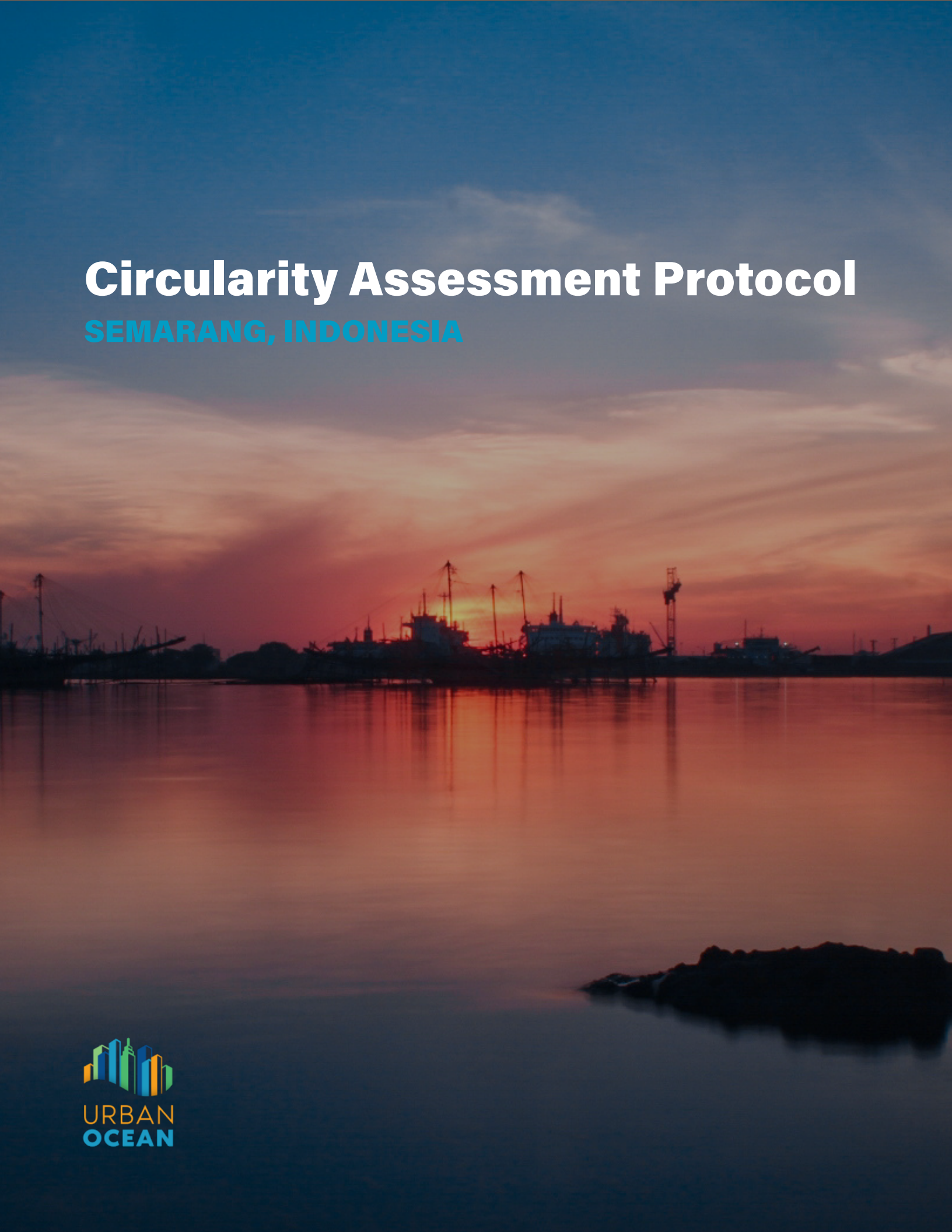
Circularity Assessment Protocol

SEMARANG, INDONESIA



URBAN OCEAN

Foreword

The Circularity Assessment Protocol (CAP) was born out an effort to define the concept of the circular economy in our cities and communities. While plastic pollution continues to be discussed at the highest levels of government and global organizations, cities and communities are the front lines. CAP is conducted where requested, where a city is engaged in the process. Local knowledge and expertise are the foundation of the information that the community uses, with additional data collected in partnership with CAP collaborators. Partners and teams build capacity through learning methods together. Open data collection is an important part of the process; leakage data contributes to a global open dataset. Trends across cities, countries and regions can illuminate global narratives.

Data is power to communities and enterprising individuals who are recognized for their role in materials management through CAP but are often marginalized in society. CAP data can catalyze economic development through business opportunities and subsequent interventions. The issue of plastic pollution is not for outsiders to solve in other locations, but for communities to address by collaboratively collecting data to lead themselves through the context-sensitive design of their own desired circular economy. Communities are empowered by local and global CAP data to inform their decisions about what is working, or where and how to intervene to increase circularity. Communities that participate in CAP can better define resource needs and participate in knowledge exchange.

Urban Ocean, a partnership of The Circulate Initiative, Resilient Cities Network and Ocean Conservancy, works with city leaders to bring new ideas, partners and resources together to solve interrelated problems around materials management, including addressing key priorities such as public health and economic development. A critical step in the Urban Ocean process is the Gap Assessment, which maps challenges, risks, and vulnerabilities within materials management systems and helps to develop a unique, integrated picture of the materials and circular economy related challenges and opportunities faced by each city. The CAP, developed in our Circularity Informatics Lab (CIL) at the University of Georgia, was chosen as the ideal tool to deploy as part of the Urban Ocean Gap Assessment.

The interconnected nature of complex urban systems and the value of circular economy in building resilient cities was starkly evident when the COVID-19 pandemic began just following the launch of the first Urban Ocean cohort. As a team, we immediately transitioned to online global work, with our local implementation partners becoming even deeper collaborators, conducting all field work with virtual training. This allowed for embedded ownership of the data at the local level and ultimately a powerful network of collaborators and supporters across learning cities to drive scientifically informed decision making. Local implementation partners have then continued to work with the Urban Ocean team through stakeholder workshops and into the proposal phase, as advocates for the science and key contributors in their own cities.

Urban Ocean and its partnerships provide an ideal platform to support resilient cities. CAP data can help guide interventions, create a baseline to measure success, and put essential data in the hands of the local community to drive change. We believe piecemeal solutions that are not contextually grounded are insufficient to create a systemic shift. Communities need to be involved, not just as stakeholders, but as the powerful change-makers they are.

— Jambeck Research Group, Circularity Informatics Lab, University of Georgia

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The Circularity Informatics Lab at the University of Georgia is committed to information sharing, data analytics, empowering communities, and systems change related to circular materials management.

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Athens, GA, April 2021

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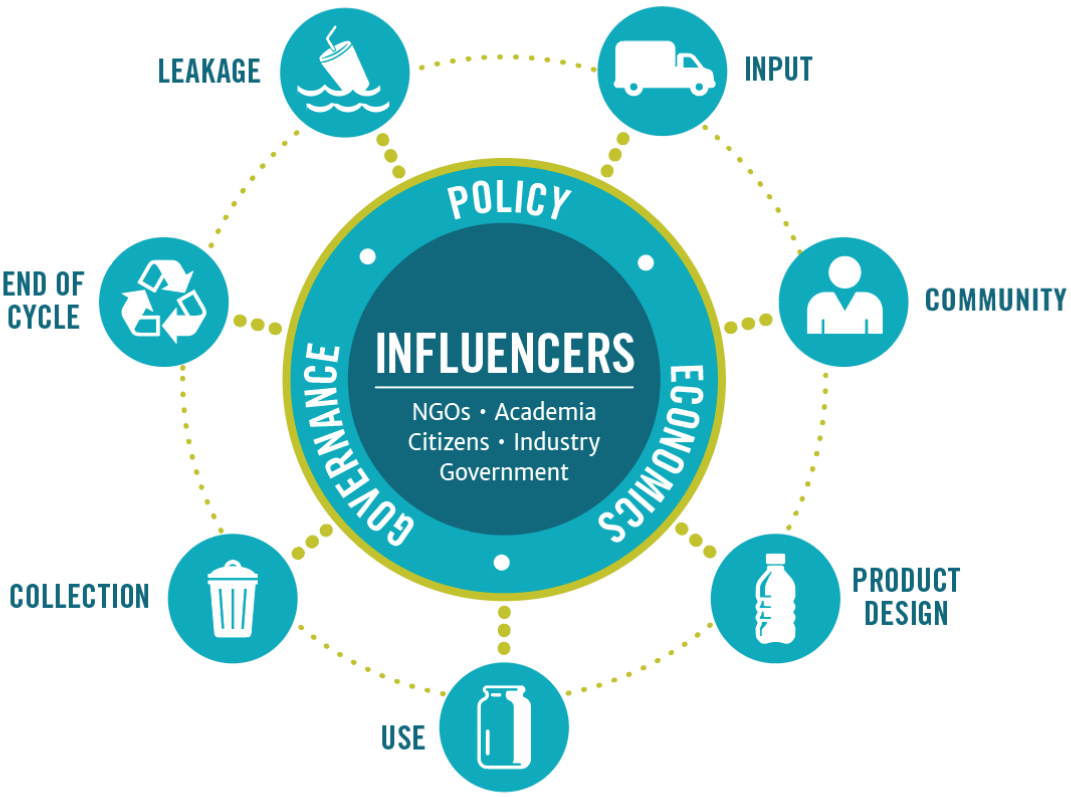
Executive Summary

Developed by the Circularity Informatics Lab (CIL) at the University of Georgia (UGA), the Circularity Assessment Protocol (CAP) is a standardized assessment diagnostic tool to inform decision-makers through collecting community-level data on plastic usage and management. Grounded in materials flow and systems thinking concepts, the CAP uses a hub-and-spoke model to holistically characterize how consumer plastic flows into a community, is consumed, and flows out, either through waste management systems or leakage into the environment. The model, shown below, consists of seven spokes: input, community, material and product design, use, collection, end of cycle, and leakage. At the center, the system is driven by policy, economics, and governance with key influencers including non-governmental organizations, industry, and government.



Between October and November 2020, a team from the Initiatives for Regional Development and Environmental Management (IRDEM) at Diponegoro University, with guidance and support from the Circularity Informatics Lab, conducted fieldwork in the city of Semarang, Indonesia. The CAP was conducted with support from the city's local

government, Resilience Officers, and the larger Urban Ocean team. Fieldwork included product and packaging assessments in stores across the city; key stakeholder interviews with government, industry, and non-profit organizations; material type characterizations for consumer plastic items; cost analysis of reusable products and alternatives to plastic available in the city; visual audits of recycling contamination; identification of public waste and recycling collection bins; and litter transects in three categories of population count (low, medium, high) based on Landscan 2019 data. Key findings from each spoke are summarized in the table below.

Urban Ocean Program

Urban Ocean is a three-way cooperative partnership among The Circulate Initiative (TCI), Ocean Conservancy (OC), and Resilient Cities Network (R-Cities) that works with city leaders to bring new ideas, partners, and resources together to solve interrelated problems around waste management. It aims to demonstrate how actions to improve waste management and recycling can provide holistic, resilient, and sustainable solutions that not only reduce ocean plastic pollution but also address key city priorities such as improving public health, promoting innovation, supporting economic development and job growth, and reducing greenhouse gas emissions through a capacity building and accelerator program for cities.

Semarang is one of six cities in the initial cohort of Urban Ocean learning cities. The CAP in Semarang, coupled with the upcoming Opportunity Assessment Tool, represents Stage 2 of the Urban Ocean Initiative which involves a comprehensive Gap Assessment to map challenges, risks and vulnerabilities within the cities' critical waste management systems. The data gathered from the CAP in Semarang will contribute to three workshops where stakeholders will discuss findings and develop proposal(s) for interventions that will then be brought to an Accelerator Summit for review and support, as showed by the timeline of the program below:

Get to know the partners:

Ocean Conservancy is working to protect the ocean from today's greatest global challenges. Together with our partners, we create science-based solutions for a healthy ocean and the wildlife and communities that depend on it. Since the formation of the International Coastal Cleanup in 1986, Ocean Conservancy has mobilized millions of volunteers to remove trash from beaches and waterways around the world while pioneering upstream solutions to the growing ocean plastics crisis. Ocean Conservancy invests in cutting-edge scientific research, implements on-the-ground projects, and works with conservationists, scientists, governments, the private sector and members of the public to change the plastics paradigm. To learn more about our Trash Free Seas® program visit oceanconservancy.org/trashfreeseas, and follow Ocean Conservancy on Facebook, Twitter and Instagram.

The Circulate Initiative is a non-profit organization committed to solving the ocean plastic pollution challenge by supporting the incubation of circular, inclusive and investible waste management and recycling systems in South and Southeast Asia. We achieve this by collaborating with key stakeholders across the sector, and by producing insights to support and accelerate investment and scale across the value chain.

The Resilient Cities Network consists of member cities and Chief Resilience Officers from the former 100 Resilient Cities — pioneered by The Rockefeller Foundation program, sharing a common lens for holistic urban resilience. The Resilient Cities Network in partnership with its global community continues to deliver urban resilience through knowledge sharing, collaboration, and creative action, seeking to inspire, foster and build holistic urban resilience around the world.

Key Findings and Opportunities

INPUT

Findings: 97% of manufacturers and 85% of parent companies for popular convenience store brands are domestic. Out of all convenience and grocery store samples, 89% of products were sold in plastic packaging and the remaining 11% were in paper packaging. Of the plastic packaged products, 69% were in multilayer plastic film, 16% were in PET packaging, 13% were in PP film packaging, and the remaining 2% were in combination film PP and HDPE packaging.

Opportunities

- The domestic proximity of both the manufacturing facilities and parent companies present an opportunity for local brands and manufacturers to discuss ways to maximize the circularity of packaging, distribution, and waste management in a decentralized circular system of materials flow and management.

COMMUNITY

Findings: There are mixed perceptions of plastic leakage and whether it is an issue among the community. People report the high influx of commuters to the city unknowingly can contribute to plastic leakage. Most people are supportive of additional interventions.

