

# RESEARCH SUMMARY



ENVIRONMENT

YAYASAN  
HASANAH

 A foundation of Khazanah Nasional



**Plastic Value Chain and Plastic Waste  
Management in Peninsular Malaysia**



## ACKNOWLEDGEMENTS

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**YAYASAN  
HASANAH**  
 A foundation of Khazanah Nasional

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# TABLE OF CONTENTS

The Plastic Ecosystem in Malaysia	6
Key Facts on Plastic Waste	10
Comparative Analysis of Plastic Waste Data Sources	
Malaysia's Biggest Plastic Waste Concerns	
Industrial Players Remain Unregulated while Small Businesses are Grasping at Straws	
Diapers and Napkins: The Silent Contributors to Plastic Waste Crisis	
Recycling Plastic Waste: The Environmental Costs of Economical Constraints	
Plastic Recycling in Malaysia: Breaking Down the Numbers	
The Plastic Waste Recycling Process: Turning Trash into Treasure	
Plastic Surpasses Food Waste: Malaysia's Overflowing Landfills	
The Growing Threat of Illegal Dumping	
Battling Corruption: The Challenge of Controlling Waste Plastic Imports in Malaysia	
Barriers and Challenges	18
Legal and institutional issues	
Exploring the root causes	
Misconceptions about the Government's biggest initiatives on plastic	
Recycling Stakeholders - The Challenges	
Recommended Interventions and Actions by Key Stakeholders	22
Role of Government	
Role of Manufacturers and Brand Owners	
Role of Consumers	
Role of Waste Management Companies	
Conclusion	26

# INTRODUCTION

Plastic waste is a global crisis requiring immediate action. The surge in plastic production and disposal has led to severe environmental, economic, and social impacts worldwide. Malaysia, in particular, experiences the detrimental effects of plastic waste pollution at local and national levels. Improperly discarded plastic threatens ecosystems and wildlife, polluting rivers, lakes, and oceans while endangering marine life. Burning plastic waste not only releases harmful toxic fumes but also poses a serious threat to public health. This is in addition to its contribution to greenhouse gas emissions, further intensifying the issue of climate change.

The economic consequences are significant, with high cleanup and disposal costs burdening local authorities, waste management concessionaires, and state governments. Plastic pollution adversely affects industries like tourism and fisheries that depend on pristine environments. At the social level, plastic waste negatively impacts communities, leading to unsanitary conditions, reduced quality of life, and limited access to clean water sources.

The study aims to provide a comprehensive overview of the plastics value chain in Malaysia, including production, consumption patterns, and waste management practices to identify the mismanagement of plastic waste and recommend actions that can be taken. This issue requires solutions that can be easily adopted at a local level.

In Malaysia, the percentage of plastic waste in landfill sites has increased to 24% as of end-2021, which is among the highest in the country's history of waste management. This highlights the urgent need for proper waste management practices to prevent thousands of tonnes of plastic waste from being dumped into landfills every day, as well to address other sources of plastic waste leakage into the environment such as littering, illegal dumping, improper waste collection and disposal practices.



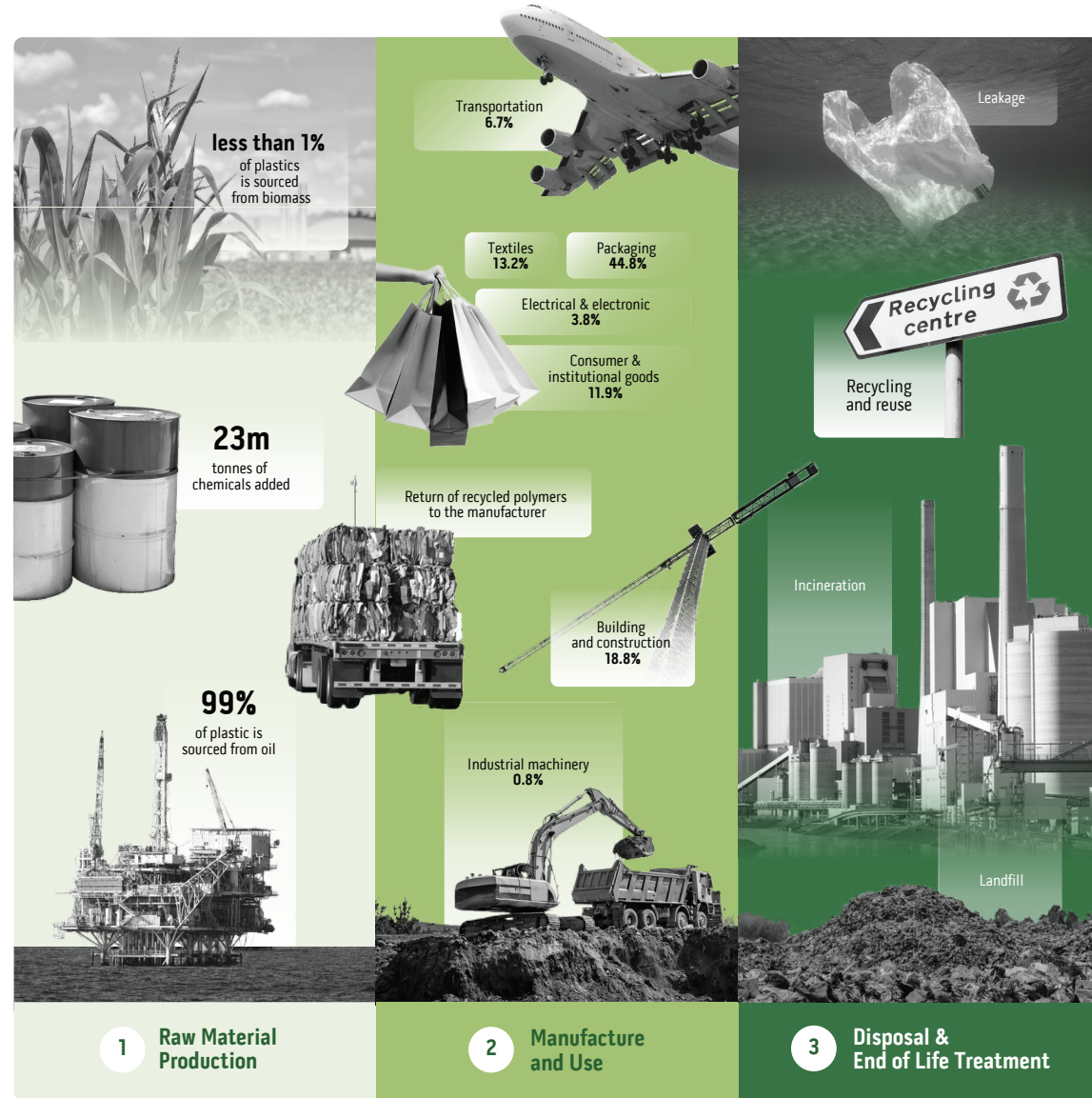
The Malaysian government has introduced various initiatives over the past decade to address global plastic pollution problems. However, certain laws and regulations on solid waste management<sup>(1)</sup> such as Waste and Public Cleansing Management Act 2007 cannot be implemented seamlessly across the country and are subject to adoption by respective state and local governments.

