY
- GERMANY
- NETHERLANDS

CONTEXT

Category 6 systems are the most advanced, and their expertise and best practices can serve as “success story” examples.

POLICIES AND LEVERS

Countries in Category 6 can focus on promoting innovation (investment and adoption), convenience of waste disposal options and enabling a level playing field

Diagram 14 - Source: World Bank, Roland Berger
The full list of countries in the category can be found in the appendix

The Plastic Waste Management Framework

CATEGORY 6: CONTEXT

Plastic waste recycling rate
Systems in this maturity category typically achieve overall plastic waste recycling rates beyond 50%, including for plastic packaging, (with even higher rates recorded for fiber-based packaging and metals in some instances).

Collection infrastructure
Collection infrastructure is well developed, featuring full coverage of household, curbside, multi-fraction separate collection at the source. This is complemented by a high density of collection points for specific waste categories such as glass, paper cups, beverage cartons, textiles, etc. There are also mandatory dedicated collection and take-back schemes for specific waste categories, such as deposit-return systems for beverage packaging and buy-back schemes for WEEE, which complement the EPR scheme. These measures are designed to maximise collection and recycling rates for these specific categories.

Waste processing and end-of-life infrastructure
These systems possess an excellent end-of-life treatment infrastructure, that covers all types of waste and creates local demand to "pull" high-quality and/or source separated waste. This infrastructure includes an advanced sorting plant network, organised in two stages: the first, for municipal waste sorting and a second, for material specialised stations, including for plastics. The recycling infrastructure is well developed and encompasses both mechanical and chemical/advanced recycling processes. It handles national and imported feedstock of all types and qualities, optimising capacity utilisation, with a focus on maximising the value of waste and the quality of recycling. Furthermore, other treatment capacities, such as waste-to-energy, composting and bio-digestion, are well developed and contribute significantly to the overall high municipal solid-waste recovery rate.

General waste legislation and institutional framework
There are complex and comprehensive waste legislation frameworks in place; these are continuously refined to enhance effectiveness, efficiency, and fairness for all stakeholders along the value chain. Enforcement is the key to the success of such systems, supported by robust institutions and incentive mechanisms for all actors involved.

Specific plastic and packaging waste regulation
Recycling targets are defined for all waste categories, with a clear vision of achieving full circularity. Volume reduction and reusability targets are established in a manner that complements recycling goals and strengthens the recycling sector.

EPR is implemented and rigorously enforced. Public actors have the necessary tools and resources, including human, financial, and technological resources, to enforce EPR legislation and related incentive mechanisms. Detailed targets, such as collection goals for specific categories and recycled content requirements, are defined to ensure comprehensive coverage of all waste streams (household, out-of-home, etc.) and the collection and recycling of all types of plastics, including the more difficult to collect (e.g., flexibles).

Mandatory deposit-return schemes are in place, covering a wide range of beverage packaging, with the aim of achieving recycling rates exceeding 80%. Mandatory take-back schemes are implemented for various other waste types (e.g., textiles, mattresses, tires).

Enablers and tools
Funding is a key enabler for the countries included in this category. The entire waste management sector is well-connected to relevant funding mechanisms such as public funding, public-private partnerships (PPP), capital markets, traditional financing institutions, and venture capital.

At the same time, these countries continue to invest significantly in technology and innovation. This allows them to develop new solutions that continually increase the effectiveness and efficiency along the entire value chain.

CATEGORY 6: POLICIES AND LEVERS

Collection infrastructure
Integrate innovative solutions such as marking, digitalisation, and gamification. The objectives are diverse: to make waste disposal more convenient, thus boosting the involvement and engagement of waste generators; to elevate the waste generators' knowledge and awareness of proper disposal practices; and to improve the overall effectiveness and efficiency of waste collection. This can be done through improved tracking, tracing, and automated sorting at the highest level of granularity required to enable full plastic waste circularity and economic viability.

Improve and expand reusable systems, take-back and deposit return schemes for single use plastic, by including new categories, materials, and options for take-back (e.g., all beverage packaging without exception, food packaging where possible).

Waste processing and end-of-life infrastructure
Enhancing treatment infrastructure involves incorporating new, innovative solutions. This encompasses advanced sorting technologies, such as optical and mechanical methods, alongside digitalisation use cases like digital watermarking and AI object recognition. It is essential to continue striking a balance between mechanical and chemical recycling, aiming to maximise the recycling rate and circularity in an economically viable and environmentally sustainable manner.

