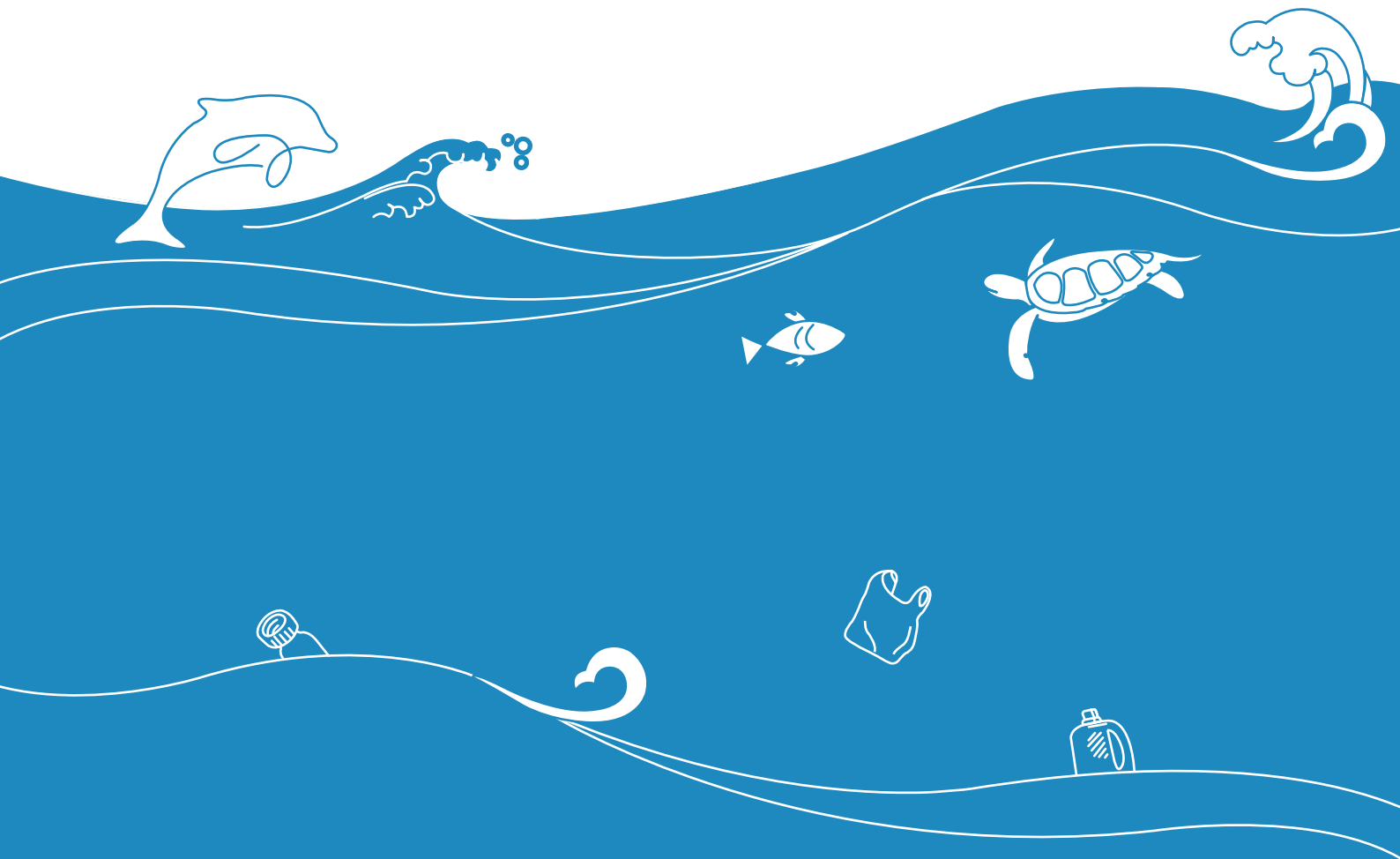


Plastic material flow and value chain analysis (Thailand)