Opportunities

- Educate consumers and business owners, potentially through a public outreach campaign regarding reducing high leakage items, source segregation and using reusable bags.
- Explore the unique challenges that Semarang faces as a regional commerce and commuter hub, and how that daily transient population can also be targeted for awareness and education.
- Stronger enforcement and proper incentive schemes to support existing regulations.

PRODUCT DESIGN

Findings: The majority of product packaging in both stores and food vendors are plastic, largely made of material that is difficult to recycle, such as film/ multi-layer film plastic and PP utensils. While some stores offer paper bag alternatives, most offer single-layer film plastic bags. However, 20% of the products sampled from food vendors were made of biodegradable material such as paper or wood.

Opportunities

- Vendors using biodegradable material such as paper or wood could provide case studies for paper or wood as economical and viable alternatives for vendors.

USE

Findings: The majority of product packaging in both stores and food vendors are single-use. Those stores who do offer reusable cloth bags charge 3800 IDR extra on average compared to free plastic bags. No other evidence of significant reuse programs were found through interviews or observation.

Opportunities

- Reuse programs and/or bulk stores are a potential opportunity in Semarang as they do not exist at scale currently.

COLLECTION

Findings: Waste collection is reportedly fragmented, irregular and may not be evenly distributed across population areas, but a fee structure does exist to fund waste management. Village-level Waste Banks show promise in increasing the collection and capture of waste in the waste stream, however, their economic situation remains challenging. The informal sector plays a role in collection and processing of materials, particularly in contributing to recycling rates. Interviewees report a disconnect in communication and trust across the waste supply chain and uneven impacts of fluctuations in the market.

Opportunities

- The fact that transportation of waste is funded by a fee structure means that there is a mechanism to provide resources for waste management. But this does not appear equal for recycling, which requires community/citizen transport. It is unclear if the system of having neighborhoods transport waste is working effectively.
- Source separation is critical to enhance the value of recyclable materials, and composting of organic materials should be explored.
- Explore why the formal and informal sectors are "in competition" and if there could be more way to be inclusive or utilize the informal sector's networks and expertise to expand collection and management of materials.
- Expand the protection of health, safety, and the environment with current waste collection and management practices.

END OF CYCLE

Findings: While the waste composition is largely organic waste (~60%), plastic (17%) is higher than the global average. Waste generation and plastic waste generation rates are projected to increase. The landfill is beyond its lifespan. There is a desire to have more youth and innovation in this space.

Opportunities

- Investment is needed in infrastructure for waste collection, transportation, sorting and cleaning to optimize waste management operations in Semarang at all levels.
- The city can explore reducing plastic waste flow to the landfill.
- The waste industry could use an infusion of youth and technology to bring in more workers with a motivation to do this type of work. Interventions to explore include increased pay for workers, prices for materials, or hosting a competition to engage young adults in the issue to bring in fresh ideas.

LEAKAGE

Findings: Tobacco products and single-use plastic food packaging were the dominant litter items found in the city as a whole and within each population count area. Cigarettes, plastic food wrappers, and straws were among the top litter items found in each population count area.

Opportunities

- Circling back to recommendations from Input and Collection, the most problematic items found in litter surveys can inform future discussions on policy, government interventions, and public outreach campaigns.
- If there is a desire to measure impact from interventions targeting opportunities to reduce plastic leakage, conducting transects over time, and at later periods in time is recommended.

Strengths

- The domestic and local locations of both the manufacturing facilities and parent companies present an opportunity for Semarang to approach circularity at the local level.
- Regional and National regulations are in place to support waste management in Indonesia and in Semarang specifically.
- A fee structure is in place whereby household collection funds could potentially support waste management infrastructure needs.
- In terms of waste characterization, there is a relatively high quantity (by mass) of organic waste in the waste stream (60.8%) and the plastic percentage (17.2%) is greater than the global average, but relatively consistent with other places in the region.
- Waste Bank systems appear to be popular and successful in the city itself, but could use more support for growth.
- In the food vendor and restaurant industry, nearly 1/3 of the packaging was organic and biodegradable, which could be explored further and potentially expanded upon.
- Many modern markets have been able to make alternatives to single-use plastic carrier bags available to their customers and seem supportive of regulations around alternatives.
- While Waste to Energy infrastructure has been mandated at the national level to be implemented in Semarang, waste production currently exceeds the plant limit (Cardno 2019) and there is therefore an opportunity for new infrastructure and existing waste management industries to work together towards more upstream solutions in Semarang.

Glossary of Acronyms and Abbreviations

ASEAN – Association of Southeast Asian Nations
CAP – Circularity Assessment Protocol
CE – Circular Economy
CIL – Circularity Informatics Lab
HDPE – High Density Polyethylene
GDP – Gross Domestic Product
IRDEM – Initiatives for Regional Development and Environmental Management
IWC – Independent Waste Collector
LGU – Local Government Unit
LIP – Local Implementing Partner
MPs – Microplastics
MSW – Municipal Solid Waste
MSWM – Municipal Solid Waste Management
NMI – New Materials Institute
OC – Ocean Conservancy
OMSW – Ordinary Municipal Solid Waste
PE – Polyethylene
PET – Polyethylene terephthalate
PP – Polypropylene
PS – Polystyrene
RCities – Resilient Cities Network
SWM – Solid Waste Management
TCI – The Circulate Initiative
TPS – Temporary Landfill/Temporary Waste Collection Site
TPST – Integrates Waste Treatment
TPD – Tons Per Day
UDW – Urban Domestic Waste
UGA – University of Georgia
UPT – Unit Pelaksana Teknis (Technical Implementation or Organizational Unit)

Introduction

Indonesia is composed of archipelagos and includes over 17,000 islands and 81,000 km of coastline (United Nations 2017, World Economic Forum 2020). Indonesia is the fourth most populous country globally, with roughly 270 million people in 2020, half of which live in cities (World Bank 2020). Indonesia's economy is among the largest in Southeast Asia and is dominated by industry (46.4% of GDP in 2012), followed by services (38.6% of GDP) and agriculture (14.4% of GDP) (World Bank 2020).

Indonesia generates the highest quantity of total annual municipal solid waste among the Association of Southeast Asian Nations (ASEAN) countries at 64 million tonnes/year. It is the sixth highest MSW producer per capita among ASEAN countries at 0.70 kg/capita/day. However, this is still a tiny fraction of the per capita generation of waste in the US (2.72 kg/capita/day) (World Bank, Law, et al., 2020). One source of marine debris in Indonesia comes from inadequate solid waste management (SWM); it is estimated that 39% of Indonesia's total solid waste is collected (World Economic Forum 2020). According to a UNEP study in 2017, the majority (60%) of MSW in Indonesia is food/organic waste, followed by plastic at 14% and paper at 9% (UNEP 2017).

Semarang is the Central Java Province's capital city and has a population of over 1.8 million people, making it Indonesia's fifth largest city (World Atlas 2017). As one of the five Learning Cities in the initial Urban Ocean cohort, Semarang has characterized and understood its materials flow and waste management systems and identified associated opportunities for collaborative solutions. As a first step in the Urban Ocean process, UGA partnered with a local implementing partner (LIP) in Semarang — Initiatives for Regional Development and Environmental Management (IRDEM) at Diponegoro University — to conduct CAP in the city.

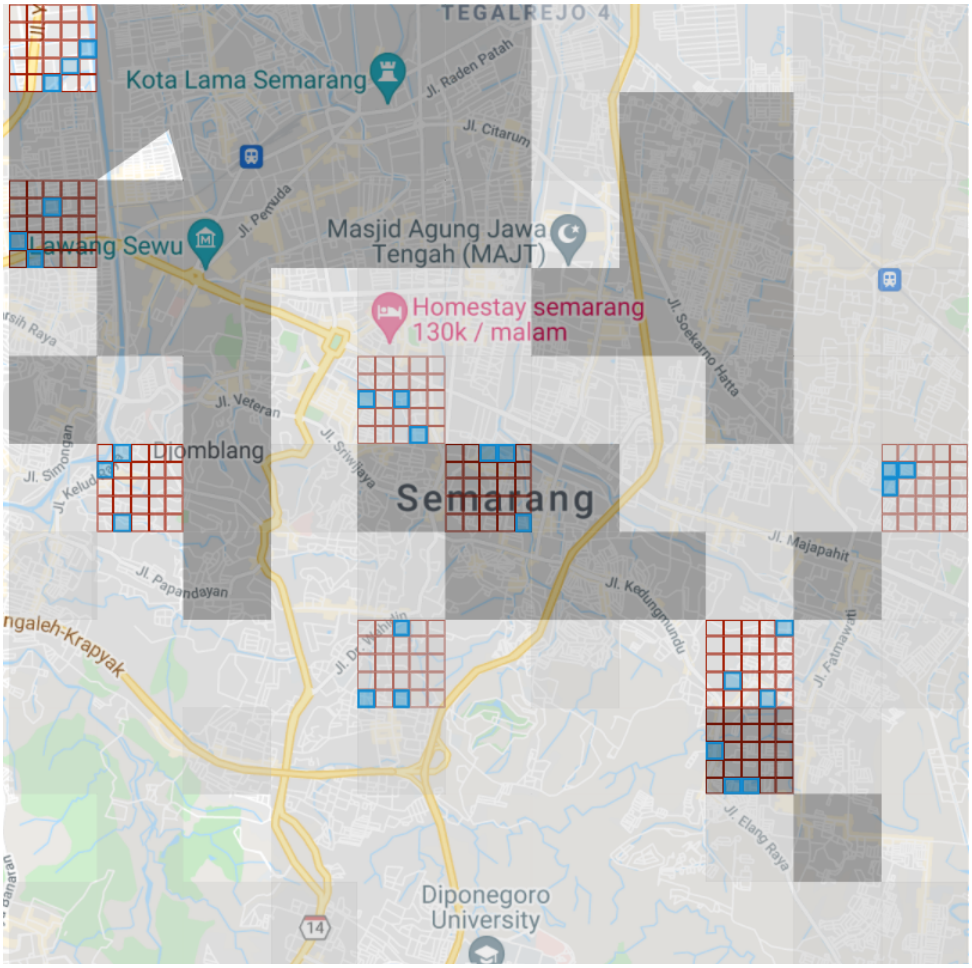
The CIL at the University of Georgia developed CAP in 2019, which is a standardized assessment protocol used to collect community-level data to inform decision-makers. The CAP characterizes seven community components:

1. **Inputs** — What products are sold in the community, and where do they originate?
2. **Community** — What conversations are happening, and what are the stakeholders' attitudes and perceptions?
3. **Product design** — What materials, formats, and innovations are found in products, particularly packaging?
4. **Use** — What are the community trends around the use and reuse of product types?
5. **Collection** — How much and what types of waste are generated? How much is collected, and what infrastructure exists?
6. **End-of-cycle** — How is waste disposed? What is the fate of waste once it is properly discarded? How is it treated?
7. **Leakage** — What waste ends up in the environment? How and why is it getting there?

Various influencing factors drive this system, including governance, economics, policy, and legislation (e.g., bans, taxes). Furthermore, multiple stakeholders exist at every level of the CAP, influencing the complex system, and these include the public, government, industry, NGOs, and academia. While the hub and spoke model illustrates the CAP, it is a complex system with components inherently interconnected and life-cycle impacts beyond each spoke. The CAP is a framework approach to the flow of materials, focusing on plastic and packaging, and the quantity and characterization of leakage from this sector will be characterized during litter assessments that can inform upstream interventions in the rest of the systems model. As of early 2021, CAP has been conducted in 26 cities in ten countries.

This report documents work conducted by the CIL at UGA and IRDEM at Diponegoro University as part of the Urban Ocean Initiative. Background information and a literature review were conducted in September 2020. Fieldwork was performed in October – November 2020. The Report is split into the following sections of the CAP, including results and discussion of each: Input, Community, Product Design, Use, Collection, End of Cycle and Leakage, followed by Recommendations to support the forthcoming System Studio workshop for Urban Ocean cohort cities. Opportunities for solutions and interventions are italicized throughout the report.

Figure 1: Map of the 10x10km sample area within the city of Semarang



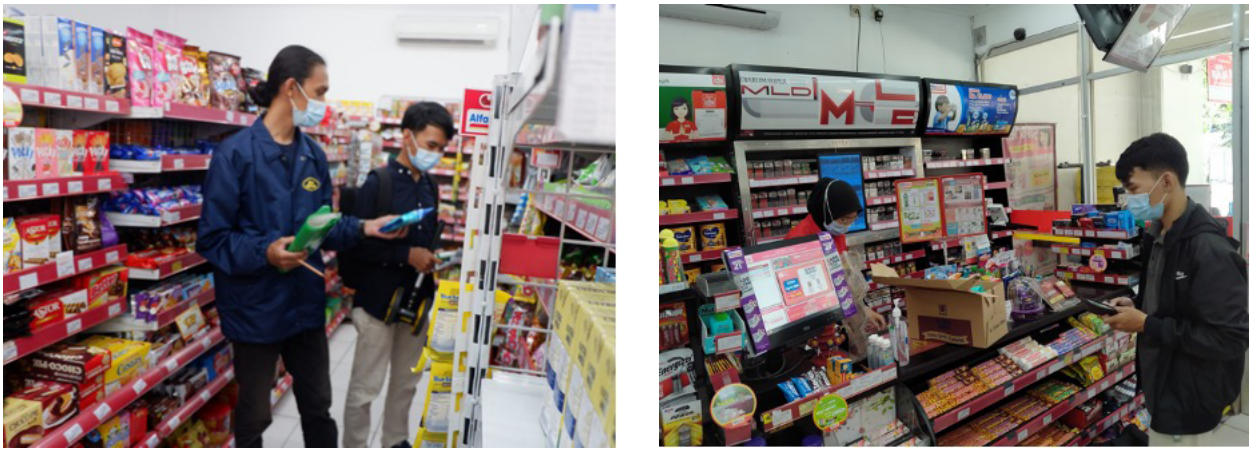
Population densities are shaded in gray. The 1km^2 sample areas for product data are shown in red and 200m^2 areas for litter transects are shown in blue.