In addition, several national policy interventions have been developed at the federal level, including the rollout of the Roadmap towards Zero Single-use Plastic and Malaysia's National Marine Litter Policy. Despite these initiatives, the increase in plastic composition at landfill sites has raised concerns on whether increasing awareness on proper waste management practices are actually effective.

Human behaviour and mismanagement of plastic at different stages in the plastic value chain are the root causes of global plastic pollution, and it is unfeasible to solve plastic waste problems through awareness creation or voluntary efforts of the population. To live in harmony with plastics in a sustainable manner, the Malaysian government needs to develop and implement the Extended Producer Responsibility (EPR) regulations and other interventions based on scientifically proven best practices for the environment, health, economy, and social acceptance.

Note (1): In August 2024, the Ministry of Housing and Local Government (KPKT) launched the Circular Economy Blueprint for Solid Waste in Malaysia (2025-2035).

## An Overview of the Global Plastic Value Chain



Raw material > Monomer production > Polymer production > Plastic conversion > Production of plastic products > Use > Collection/ sorting and recycling > End of life



The process of producing plastic, from extracting raw materials sourced from oil, converting them into plastic resins and products, consumption by users, and ultimately discarding them as waste into recycling or waste disposal streams, is generally consistent across the world. This global process can be described as the plastic value chain.

In Malaysia, there are nine government agencies that are responsible for various operations within the plastic value chain, including plastic waste importation, plastic production, plastic product consumption, and plastic waste management (this study does not cover the first step of raw material extraction from oil). Some of the government agencies responsible include the Ministry of Finance, Ministry of Housing and Local Government, Ministry of Natural Resources and Environmental Sustainability, Environment and Climate Change, and the Ministry of Domestic Trade and Cost of Living and Department of Environment (DOE). They are involved in a range of processes, such as waste clearance, compliance, waste management policies, and monitoring.

There are 28 member companies in the Malaysian Petrochemicals Association (MPA), that are involved in the production and trading of petrochemicals and plastic resins in Malaysia where the majority of these companies operate on a large scale.

The plastic product manufacturing and consumer sectors represent the largest segment in the entire plastic value chain. These sectors cater to a wide range of consumers, including individual households, as well as various industrial sectors such as commercial, institutional, medical, agriculture, and construction.

The Malaysian Plastic Manufacturers Association (MPMA) classifies plastic manufacturers into 29 Product Categories, including toys, packaging, mechanical, and medical; 15 Business Lines, such as chemicals, lubricants, and machinery equipment; and 17 Production Processes, such as casting, lamination, and recycling. The sheer number of players in this sector is substantial, covering a wide range of products and processes.

The final stage is the plastic waste sector, where the plastic product has reached the end of its lifespan and is discarded into the waste stream. In Malaysia, there are generally three categories of waste management companies involved in plastic waste management: Recyclable collectors,

treatment or recycling industries, and final disposal companies. Recyclable collection efforts typically include recyclable materials like plastics, metals, and papers. However, it is common for players to focus on specialising in recycling specific types of plastics only. As a result, the plastic recycling sector in Malaysia is the largest and most diverse.



Plastic waste collectors include concessionaire companies, non-governmental organisations, private collectors, local governments, and other related institutions. Plastic waste recycling companies, on the other hand, consist of registered companies such as the Malaysian Plastic Recyclers Association (MPRA), SWCorp, and the National Solid Waste Management Department (JPSPN). Additionally, there are a total of 138 landfill sites scattered across the country. Private entities also manage their own waste disposal and incineration, particularly in special cases involving municipal solid wastes (MSW), companies receiving Refuse Derived Fuel (RDF), cement industries, and medical waste.

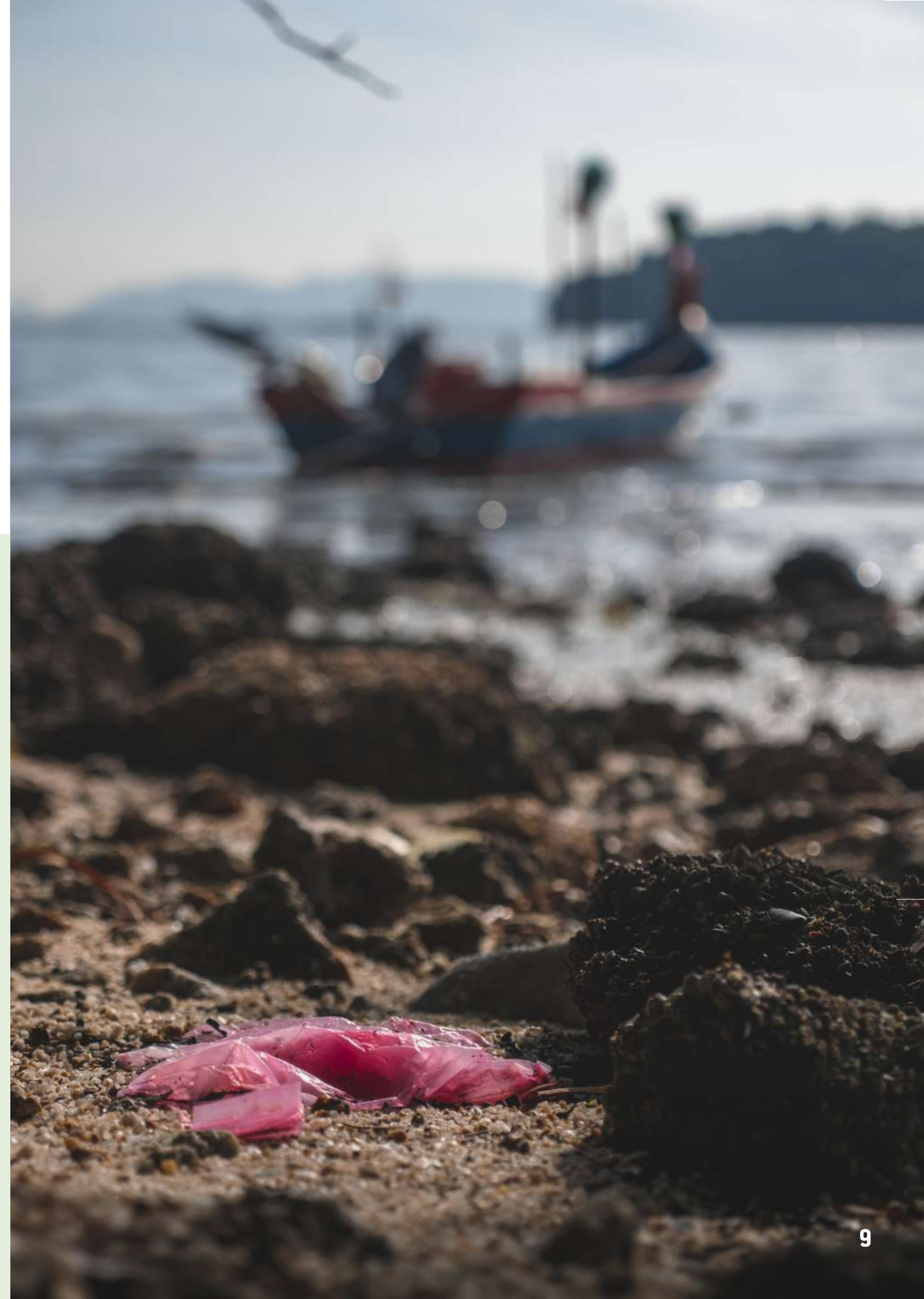
Environmental NGOs play a significant role in Malaysia's plastic value chain space/ecosystem by addressing plastic pollution. 43 NGOs have been identified as advocates for policy direction, contributing to policy development, enhancing institutional capacity, and fostering constructive dialogues among government agencies and civil society regarding environmental and sustainability issues within the plastic ecosystem.

