

CRIC Training on Integrated Waste Management (IWM)

Module 2 Plastic waste management



Main learning objectives of this module



be able to compare different types of plastics and evaluate their environmental impact



be able to differentiate and name different plastic management strategies applied at different levels of the plastic life cycle

What is plastic?

- Made of **virgin fossil fuel** feedstocks
- Seven polymer types and resin codes
- 3 categories for municipal SW purposes : Nondurable vs durable goods (lifespan > or < 3 years) and containers and packaging
- **Cities can develop polymer-specific solutions** if certain products are commonly mismanaged or littered

Exhibit 1. Plastic Polymer Types, Resin Codes, and Product Examples						
Plastic Polymer Types and Resin Codes						
 PETE PET Polyethylene Terephthalate	 HDPE PE-HD High Density Polythene	 V PVC Polyvinyl Chloride	 LDPE PE-LD Low Density Polythene	 PP Polypropylene	 PS Polystyrene and Expanded Polystyrene	 OTHER Other, such as: - Acrylic polycarbonate - Acrylonitrile butadiene styrene (ABS) - Bisphenol A (BPA) - Fiberglass-reinforced plastic (FRP) - Nylon - Polylactic acid (PLA)
Sample Products						
Water bottles, dispensing containers, food-grade containers and bakery trays 	Shampoo bottles, milk bottles, freezer bags, ice cream containers 	Cosmetic container, plumbing pipes and fittings, electrical conduct, blister packs, wall cladding, roof sheeting, bottles, garden hose, shoe soles, cable sheathing, blood bags and tubing 	Bags, trays, containers, food packaging film 	Potato chip bags, microwave dishes, ice cream tubs, bottle caps, single-use face masks 	Cutlery, plates, cups, protective packaging, hot drink cups 	Automotive and appliance components, computers, electronics, cooler bottles, packaging 

Plastic Polymer Types, Resin Codes, and Product Examples

Recyclability potential per type of plastic

	 PET	PET PLASTIC: Bottles of water and other beverages
	 HDPE	HDPE PLASTIC: Shampoo, detergent and milk bottles
	 LDPE	LDPE PLASTIC: Shopping bags, rubbish bags, cling film
	 PP	PP PLASTIC: Straws, drinking cups, detergents, food containers and bags, pill bottles
	 PS	PS PLASTIC: Food trays, single-use cups, yoghurt pots
	 PVC	PVC PLASTIC: Credit cards, windows, pipes, cable insulation
	 OTHER	OTHER: Other types of plastic and mixed plastic materials

RECYCLABILITY*:

HIGH

MEDIUM

LOW

VERY LOW

*Source: Indicator of Honest Alternatives to single-use plastics, produced by Save The Med Foundation

Food and beverage sector is the biggest plastic user in Indonesia

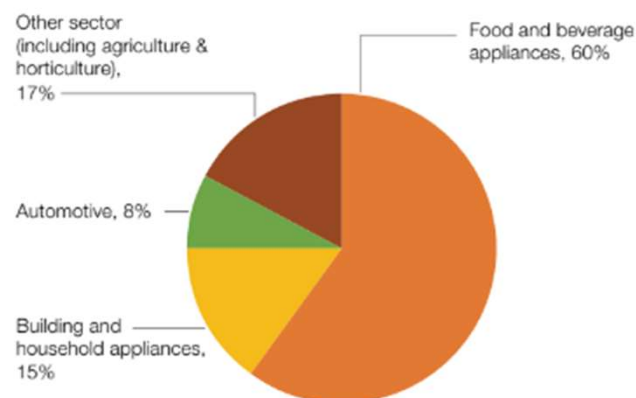


Fig. 15 Type of plastic appliance

(Source: Directorate for Downstream Chemical and Pharmaceutical Industry, Mol (2019). *Policy of National Plastic Industry*. Presented at Seminar Peran Industri Daur Ulang Plastik Sebagai Upaya Pengurangan Sampah Plastik di Indonesia 7 February 2019, Jakarta, by IGES – KLHK – SWI, and http://www.gbgindonesia.com/en/manufacturing/article/2016/indonesia_s_plastic_andamp_packaging_industry_still_dependent_on_raw_material_imports_11500.php)

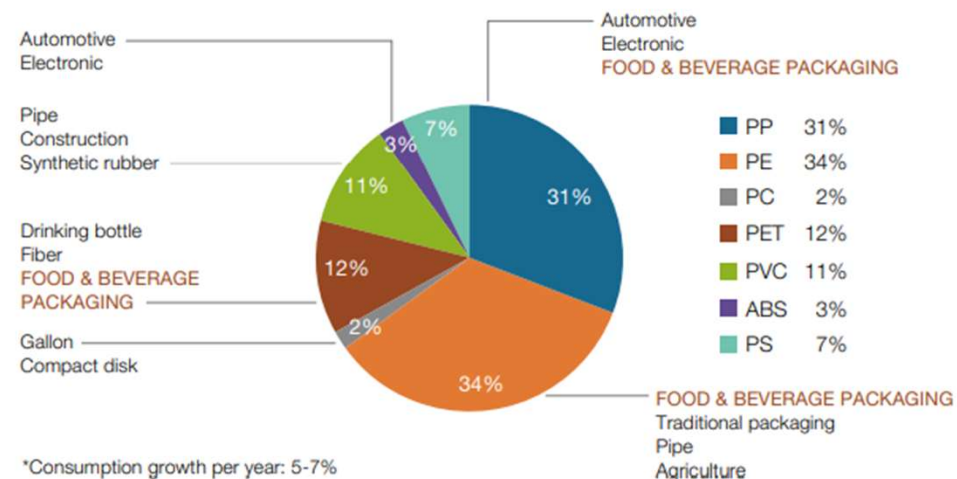


Fig. 16 Grouping industries based on plastic product

(Source: Directorate for Downstream Chemical and Pharmaceutical Industry, Mol (2019). *Policy of National Plastic Industry*. Presented at Seminar Peran Industri Daur Ulang Plastik Sebagai Upaya Pengurangan Sampah Plastik di Indonesia 7 February 2019, Jakarta, by IGES – KLHK – SWI)

of plastic containers and packaging consumed in Indonesia

Category	Percentage
Plastic packaging	57%
Plastic bottle	13%
PET	2%
Plastic pouch	1%
Gallon	1%
Plastic and carton	8%
Plastic and aluminium foil	2%
Plastic and can	1%
Plastic tube	1%
Plastic cup	5%
Jerry can	1%
Plastic and paper	1%
Plastic jar	2%
Plastic pail	1%
Plastic cosmetic case	3%

and packaging consumed in Indonesia

(Source: BPOM, 2019. Retrieved from: cekbpom.pom.go.id)