CAP Results

Input

To get a snapshot of the characterization, scope, and source of common plastic packaged items that are entering Semarang, samples of common convenience items were sampled within nine 1km^2 transects in Semarang—three within each tertile of the population count. The LIP selected 3 convenience or grocery shops to sample within each 1km^2 transect area, totaling 27 shops. For each shop, the LIP collected the three most popular brands of candy, chips, drinks, wafers/biscuits, as well as the three most popular brands of tobacco products where possible. The "most popular brand" was determined as the most purchased brand based upon shelf space taken up and/or the shopkeeper's input. This yielded 252 product samples total, 82 of which were candy, 74 chips, 78 drinks, 11 tobacco products, and 7 wafer/biscuit products. The weight of both the plastic packaging and the product itself were measured for each item using a kitchen scale.

Figure 2: Photographs from LIP of shop surveys conducted in Semarang



(photo credit: IRDEM)

For each of the top products documented, the LIP noted the type of packaging (including polymer, if possible), the brand, and the parent comvpany. From there, the team was able to determine the manufacturing location, which was determined from manufacturing locations listed on product packaging or desktop research, as well as the headquarters location for the parent company of the brand (largely determined by desktop research).

Out of all the 252 samples collected from convenience and grocery stores, 89% of products were sold in plastic packaging, and the remaining 11% were in paper packaging (mostly cigarettes and candy, as well as seven drink items that were served in paper cups, that were likely lined with plastic). All 11 of the tobacco products were listed as having paper packaging, though they may have had plastic lining and the products themselves contained plastic in the filters. Of the plastic packaged products, 69% were in multilayer plastic film, 16% were in polyethylene terephthalate (PET) packaging, 13% were in polypropylene (PP) film packaging, and the remaining 2% were in combination film PP and high-density polyethylene (HDPE) packaging (warm sweets items). The packaging and material types are discussed further in the Product Design section.

All top product types except for candy had manufacturing facilities within an average of less than 1000km of Semarang, and the average distance for candy products was only around 1200km (Table 1). In total, tobacco products had the shortest average distances between the shops and the product manufacturing locations and parent company locations. Chip products had the highest average distance between the shop and the parent company, and candy products had the highest average distance between the shop and the manufacturing location.

Table 1: Most Popular Product Distances to Parent Company Headquarters and Manufacturing Facilities

	Distance Store to Parent Company (km)				Distance Store to Manufacturer (km)			
	Minimum	Maximum	Average	Median	Minimum	Maximum	Average	Median
Candy	85	32,423	5,431	474	127	32.423	1,271	443
Chips	2	38,864	16,437	484	2	6,148	386	346
Drinks	39	38,844	5,668	443	31	34,603	817	413
Tobacco Products	34	280	157	73	34	280	157	73
Wafers/Biscuits	331	38,848	11,392	479	246	480	367	332

Note: Distances were projected using an Azimuthal Equidistant projection. Values have been rounded to the nearest km.

Of the most popular convenience products sampled in Semarang, 97% of manufacturers and 85% of parent companies were located domestically (Figures 3, 4, and 5). Of the products sampled, only three had manufacturing locations outside of the SE Asia region — two candy product in multi-layer film and one drink product in a PET bottle, manufactured in Vietnam and the United States respectively. All the tobacco product companies had both their manufacturing plants and their parent companies located in East Java. The domestic and local locations of both the manufacturing facilities and parent companies present an opportunity for Semarang to approach circularity at the local level. With the ability

to create change together, local brands and manufacturers can discuss the circularity of packaging, distribution, and waste management, along with a decentralized circular system of materials flow and management.

Figure 3: Location of parent company headquarters of common brands of convenience products in Semarang

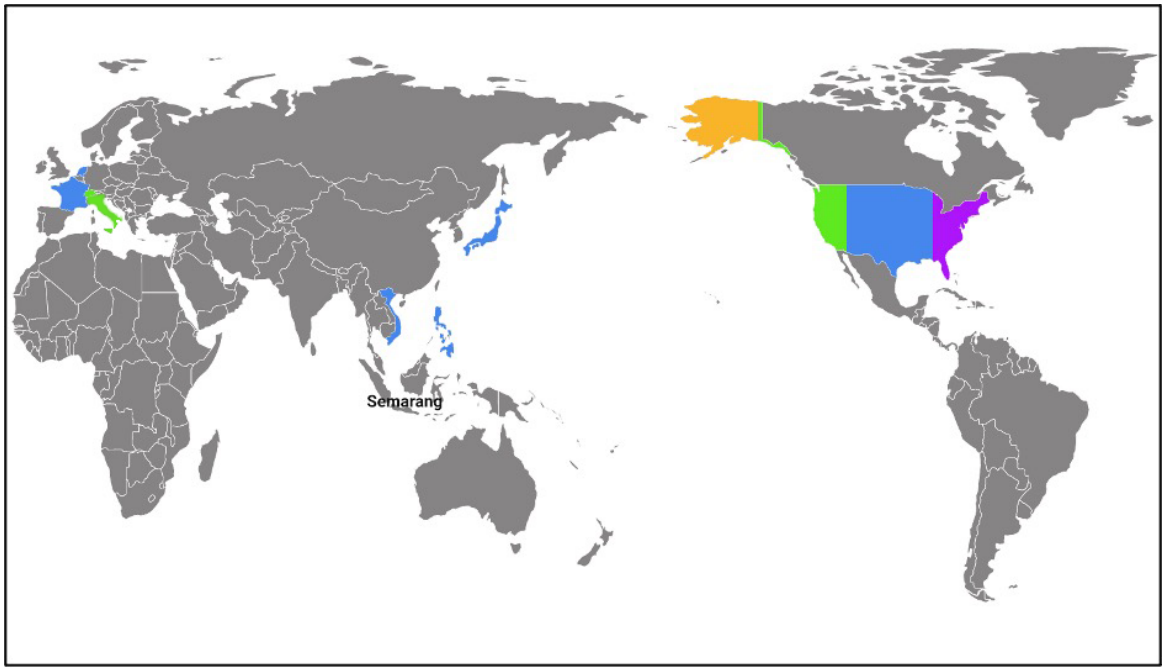


Figure 4: Location of manufacturing facilities of common brands of convenience products in Semarang

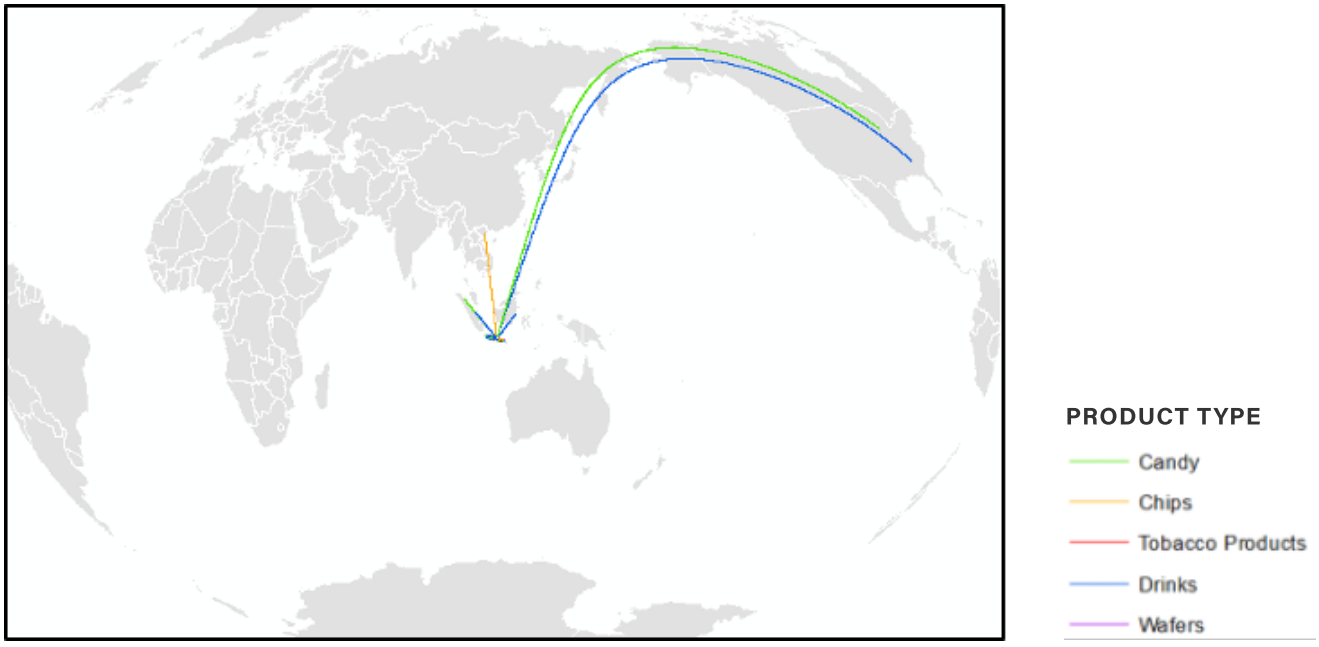
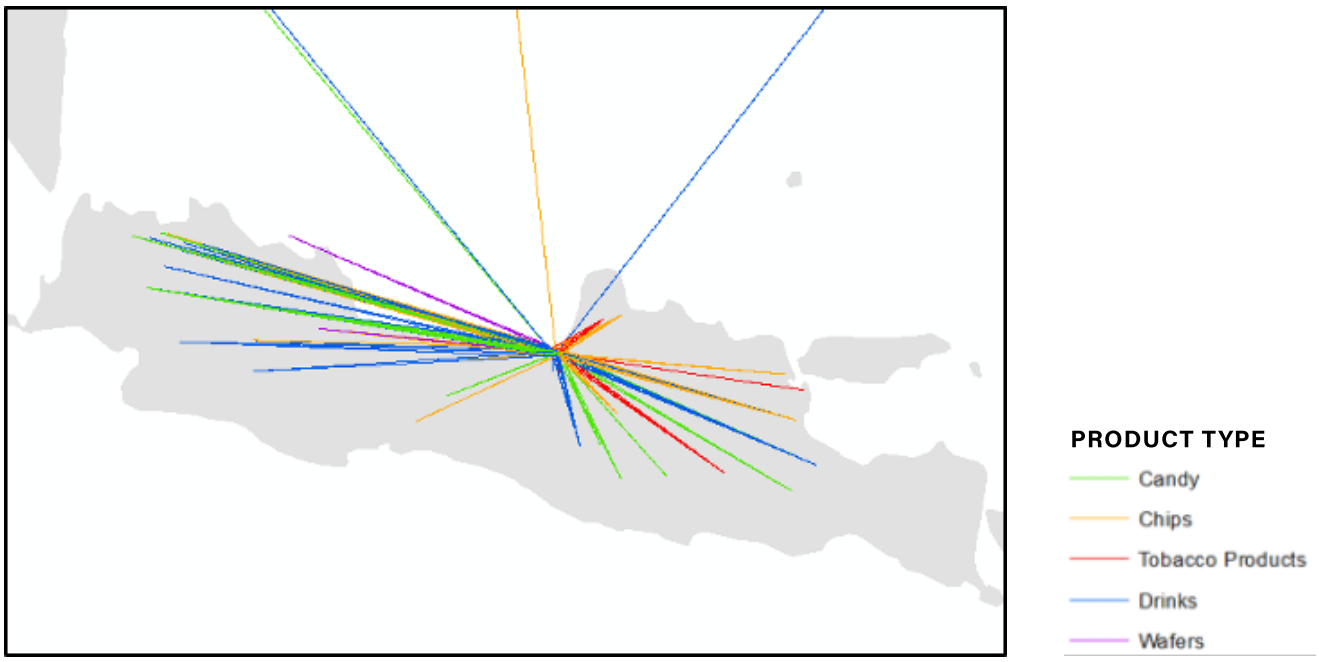


Figure 5: Location (in East Java only) of manufacturing facilities of common brands of convenience products in Semarang



Community

To understand current attitudes and perceptions of plastic waste, semi-structured interviews were conducted by the LIP with 25 key stakeholders (Table 2). Among those interviewed, four were food vendors, three were from local NGOs, three were from academia, three were grocery or convenience store staff, three were from local government, three were from private waste hauling, landfilling, or recycling companies, three were informal recycling aggregators, two were local hotel staff, and one was from a local plastic packaging products company (Table 2).

Table 2: Summary of stakeholder interview list

Stakeholder Group	Number of Interviews
Food Vendors	4
Local NGOs	3
Academia	3
Grocery or Convenience Store Staff	3
Local Government	3
Private Waste, Hauling, Landfill, or Recycling Companies	3
Informal Recycling Aggregators	3
Local Hotel Staff	2
Local Plastic Packaging Products Company	1

When asked about general perceptions and awareness around plastic waste, responses were mixed. Some said that plastic waste and plastic pollution was not an issue in their area, while others said that it was a major problem and that people's behavior was the biggest challenge. The stark contrast can be seen in the groups of quotes below:

Examples of interviewees that did not feel that plastic waste was an issue in Semarang:

> **"In terms of public awareness of waste, it's not bad here, not bad. Not like in other places. Some people care. Not too many people litter."**
>
> **— Local Business Owner**

> **"Plastic waste doesn't have a direct impact on the environment...There are no such [plastic waste] problems in my neighborhood."**
>
> **— Private Waste Company Manager**

> **"Plastic pollution is not yet [an issue in the neighborhood], perhaps. Because people feel, It's fine." Not yet. Because we can throw plastic waste to TPS, right? ... There's people who take care of [the waste]. As long as there are people**

> **who take it to TPS, we're not affected yet, maybe. Except for people who live in areas affected with piles of plastic waste, maybe it's an issue for them."**
>
> **— Private Waste Company Manager**

Examples of interviewees that did feel that plastic waste was an issue in Semarang:

> **"Yes, [plastic waste] becomes a problem. Because of this, we have educated the people in my neighborhood. But it needs time. I often still see in the gutter, after it rains, a lot of garbage is still dumped in the gutter."**
>
> **— Private Waste Company Manager**

> **"[Plastic waste] has [become a problem within the community]. Because there are piles of them. So, a street sweeper will find so many plastic wastes every morning, because many street users — Even if they dump their waste properly."**
>
> **— Academia Member**

Another theme that emerged from the interview process was the challenge of behavior change in Semarang. In general, there seems to be a lack of clarity around who is responsible for educating the public and consumers about waste management and plastic pollution. A great deal of onus is put on individual consumer-level choices, and yet it seems that past attempts at public education have not been at the level needed or have not been successful within Semarang. Public education to date has largely been conducted by NGOs and the local environmental agency. Several interviewees talked about the importance of education. However, they noted that many individual consumers are still not aware of the alternatives available to them or the impacts of their habits and choices they are making within their hometown.