CHULALONGKORN UNIVERSITY



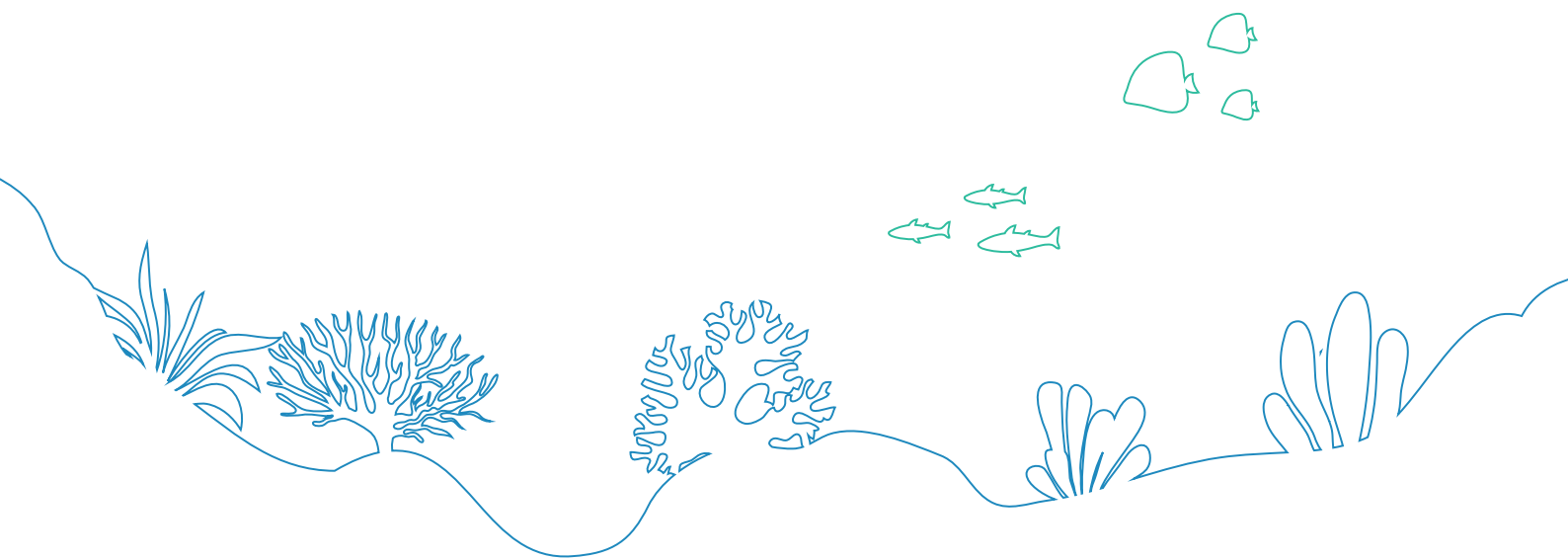
Acknowledgements

This report was developed as part of the **SEA circular project – Reducing marine litter by addressing the management of the plastic value chain in Southeast Asia** – implemented by the United Nations Environment Programme ([UNEP](#)) and the Coordinating Body on the Seas of East Asia ([COBSEA](#)), with funding support from the Government of Sweden.

This study on plastic material flow and value chain analysis (Thailand) provides the most recent primary and secondary data available on plastic waste management in the country, focusing on types of plastic packaging and products being produced and recycled, waste forms

and the ways in which waste is being managed and mismanaged, and estimates of plastic waste leakage. The research project was completed in December 2021. UNEP's national partner in Thailand, Chulalongkorn University, implemented this project, conducted the research for the study and created the recommendations presented, with SEA circular project team members providing supervision, coordination and support for the development of this document.

The SEA circular project team also coordinated the editing, layout and design of this document.