Fig. 17 Type of plastic containers and packaging consumed in Indonesia

(Source: BPOM, 2019. Retrieved from: cekbpom.pom.go.id)

Problematic plastic waste in Indonesia (1)

Flexible plastic waste represents 3/4 or 76% of plastic waste that leaks into the environment (World Economic Forum, 2020)

CHALLENGES TO THE DEVELOPMENT OF A FLEXIBLE PLASTICS RECYCLING SYSTEM

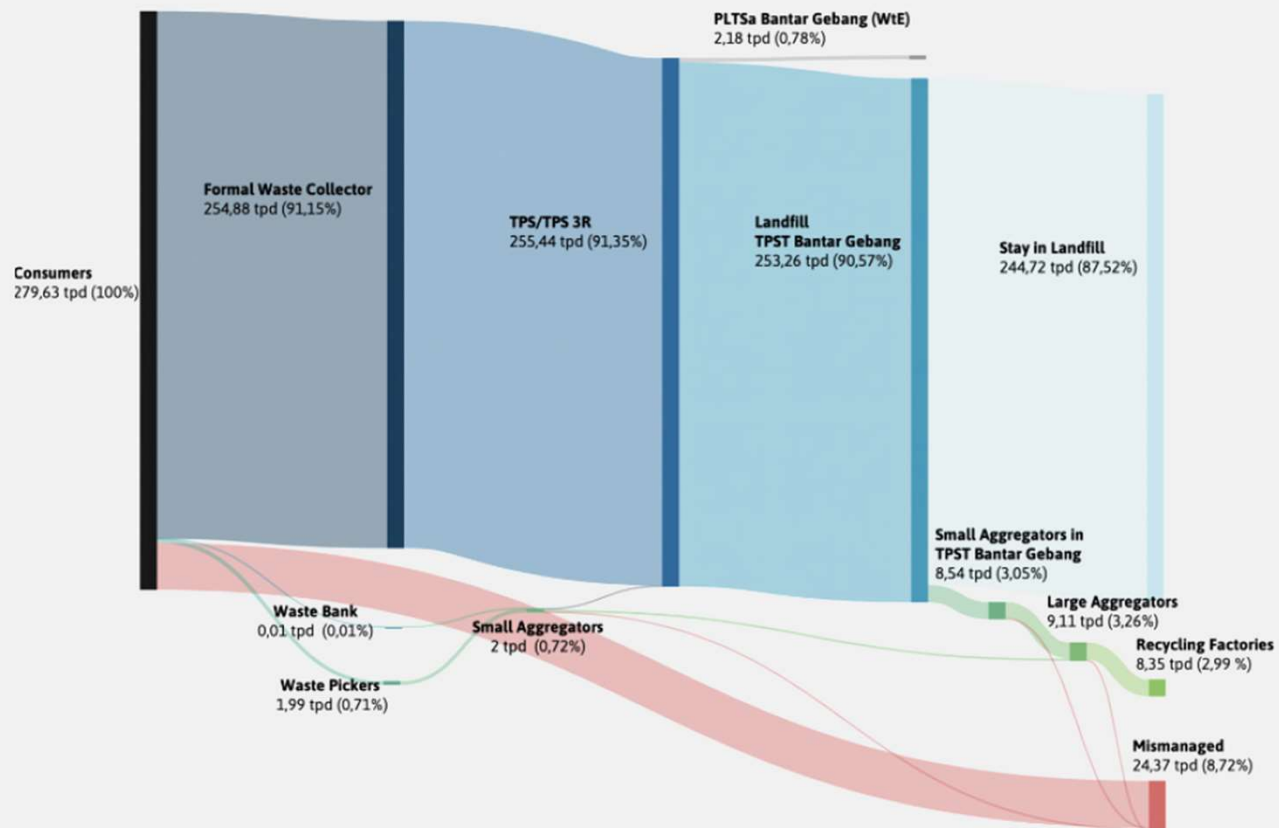
- Hard to recycle Material design
- Optimizing initiatives of flexible plastic waste craft
- Lack of sorting from the sources impact on the difficulty of recovery and data collection of flexible plastic waste

OPPORTUNITIES

- Developing alternative packaging-
- Developing plastic waste processing technology



Flexible Plastic Waste Material Flow in DKI Jakarta



Problematic plastic waste in Indonesia (2)

59% of plastic waste found in river estuaries in Jakarta, mostly is styrofoam waste (LIPI, 2019)

CFC material in styrofoam that is stable means that styrofoam waste will remain in nature for a long time.

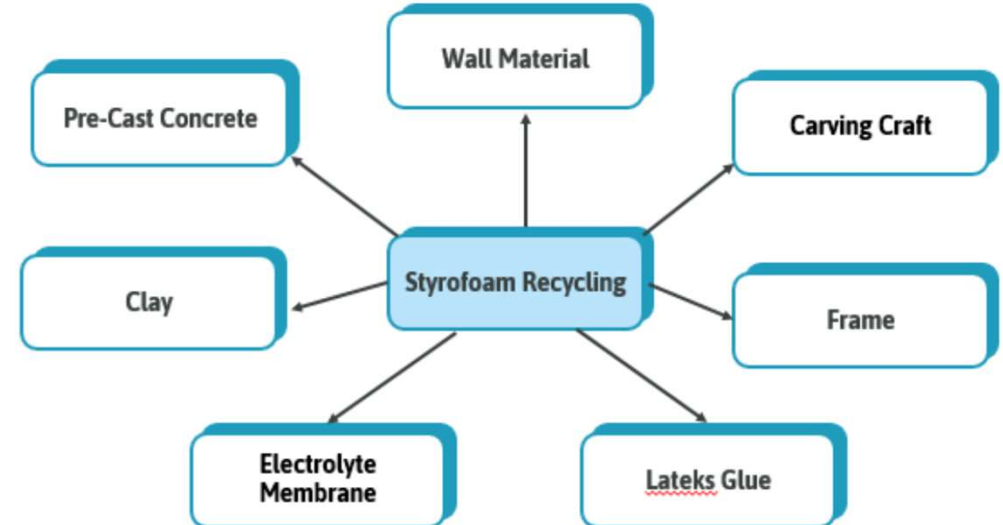
If styrofoam waste is not utilized or processed, the presence of styrofoam will have a high potential to harm the environment