> **"What is needed is educating the public. We have spoken about modern markets. It will be different for traditional markets. In traditional markets, in convenient stores, sellers still use plastics. Education is needed not only for the sellers but for the buyers as well."**
>
> **— Academia Member**

> **"Whereas if our people go abroad, they are orderly [about properly disposing waste]. Once back in Indonesia, they are disobedient; they're arbitrary… The reinforcement and awareness have not yet [happened]… But it's about habit."**
>
> **— Local Government Worker**

It was also expressed that behavior change is a lengthy process, and that often the development of infrastructure precedes the necessary behavior change to make it useful. That time gap can be stressful for stakeholders involved. It seems that one of the main barriers to behavior change is the inconvenience of alternatives, or the impression of

giving up convenience items, particularly in the traditional markets in Semarang. This was expressed in several interviews, including the following statements referencing the use of plastic bags instead of alternatives in local markets:

> **"It's different at traditional markets; however, there's a Javanese term tepo seliro. So, 'I won't make it difficult for her.' Such things prevent good habits from developing; what should be successful becomes unsuccessful. We could have actually reduced plastic wastes from there."**
>
> **— Academia Member**

> **"When it's possible, I advise them not to use plastic bags. But still… Many of them are ignorant, and when they buy something here, they will grumble."**
>
> **— Grocery Store Owner**

The theme of convenience was also brought up among interviewees when stressing the importance of regulations instead of suggestions for reducing plastic use among consumers. Several interviewees noted that there were regulations in place, such as the Regional Regulation on plastic bag use passed by the Semarang City Council in 2019. Still, ultimately it seems that people feel they are not implemented or are not enforced. Several also noted that there are no sanctions associated with the regulations, so interviewees referred to them several times as "recommendations" or "encouragements" instead of rules, stressing again the importance of individual consumer awareness and choices.

> **"Awareness level, it's getting better. It's there, but whether it's effective or not, what can I say?… It's a suggestion, encouragement. Sometimes something can only be effective when there are sanctions…Encouragements are not effective… Previously, when we had meetings, we always encouraged people, we reminded them to reduce plastic use. Always. But people still did whatever was easier, whatever was more practical."**
>
> **— Private Waste Company Manager**

> **"The regulation [for the proper disposal of waste] exists, but it's not executed."**
>
> **— Local Government Worker**

> **"I have implemented it [governmental plastic waste reduction strategy] here. But some people refused because this is a small store. Some of the customers don't bring their own bags. I actually have-- Some of them bring their own bag, and some don't."**
>
> **— Grocery Store Owner**

Interestingly, several grocery store owners, food vendors, and hotel workers said that they would support something like a plastic bag ban or a stronger regulation against plastic items. Some expressions of support can be seen in the quotations below:

> **"I will [support a plastic bag ban]... Because then we can reduce plastic waste. Especially when people buy rice. 5 kgs pack of rice needs two plastic bags, otherwise it won't hold. So, yes, I agree."**
>
> **— Grocery Store Owner**

> **"I would agree to [a plastic bag ban]...So that we don't have to spend any money for plastics. We spend much for plastics...We have to purchase plenty of them. We can't buy one piece by one piece."**
>
> **— Food Vendor**

From the stakeholder interviews, we discover some potential plastic pollution production inhibitors as well as barriers to effective waste management in Semarang. Habits are reported to drive individual choices around waste management practices, and there seem to be overwhelming obstacles, barriers, and inconvenience when it comes to change relating to the current system. The repercussions for not following or implementing local regulations do not seem to outweigh the convenience that comes with the use of standard plastic items that consumers have become used to. There are, however, clear ideas from the community on ways to improve going forward, and the general trends of awareness and waste management seem to be going in a positive direction.

Product Design

To characterize material types used in common consumer plastics, samples of common convenience and to-go items were obtained as described in the Input section. The average weight of both the packaging and the product itself were collected for all 252 samples (Table 3). Drink products, on average, had the highest packaging and product weight.

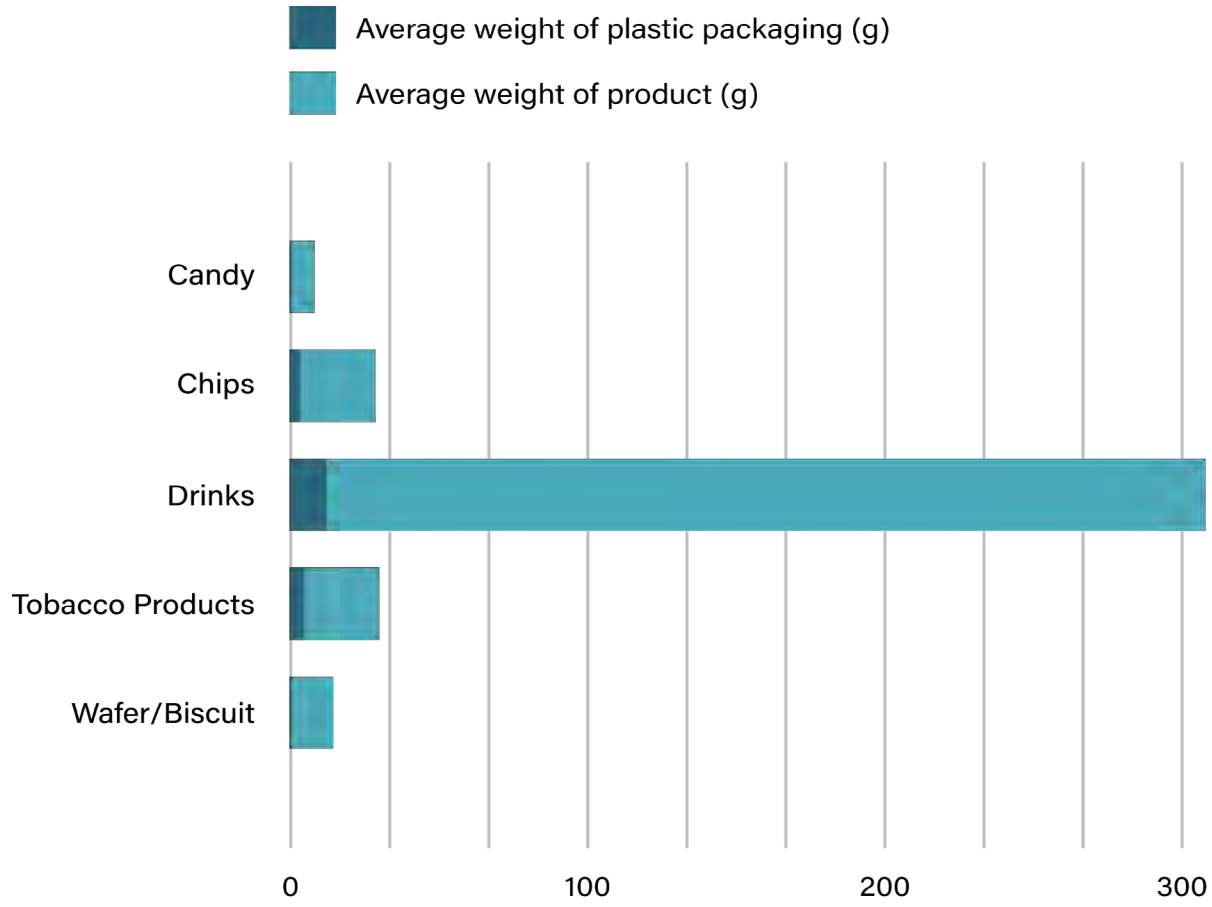
Table 3: Average weight of products and their plastic packaging for common convenience items.

Product Type	Number of Samples	Average Weight of Plastic Packaging (g)	Average Quantity of Product (g)
Candy	82	0.76	7.44
Chips	74	3.32	24.46
Drinks	78	12.04	298.31
Tobacco Products	11	5.18	25.54
Wafers / Biscuits	7	0.70	14.42

Chip and wafer products were exclusively packaged in multilayer plastic film. The vast majority of candy products were also packaged in multilayer plastic film, though a small percentage were packaged in polypropylene (PP), high density polyethylene (HDPE), or paper. Around 50% of drink products were packaged in polyethylene terephthalate (PET), about 30% in PP cups and smaller percentages were packaged in paper, multilayer film, or kaleng (tin can). All of the tobacco products were packaged in paper containers, though they may have contained plastic lining.

Packaging weight for convenience items was also compared to product weight (Figure 6). While each product type had a small ratio of packaging to the product weight (most less than 10% the product's weight), it was found that drink products had the smallest ratio at 4% on average.

Figure 6: Convenience Store product to plastic ratios



This information demonstrates that on average, the convenience product itself outweighs the packaging that it is contained within. Light packaging is often considered good for the transport and distribution of goods, but light-weight packaging tends to be low in value in the recycling supply chain, difficult to capture and contain in the waste stream, and can contain multiple different types of polymers (e.g., multi-layer film). Drinks held the highest product weight, so even though the packaging was the smallest percentage of total mass, the drink packaging weighed over 3.5 times more than the next heaviest packaging. PET bottles are often valuable in the recycle stream as well.

FIGURE 7: PHOTOGRAPHS FROM LIP OF FOOD VENDOR SURVEYS CONDUCTED IN SEMARANG

(photo credit: IRDEM)

Within each of the selected nine 1km^2 transects in Semarang, the LIP also visited 3 randomly selected food vendors or to-go restaurants to sample the food packaging and utensil types that were being distributed, totaling 27 vendors sampled. The LIP collected 110 to-go items from those vendors and documented their weight, material type, and brand, where possible (Table 4).

Figure 8: Material breakdown of the top convenience items

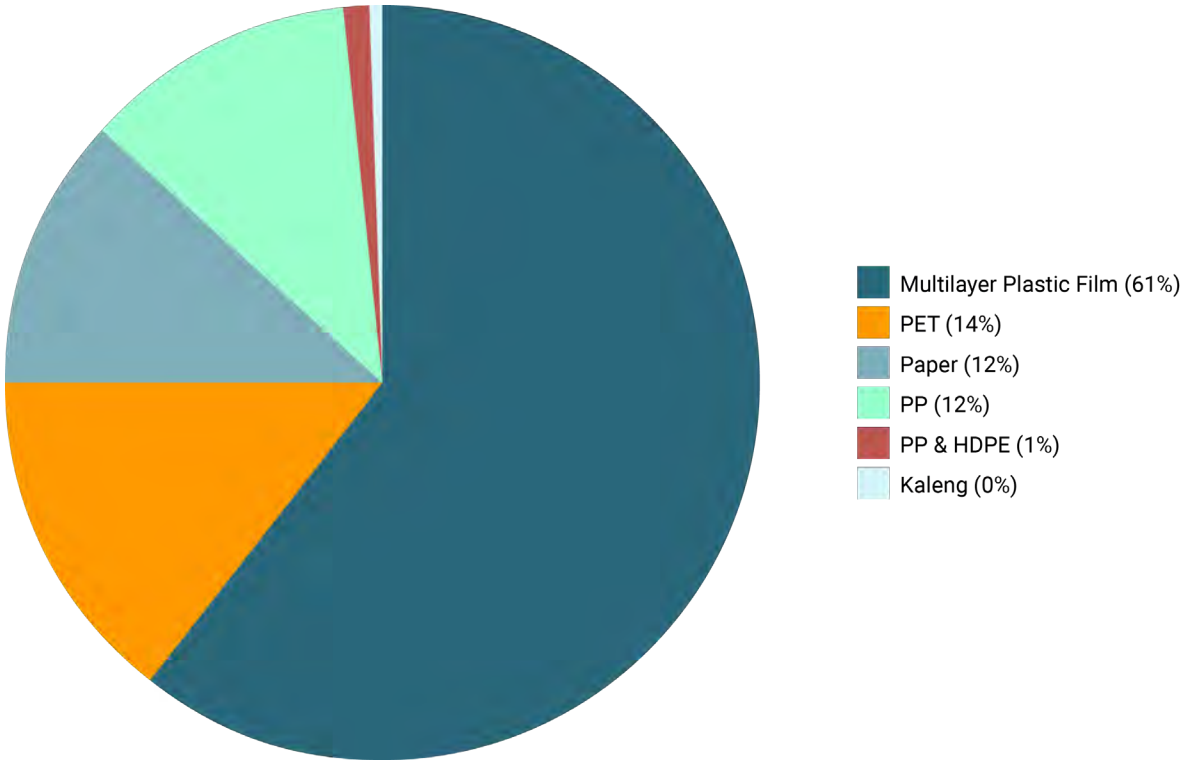
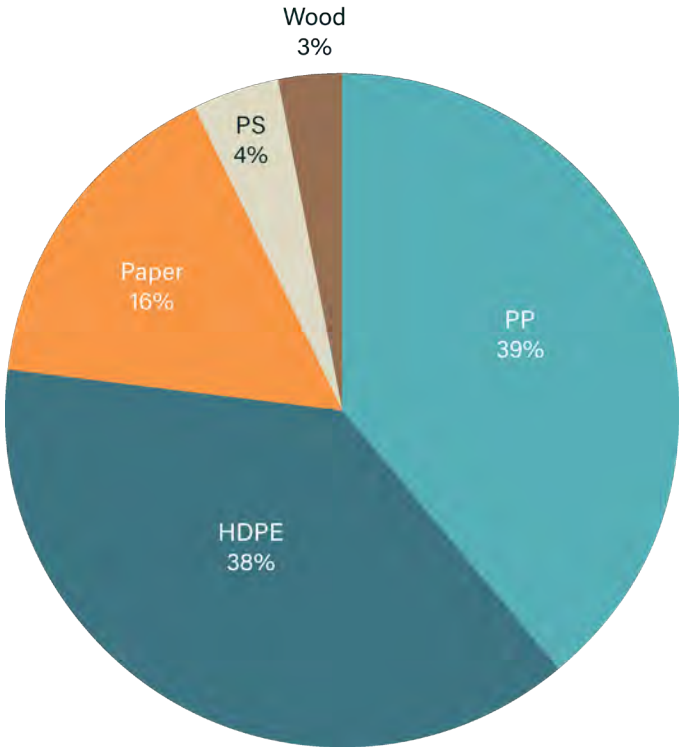


Table 4: Average weight of common plastic packaging and to-go items from food vendors

Material Type	Number of Samples	Average Weight of Plastic Packaging (g)
Clear plastic wrapping film (PP)	18	0.8
Mica plastic to-go containers (PP)	3	4
Plastic drink (single layer film, likely PP)	1	0.8
Plastic grocery bag (single layer film, likely HDPE)	25	2.28
Plastic spoon (HDPE)	17	2
Plastic straw (PP)	19	0.5
Skewer (wood)	3	1
Expanded polystyrene container (PS)	4	10
To-go cup (PP)	2	5
Wrapping paper (paper)	16	3
Wrapping paper (newspaper)	2	3

Nearly half of the to-go products were made of PP, a less expensive and lower value polymer for recycling. The polymer type was largely identified on the label of the product itself, otherwise it was deduced by the LIP. The second most commonly found polymer was HDPE, which can often be recycled if it is rigid, but also depends on the form, and is not as readily recycled as PET. Given that most of the HDPE products were single-layer films and not rigid plastics, they are less likely to be collected and recycled. Many vendors distributed single-layer film items such as shopping bags and drink packets, which are difficult to collect and capture for recycling. Around 20% of the products sampled from vendors were made of biodegradable material such as paper or wood, which seems like a relatively high amount in comparison with other communities where this is often minimal.