Meanwhile, the policy, legal, and institutional framework for the plastic value chain in Malaysia involves various government agencies. The Economic Planning Unit (EPU) of the Prime Minister's Office (PMO) oversees overall planning.

The Ministry of Investment, Trade and Industry (MITI) is responsible for resin/plastic manufacturers, while the Ministry of Domestic Trade and Cost of Living (KPDN) oversees plastic consumption (products). The Ministry of Housing and Local Government (KPKT) and the Ministry of Natural Resources and Environmental Sustainability (NRES) are responsible for plastic waste management, while local and state governments provide support to all sectors of the value chain.





**The following are four significant issues which need addressing in the plastic value chain:**

- 1 High plastic consumption and waste generation by users and consumers, with poor commitment to waste segregation and recycling.**
- 2 Waste management companies are driven by profitable recyclables but face operational inefficiencies and constraints, with limited alternatives to landfills.**
- 3 Manufacturers lack environmental accountability in the production and impact of their products.**
- 4 The government is in need of holistic plans and solutions - communication channels between agencies appear fragmented, with low policy enforcement.**



## Comparative Analysis of Plastic Waste Data Sources

The published data show significant variations in plastic waste generation and recycling rates, leading to difficulties in determining the actual quantity of plastics consumed in the market and true recycling rates. For instance:

	 World Bank	 SWCorp	 World Wide Fund for Nature (WWF)	 United Nations Centre for Regional Development (UNCRD)
Plastic Waste Generation (tpy)	1,408,300	3,478,472	1,073,920	3,225,600
Plastic Waste Recycling Rate	23.9%	79.3%	Only 15% is safely disposed of	> 70%
Year of References	2019	2019	2016	2014 & 2018
Remarks	Only estimated for PET, HDPE, LDPE and PP	With assumptions that 25% of the total wastes generated are plastics	Only estimated for certain plastic packaging wastes	Based on country report submitted by JPSPN

**These wide disparities are often due to the unavailability of data and the fragmented nature of tracking, emphasising the need for consistent data collection and reporting methodologies to accurately assess global plastic waste trends.**

Moreover, local and imported plastic wastes are often mixed during recycling in Malaysia, which should be excluded in the recycling rate calculation as they are not generated locally. Therefore, the recycling rate for plastic wastes generated in Malaysia in 2019 was calculated at 33.4% based on data collected from SWCorp. Verification with official data from JPSPN showed that plastic composition contributes to 26.5% of total waste generation in Malaysia, consistent with the

plastic waste composition range reported by JPSPN/SWCorp. Further calculations based on per capita generation rate also supported that approximately 26.3% of per capita waste generated in Malaysia is plastics.

**To conclude, the entire material flow shows that Malaysia generates 3.68 million tpy of plastic waste, with 1.23 million tonnes being recycled, at 33.4%, consistent with SWCorp's calculation in 2019.**

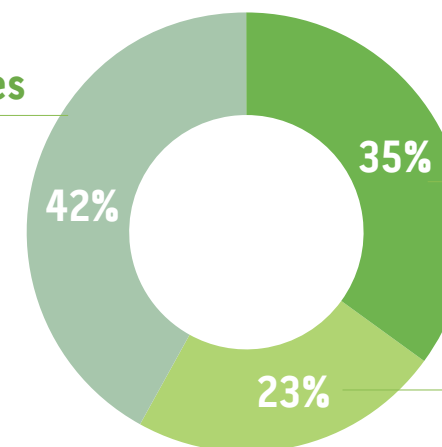
Based on the estimations, the current plastic waste flow from generation to disposal in Malaysia is summarised and illustrated below.

### PLASTIC WASTE GENERATION <sup>(1)</sup>

**3,467,500**  
tonnes

**1,455,500 tonnes**

Plastics disposed at landfill sites <sup>(3)</sup>



**1,207,500 tonnes**

Plastic waste diverted/loss (recycled)

**805,500 tonnes**

Plastic waste diverted/loss (other) <sup>(2)</sup>

#### Summary

- Loss before landfill = **~0.8 million tpy**
- Disposed to the landfill = **~1.5 million tpy**
- Total plastic waste not recycled = **~2.3 mil tpy or 65.2% (loss or disposed)**
- Plastic waste recycling rate = **34.8%**

Note (1): Waste generation derived from actual sampling and per capita waste generation rate