CHALLENGES TO THE DEVELOPMENT OF A STYROFOAM RECYCLING SYSTEM

- Large volume of styrofoam affected the high need for space for storing waste = no collection in waste banks and thus landfilling
- Low economic potential perceived

OPPORTUNITIES

- Various styrofoam recycling efforts have been initiated in Indonesia (Java)
- Effort is considered simple with a stable market price

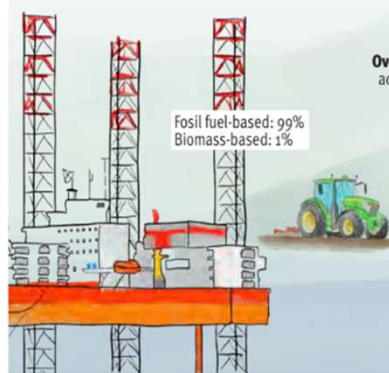


The plastic life cycle

The plastics life cycle

1. Extraction & conversion

Key stakeholders:
Raw material producers
Monomer producers
Polymer producers



Sources: UNEP (2018), UNEP (2019), EEA (2020), Geyer (2020). Illustration by Levi Westerveld / GRID-Arendal (2021). Research by Maria Tsakona.

2. Manufacture

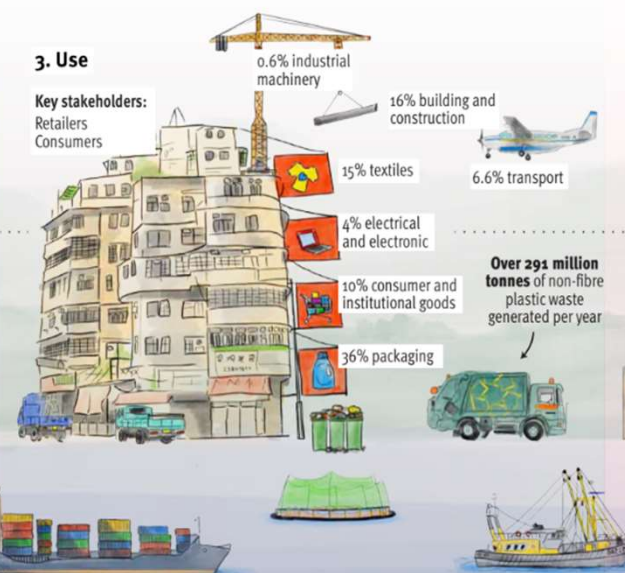
Key stakeholders:
Plastic processors
Plastic producers
Brands



Plastic lost during transport

3. Use

Key stakeholders:
Retailers
Consumers



4. End of life

Key stakeholders:
Formal waste sector
Informal waste sector



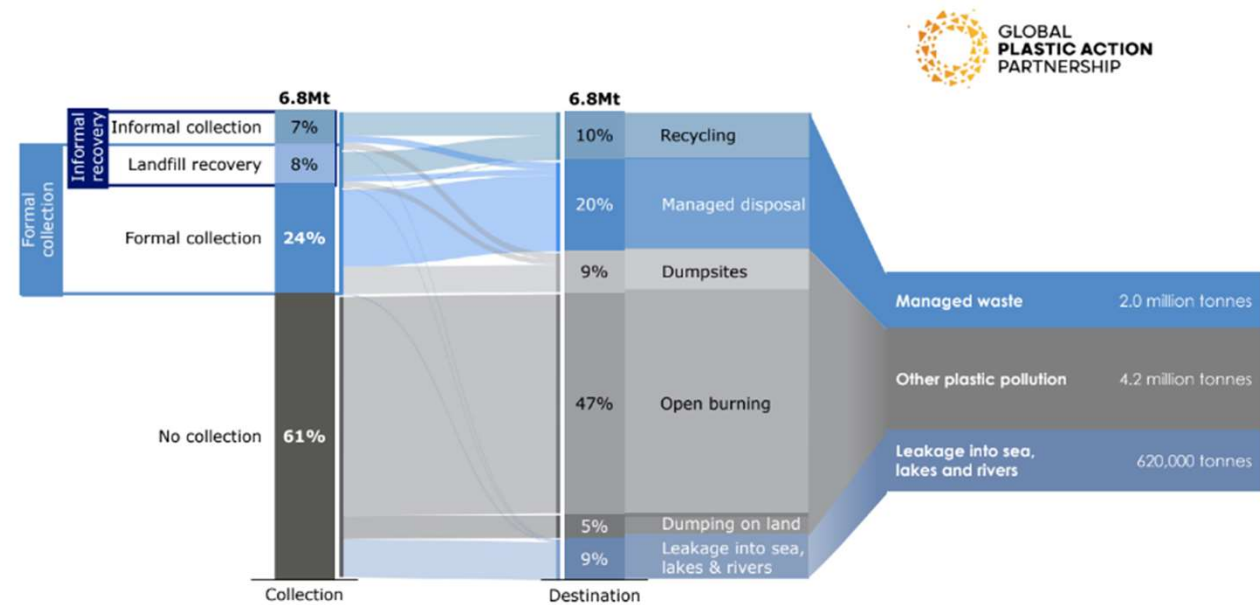
Journey of plastic waste in Indonesia

Only a small amount recycled/ properly managed

The remaining waste:

- **Open burned**
- **Leaks into sea, lakes and rivers**
- **Landfilled**

FIGURE 1. WHERE INDONESIA'S PLASTIC WASTE ENDS UP TODAY



Source: SYSTEMIQ, Indonesia National Plastic Action Partnership (NPAP), World Economic Forum

Plastic waste management

Why addressing plastic waste?