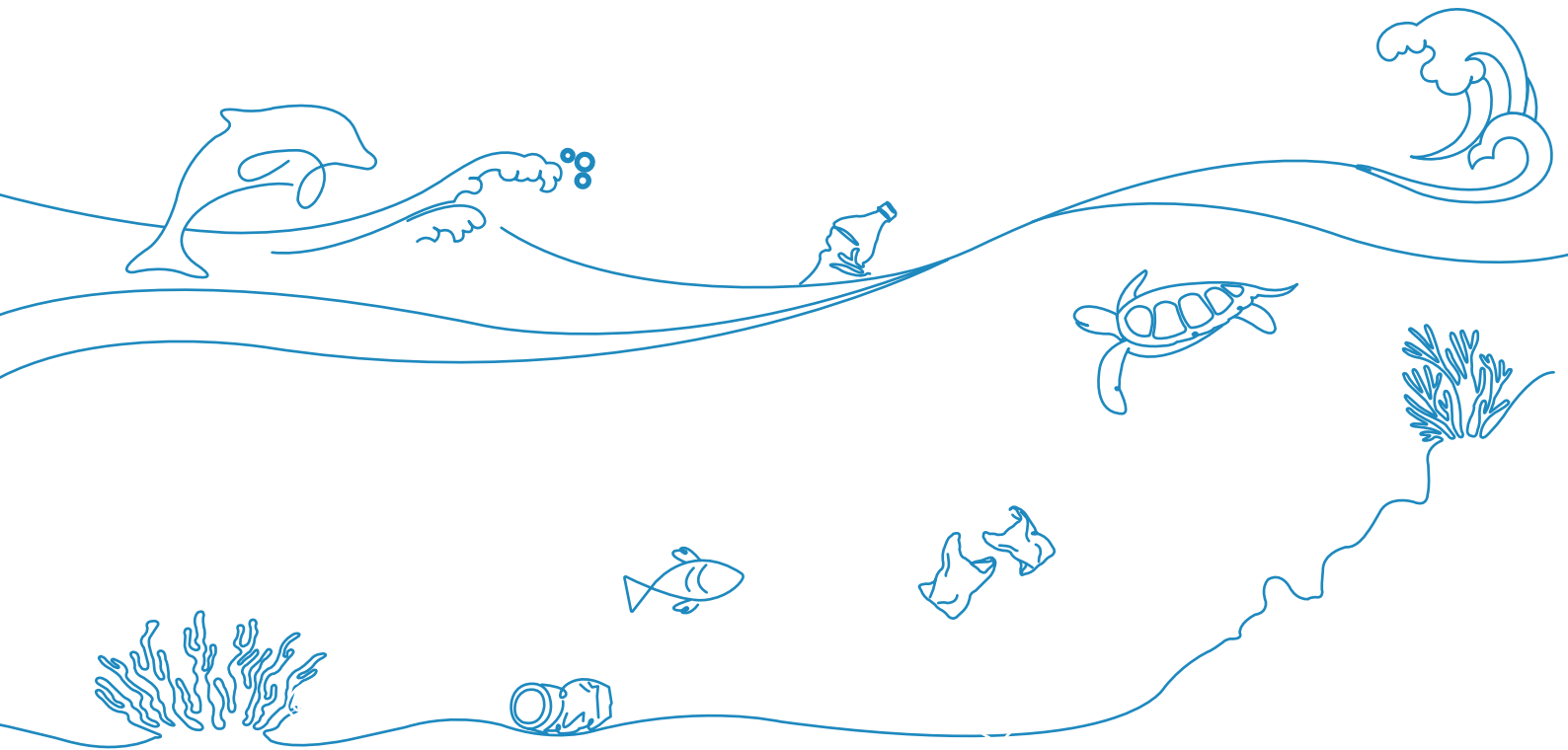


Marine debris is an increasing concern as it affects both coastal and marine ecosystems. Single-use plastic waste is one of the main forms of marine debris and also constitutes a primary source of contaminant concentrations in the food chain. Thailand is currently facing a growing waste crisis yet lacks sufficient scientific data on the contribution of single-use plastics and waste management to this crisis.

In Thailand alone, the total annual consumption of plastics was 5.53 million metric tons (MMT) in 2018, about 40 per cent of which was used in single-use applications, such as packaging.¹ This resulted in 1.91 MMT of single-use plastic waste, with an estimated 20 per cent recycled or incinerated and the remaining 80 per cent sent to landfill sites. Marine litter pollution is a complex environmental problem that Thailand finds itself facing. Around 7.88 MMT (31.07 per cent) of municipal solid waste was improperly disposed of in Thailand, which may be the cause of marine debris pollution from land-based sources.

Marine debris

is an increasing concern as it affects both coastal and marine ecosystems.



1. Plastics Institute of Thailand (PITH). Plastic Waste Database in Thailand. 2018.



The objectives of this study are to:

- update the existing methodology that was previously used for the analysis of plastic material flows and leakage along the value chain conducted by the United Nations Environment Programme (UNEP) and its partners
- analyse material flows and leakage with a focus on the food and beverage packaging industry (non-polyethylene terephthalate – PET), the retail industry and low-value materials and flexible packaging, taking into account informal waste management (while recognizing gender-specific needs and the contributions of disadvantaged groups) and developing three key baseline metrics to inform decision-making (plastic packaging recycling rate, landfill rate and leakage rate at the national, city and town/rural levels for different packaging materials)
- collect and analyse relevant data (e.g. economic value from employment, machinery value following modifications to conventional products to make them environmentally-friendly) to inform policy

aimed at reducing potentially environmentally-harmful plastic products, improving recycling and replacing non-recyclable or non-valuable plastic products with environmentally-friendly alternatives

- propose supporting measures or options that could inform the policy to reduce potentially environmentally-harmful products and improve recycling.

This study presents an analytical model of typical single-use plastics (plastic bags, bottles, food containers, cutlery and other packaging items) and their plastic category (see categories below on this page). Material flow analysis (MFA) – a method used to understand life cycle processes and monitor single-use plastic quantities in and between system processes – was applied to: (i) monitor the physical flows and stocks of single-use plastics in Thailand through production, consumption and waste management processes to better address marine litter pollution; and (ii) better understand the factors that contribute to pollution prevention and identify appropriate responses.