The aim is to fully restrict landfilling and discourage practices such as incineration, low-quality recycling and/or downcycling, as well as waste exports.

General waste legislation and institutional framework
Aim to achieve full circularity for all waste types, guided by a clear roadmap and established legislation. Ensuring the stability of legislation is crucial, with structural changes, such as alterations to targets or measurement methods, occurring no more frequently than every 8-10 years.

Additionally, a comprehensive framework for capacity building, covering pre-university education, university degree programs, the development of professions, and career paths in both the public and private sectors is key.

Specific plastic and packaging waste regulation
Volume reduction targets, particularly for virgin plastic, and reusability targets that complement existing recycling targets are useful, as are those that aim to ensure a level playing field for all recyclable materials and polymers. Achieving this includes setting targets and implementing mandatory take-back schemes for all competing materials.

Enhance the reporting, standards, data availability, and transparency is another focus area. Here, the use of digitalisation and other innovations is encouraged, wherever there is a viable use case.

Pitfalls to avoid are excessive regulation or overly granular or specific targets, as they may lead to distortions in the value chain and the composition of waste.

Supporting tools and enablers
Focus on technology and innovation as supporting tools. Secure funding and provide incentives to drive ongoing improvements in system performance.

Invest in the education and engagement of waste generators, at the household and business levels. In this case, the objective is to enhance awareness and promote correct disposal, separate collection, source reduction, and the reuse of materials to minimise waste generation.

Policy Deep-Dive: Deposit Refund System

The Deposit Refund System (DRS) is a policy tool commonly used for beverage packaging, and it has been successfully implemented in Europe, North America, and Australia.

All DRS systems include PET bottles and aluminum cans. Some systems go further and also include other types of non-plastic packaging like one-way glass and beverage cartons (e.g., certain provinces in Australia and Canada).

The latest draft of EU legislation mandates the introduction of Deposit Return Systems (DRS) in all EU countries by 2029, unless they reach a 90% collection rate for beverage packaging by then. The DRS is to be implemented for plastic bottles and metal/aluminum cans.

Notably, several countries, such as Romania, Ireland, Hungary, Austria, Greece, and Poland, have already passed DRS legislation. This paves the way for the implementation of DRS as soon as 2025 in these geographies. The primary focus is typically on non-alcoholic beverages and beer, with occasional inclusion of spirits. In many European deposit schemes, there are single-value deposits for PET and cans. Some DRS systems, however, have varying deposit amounts based on the size and material, but this is often considered confusing for consumers.

Determining the appropriate deposit amount is key, as it strongly influences the return rates. In Europe, deposit fees vary widely, ranging from €10 to €25. Typically, the deposit amount is linked to local purchasing power, and high return rates of over 85% are often achieved for PET and cans. On the other hand, voucher-based non-mandatory systems with low deposit values tend to yield return rates significantly below 50%, essentially undermining the purpose of DRS schemes.

The take-back strategy is also a critical factor. Successful DRS systems offer options such as returning items to the retailer, returning them to a collection center, or a combination of both. In the case of returning items to retailers, smaller stores are sometimes exempt from the system or can opt for manual return processes instead of automatic ones (like Reverse Vending Machines, or RVMs), which are typically used in super- and hypermarkets. While automated take-back methods are generally considered more efficient, manual methods are more cost-effective.