Negative impacts



Human health: microplastics in human organs; carcinogenic chemicals leach into tap water and can cause developmental, reproductive, neurological and immune disorders; plastic can clog sewers, leading to proliferation of mosquitoes and pests and increased risk of malaria



Air pollution: open burning emits carcinogens posing health risks



Environment: threat to marine environment due to risk of ingestion, suffocation and entanglement of marine species > reduced ability to digest food, leading to intestinal blockage, starvation and internal injury

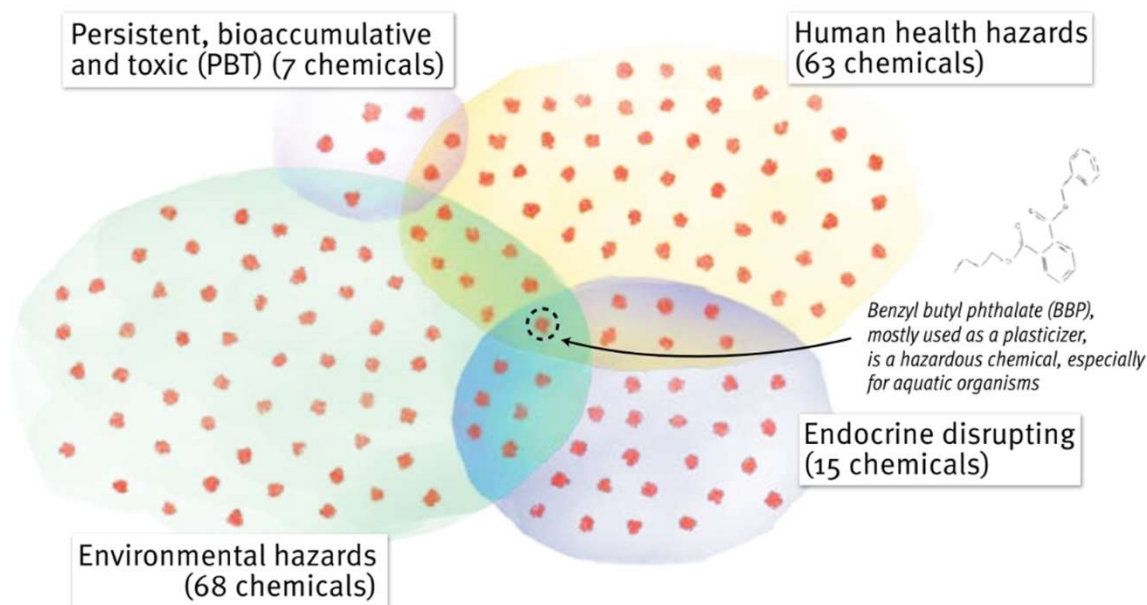


Economic : plastic pollution accounts for more than \$2.2 trillion in damages per year (e.g., damage to infrastructure, ocean damage, greenhouse gases, land pollutants)

The health cost of plastic pollution

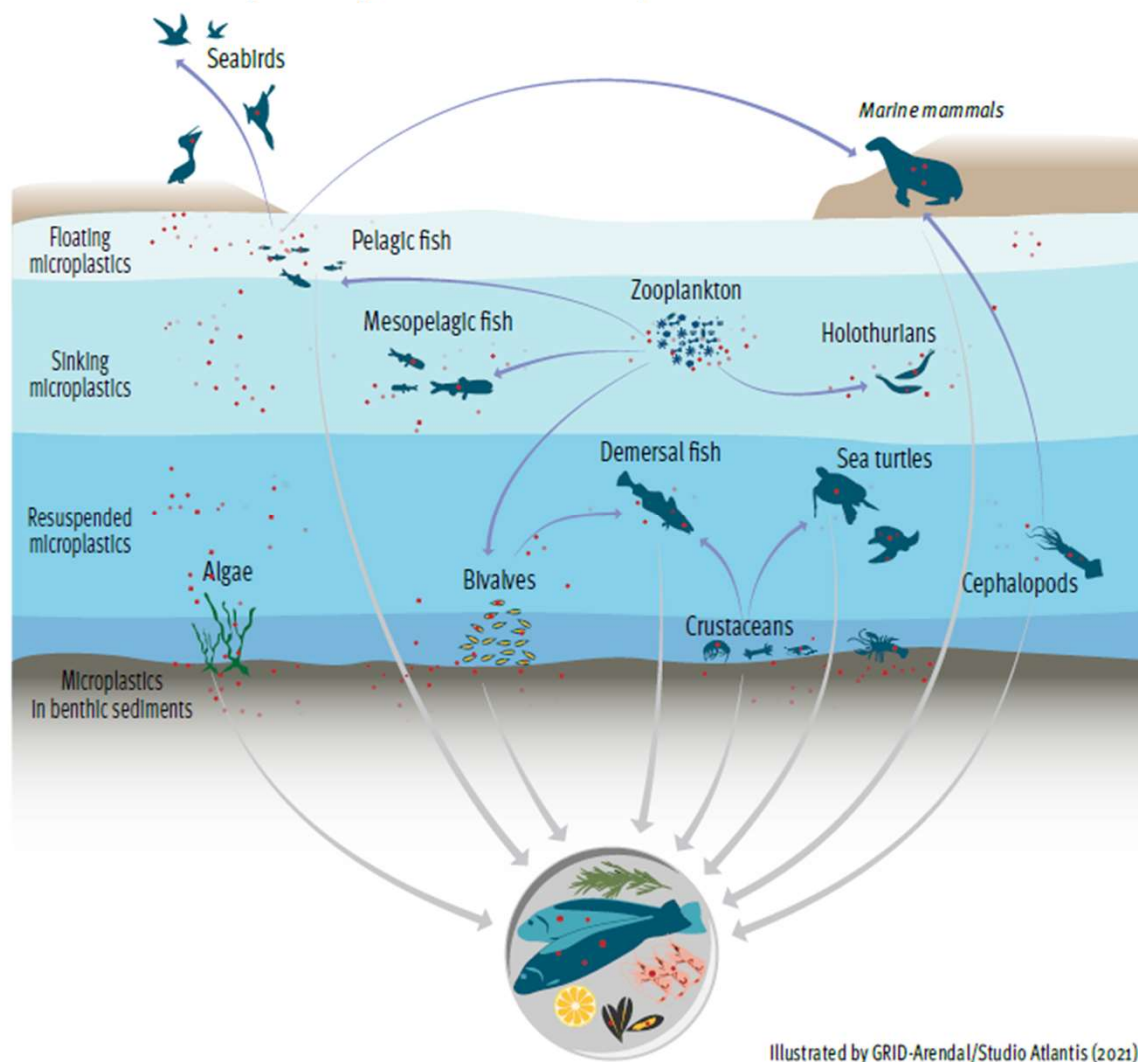
Hazardous chemicals in plastics

A 2018 study found that 3,377 chemicals are potentially associated and 906 chemicals are likely associated with plastic packaging. Out of these, 148 have been identified as most hazardous (Groh et al. 2018).