Categories of plastic

HDPE

High-density polyethylene

LLDPE

Linear low-density polyethylene

LDPE

Low-density polyethylene

PET

Polyethylene terephthalate

PP

Polypropylene

PS

Polystyrene

PVC

Polyvinyl chloride

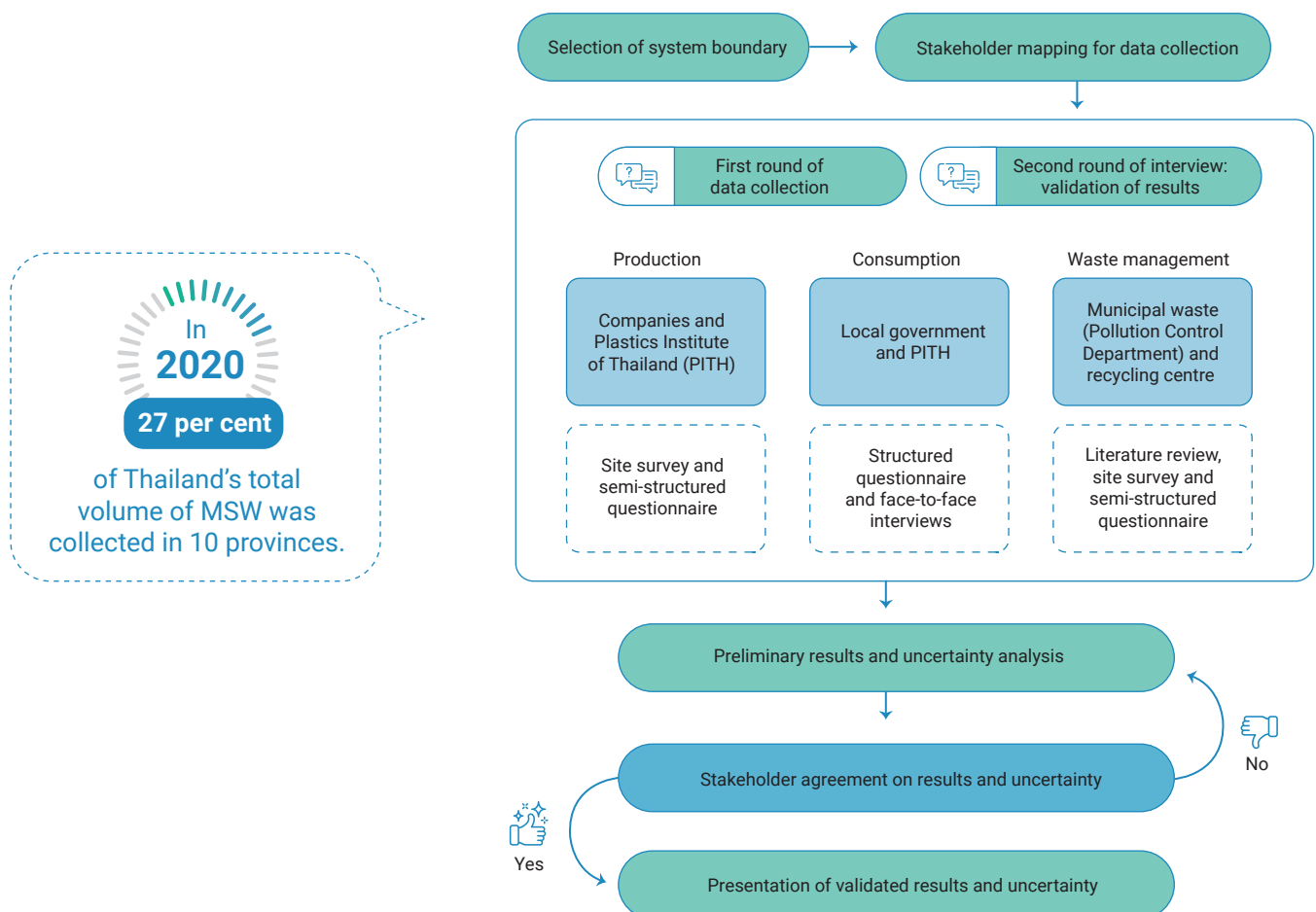


It is difficult to enter into the circular economy and reuse and recover materials efficiently unless a baseline analysis is completed beforehand that can provide waste management stakeholders with knowledge of available resources for circulation. Actions that prevent and reduce marine debris and pollutants are also needed and require the collaboration of a broad range of stakeholders, including local communities, non-governmental organizations (NGOs), academic

institutions, governments, the private sector and all citizens, to implement and adopt long-term, strategic and coordinated initiatives, laws and policies. Waste management is a huge undertaking that not only requires successful recycling, but also access to various resources, safe and dependable waste collection and disposal services, long-term financing and strategic commitments from the government, citizens and NGOs.