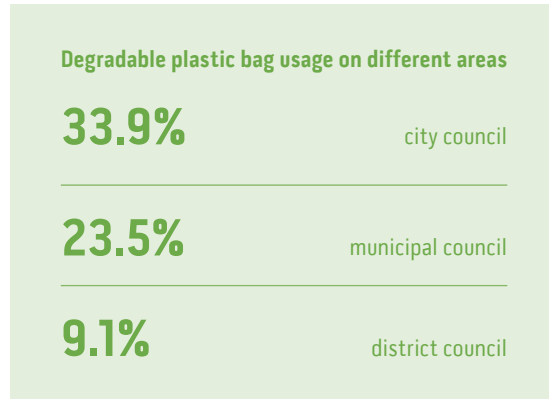
Note (2): With assumption that 60% of plastic waste recycled; 40% of plastic waste diverted/loss

Note (3): Waste disposed derived from actual records of waste as disposed at the landfill sites

## Malaysia's Biggest Plastic Waste Concerns

### Industrial Players Remain Unregulated while Small Businesses are Grasping at Straws

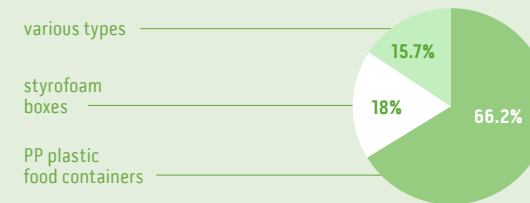
To examine the consumer/commercial patterns of plastic consumption in Malaysia, a comprehensive survey was conducted on a total of 548 samples obtained from diverse shops and eateries across three tiers of local authorities (city, municipal and district) in Peninsular Malaysia. Degradable plastic bag usage was found to be higher in city council areas at 33.9%, followed by municipal council area at 23.5%. However, only 9.1% of the samples from areas of district councils were observed to be using degradable plastic bags.



It was observed that shops and eateries in Malaysia still preferred to use conventional plastic bags due to low costs, better durability, lack of degradable plastic suppliers and lack of enforcement by authorities.

1	2	3	4	5	6	7
<b>PETE</b>	<b>HDPE</b>	<b>PVC</b>	<b>LDPE</b>	<b>PP</b>	<b>PS</b>	<b>OTHER</b>
Polyethylene Terephthalate	High Density Polyethylene	Polyvinyl Chloride	Low Density Polyethylene	Polypropylene	Polystyrene	Other
Recyclable	Recyclable	Recyclable at specialist points	Recyclable at specialist points	Recyclable	Recyclable at specialist points	Not easily recyclable
Soft drink bottles, mineral water, fruit juice containers, and cooking oil	Milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing, and shower soaps	Trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff	Crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	Furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars	Toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	An example of one type is a polycarbonate used for CD production, and baby feeding bottles

It was also found that 66.2% of eateries are using PP plastic food containers for take-away packaging, while 18% still use styrofoam boxes, and only 15.7% were observed to be using various types of degradable food containers.



In municipality and district council areas, PP plastic containers were the most commonly used, followed by styrofoam containers, with degradable containers being used the least. However, in city council areas, a different trend was observed, with more degradable food containers being used compared to styrofoam containers, largely due to requirements set by city councils such as DBKL, MBPP, MBSP, and local councils in Selangor. Nonetheless, the usage of degradable food containers in city councils remained low at 22.3%. There has also been an increase in people bringing their own containers, which is less than 10% of all consumers.

In city council areas, the usage of paper straws was relatively higher at 11.3% due to more stringent requirements by local authorities. However, in municipality and district council areas, the usage of paper straws was low, below 5%.

Efforts to switch to environmentally friendly materials are more evident in city councils compared to municipal councils, with district councils showing the least progress in reducing plastic consumption. Therefore, interventions should focus on district council areas to improve plastic consumption practices.

The assessment on the industrial sector on the other hand, found that there is currently **no regulation in place that controls the industrial sector on matters related to plastics**. Therefore, there are no specific plastic consumption patterns among the industries, and industries

are generally allowed to use whatever plastic materials they want, and produce their products in whatever designs based on the market demands.

Industries are responsible for managing the waste they generate, ensuring that it is collected by legitimate collectors and sent to appropriate destinations for recycling or disposal in accordance with the Solid Waste and Public Cleansing Management Act (Act 672). However, Act 672 is not adopted nationwide, meaning that not all industries are required to follow the same regulations.

While industrial sectors in Malaysia currently lack specific regulations pertaining to plastic materials, some industries are taking voluntary or corporate social responsibility (CSR) initiatives to reduce plastic consumption or promote plastic recycling. Large corporations or multinational companies may establish their own Producer Responsibility Organisation (PRO) to focus on plastic waste management. Other sectors such as agriculture, medical, and construction also lack specific requirements related to plastic materials, with obligations primarily focused on proper disposal, considering hygiene, health, and safety factors.



## Diapers and Napkins: The Silent Contributors to Plastic Waste Crisis

When it comes to waste plastic, the conversation typically revolves around familiar items like bottles, bags, containers, straws, and various types of packaging. However, it is essential to recognise that there are numerous other plastic products we use daily that may not receive sufficient attention despite its significant environmental consequences.

Disposable diapers were found to constitute a significant portion (13.6%) of waste disposed at landfill sites in Malaysia, making them one of the top three contributors. Furthermore, approximately 50% of disposable diapers are made of plastics, though this may vary slightly depending on the type and brand. Additionally, there is no recycling of disposable diapers in Malaysia, resulting in nearly 100% of them ending up in landfill sites. Based on the baby population in Malaysia in 2021, it is estimated that approximately 1.9 million tonnes of waste disposable diapers are generated annually - this translates to approximately 950,000 tonnes of plastic waste.

Sanitary napkins are another significant contributor to unrecyclable plastic waste, as they are composed of over 90% plastic - most of which are disposed of in landfill sites, and some hygiene service sites have also been found to use landfills for disposal. Based on the population, it is estimated that 2.4 billion pieces of sanitary napkins, or 24,000 tonnes, are disposed annually.

Single-use disposable face masks are lightweight and widely used across the country. It does not create a significant burden in terms of waste collection and disposal but assuming 26.4 million face masks are generated, they contribute about 106 tonnes of plastic waste to the environment and landfill sites every day. These masks are non-degradable and remain in the land indefinitely, posing potential environmental and health threats, such as microplastic pollution in the environment and food chains.

Although the government has taken initiatives to reduce plastic usage, there are still other plastic products that are neglected and have similar or even greater environmental impacts compared to plastic straws, plastic bags, and styrofoam containers. The "Malaysia's Roadmap towards Zero Single-Use Plastics (2018-2030)" initiated by the Ministry of Natural Resources and Environmental Sustainability (NRES) outlines milestones to achieve widespread adoption of biodegradable plastic bags, extension of coverage to other single-use plastic products, and further expansion to cover items such as medical devices, diapers, and feminine hygiene products.