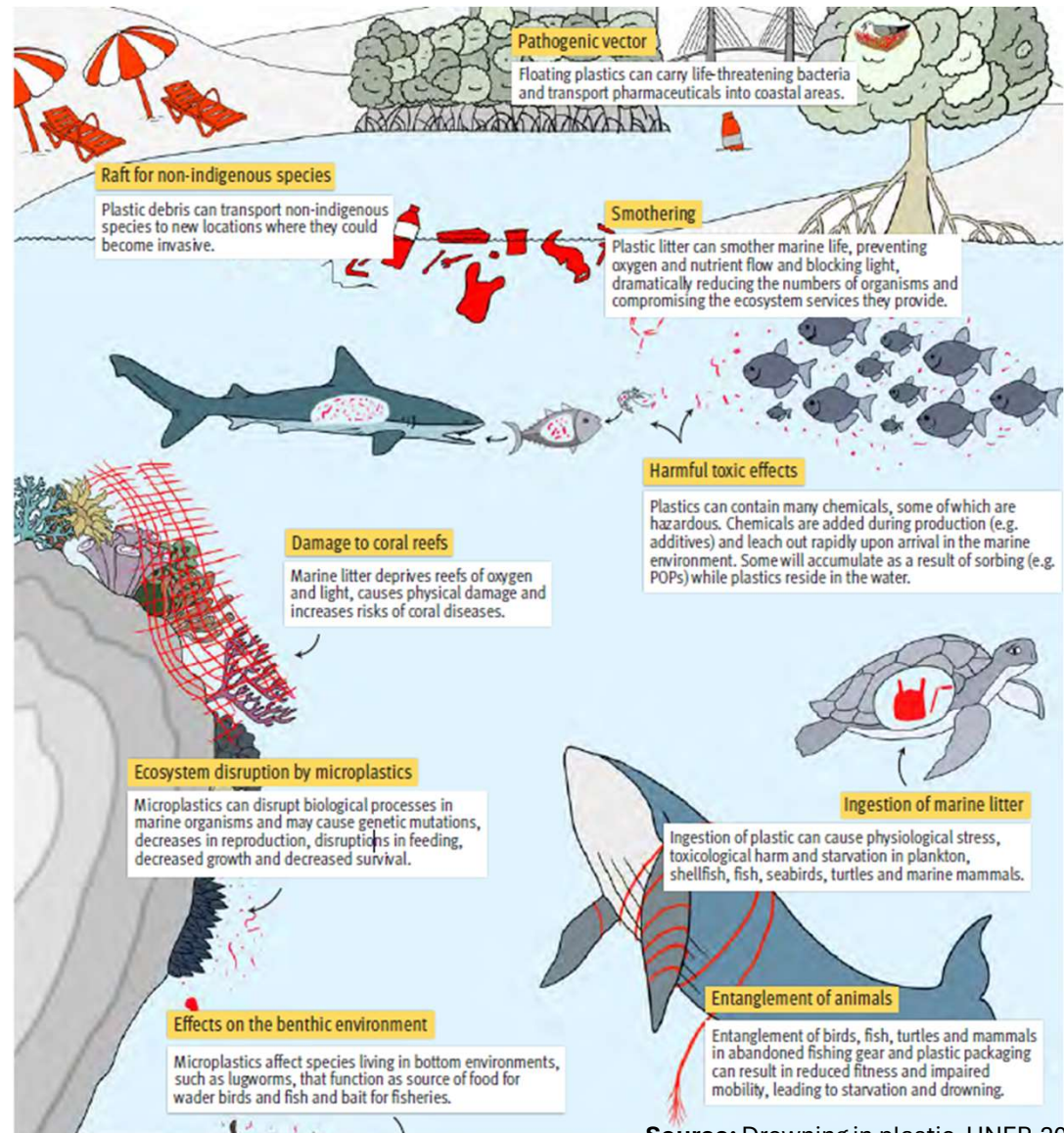
Source: Groh et al. (2018). Illustration by GRID-Arendal (2020).