The Plastic Waste Management Framework: Conclusion

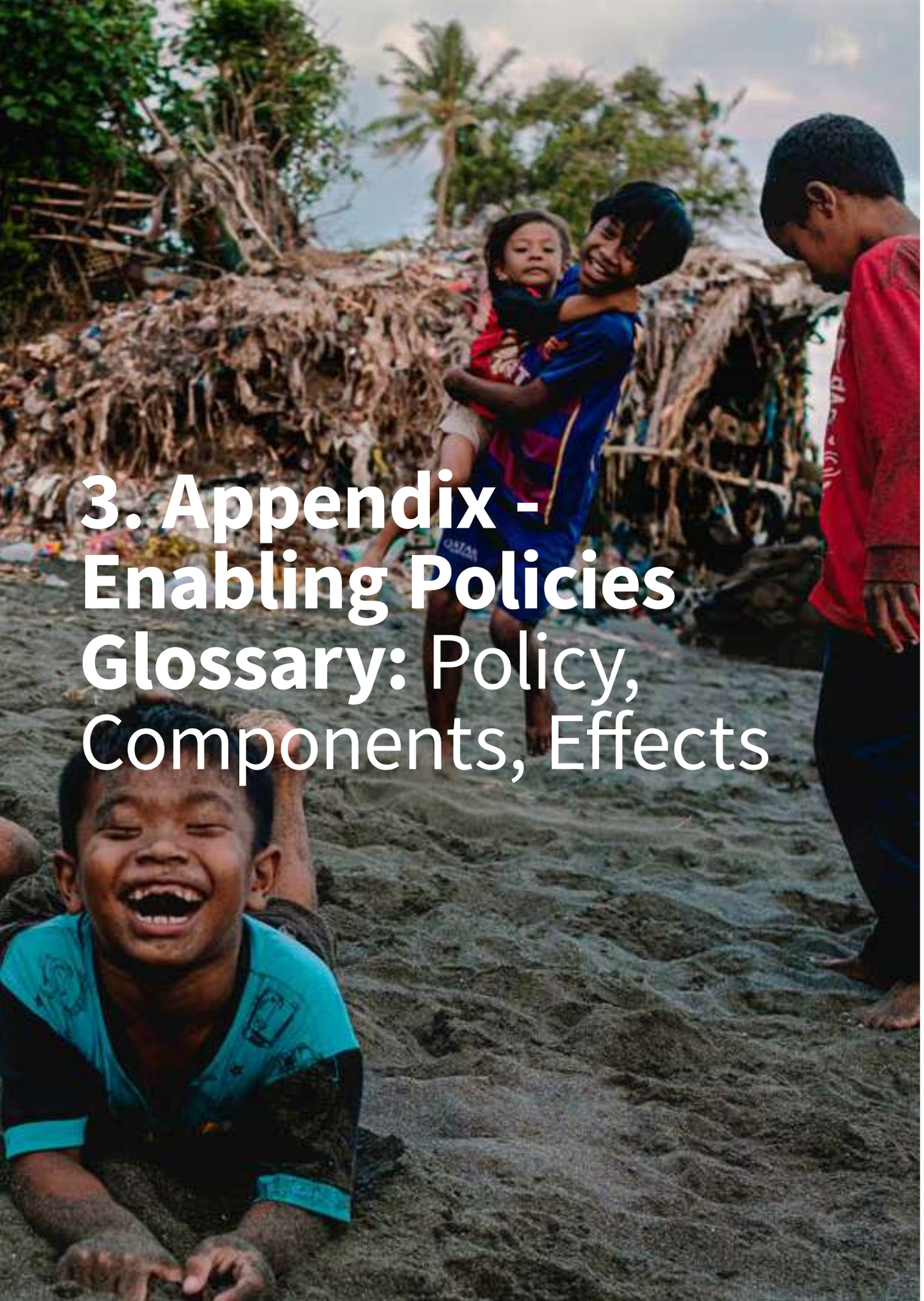
Plastic pollution is a pervasive global issue, with significant environmental, economic, and social implications. Much of the 360 million tonnes of plastic waste generated annually is not safely and effectively managed, leading to environmental degradation, wildlife harm and human health risks.

The United Nations Environment Assembly's resolution for Member States to enter negotiations for an international legally binding instrument to put an end to plastic pollution is a positive step in tackling the problem of plastic waste. Such an international platform will enable countries to unite and collaborate on solutions.

However, as discussed in this report, different countries have varying abilities to tackle this issue. Therefore, tailored strategies that factor in a country's national circumstances, infrastructure capacities and resources, are crucial to improving plastic waste management in the world. This report also suggests a framework of strategies and policy levers, while considering these national contexts and plans. It also emphasises the importance of public-private partnerships. The range of measures discussed in this framework, from overarching policies to specific infrastructural and operational enhancements highlights the multifaceted approach needed to combat the problem of plastic waste.

There are caveats to how uniformly this framework can and should be applied. We must remain sensitive to the fact that there are distinct factors that can affect how systems transition through categories and their overall evolution pathways. This system evolution framework is primarily built on empirical observations and analyses conducted at the individual system level, often corresponding to specific countries. In certain federal systems, individual system entities can be represented by states or provinces within these countries and may have full autonomy over environmental legislation, processes and timelines. Similarly, system evolution, stakeholder alignment and determination at a transnational level (e.g., global or regional, such as the European Union) can also act as catalysts to accelerate the timeline or allow states to leap-frog the evolutionary process.