**13.6%**

of waste disposed at landfills consisted of **disposable diapers**



**106 TONNES**

of **single-use disposable face masks** contribute to plastic waste



**24,000 TONNES**

of **sanitary napkins** are disposed annually



## Recycling Plastic Waste: The Environmental Costs of Economical Constraints

There is misinformation about the recyclability of certain plastic categories such as polystyrene (PS) and polyvinyl chloride (PVC). Technically, almost all plastic waste from the 6 main resin categories can be recycled, including ABS and CD under category 7. However, based on surveys and communication with recyclers, it was found that recycling for some plastic categories is limited to soft PVC instead of hard PVC, and PET is mainly focused on bottles and industrial waste instead of post-consumer films.

Several factors determine the recyclability of plastics, including:

### Market availability

Market demands for recycled plastic resins vary by location and plastic type, and can affect the viability of recycling programs.

### Price fluctuation

Price fluctuations in the market, influenced by external factors like oil prices, can impact the collection and storage of plastic waste for recycling.

### Logistics constraints

Logistic constraints, such as high transportation costs in rural or remote areas, may hinder recycling efforts.

### Feasible Quantity & Quality

Feasible quantity and quality of plastic waste are important considerations, as low quantities or contaminated plastic waste may not be economically viable for recycling.

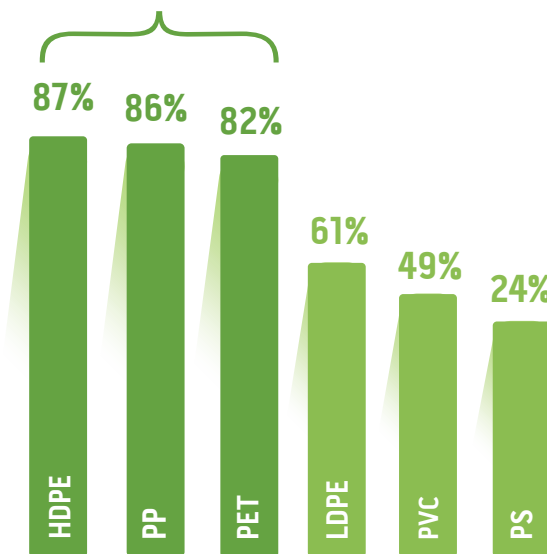
### Setting of Priorities

Setting priorities based on market demand and prices can also affect which plastics are prioritised for recycling, and some plastic types may be neglected.

## Plastic Recycling in Malaysia: Breaking Down the Numbers

A total of 208 recycling players in 59 local authorities were surveyed for data collection. It was found that recyclers in Malaysia generally accept all six main categories of plastic resins, although some may be selective based on various factors. This clarifies misconceptions that certain plastics, such as PVC and PS (including styrofoam), are not recyclable in Malaysia.

most commonly recycled by  
**80%**  
of recyclers



HDPE (87.0%), PP (85.6%), and PET (82.2%) are the most commonly recycled plastics by over 80% of recyclers, followed by LDPE (61.1%), PVC (48.6%), and PS (23.6%). "Other plastics" (53.8%) includes recyclers accepting mixed plastics or specific types like ABS and CD made from polycarbonate plastics. PET mineral bottles are preferred over PET films, and only soft PVC from industries is focused on, not hard PVC like PVC pipes.

**Thus, the survey findings show that priority should be given to strengthen recycling capability for LDPE, PVC and PS in all regions, while the recycling activities for PP, HDPE and PET are quite stable.**

## The Plastic Waste Recycling Process: Turning Trash into Treasure



Plastic recycling involves several common processes, including sorting, washing/cleaning/drying, crushing/sizing/chipping, melting/extrusion/palletization, and depolymerization. Sorting is the first step and can be labour-intensive and costly, with industrial-generated plastic wastes preferred over post-consumer plastic wastes due to less sorting requirements. Washing processes vary depending on the types of plastics, with some requiring chemical washing using chlorine and acid. Crushing is done to reduce plastic wastes into smaller pieces, which may be sold directly or fed into the next step of recycling. Melting/extrusion/palletization involves melting plastics at high temperatures, extruding and cooling them into resin pellets. Depolymerization is a specific chemical treatment process for certain plastics, such as PET, to produce chemical precursors through reactions like hydrolysis, pyrolysis, and gasification.

## Plastic Surpasses Food Waste: Malaysia's Overflowing Landfills



In 2019, the proportion of plastic waste disposed at landfill sites significantly increased to 24.8%, up from 11.9% in 2013. This rise in plastic composition has led to a notable decrease in food waste composition, with only 30.2% recorded in 2019. This is a rare occurrence in studies conducted in Malaysia, where food waste composition typically exceeds 40%. It is important to note that this decrease in food waste composition is not due to a reduction in food waste, but rather a substantial increase in plastic waste.

According to official data, there are currently 138 landfill sites in operation in the country, of which 21 are classified as sanitary landfills. In addition to these official sites, there are also numerous illegal dumpsites across the country, as reported by SWCorp. For instance, in Johor State alone, there are a staggering 64 illegal dumpsites.

## The Growing Problem of Illegal Dumping



Illegally dumping or littering waste into the environment, such as drains, rivers, or roads, is a prevalent issue in Malaysia, particularly in rural and outskirts areas, where it is becoming increasingly serious. A report by Urbanise Kuala Lumpur (2021) reveals that plastic waste from littering in the city of Kuala Lumpur contributes to 20% to 70% of the total waste trapped in water bodies, with an average of 47%. This data highlights that plastic waste is a significant contributor to ocean pollution from land, leading to long-term environmental issues such as microplastics.

The report shows that littering is the main source of plastic pollution, accounting for 64% of total emissions, followed by illegal dumping (15%), leakage before collection (15%), and other routes (6%). Plastic pollution makes up only 1.9% (3,069 tonnes/year) of total plastic generation in Kuala Lumpur, with 1.5% remaining on land or in drains, and 0.5% ending up in marine environments. This means that approximately 8.4 tonnes of plastic waste are littered or leaked from Kuala Lumpur daily.

## Battling Corruption: The Challenge of Controlling Waste Plastic Imports in Malaysia



The Malaysian government permits the importation of waste plastics for the purpose of recycling, provided the processes adhere to rigorous guidelines outlined by the JPSPN and the DOE, and in strict accordance with the restrictions specified in the Basel Convention. Following China's ban on such imports in 2018, waste plastics made its way into Southeast Asia – with a substantial influx of unlawful waste plastic imports recorded to have entered Malaysia between 2018 and 2019. This gained international media coverage, which in turn led to the closure of numerous illegal recycling facilities, along with the repatriation of countless shipping containers to their respective countries of origin.