Potential pathways of marine microplastics into our seafood



The environmental impact of plastic pollution

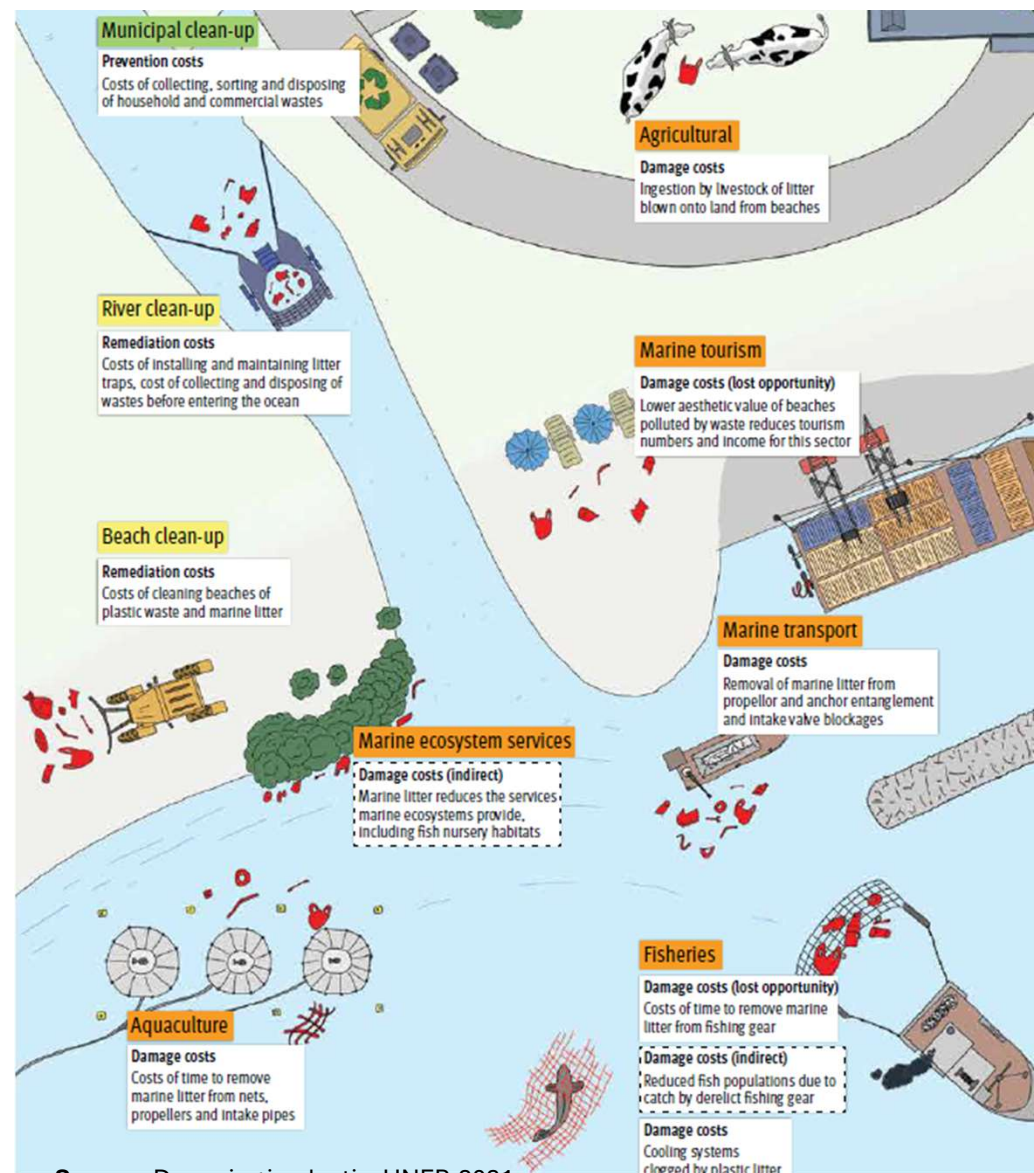
- Risk of ingestion, suffocation, and entanglement of marine species
- Microplastics may reduce the ability of animals to digest food, leading to intestinal blockage, starvation, and internal injury



Source: Drowning in plastic, UNEP, 2021

The economic cost of plastic pollution

- **Prevention cost:** reduce the likelihood of plastic waste leaking into the environment (pre-leakage)
- **Remediation cost:** reduce the risks posed by plastic pollution leaked into the environment (post-leakage)
- **Damage cost:** all forms of costs incurred by various sectors and the environment resulting from the presence of plastic pollution in the environment (post-leakage)



Source: Drowning in plastic, UNEP, 2021



Benefits of plastic reduction and recycling

Reduced health impacts: Limiting the volume of plastic waste that enters the environment decreases human and environmental health risks from plastic pollution.

Increased recycling rates: Recycling rates increase as strategies aim to increase recycling of plastics and reduce contamination in the recycling system.

Reduced consumption: Plastic consumption decreases as strategies discourage or ban the use of plastics.

Reduced contamination: Contamination of plastics (biodegradable plastics mixing with other plastics, plastics contaminated with other materials) decreases as strategies streamline plastic consumption and disposal, and manufacturers simplify design with fewer harmful contaminants.

Reduced leakage: Litter and other mismanaged waste decreases as strategies are implemented to collect and capture more plastics before entering the environment or waterways.

Enhanced collaboration: Partnerships among stakeholders grow as strategies encourage collaboration.

Enhanced markets: Market values of plastic increase as the quality of end-use plastic increases from improved recycling rates and decreased contamination.

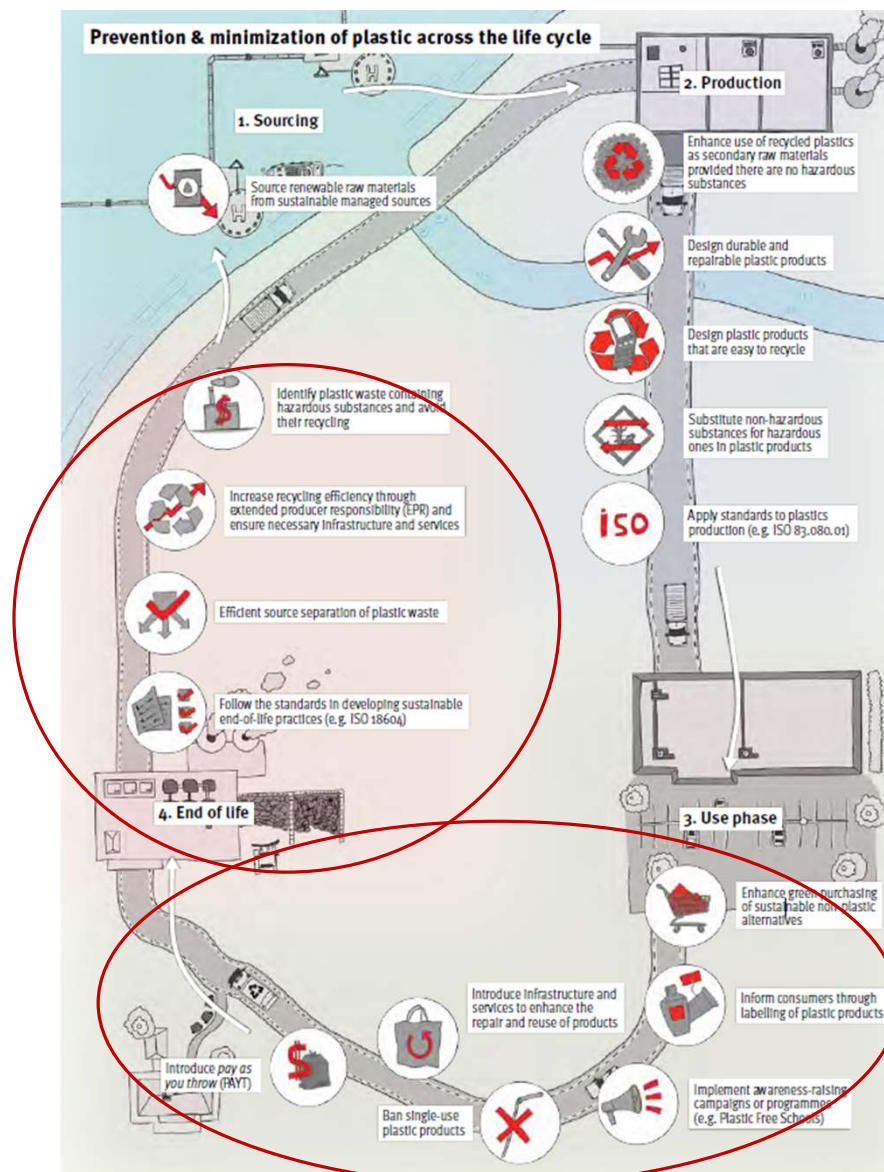
Prevention and minimization of plastic waste