The challenge, of course, lies in implementing, funding, and continuously monitoring and adapting these strategies. Ultimately, there is no one-size-fits-all solution to the problem of plastic pollution. Governments, businesses, civil society, and communities all must exercise collective action to ensure the efficient and effective implementation of waste management systems.



3. Appendix - Enabling Policies **Glossary:** Policy, Components, Effects

Enabling Policies Glossary: Policy, Components, Effects

Enabling policy	Components	Level of enforcement	Effect
Disposal control	• Development of engineered & managed landfills • Penalties for improper disposal (prerequisite: access to municipal waste collection service)	**National**	• Channelling waste volumes to unique site, leakage limitation • Transparency on disposal sites and leakage
Recovery & landfill diversion targets	• Landfill reduction or landfill diversion target • Recovery target = recycling + waste-to-energy	**National**	• Incentives for all stake-holders in the waste management chain
Landfill taxation	• Minimum gate fee threshold = fee per ton of landfilled waste	**National** (enforced at landfill)	• Incentives to divert waste to treatment (recycling, waste-to-energy etc.)
Municipality targets	• Coverage of households with curbside basic or multi-stream collection • Landfill diversion target	**Municipality, county/ regional level**	• Incentives for stakeholders at local level to collaborate with waste value chain
Pay as you throw principle for generators	• Disposal fee for households and businesses variable per weight of disposed non-recyclable waste (instead of per household, persons in household etc.)	**Municipality** (enforced at household level)	• Incentives for waste generators (households, small and medium enterprises etc.)
Incineration fees & limitations	• Bans for plastic incineration • Gate fee = fee per tonne of burned waste • Certification of capacities	**National** (enforced at incinerator)	• Incentives for recycling, composting/ biodigestion
Standards, guidelines	• Standards & guidelines for certification (e.g., recycling facilities) licensing (e.g., PROs), measurement • Reporting/ monitoring procedures, tools, databases	**National and local**	• Enables enforcement and ensures level playing field and buy-in/ trust of all stakeholders

Enabling Policies Glossary: Policy, Components, Effects

Enabling policy	Components	Level of enforcement	Effect
Capacity building	• Profession and career path • Educational offering at all relevant levels: schools, professional and academic	**National** (enforced in education institutions)	• Develops specialized human resource, underlines importance of topic in society, creates awareness
Individual (voluntary) commitments	• Pledges/ commitments at individual company level globally or at national level, for entire assortment or for specific packaging type, product • No direct penalties if not achieved	**Company level**	• Positive environmental effect (prop. to size/ pledge) • Marketing/ PR benefits in short-term, can be negative if pledges are not reached
Industry wide (voluntary) commitments	• Pledges/ commitments at industry level regionally or at national level, for entire assortment or for specific packaging type, product • No direct penalties if not achieved	**Industry/ economic sector level**	• Positive environmental effect (prop. to size of the industry/ pledge)
Volume reduction targets, bans	• Bans of certain packaging types (perceived as non-recyclable) • Volume reduction targets (overall) or for virgin plastic only	**National, industry/ packaging type**	• Shifts in packaging mix to materials without such targets/ bans • Increase of recycled content
EPR pilots (voluntary EPR)	• EPR scheme for certain packaging, without mandatory targets, reporting and enforcement (penalties etc.)	**National, industry/ packaging type**	• Precursory to mandatory EPR to finetune scheme locally • Negative effect in mid-term if it does not evolve into a mandatory EPR
EPR (targets & enforcement)	• Mandatory targets and milestones • Penalties (higher than cost to comply) for freeriding and not achieving targets, misreporting	**National, industry/ packaging type**	• Key instrument globally to increase recycling rates for packaging from 20-30% to >50% across most materials

Enabling Policies Glossary: Policy, Components, Effects

Enabling policy	Components	Level of enforcement	Effect
Plastic tax	• Tax on plastic products, on plastic packaging • Tax on non-recycled plastic packaging	**Company level**	• Can create mistrust on the matter if tax income used for other purposes than waste management • Distorts level playing field, can drive less environmentally acceptable solutions
Specific targets	• Collection targets of plastic bottles • Recycling targets for certain polymers (e.g., PET) • Recycled content targets	**Industry/ economic sector level**	• Can positively complement recycling targets • Can however also distort level playing field and result in shifts
Eco-modulation	• EPR fee modulation/ pricing incorporating both mandatory targets and recyclability guidelines elements	**National, industry/ packaging type**	• Complement specific targets • Ensures fair treatment of all packaging types • Drives recyclability, reduces toxicity of packaging
Digitalisation	• Mandatory digitalisation of processes and tracking and tracing equipment along the waste value chain	**National, industry/ packaging type**	• Substantially improves data transparency • Increase trust & awareness of consumers • Allows for fair pricing/ cost allocation across the value chain (incl. EPR fee)
Reusability targets	• Targets for beverage packaging only • Targets considering also refilling solutions in food service, at-home, industrial context	**National, industry/ packaging type**	• Risks a shift to glass, which has higher CO2 footprint than plastic • Disincentivises plastics recycling