Figure 9: Material breakdown of the to-go items sampled



Use

Among the 27 convenience and grocery stores sampled in Semarang, five (18.5%) offered bags that were an alternative material to plastic, either cloth or paper. The paper bags were no additional cost to consumers in these stores—though the LIP noted that they can cost between 1000-2000 IDR for the store owner. One of the stores used paper at their main type of bag. Cloth bags were available to consumers at an average additional cost of 3800 IDR (Table 5).

Table 5: Cost of alternatives of plastic in convenience stores.

Product Type	Alternative Material Type	Average Cost of Alternative to Consumer	Cost of Traditional Plastic to Consumer
Plastic Grocery Bag	Cardboard (paper)	1500 IDR	No Cost
Plastic Grocery Bag	Cloth bag	3800 IDR (n=5)	No Cost

From the stakeholder interview process, it was noted that in the past, women used to bring "tiffin carriers" or "dunak" made from bamboo as reusable containers and bags to carry their items in from the store. However, due to low cost

and high convenience, many have switched to using plastic bags. Several interviewees also noted that many people didn't seem to be making the transition towards plastic alternatives on the individual level. More education was needed on what alternatives were available to people.

> **"In my place, most [residents] haven't yet [made the move toward plastic alternatives]. Even for education about the use of plastic waste, we really need time to educate residents about reducing plastic waste for the environment."**

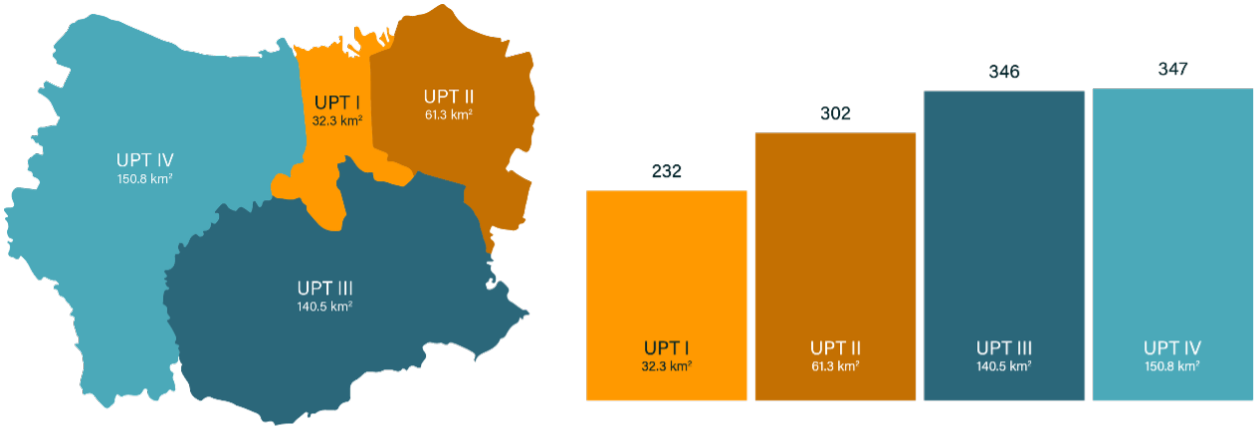
It was noted several times in the stakeholder interview process that changes are being made incrementally. Many shop-owners and business owners are extremely open to alternatives, regulation, and other interventions. Still, the general theme was that the proper incentives are not in place for consumers to make a change, and plastic is the 'default' option in most cases. It was also quoted several times that residents in Semarang sometimes forget certain policies are encouraged (e.g., Regional Regulation passed in 2019 regarding the use of plastic in mini-marts in Semarang) available alternatives, and other options to avoid producing plastic waste.

Prior to 2019, plastic bags were still available in Semarang markets and consumers were charged 200 IDR per plastic bag at the national level. In 2019, the Regional Decree 27/2017 was passed, which prohibited the use of plastic for restaurant, hotel, and modern market uses (e.g., bags, straws, to-go containers, etc). While implementation is not fully realized, the passing of the regulation has resulted in many modern markets now selling fabric bags to consumers as a reusable replacement for plastic bags. The fabric bags available as alternatives in Semarang come in three sizes, and the cost depends on the size. The smaller bags range from 1500-2000 IDR, the medium bags range from 3500-5000 IDR, and the large ones range from 10,000-15,000 IDR. Paper bags are also available in some places, which typically cost 1000-2000 IDR. It was noted that some people do bring their own bags to the markets, but not the majority of consumers. It was also noted that there is a difference with Traditional Markets in Semarang, where plastic bags and packaging are still being used and distributed by vendors (Bintang Septiarani, IRDEM).

Collection

A study from 2018 estimated that Semarang had a waste collection rate of 61%. Waste separation is typically not performed in Semarang at the household level. It's been noted that those who do not have access to collection services often turn to burning or dumping their waste in the surrounding environment (Andarani et al., 2018). The Office of Environmental Management handles waste transportation in Semarang. There is a formal collection by garbage collectors, local neighborhood associations oversee temporary waste collection points (TPS) and final disposal sites (TPA). There are four Technical Implementation Units (UPTs) that represent the administrative boundaries for waste management in the city of Semarang. Their respective areas and relative amounts of waste generation are show in Figure 9 below.

Figure 10: UPT Area Coverage and Waste Generation (tpd) in Semarang



(Cardno 2019)

The payment structure for Waste Management and the respective responsible agencies in Semarang, based on information provided by RCN, is as follows:

Table 6: Payment Structure for Waste Management in Semarang (RCN)

Waste Transport	What	How	Payment
From household to temporary transfer station (TPS)	Self-organized by household/ community	Usually organized at community (RT/Rukun Tetangga) level or neighbourhood level (RW/Rukun warga) Each RT or RW will hire minitruck/pedicab driver to collect their household waste and deliver to TPS (Transfer station) 1 RT= around 20-40 households 1RW = around 150-400 households	RT/RW or community group will collect and manage the fee
From transfer station to final landfill	By the city government, the DLH (Environmental Agency)	DLH operates trucks to final landfill; waste stay in the temporary landfill for a day	Retribution fee included in the PDAM/water bill. For those household without water connection, payment collected via RT/RW head.

However, because the city lacks the necessary collection, transport, and sorting infrastructure, a large amount of SWM is handled by the informal sector or by local partnerships such as Bank Sampah, which occur at the village level (Andarani et al., 2018). As of 2019, there were a recorded 77 Waste Banks in the city of Semarang (Cardno 2019). Despite the collecting and sorting that the informal sector does, it is estimated that only 23.59% (53.54 metric tons) of plastic produced by households in Semarang were recycled (Andarani et al., 2018).

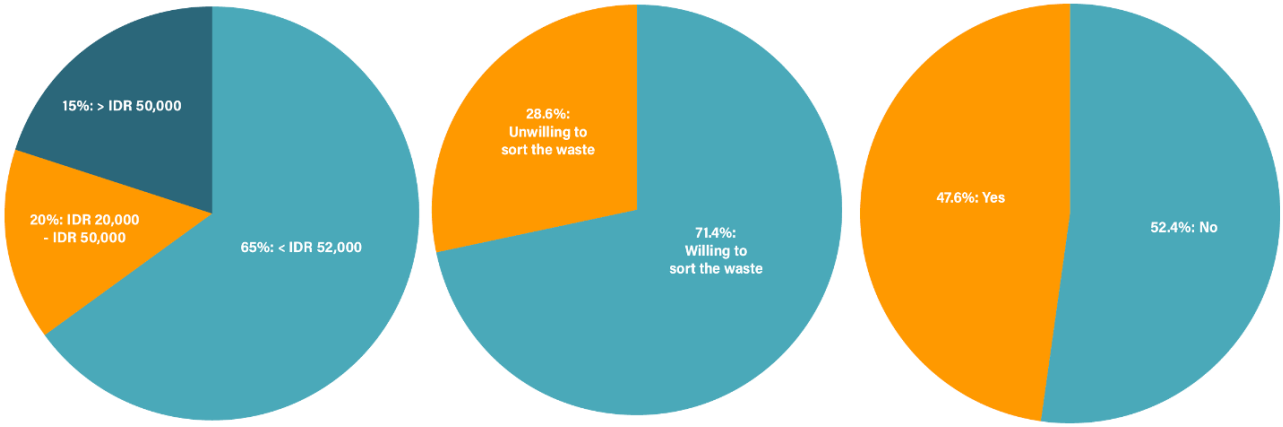
Environmental Agency staff, through the interview process, characterized the collection process as follows:

> **"Technically, there are two processes for waste collection and waste management. Waste transport directly from its source by garbage rickshaw or Tossa motorcycles is the responsibility of individual citizens, community associations or KSM, Kelompok Swadaya Masyarakat, non-governmental organizations. Waste transport from garbage dumps to landfills is handled by the government … Waste collection and waste temporary storage are the responsibility of waste producers…Neighborhood Associations and Community Associations [are responsible for that].**

> **"Transporting waste from garbage dumps to landfills is the responsibility of the City Council, and it is handled by the Office of Environmental Management. The budget comes from the citizens themselves, which is the fee that is included in water bills. It's for those who use the PDAM service. For those who don't use PDAM service, the fee is collected at community level."**

Several times in the stakeholder interviews it was noted that, with the development of the Waste Banks, the informal waste sector or "scavengers" comprise an increasingly smaller percentage of waste collection in Semarang. Many waste businesses interviewed do not work with informal waste collectors — one company noted that they are considered 'competition' in the waste collecting and selling space — and noted that both informal waste collectors and city garbage collectors typically bring their waste directly to Waste Banks now. The fact that transportation of waste is associated with a fee structure (similar to water) means that there is a mechanism to provide resources for waste management. It is our understanding It is unclear if these resources are enough to operate these systems as desired or intended.

Figure 11: Diagrams showing the waste management costs to the citizens of Semarang per month (left), the willingness of Semarang citizens to sort waste at the household level (middle), and the willingness of Semarang citizens to provide a place for waste sorting (right).



(Cardno 2019)

From the waste bin mapping process as part of CAP, there appear to be very few public recycling bins within the city, and dump sites appear to largely be within the lowest population count areas (Figure 11). This may suggest that the access to formalized waste management is not distributed equally among densely populated urban areas and less populated areas of the city. This is a common issue related to waste management globally, urban areas typically have more infrastructure than rural areas because of population density. It is also typical to have dumpsites or landfills where there are fewer people (less of a nuisance to a larger number of people), although this can also mean that people with less power end up living near a dumpsite or landfill.

Figure 12: Locations of public waste bins, recycling bins, dumpsites, and ash piles from CAP transects in Semarang.