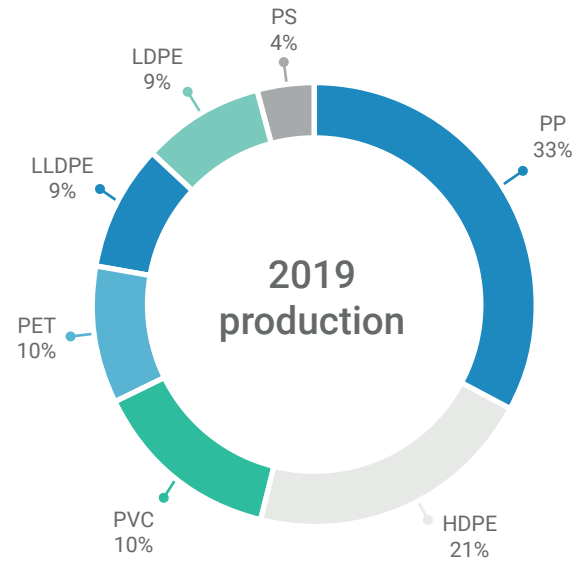
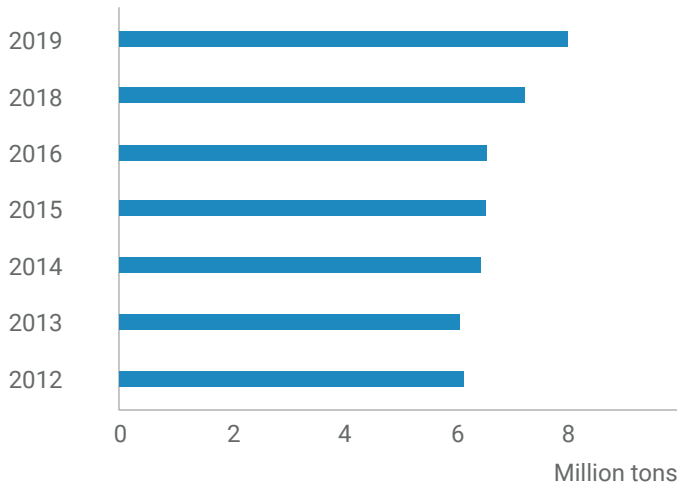
Data collection

In addition to primary data collection, other data and information sources included literature reviews, official statistics and interviews with different stakeholders once system boundaries and stakeholder mapping had been established for products-related information.



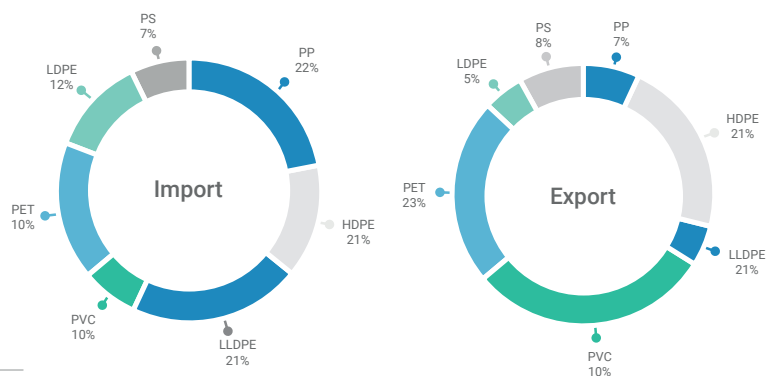
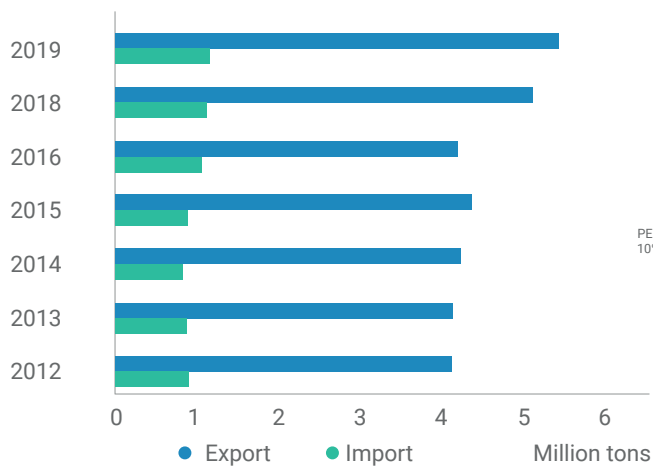
Summary of results