- **Use phase**

- Green purchasing of sustainable non plastic alternatives
- Ban singles use
- Plastic free awareness raising campaigns
- Introduce infrastructures to repair and reuse

- **End of life**

- Efficient source separation
- Increase recycling efficiency through EPR and ensure necessary infrastructure and services
- Introduce Pay as you throw



Source: Drowning in plastic, UNEP, 2021

1. Avoid, re-use and reduce

The best plastic waste.... is the one never generated in the first place!



HOW?

- Single use plastic phase out policies
- Consumer education

Plastic reduction at source



BAGS

PRODUCT	HAPI
✗ Disposable lightweight or very lightweight plastic bags (e.g. 15 to 50 micron fruit and vegetable bags)	10
✗ Disposable biodegradable/compostable bags	7,02
Disposable thick plastic bags (>50) - composed of 50% recycled material	6,3
Disposable paper bags	5,85
Reusable and durable bags or baskets made of organic material (cotton, jute, hemp, palm)	3,19
<u>BYO policy</u> (bring your own bag)	0
Disposable bags eliminated	0



SNACKS

PRODUCT	HAPI
✗ Single-serve confectionery, chocolate, ice cream and other snacks in disposable plastic and/or foil wrappers	10
✗ Sweets, chocolate, ice cream and snacks in medium-sized disposable plastic and/or foil packaging	8,55
✗ Single servings of ice cream in disposable, plastic-lined tubs	6,75
Sweets, chocolates and snacks served in individual portions in disposable glass jars	5,85
Ice cream bought in bulk and served in an edible cone	5,85
✗ Sweets, chocolates and snacks in medium-sized, disposable paper bags	4,38
Sweets, chocolates, ice cream and snacks served in single portions from large packets	3,51
Ice cream bought in bulk and served in reusable containers	1,50
Sweets, chocolates and snacks bought in bulk (without plastic wrapping)	0



TAKEAWAY CONTAINERS

PRODUCT	HAPI
✗ Disposable takeaway food packaging (including expanded polystyrene)	10
✗ Disposable takeaway food packaging made of biodegradable/compostable materials (PLA, etc.)	7,02
✗ Disposable plastic-coated cardboard takeaway food packaging	6,75
Takeaway food packaging made of naturally biodegradable, disposable materials (wood, bamboo)	6,03
Pizza takeaway packaging made from cardboard	4,38
<u>Deposit and return system</u> for reusable packaging (<u>Bömerang system</u>)	3,51
<u>Own deposit and return system</u> with reusable packaging (e.g. metal). The score may vary depending on the material	3,01
<u>BYO policy</u> (bring your own container or tupperware)	0
Disposable take-away containers eliminated	0

MOST PREFERRED OPTIONS:

- Reusable bags, baskets and takeaway containers
 - Buying and selling in bulk
- Deposit and return system for reusable packaging



Restriction on single use plastic

Peraturan Bupati Jombang Nomor 56 Tahun 2022 tentang Pembatasan Penggunaan Plastik Sekali Pakai

PERATURAN BUPATI

Jenis Dokumen	Peraturan Bupati
Judul	Peraturan Bupati Jombang Nomor 56 Tahun 2022 tentang Pembatasan Penggunaan Plastik Sekali Pakai
Nomor	56
T.E.U	Jombang (Kabupaten)
Tahun	2022
Tempat Penetapan	Jombang
Tanggal Penetapan	13 September 2022

Jombang Regent Regulation Number 56 of 2022 concerning Restrictions on the Use of Single-Use Plastics

<https://jdih.jombangkab.go.id/dokumen/detail/peraturan-bupati-jombang-nomor-56-tahun-2022-tentang-pembatasan-penggunaan-plastik-sekali-pakai-230>

Efficient segregation and source separation



1. Infrastructure Development:
Adequate facilities for waste collection must be available.



2. Regular Collection Schedules: Waste must be collected regularly to prevent overflow and littering.



3. Specialized Waste Collection Vehicles:
These vehicles should be designed to navigate the often crowded and narrow streets of tourist areas.



4. Collaboration with Local Businesses:
Hotels, restaurants, and other businesses should be involved in waste management practices.