4. Appendix - List of Countries by Categories

List of Countries by Category

Country indicative starting point estimates[1)], 2020

Afghanistan	Undeveloped system
Albania	Developing system
Algeria	Undeveloped system
Andorra	Advanced systemw ithc hallenges
Angola	Undeveloped system
Antiguaa nd Barbuda	Undeveloped system
Argentina	Functional, largelyu nregulated system
Armenia	Undeveloped system
Australia	Developing system
Austria	Advanced systemw ithc hallenges
Azerbaijan	Incipient system
Bahamas	Functional, largelyu nregulated system
Bahrain	Incipient system
Bangladesh	Incipient system
Barbados	Incipient system
Belarus	Developing system
Belgium	Developed performing systems
Belize	Incipient system
Benin	Developing system
Bhutan	Undeveloped system
Bolivia (Pluri-nationalS tate of)	Incipient system
Bosnia and Herzegovina	Incipient system
Botswana	Developing system
Brazil	Functional, largely unregulated system
Brunei Darussalam	Functional, largely unregulated system
Bulgaria	Advanced systemw ithc hallenges
Burkina Faso	Undeveloped system
Burundi	Undeveloped system
Cabo Verde	Undeveloped system
Cambodia	Incipient system
Cameroon	Undeveloped system
Canada	Functional, largely unregulated system
Central African Republic	Undeveloped system
Chad	Undeveloped system
Chile	Incipient system
China	Developing system
Colombia	Incipient system
Comoros	Undeveloped system
Congo	Incipient system
Congo (Democratic Republic of)	Undeveloped system

List of Countries by Category

Country indicative starting point estimates[1)], 2020

Costa Rica	Undeveloped system
Côte d'Ivoire	Undeveloped system
Croatia	Advanced system with challenges
Cuba	Developing system
Cyprus	Advanced system with challenges
Czech Republic	Advanced system with challenges
Denmark	Functional, largely unregulated system
Djibouti	Undeveloped system
Dominica	Developing system
Dominican Republic	Undeveloped system
Ecuador	Incipient system
Egypt	Incipient system
El Salvador	Incipient system
Equatorial Guinea	Undeveloped system
Eritrea	Incipient system
Estonia	Advanced system with challenges
Eswatini	Undeveloped system
Ethiopia	Incipient system
Fiji	Undeveloped system
Finland	Advanced system with challenges
France	Advanced system with challenges
Gabon	Undeveloped system
Gambia	Undeveloped system
Georgia	Developing system
Germany	Developed performing system
Ghana	Undeveloped system
Greece	Advanced system with challenges
Grenada	Undeveloped system
Guatemala	Undeveloped system
Guinea	Undeveloped system
Guinea-Bissau	Undeveloped system
Guyana	Undeveloped system
Haiti	Undeveloped system
Honduras	Incipient system
Hungary	Advanced system with challenges
Iceland	Advanced system with challenges
India	Functional, largely unregulated system
Indonesia	Incipient system
Iran (Islamic Republic of)	Incipient system
Iraq	Undeveloped system

List of Countries by Category

Country indicative starting point estimates[1)], 2020

Ireland	Advanced system with challenges
Israel	Developing system
Italy	Advanced system with challenges
Jamaica	Incipient system
Japan	Advanced system with challenges
Jordan	Incipient system
Kazakhstan	Incipient system
Kenya	Undeveloped system
Kiribati	Undeveloped system
Korea (Republic of)	Developed performing system
Kuwait	Incipient system
Kyrgyzstan	Developing system
Lao People's Democratic Rep.	Developing system
Latvia	Advanced system with challenges
Lebanon	Developing system
Lesotho	Undeveloped system
Liberia	Incipient system
Libya	Incipient system
Liechtenstein	Functional, largely unregulated system
Lithuania	Advanced system with challenges
Luxembourg	Advanced system with challenges
Madagascar	Undeveloped system
Malawi	Undeveloped system
Malaysia	Functional, largely unregulated system
Maldives	Undeveloped system
Mali	Undeveloped system
Malta	Advanced system with challenges
Marshall Islands	Undeveloped system
Mauritania	Incipient system
Mauritius	Incipient system
Mexico	Developing system
Micronesia (Federated States of)	Undeveloped system
Moldova (Republic of)	Incipient system
Monaco	Advanced system with challenges
Mongolia	Developing system
Montenegro	Incipient system
Morocco	Incipient system
Mozambique	Undeveloped system
Myanmar	Incipient system
Namibia	Developing system