Annual plastic resin production in Thailand



Production and consumption

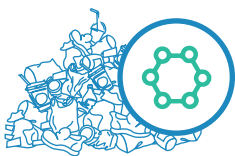
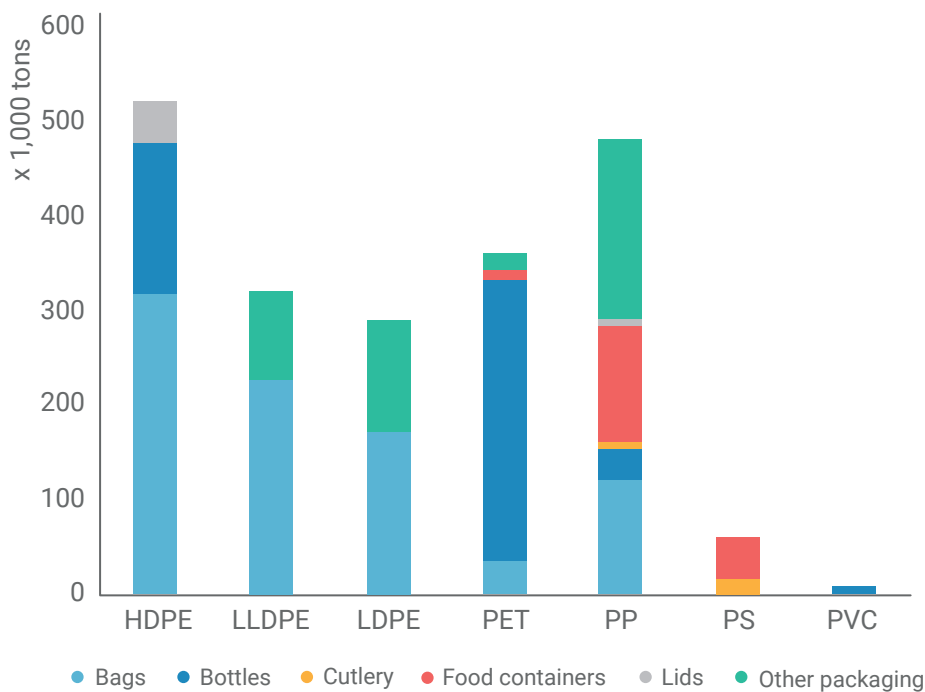
In Thailand, plastic production is increasing, reaching 7.97 MMT in 2019, with imports totalling just 1.12 MMT. Export markets consumed about 5.36 MMT of plastic resins, with the remaining 3.73 MMT used for manufacturing target products (HDPE, LDPE, PP, PS, PET and PVC) for domestic industries.



The findings of this study indicate that in 2019, the total domestic plastic resin production for single-use plastics in Thailand was 2.90 MMT, with 2.15 MMT of plastics available for manufacturing into different products. Across the packaging consumption sectors, plastic bags contributed the most at 43 per cent, followed by bottles (25 per cent), other packaging items (22 per cent), food containers (7 per cent) and lids and cutlery (both 3 per cent).

After consumption, the total amount of single-use plastic waste generated was 2.15 MMT, which was collected and handled by the waste management system.

Based on statistical estimates, the amount of well-managed target plastic waste at municipal disposal sites was 0.82 MMT, while 0.42 MMT was recycled at recycling centres. The recycled plastic accounts for 22 per cent of waste generation compared with expected waste creation, based on 0.71 MMT of plastic waste found at improper landfills.²