Corruption and bribery of authorities have been identified as key factors allowing illegal importation and operation of recycling centres to persist, as highlighted by the Centre to Combat Corruption and Cronyism. The National Anti-Corruption Plan 2019-2023 revealed that Malaysia is known for illicit transboundary trade, with enforcement (23.9%), licensing and permits (8.6%), and business and industry-related corruption complaints (1.2%) accounting for a significant portion of reported cases. Nevertheless, there are legitimate waste plastic importers in Malaysia according to JPSPN data. The total approved importation of waste plastics in 2019 amounted to 333,887 tonnes.



## Legal and Institutional Issues

For the government to ban the usage or to phase out specific plastic products in Malaysia, it needs to be supported by a legal mandate. Such a mandate will support initiatives to reduce plastic consumption among consumers along with rules and requirements as illustrated in the zero single-use plastic roadmap. On plastic issues in particular, there are three common issues observed from legal and institutional aspects:



### Lack of holistic legal framework

At the time of writing, the Solid Waste and Public Cleansing Management Act (Act 672) is the only national-level legislation on solid waste management, with no comprehensive legal framework to control product manufacturing or importation from a waste management perspective. This puts the responsibility for proper waste management solely on waste management activities, while producers/importers act as free-riders.



### Constraints of existing Acts

Act 672 is not adopted by all states in Malaysia, making it challenging to introduce nationwide regulations like Extended Producer Responsibility (EPR) regulations. Other Acts such as the Environmental Quality Act (EQA) and Industrial-related Act are not effectively linked to waste issues. Corruption/bribery problems are also closely linked to illegal importation and operations.

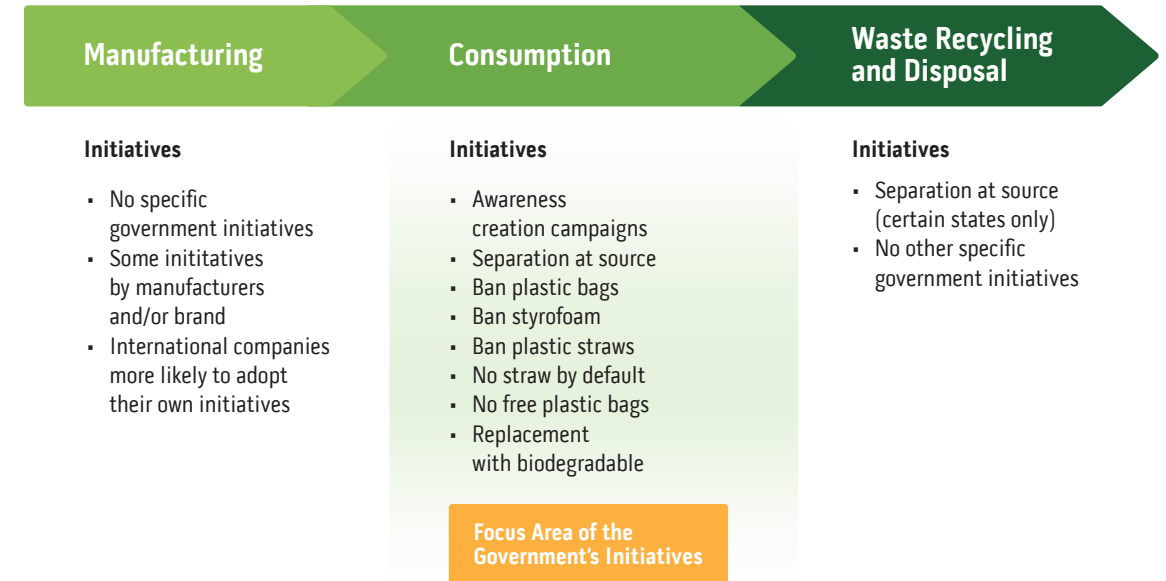


### Institutional conflicts between ministries

Conflicts and communication gaps exist between government ministries, particularly the Ministry of Housing and Local Government (KPKT) and the Ministry of Natural Resources, Environment and Climate Change (NRES), on the control of plastic waste. Waste plastic importation is under the Basel Convention, while the awarding of import permits (AP) is managed by KPKT, previously by MIDA, which creates confusion. Communication gaps also exist with the Ministry of International Trade and Industry (MITI) and other relevant ministries on regulating industries related to plastic manufacturing and controlling different plastic issues.

## Exploring the Root Causes

Government initiatives to reduce plastic wastes are focused only on the plastic consumption and plastic waste generation post-consumption in the consumer level of the value chain.



The causes of the plastic waste problem in the country can be traced to all levels of the value chain, necessitating a comprehensive approach with legally supported regulations to effectively address and reduce plastic waste.

## Causes of the Plastic Waste Problem

### Producers / Importers

- No manufacturer responsibility for product end-of-life management.
- Market demand overrides environmental concerns for manufacturers.
- Lack of restrictions lead to non-recyclable, eco-unfriendly products.

### Consumers

- Lack of awareness and irresponsible plastic consumption.
- Low participation in waste segregation.
- Littering and illegal dumping of plastic waste.

### Waste Management

- Low quality and quantity hinder recycling feasibility.
- Inefficient recycling leads to landfill disposal.
- Limited disposal options, predominantly landfills.

# An Assessment of Malaysia's Main Initiatives on Plastic



### Banning Styrofoam Containers

Styrofoam containers, although 100% recyclable, are not economically viable for recycling due to high processing and transportation costs. Instead, PP food containers are commonly used as an alternative. However, if these containers are not properly cleaned and segregated by users, they often end up in landfill sites, leading to potentially greater environmental impacts than styrofoam containers.



### Banning Non-Degradable Plastic Bags

Conventional plastic bags, which are 100% recyclable, have been the focus of banning initiatives. However, degradable plastic bags present challenges in recycling as it is uncertain whether these plastic bags are fully degraded or biodegraded. Mixing degradable plastic with conventional plastic renders it non-recyclable. Additionally, degradable plastic bags have a short shelf life, leading to potential wastage and limited storage options.



### Ban on Plastic Straws

The ban on plastic straws has generated controversy due to the replacement of recyclable PP plastic straws with non-recyclable paper straws that ultimately end up in landfills. While plastic straws are fully recyclable, they often go unsegregated for recycling. On the other hand, paper straws have no quality control for chemicals, colouring, bleaching agents or any other harmful substances. Additionally, paper straws are non-recyclable because they contain plastic or wax liners, which interfere with the recycling process.