List of Countries by Category

Country indicative starting point estimates[1)], 2020

Nauru	Undeveloped system
Nepal	Undeveloped system
Netherlands	Developed performing system
New Zealand	Functional, largely unregulated system
Nicaragua	Undeveloped system
Niger	Incipient system
Nigeria	Undeveloped system
North Macedonia	Advanced system with challenges
Norway	Developed performing system
Oman	Incipient system
Pakistan	Incipient system
Palau	Undeveloped system
Panama	Undeveloped system
Papua New Guinea	Undeveloped system
Paraguay	Functional, largely unregulated system
Peru	Incipient system
Philippines	Incipient system
Poland	Advanced system with challenges
Portugal	Advanced system with challenges
Qatar	Developing system
Romania	Advanced system with challenges
Russian Federation	Developing system
Rwanda	Developing system
Saint Kitts and Nevis	Undeveloped system
Saint Lucia	Undeveloped system
Saint Vincent and the **Grenadines**	Undeveloped system
Samoa	Undeveloped system
San Marino	Advanced system with challenges
São Tomé and Príncipe	Undeveloped system
Saudi Arabia	Incipient system
Senegal	Undeveloped system
Serbia	Incipient system
Seychelles	Undeveloped system
Sierra Leone	Undeveloped system
Singapore	Developing system
Slovakia	Advanced system with challenges
Slovenia	Advanced system with challenges
Solomon Islands	Undeveloped system
Somalia	Undeveloped system
South Africa	Developing system

List of Countries by Category

Country indicative starting point estimates[1)], 2020

South Sudan	Undeveloped system
Spain	Advanced system with challenges
Sri Lanka	Undeveloped system
Sudan	Undeveloped system
Suriname	Undeveloped system
Sweden	Advanced system with challenges
Switzerland	Functional, largely unregulated system
Syrian Arab Republic	Undeveloped system
Tajikistan	Developing system
Tanzania (United Republic of)	Undeveloped system
Thailand	Developing system
East Timor	Undeveloped system
Togo	Undeveloped system
Tonga	Undeveloped system
Trinidad and Tobago	Developing system
Tunisia	Incipient system
Turkey	Functional, largely unregulated system
Turkmenistan	Undeveloped system
Tuvalu	Undeveloped system
Uganda	Undeveloped system
Ukraine	Incipient system
United Arab Emirates	Incipient system
United Kingdom of Great Britain and Northern Ireland	Functional, largely unregulated system
United States of America	Developing system
Uruguay	Developing system
Uzbekistan	Undeveloped system
Vanuatu	Undeveloped system
Venezuela (Bolivarian Republic of)	Undeveloped system
Viet Nam	Functional, largely unregulated system
Yemen	Undeveloped system
Zambia	Undeveloped system
Zimbabwe	Undeveloped system

Table of Acronyms

ACRONYM	DEFINITION
B2B	Business-to-Business
CAGR	Compounded Annual Growth Rate
C&I	Commercial and Industrial
CO2	Carbon Dioxide
DRS	Deposit Return Scheme
EPR	Extended Producer Responsibility
EU	European Union
FMCG	Fast-Moving Consumer Goods
GDP	Gross Domestic Product
HDPE	High Density Polyethylene
HoReCa	Hotels, Restaurants and Cafes
LDPE	Low Density Polyethylene
MSW	Municipal Solid Waste
PET	Polyethylene Terephthalate
PP	Polypropylene
p.p.	Percentage Point
PPP	Public–Private Partnership
PRO	Producer Responsibility Organisation
PRN	Packaging Recovery Note
SME	Small and Medium Enterprise
UK	United Kingdom
USA	United States of America
WEEE	Waste from Electrical and Electronic Equipment

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You can be part of the solution.
To find out more, visit endplasticwaste.org

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