2.90 MMT
production

Resin production
for single-use plastics



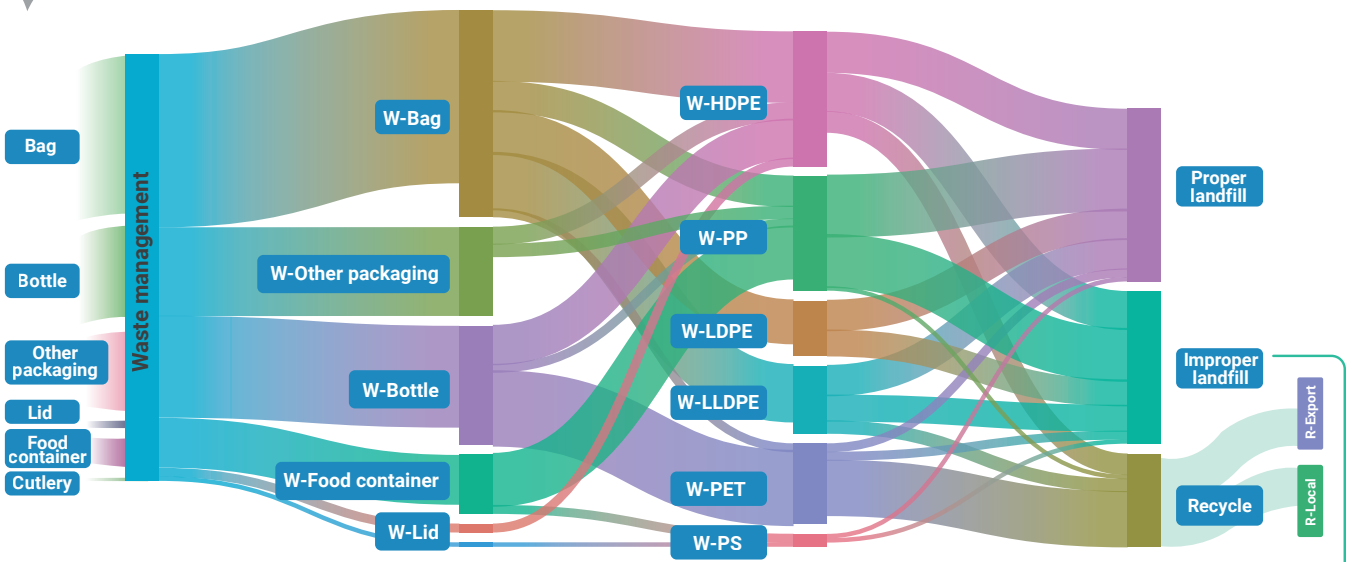
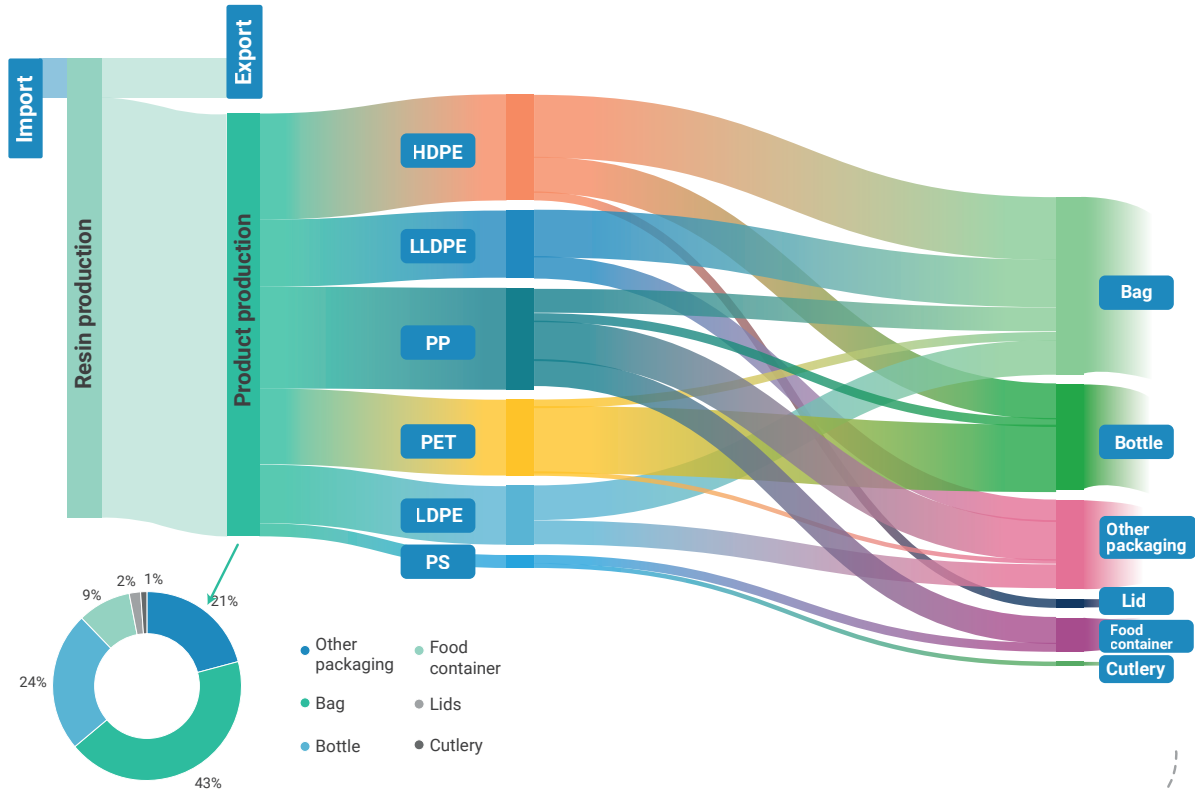
2.15 MMT
consumption

Plastics available for
manufacturing into
different products

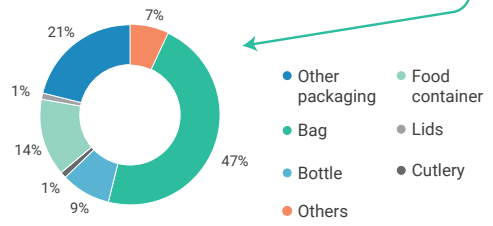
2. The term "improper landfills" refers to dumpsites and non-engineered sanitary landfills.



Material flow analysis



Recycling rate		
PET	PE	PP
79%	14%	3%
Bottle	Bottle + bag	Bottle + food container



The MFA was used for six types of single-use plastic products in Thailand. All packaging products had a short service lifespan, which suggests that the volume

of 2019 production could equal the volume of waste output in 2020 (assuming that input equals output).