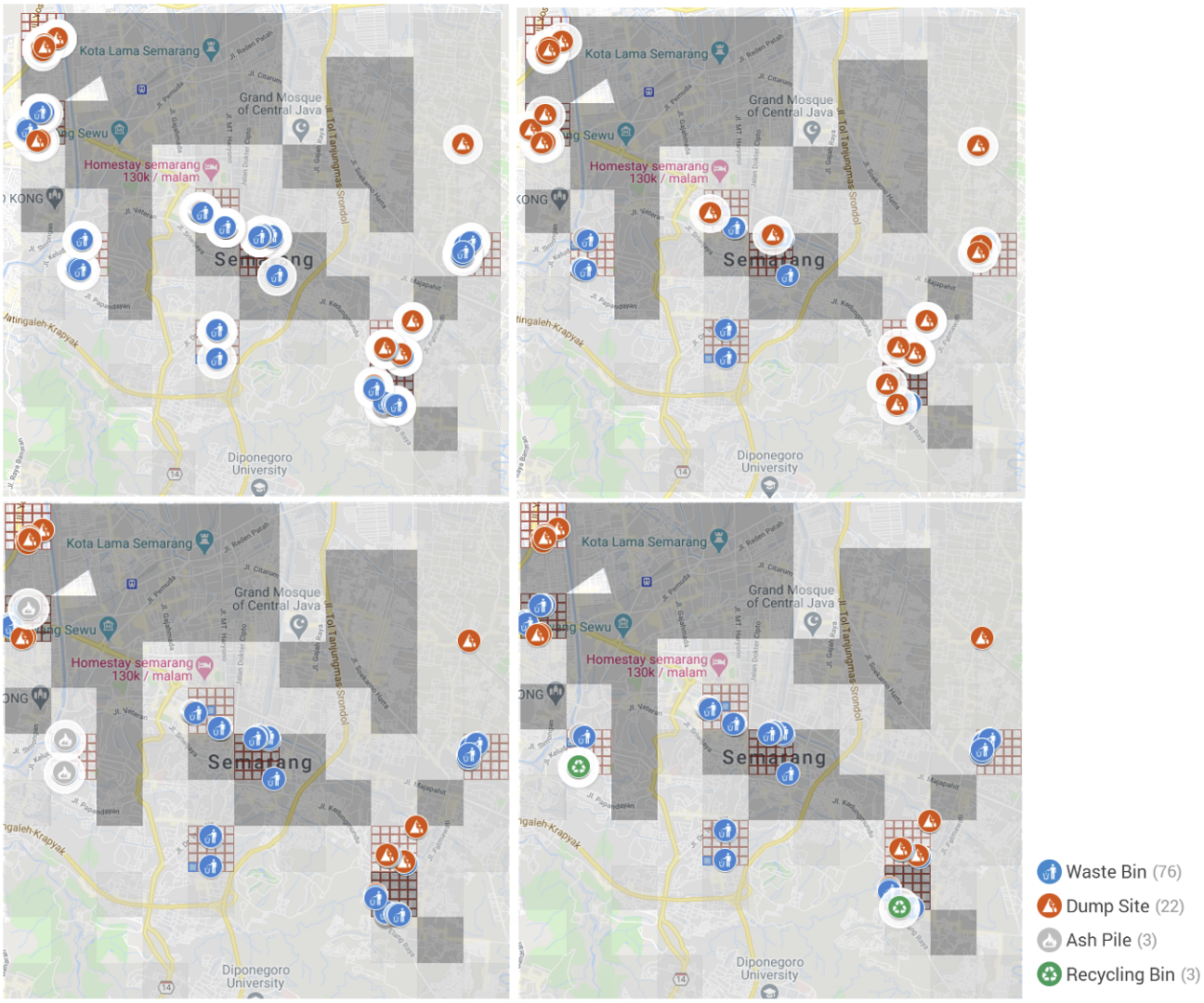


Figure 13: Photos taken by LIP of public waste bins in Semarang

(photo credit: IRDEM)

Through the interview process, it became clear that there are major disconnects between the waste supply chain in Semarang, for example between consumers, waste collectors, and Waste Bank owners. One issue that was repeatedly cited was the volatility of plastic waste prices and how the impact of that fluctuation is not felt evenly across the supply chain. One Waste Bank owner described the following:

> **"...sometimes when the price drops, we can't buy the materials. Like, price drops but garbage collectors refuse to lower their price, then we can't buy their waste."**
>
> **— Private Waste Company Owner**

In terms of waste storage, it was also noted in the interview process that there is insufficient space in Semarang for waste that is bound for landfill and that the city's main landfill is aging. Particularly considering that the majority of waste that is produced in Semarang is organic, and therefore typically destined to end up at the sanitary landfill, this could provide a problem of scale as waste generation rates increase into the culture. One professor explained the following:

> **"Jatibarang Landfill site started operating in '93. With 30 hectares area, it should have**

been filled up by mid-2000; it should have been closed ... By operational lifetime, however, it should have been closed. Semarang has no more space though."

— Academia Member

The impact of the COVID-19 pandemic on both the price and quality of recyclable plastic was also mentioned several times in interviews, both from Plastic Recycling Managers and Waste Collectors alike:

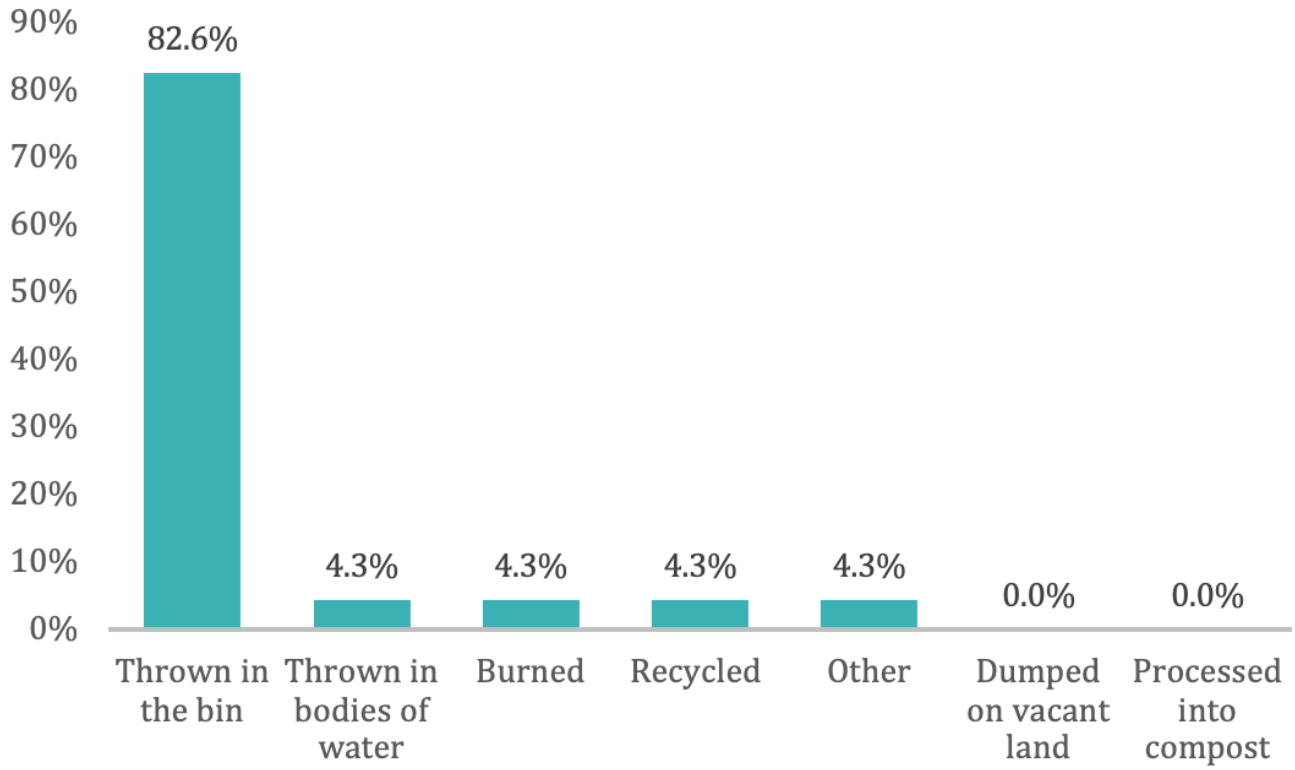
"In the past, before 'Corona', the available plastic reached 12 thousand, now only eight thousand."

— Recycling Company Manager

"During [the] coronavirus pandemic, no one wants to buy anything. Nothing can be sold."

— Waste Collector

Figure 14: Community habits in disposing of trash in Semarang



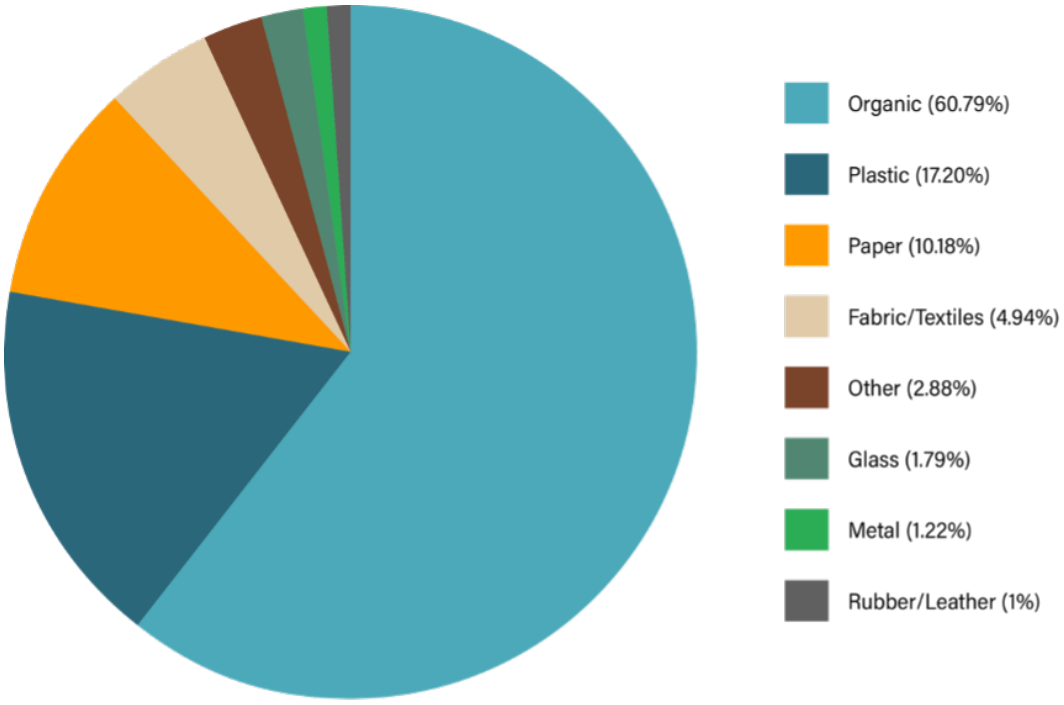
(Cardno 2019)

End Of Cycle

The Semarang Waste Management White Book from 2020 reported that in 2019, Semarang produced 1,276 tons of waste per day. Of that, 77.64% ended up in TPS or TPAs via waste handling, 17.65% went to Waste Banks, TPST/TPS3Rs, and recycling, and the final 4.71% was unmanaged garbage which likely ended up in the environment (Adipradana 2020). Indonesia has declared that the country will be installing Waste to Energy plants in five of their top urban cities, one of which is Semarang, and plans are already underway for their development. However, it is estimated that the capacity for those plants is around 780-1,200 tons of waste feedstock per day, and waste generation in Semarang is over that limit (Cardno 2019). Therefore there is still a need and opportunity for an integrated waste management system consisting of waste reduction — especially items that cannot be composted or recycled — improved segregation, the expansion of composting, and increased recycling.

A study from 2019 reported that household waste accounted for 67% of Semarang's daily waste generation rates, markets and commercial areas generated 20%, industrial areas generated 7%, and the remaining 6% was generated from public facilities, streets, and sewers. Waste composition in Semarang consisted of 78% organic waste (e.g., organic materials and paper) and 22% inorganic waste (Figure 14).

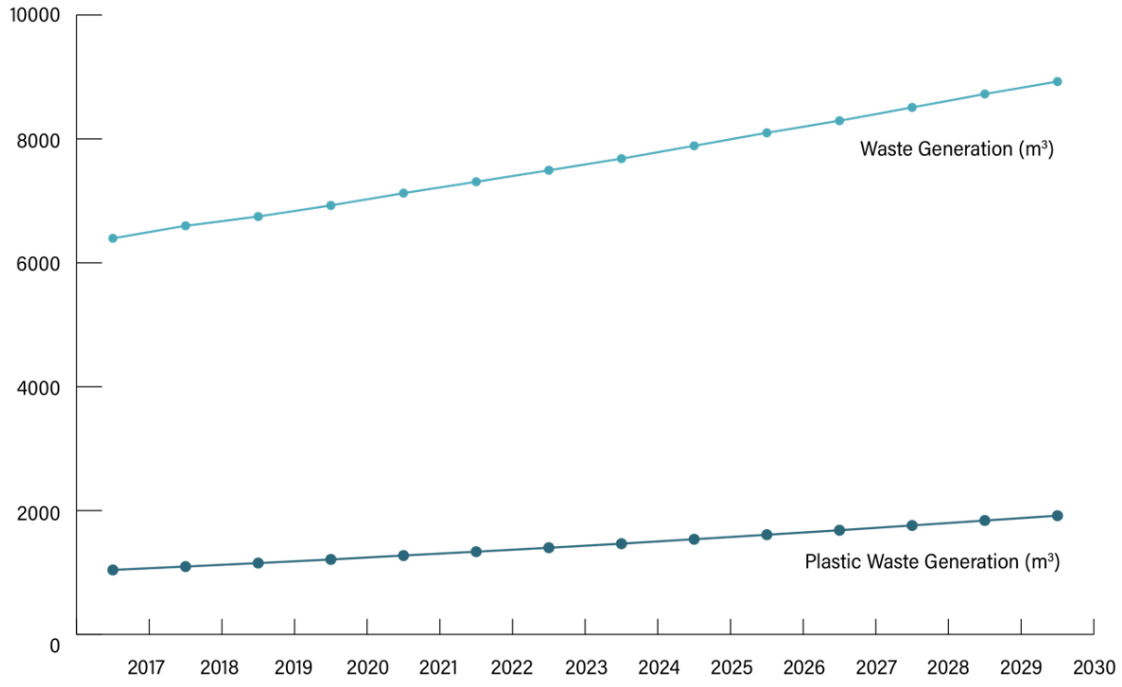
Figure 15: Waste composition in Semarang in 2019



(Sapto 2020)

A study conducted in 2018 also showed the projected change in waste generation in Semarang between 2017 and 2030 (Figure 11). The waste generation itself is projected to increase around 70%, and the plastic waste generation is projected to nearly double within that time frame. This trend will be difficult to manage with the already extenuating circumstances of an over-aged landfill and incomplete collection and recycling.

Figure 16: Plastic waste generation rates in Semarang from 2017-2030.



Data from Andarani et al. (2018).

A 2020 USAID report on improving business strategies for waste banks, noted the composition of materials for recycling (plastic, glass, metal, paper, etc.) and plastic made up 24% of the materials by mass. The two greatest types (by mass) were 11% HDPE and 6.7% PET. PP was 3.6%, with film and low value plastics cumulatively making up about 2%. The USIAD report also reinforced the challenging economic situation for waste banks to operate at a profit (USAID, 2020).