# Recycling Stakeholders - The Challenges

Recycling stakeholders have identified several challenges in plastic waste recycling from a technical perspective.



#### Material Contamination

- Issues with stickers on plastic envelopes
- Plastic contamination with food residues
- Attachments like metal or stickers on plastic products
- Mixing of degradable plastics with conventional plastics



#### Logistical and Operational Challenges

- Logistic constraints for post-consumer plastic waste collection
- Fluctuating market prices for plastic waste

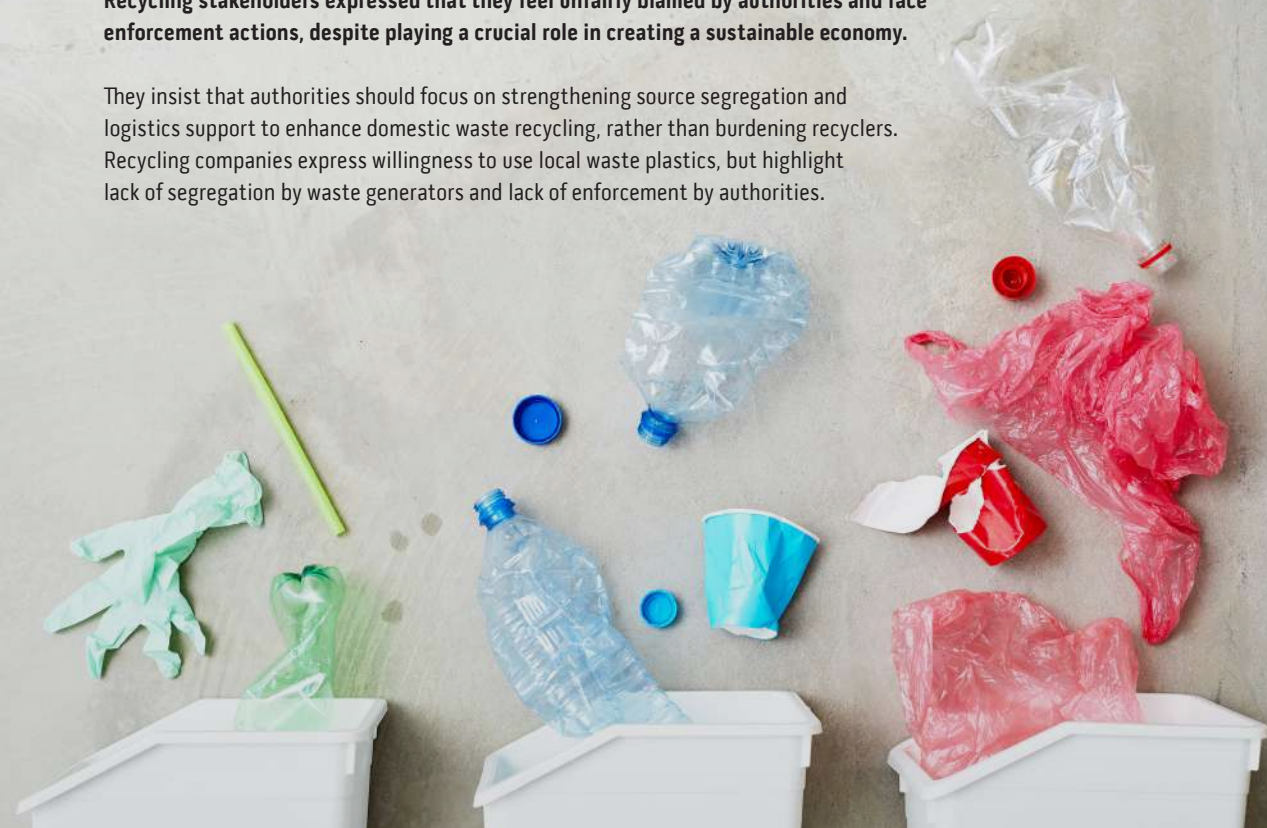


#### Needed Support

- Lack of support and appreciation from authorities
- Need for better enforcement of source segregation
- Logistical support for collection
- Recognition of recycling companies' role in developing a circular economy

Recycling stakeholders expressed that they feel unfairly blamed by authorities and face enforcement actions, despite playing a crucial role in creating a sustainable economy.

They insist that authorities should focus on strengthening source segregation and logistics support to enhance domestic waste recycling, rather than burdening recyclers. Recycling companies express willingness to use local waste plastics, but highlight lack of segregation by waste generators and lack of enforcement by authorities.



# RECOMMENDED INTERVENTIONS AND ACTIONS BY KEY STAKEHOLDERS

All interventions and actions aimed at improving the plastic ecosystem should focus on “Shared Responsibilities” based on three main principles: a holistic approach considering environmental, health, economic, and social aspects; being science-based with sufficient evidence from recognised sources or local research; and a focus on sustainability, ensuring interventions are viable in the short, medium, and long term. For these key stakeholders, recommendations and interventions are to:



## Government

- Strengthen policy and institutional frameworks, enacting new legal frameworks, regulating plastic consumption, improving plastic waste management, and enhancing plastic collection and recycling systems.
- Establish a national policy that covers all aspects of the plastic ecosystem, while enacting laws to mandate responsibilities for manufacturers, importers, and users of plastic products, imposing regulations on single-use plastic items, implementing recycling targets and authorizations for recyclable collectors, and promoting research and innovation for sustainable solutions.
- Focus on responsible plastic consumption through education and awareness programs, and incentivised collection systems, especially in rural areas.
- Improve the nationwide separation at source initiative and formalise collection activities while including the informal sector in compliance with regulations.



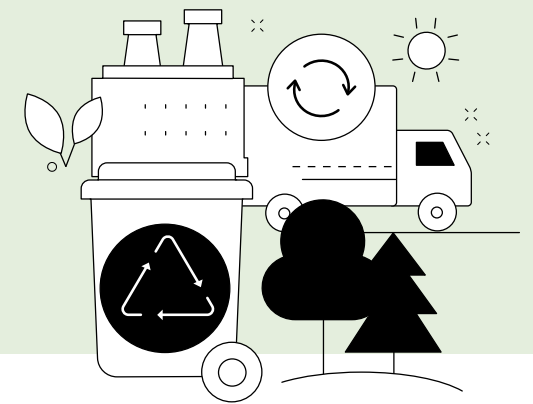
## Consumers

- Foster a sense of responsibility and attitude change towards plastic use and waste generation.
- Practise “green purchasing” by selecting products with circular thinking in product design, recyclable and environmentally friendly packaging materials.
- Users from specific sectors (e.g. medical, agriculture, construction) should conduct waste audits, explore alternative materials, and emphasise circularity and sustainability.
- Support awareness creation, EPR schemes, and participate in community activities to strengthen local capabilities in tackling local issues.