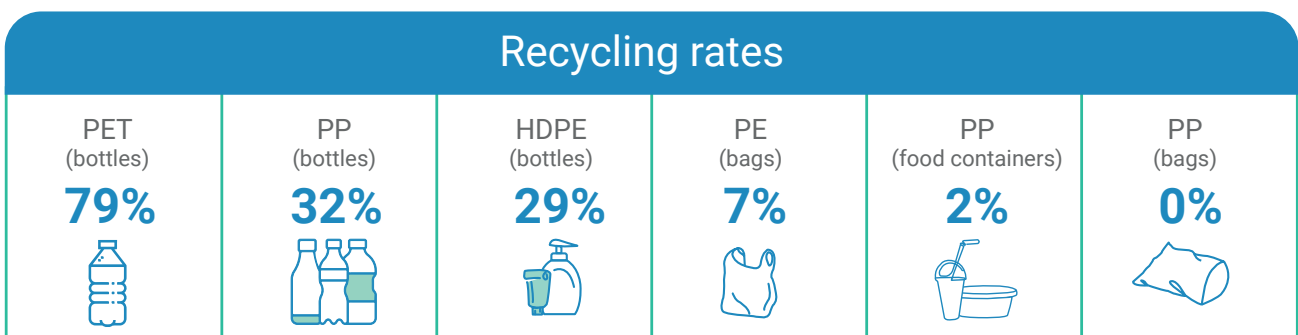


The MFA shows that there is significant plastic waste management potential within industry and among policymakers, with recycling results proving that mechanical recycling plays an important role in reducing plastic waste emissions and build-up in the environment. The Government of Thailand and trade groups should therefore develop policies that encourage the use of recycled plastic materials to increase their demand in the country as well as the production of environmentally-friendly products. Designing recyclable packaging is key to developing a long-term strategy for creating a circular economy.

- **PET bottles** were the most recycled packaging in Thailand, with approximately 0.29 MMT (**79 per cent**) of total PET bottles recycled. PET bottles are commonly used for drinking water as they are clean, easy to collect and recyclable due to their transparent colour and lack of filler. They can also be separated easily from other types of plastic.
- **HDPE bottles** were also recycled at a high rate, with approximately 47 kilotons (**29 per cent**) recycled each year. Almost all HDPE milk containers (such as cartons and bottles) were collected for recycling at a high price due to their high quality, which included clear bottles with no or little filler that were clean after use. Surveys of landfill sites and recycling centres also supported this result, with no HDPE milk containers found at the landfill sites and a large

amount found at the recycling centres. HDPE bottles are also used for personal care products, some of which are also recycled, though a proportion end up in landfills due to product contamination.

- **PE bags**, including HDPE, LDPE and LLDPE bags, were disposed of in large quantities, with most used to transport items from markets, small retail shops or convenience stores. After this initial use, the bags were often used as garbage bags, which were then collected and transported to landfills by local government services. Such bags are dirty and lightweight, and are therefore perceived as being less suitable for recycling, with the rate at just **7 per cent**.
- **PP bags and food containers**, such as boxes, trays and cups, were also common waste items found at landfills due to the difficulty in collecting and cleaning them. Such containers were mainly used to pack food from markets, restaurants, small retail shops and convenience stores. If these waste items were to be cleaned, sorted and collected (rather than being sent to and recontaminated at landfills), their recycling rate could be increased. However, the use of colour (e.g. red or black) and filler in such packaging, along with their mechanical properties, limits their ability to be reused, which adds to why they are often not collected for recycling.



Loss of plastic to the environment

Plastic waste impacts the environment at all phases of its life cycle, including its manufacture, consumption and disposal, with the loss of plastic linked to indirect losses caused by plastic usage and weathering. Losses from

microplastic-containing items, such as cosmetics and personal care products, account for a small proportion of overall microplastic loss.



The survey and expert opinions indicate that the leakage rate from mismanaged plastic waste in Thailand is **1–5 per cent** of waste generation.

Mismanaged plastic waste per year: **1.76 MMT**

Estimated range of plastic waste leakage per year: **18,414.98–88,941.12 MT**



Recommendations



Recyclers and collectors

- Thailand should have a policy to encourage the use of recycled plastic materials to increase their demand in the country.
- Communities should work together to collect recyclable quantities that are worth the investment, thus lowering the cost of transportation.
- The duty-free importation of plastic grinders, sorting machines, washing machines and melting machines should be encouraged.



Plastic convertors

- Other plastics, such as bioplastics, should have identifiable symbols.
- The use of colour in bottles is still a concern that needs addressing.
- Policies should be adopted that require the use of recycled pellets in various products or packaging.
- The purchase price of plastic waste should increase accordingly.



Consumers or users

- The requirements for post-consumer recycled products are diverse and should be coordinated with the requirements of manufacturers and customers.
- A community-wide network should be formed to educate people on how to distinguish between plastic and organic waste.
- Alternative materials, such as food boxes or tiffin sets, should be used instead of plastic bags.
- The Food and Drug Administration should allow the use of recycled PET for food products, which would further increase the demand and price of the material.
- Thailand should develop a long-term strategy to create a circular economy.