From the interview process, it was commonly noted that some of the major barriers to effective waste management and processing are sorting, transportation, and access to technology and innovation.

Sorting was a major theme throughout the interviews. Different points along the waste supply chain had various opinions on the quality, importance, and responsibility of the action. Still, generally, most interviewees felt that it was critical to manage and recycle waste effectively. One Waste Bank manager put the importance of effective sorting for his business into very clear terms:

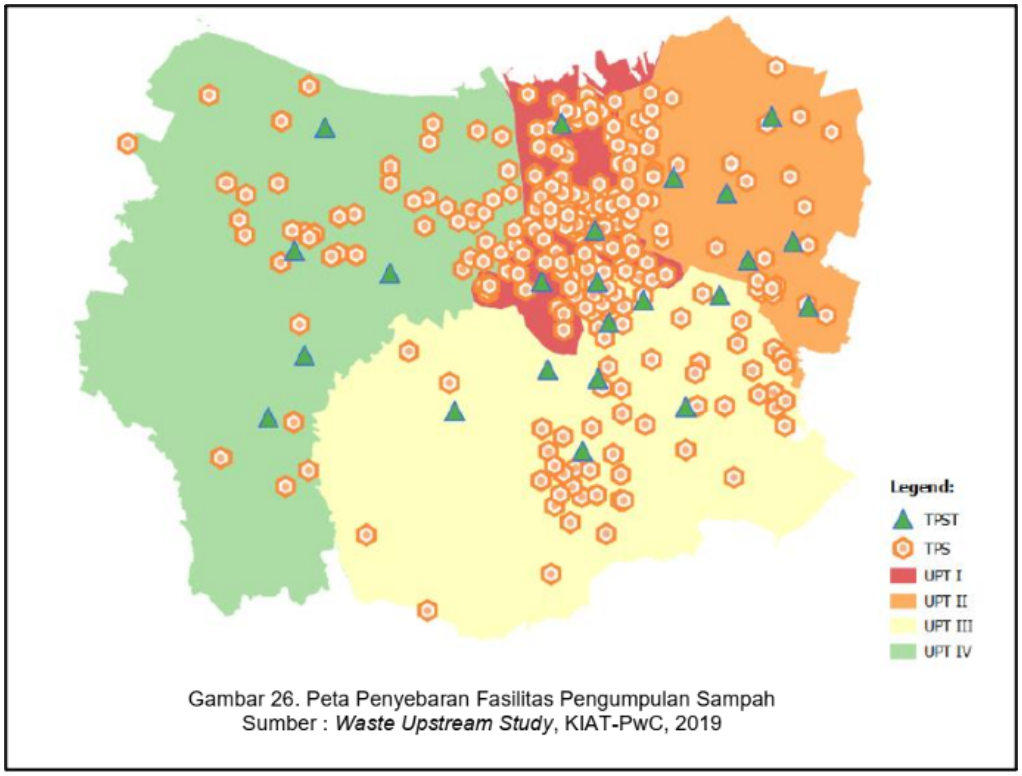
> **"Bottles that are separated from the caps and the labels cost 4.000 per kilogram, if I'm not mistaken. Bottles that are not separated from the caps and labels cost 1.500 per kilogram."**
>
> **— Private Waste Company Manager**

In a similar vein, several Waste Bank and Recycling staff also mentioned that items that made it into the recycling stream were often not properly cleaned. It seems that adequate cleaning and proper sorting could have a significant impact on the effectiveness of the waste management and treatment chain in Semarang.

Transportation was also cited often in interviews as a barrier to waste collection and management. Both Waste Bank managers and Recycling staff alike noted in their interviews that transportation presented a challenge to their business. For the Waste Banks, they are dependent on village residents bringing their waste to them, and for some, it can be too far or too difficult to transport their waste. Some mentioned that for Recycling businesses, they usually have to travel long distances to retrieve recycled waste from consumers and that they have had to rent or borrow vehicles in the past to conduct their work.

Finally, several interviewees noted that Semarang's waste management business needs a younger generation of workers that are more technologically savvy and can bring new energy and ideas to the sector. In particular, Waste Banks noted that they have been trying to encourage young people with IT experience to join Waste Bank and help automate and digitize more of their process. They also cited that many Waste Bank managers are of the older generations, who originally got into the business of waste management out of passion and not for profit, and that the younger generation that is attracted by economics and profit are not typically drawn to the waste management sector at-large. According to interviewees, waste sorters typically work 6 days a week, between 8 and 11 hours a day, and earn around 35,000 IDR per day. This is 72% below the minimum wage, which is currently 2.8 million IDR, or the equivalent of roughly 127,000 IDR per day. This extremely low salary and long hours really limits the ability and motivation to enter this profession for anyone potentially interested, and especially the incoming generation of workers.

Figure 17: Distribution Of Waste Collection Facilities In Semarang



Gambar 26. Peta Penyebaran Fasilitas Pengumpulan Sampah
Sumber : *Waste Upstream Study*, KIAT-PwC, 2019

(Cardno 2019)

Leakage

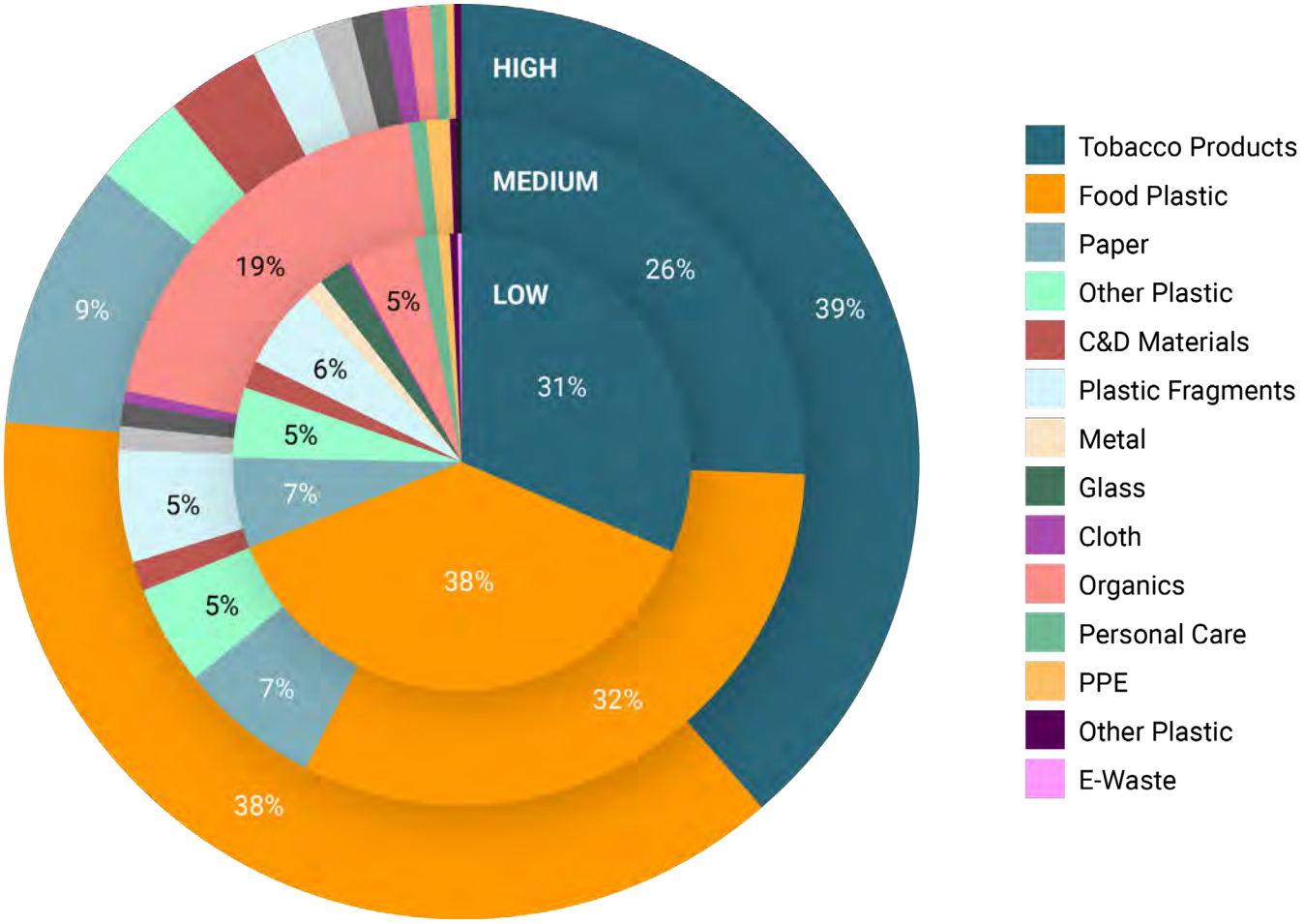
In total, 2,159 litter items were recorded across 27 100m transects in nine different square kilometer areas sampled between October and November 2020. Litter transect locations were selected using a stratified random sampling method. The transects were randomly selected in nine square kilometers distributed across three groups of population count (upper, middle, lower) based on LandScan ambient population data. Litter items were recorded using the open source Marine Debris Tracker app.

Figure 18: Photographs from LIP of litter transects conducted in Semarang

(photo credit: IRDEM)

Across all 27 transects, the largest percentage by category of litter items was food plastic, followed by tobacco products. Organics, paper, and plastic fragments comprised between 4% and 8%, respectively, and C&D materials, glass, and metal all formed 2% or less of the total litter count (Figure 18).

Figure 19: Categories of litter collected in Semarang across all transects by population count



(proportion by count)

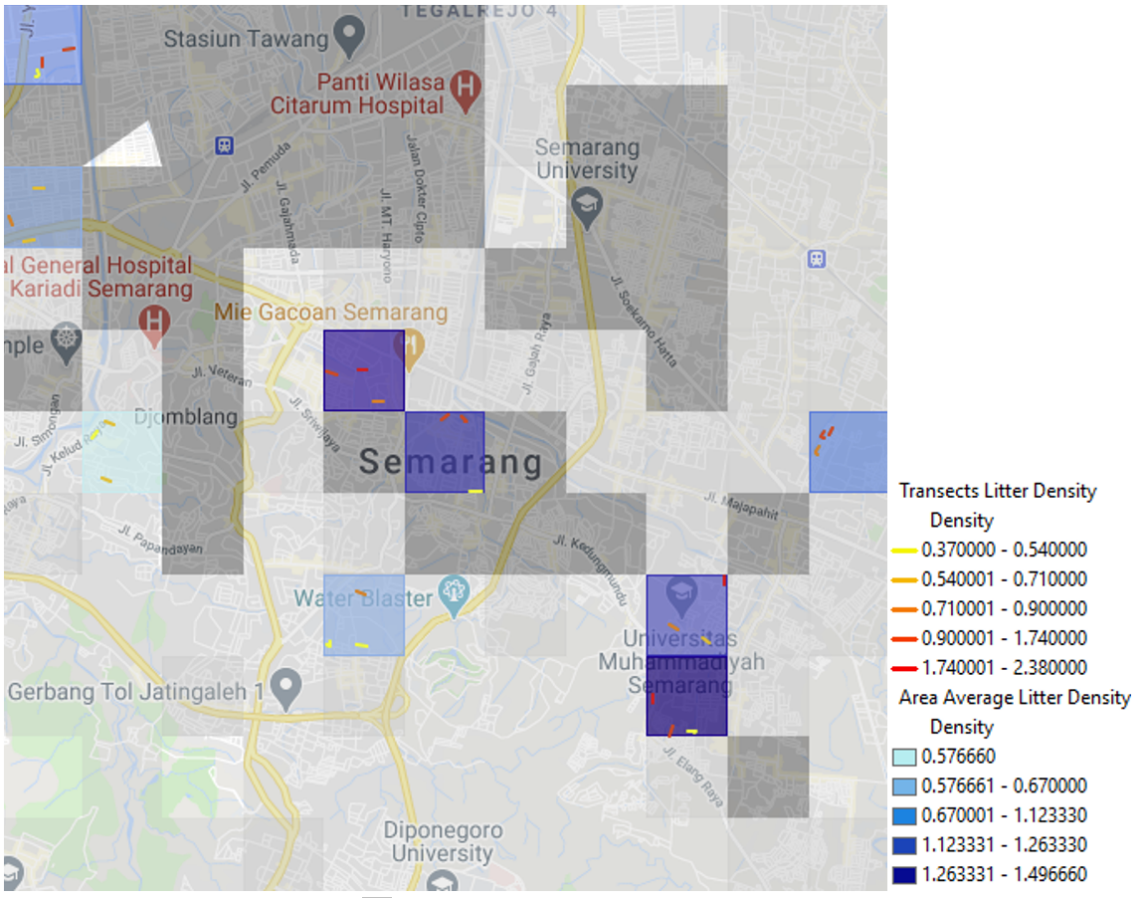
The litter density was calculated for each of the three population count tertiles (Table 7). Although the values are relatively close, the density of litter per square meter was slightly higher in the upper population count areas and lowest among the lower population count areas. For individual items in each of the three tertiles, cigarettes were the top items recorded by number. Food wrappers were the second most commonly found litter item in the upper and lower population areas. Straws were found among the top five recorded litter items in each of the three population areas. Hard plastic fragments were among the top five items in lower and middle population areas, while receipts were a unique item in the top five for the upper population areas. Organic waste also appears among the top items in the lower and middle population areas, reflecting the litter material compositions shown in Figure 18.

Table 7: Litter density and top litter items from all transects separated by population count Semarang.