## Manufacturers and Brand Owners

- Adopt circular thinking in production, using eco-friendly materials, maximising recycled materials, and setting recycling rate targets.
- Implement voluntary Extended Producer Responsibility (EPR) and taking responsibility for end-of-life impacts and developing environmental management plans for non-recyclable plastic waste.
- Conduct continuous R&D on life cycle assessments, reducing carbon footprint, and creating markets for recycled products.
- Establish data management and reporting systems and transparently disclose data on plastic materials used and products put on the market.



## Waste Management Companies

- Improve collection efficiency through collaborations with local authorities and communities and provide drop-off centres or door-to-door collection.
- Increase recycling efficiency by adopting technologies for plastic waste recycling, implement higher productivity processes, and improve segregation of mixed plastic wastes to minimise residue disposal.
- Increase awareness among communities to improve plastic waste quality through rinsing and cleaning before segregation.

## Strategic Goal Setting and KPIs: A Framework



### Government Interventions

- Clarify legal mandate / jurisdictions
- New regulatory frameworks (EPR / Packaging Law etc.)
- Guidelines, standards
- Incentive / subsidies
- Research & development (R&D):
  - substitute / alternative
  - waste management option
  - cost implications
- Enforcement mechanisms
- Waste treatment alternatives

**Strengthen the Legal Framework**



### Product Manufacturers/ Importers/ Brand Owners

- Extension of responsibilities (end of life)
- Voluntary EPR scheme
- Willingness to pay
- Research & development (R&D):
  - product design
  - life-cycle / GHG analysis
  - recycling options / markets
- Data management/reporting
- Compliance with all regulations
- Awareness creation

**Mainstreaming Production with Circular Thinking**



### Consumers/ Waste Generators

- Waste is responsibility
- Conduct waste audit
- Segregation at source
- Willingness to pay
- Attitude change (consumption patterns)
- Support local initiatives

**Enhance the Sense of Responsibility**



### Civil Society/ NGOs

- Awareness campaigns
- Sustainable partnerships
- Localised solutions
- Advocating policy change

**Driving the Plastic Revolution**



### Waste Recyclers

- Collection and Recycling efficiency
- Technology improvement
- Networking / collaborations
- Outreaching to communities

**Increase Recycling Efficiency**



### Disposal

- More disposal options
- Compliance to regulations (e.g. plastic disposal ban)



Short Term	Medium Term	Long Term
2022 — 2024	2025 — 2027	2028 — 2030
<ul style="list-style-type: none"> <li>• Immediately strengthen the existing policy and institutional frameworks</li> <li>• Strengthen and improve all the existing systems</li> <li>• Carry out sufficient preparatory works towards enactment of necessary legal frameworks</li> <li>• Conduct more R&amp;D and studies</li> </ul>	<ul style="list-style-type: none"> <li>• Put more actions into implementation, including enactment of legal frameworks/ regulations</li> <li>• Creation of more support for stakeholders e.g. schemes, markets for recycled products</li> <li>• Continuous efforts on setting up more legal and economic instruments for long term implementations</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of wide range of regulations with continuous support from necessary schemes and industrial symbiosis</li> <li>• Continuous improvements of the entire system, close monitoring on the performance and achievements</li> </ul>

## CONCLUSION

Within the extensive analysis of Malaysia's plastic ecosystem, several significant challenges and potential solutions have been identified.



This study revealed an essential issue with data fragmentation, making it challenging to obtain precise statistics along the plastics lifecycle. Despite this, expert consultations and estimations suggest that approximately 3,595,500 tonnes of plastic products were consumed in Malaysia in 2019 alone.

While the government has launched initiatives to address single-use plastics, these efforts have not yielded the anticipated results. Specifically, the roadmap aimed at reducing single-use plastics has fallen behind schedule, and various single-use plastic items, including cutlery, diapers, face masks, and product packaging, remain unaddressed.

These gaps in the national strategy raises concerns about the effectiveness of focusing on consumption alone, which neglects the role of manufacturers in minimising plastic waste. For effective change, the study highlights the importance of implementing Extended Producer Responsibility (EPR) and plastic packaging regulations, setting the stage for control over the production and end-of-life management of plastic products.

Recycling activities, on the other hand, reflect differences in plastic recycling patterns across different areas, with urban centres displaying more active recycling efforts compared to municipalities and districts. These patterns align with government initiatives that concentrate their efforts primarily in urbanised cities.

The study also highlighted that aside from plastic, there is also a pressing concern of food waste, which constitutes nearly 50% of the municipal waste stream. This waste category poses not only an environmental challenge but also is a significant contributor to greenhouse gas emissions, notably methane and carbon dioxide, further exacerbating global warming and climate change.

In response to these multifaceted issues, the study recommends a holistic approach. It urges government initiatives to focus on generating comprehensive evidence that takes into account environmental, health, economic, and social implications. Furthermore, this approach encompasses the development of alternative waste disposal methods, encouraging

efficient recycling efforts, and fostering a circular economy, in alignment with the vision of a "Circular Economy Roadmap" for the nation.

However, it's not merely the government that bears responsibility. The study underscores the need for all stakeholders within the plastic value chain to play their respective parts actively. This includes manufacturers, importers, consumers, and recycling players, and all contributing to responsible consumption, efficient recycling, and better waste management.

In summary, this study reinforces the urgency of addressing the challenges within Malaysia's plastic ecosystem. It highlights the importance of employing a balanced government approach, active stakeholder involvement, and the implementation of comprehensive waste management strategies to minimise the environmental impact of plastic consumption. By adopting a collective commitment to the issue, Malaysia can pave the way for sustainable plastic management practices, ensuring a brighter future for generations to come.

## GLOSSARY

ABS	Acrylonitrile Butadiene Styrene
HDPE	High-Density Polyethylene
LDPE	Low-Density Polyethylene
Nylon	Polyamide
PC	Polycarbonate
PET	Polyethylene Terephthalate
PEEK	Polyether Ether Ketone
PLA	Polylactic Acid
PMMA	Polymethyl Methacrylate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl Chloride
PVA	Polyvinyl Alcohol
PUR	Polyurethane
PTFE	Polytetrafluoroethylene



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