2. Recycle and recover

Three recovery options:

- **material recovery**, whereby plastic is reused to create new objects and serve new functions
i.e construction material
i.e asphalt-plastic road
i.e PET to PET
- **energy recovery (thermal recycling)**, whereby the energy contained in plastics is recovered
- **feedstock recovery (chemical recycling)**:
plastic to oil through liquefaction

Plastic collection and treatment flow

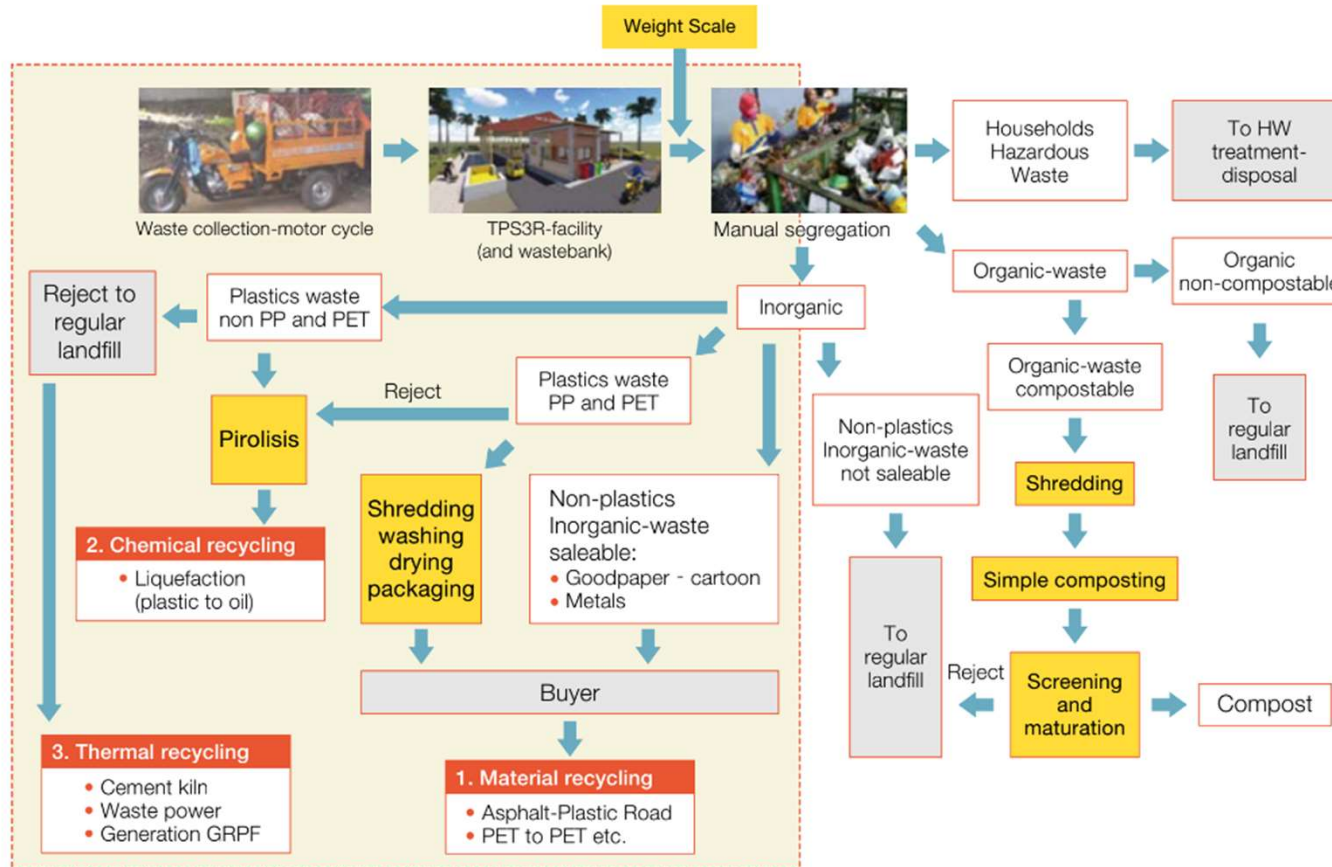


Fig. 23 Plastic collection and treatment flow

(Source: Originally from Prof. Dr. Ir. Enri Damanhuri, Department of Environmental Engineering, Faculty of Civil and Environmental Engineering, Institute of Technology Bandung, modified by Makoto Tsukiji)

Plastic prevention and recycling initiatives in Indonesia

RECYCLING AND RECOVERY:

- [Transforming rejected plastic into eco building material](#)
- [From The Shore To Success: Conplas' Journey In Transforming Waste And Empowering Communities | United Nations Development Programme \(Undp.Org\)](#)

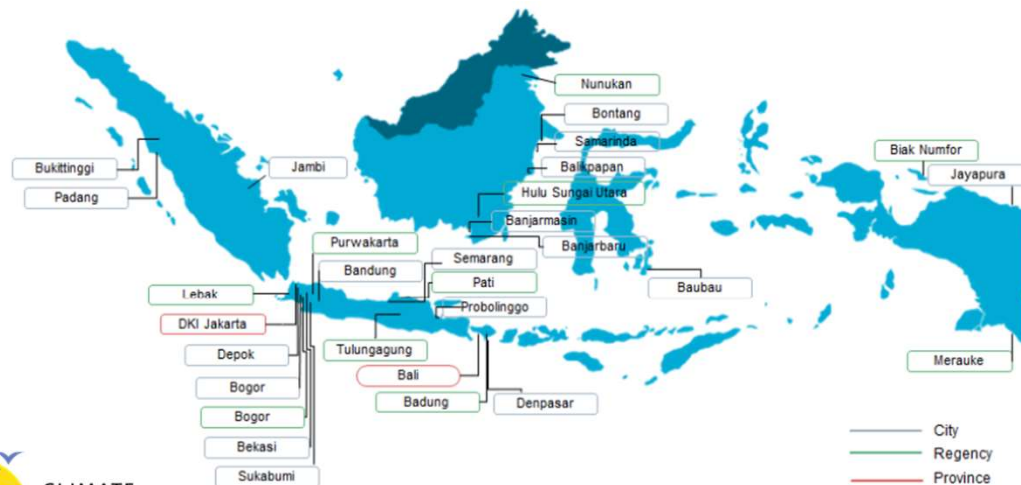


Figure 2 Regions in Indonesia with Plastic Bags Reduction Policy

REDUCTION:

After Banjarmasin City and Bali Province having policies regarding plastic bags reduction, other regions were triggered to take the same action. Until July 2020, there are 29 cities/regencies and 2 provinces that have plastic bags reduction policy, as shown in Figure 2.

Plastic smart cities framework

The Plastic Smart Guides were developed for cities as a step-by-step process to achieve their Plastic Smart targets by WWF

More information:

<https://plasticsmartcities.org/plastic-smart-cities-guides/>