Population Tertile	Top 5 Litter Items	Litter Density (count/m^2)
Lower (214-5,582 persons/sq km)	1) Cigarettes 2) Plastic Food Wrapper 3) Straws 4) Other Organic Waste 5) Hard Plastic Fragments	**2.95**
Middle (5,582 - 8,122 persons/sq. km)	1) Cigarettes 2) Other Organic Waste 3) Plastic Food Wrapper 4) Straws 5) Hard Plastic Fragments	**3.21**
Upper (8,122 - 15,534 persons/ sq km)	1) Cigarettes 2) Plastic Food Wrapper 3) Other Food-Related Plastic 4) Straws 5) Receipts	**3.39**

Litter densities across other developing countries in South Asia range from 0.5 items/m^2 to 15 items/m^2. With an average of around 4-5 items/m^2 (n = 40). The litter in Semarang is just under the average values of those observed in South Asia, but higher than those found in a small island nation (1.8 items/m^2) and on an island in the USA (0.49 items/m^2) (Youngblood et al., In Preparation).

Figure 20: Litter densities sampled in Semarang.



Opportunities

By 2030, waste generation in Semarang is projected to increase by 70% and the plastic waste generation is projected to nearly double within that time frame. Given that, materials flow and management within the community is at a crucial point. There are opportunities to continue and expand some practices that can increase circularity. There are also opportunities for change. With the already extenuating circumstances of an over-aged landfill and incomplete collection and recycling, the predicted increase in waste and plastic waste will be difficult to manage; both "upstream and downstream" interventions to get ahead of this trend are critical to keep plastic out of the environment.

We recommend exploring the following opportunities to expand and enhance circularity (recognizing that the forthcoming Participatory and Solutioning Sessions as part of Urban Ocean will present an opportunity to further develop solutions and ideas with local stakeholders):

INPUT

- The domestic and local locations of both the manufacturing facilities and parent companies present an opportunity for Semarang to approach circularity at the local level. With the ability to create change together, local brands and manufacturers can discuss the circularity of packaging, distribution, and waste management, along with a decentralized circular system of materials flow and management.

COMMUNITY

- There seems to be an opportunity for educating consumers and business owners, potentially exploring the possibility of a public outreach campaign around high-impact changes such as reducing high leakage items, source segregation and using reusable bags. It is also worth exploring the unique challenges that Semarang faces as a regional commerce and commuter hub, and how that daily transient population can also be targeted for awareness and education.
- There are several regulations currently in place in Semarang to support waste management, such as the Law of the Republic of Indonesia No 18 of 2008, the Presidential Regulation No 97 of 2017, the Semarang Regional Regulation No 6 of 2012, and the Semarang Mayor Regulation No 79 of 2018. However, there seems to be an opportunity for stronger enforcement and proper incentive schemes to support those existing regulations.

- Explore the unique challenges that Semarang faces as a regional commerce and commuter hub, and how that daily transient population can also be targeted for awareness and education.

PRODUCT DESIGN

- Explore the fact that approximately 20% of the products sampled from vendors were made of biodegradable material such as paper or wood, which could provide case studies for paper or wood as economical and viable alternatives for vendors.

USE

- Reuse programs and/or bulk stores are a potential opportunity in Semarang as they do not exist at scale currently.

COLLECTION

- The fact that transportation of waste is funded by a fee structure (similar to water) means that there is a mechanism to provide resources for waste management. But this does not appear equal for recycling, which require community/citizen transport. It is unclear if the system of having neighborhoods transport waste is working or expanding to recycling or composting and expanding to recycling or composting. This could be explored further in the Sessions.
- With many organic materials in the waste stream, source separation is critical (and does not seem to be happening). The possibility of source separation to enhance the value of recyclable materials and then compost organic materials should be explored.
- Further explore why the formal and informal sectors are “in competition” and if there could be more way to be inclusive or utilize the informal sector’s networks and expertise to expand collection and management of materials.
- Explore ways to expand the protection of health, safety, and the environment with current waste collection and management practices.
- Investigate potential methods to decrease the volatility of material price and keep those costs more consistent.

END OF CYCLE

- The landfill should be further examined as it appears to be beyond its lifespan — Look into how can waste to landfill be reduced (e.g., increase composting and recycling, decrease items that cannot be recycled or composted) and how the city can reduce its plastic waste and simultaneously manage the existing waste and its leakage.
- There appears to be a need for investment in infrastructure for waste collection, transportation, proper sorting and cleaning to optimize the waste management infrastructure and operations in Semarang at all levels.
- The waste industry could use an infusion of youth, and likely technology, to bring in more workers with a motivation to do this work. It does not have a large profit margin, salaries are low and work is hard. Interventions to explore include, increases pay for workers, prices for materials, or hosting a competition to engage young

adults in the issue to bring in fresh ideas for interventions on this issue, including product delivery, infrastructure, recycling, and waste management.

LEAKAGE

- Circling back to recommendations from Input and Collection, the most problematic items found in litter surveys can inform future discussions on policy, government interventions, and public outreach campaigns.
- If there is a desire to measure impact from interventions targeting opportunities to reduce plastic leakage, conducting transects over time, and at later periods in time is recommended.

References

Adipradana, Ismet (2020). Waste Management White Book 2020. Buku Putih Semarang Kelola Sampah.

Andarani, P., Puspandiyah, K.S.M., Budiawan, W., Purwaningsib, R., Samadikun, B.P., & Rezagama, A. (2018). Preliminary study on plastic waste handling in Semarang City - Indonesia: Estimated generation and existing management. E3S Web of Conferences, 73.

Atmanti, H.D, Sasana, H., & Setyaningsih, Y. (2019). Waste management efficiency in Semarang. International Journal of Civil Engineering and Technology (IJCIET), 10(4), 1282-1290.

Sapto Adi Sugihartono, MM. (2020). Sinergi Hulu Hilir Pengelolaan Sampah Kota Semarang (Upstream Synergy of Semarang Waste Management). Dinas Lingkungan Hidup Kota Semarang (Environmental Agency of the City of Semarang).

Cardno (2019). Pre-Feasibility Study (Outline Business Case) Technical Assistance to Semarang Waste to Energy Project: Waste Upstream Study Report.

Packaging and Recycling Association for Indonesia Sustainable Environment (PRAISE) (2021). Strategi Dan Tantangan Kolaborasi Produsen Dalam Mendukung Ekosistem Ekonomi Sirkular.

United Nations (2017). Identification of Islands and Standardization of Their Names: Submitted by Indonesia. 11th United Nations Conference on the Standardization of Geographical Names, New York, 8 -17 August 2017. https://unstats.un.org/unsd/geoinfo/UNGEGN/docs/11th-uncsgn-docs/E_Conf.105_115_CRP.115_Agenda%209a%20Identification%20of%20Islands%20and%20Standardization%20of%20Their%20Names_BIG_Indonesia.pdf

United Nations Environment Programme. (2017). Summary report: Waste management in ASEAN countries. United Nations. https://environment.asean.org/wp-content/uploads/2020/03/Summary-Report-Waste-Management-in-ASEAN-Countries-UNEP.pdf.

USAID, 2020. Improving Business Strategy Toward a Sustainable Waste Bank, prepared by Bintari Foundation, April 10, 2020.

World Atlas (2017). Biggest Cities in Indonesia. Written by Kimutai Gilbert in World Facts. https://www.worldatlas.com/articles/biggest-cities-in-indonesia.html

World Bank (2020). DataBank for Indonesia. https://data.worldbank.org/country/indonesia?view=chart

World Economic Forum (2020). Radically Reducing Plastic Pollution in Indonesia: A Multistakeholder Action Plan National Plastic Action Partnership. https://globalplasticaction.org/wp-content/uploads/NPAP-Indonesia-Multistakeholder-Action-Plan_April-2020.pdf

Youngblood, Y., Brooks, A., Das, N., Singh, A., Nigar, M., Verma, G., Zakir, T., Duncan, E., Khatoon, H., Maddalene, T., Napper, I., Nelms, S., Patel, S., Jambeck, J. (In Preparation). Characterizing litter in communities along the Ganges River: An ambient population-based method for surveying active input.

Appendix

Figure 21: Magnified Litter Transects

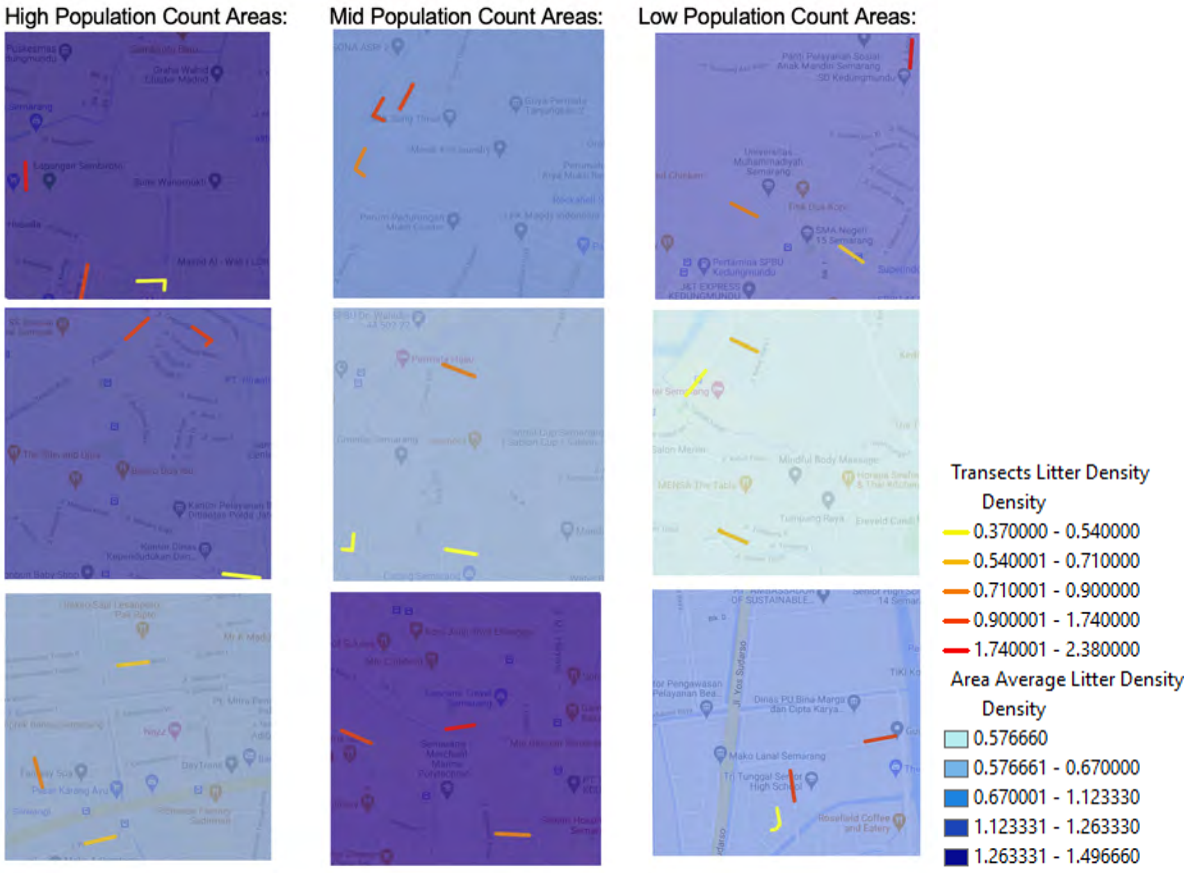


Table 8: Full List of MDT Litter Items and Associated Material Categories

Material	Items
C&D Materials	Aggregate & Brick Bolts, Nails, and Screws Building Materials Lumber Other C&D
Cloth	Clothing Fabric Pieces Other Cloth
E-Waste	Batteries E-Waste Fragments Other E-Waste
Fishing Gear	Buoys and Floats Fishing Line Other Fishing Gear Plastic Net or Net Pieces Plastic Rope
Glass	Glass Bottle Glass or Ceramic Fragments Other Glass
Metal	Aluminum Foil Aluminum or Tin Cans Metal Bottle Caps or Tabs Metal Fragments Other Metal
Organic Waste	Food Waste Other Organic Waste
Other	Other Popsicle Stick
Other Plastic Products	Bulk Bags Flip Flops Other Plastic Plastic String, Tape, or Packing Straps Rubber Bands Tires

Material	Items
Paper	Coated Paperboard Corrugated Cardboard Multi-material Paper Box Noncoated Paper Food Wrapper Other Paper Paper Receipts
Personal Care Products	Blister Pack Cotton Buds Other Personal Care Product Personal Care Product Sachet Shampoo or Other HDPE Container Toothbrushes Toothpaste or Other Product Tube
Plastic Food Products	Foam or Plastic Cups or Lids Other Food-Related Plastic Other Plastic Bag Plastic Bottle Plastic Bottle Cap Plastic Food Wrapper Plastic Grocery Bag Plastic Utensils Straws Street Food Bowl Styrofoam Container
Plastic Fragments	Film Fragments Foam Fragments Hard Plastic Fragments Other Fragments
PPE	Associated PPE packaging Disinfectant Wipes Disposable Gloves Face mask packaging Face Masks Face Shield Hair nets Hospital shoe covers Other PPE

Material	Items
Tobacco Products	Cigarette Packaging Cigarettes Other Tobacco Product Tobacco Sachets

Table 9: List of Product Manufacturers and Parent Companies:

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Ades	Drinks	PET	PT. Akasha Wira International	Pasuruan, East Java, Indonesia	The Coca-cola Company	USA
Ades	Drinks	PET	PT. Akasha Wira International	Pasuruan, East Java, Indonesia	The Coca-cola Company	USA
Ale ale	Drink	Multilayer Film	PT. Wings Surya	Surabaya, East Java	PT. Wings Surya	Surabaya, East Java
Ale Ale Strobery	Drink	Multilayer Film	PT. Wings Surya	Surabaya, East Java	PT. Wings Surya	Surabaya, East Java
Ale-ale	Drinks	PP Cup	PT. Mitra Alam Segar	Pasuruan, East Java, Indonesia	Wings Food	Surabaya, East Java, Indonesia
Alpenlibel	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java	PT. Perfetti Van Melle Indonesia	Bogor, West Java
Alpenlibel	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java	PT. Perfetti Van Melle Indonesia	Bogor, West Java
Alpenlibel	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java	PT. Perfetti Van Melle Indonesia	Bogor, West Java
Alpenlibel	Candy	Multilayer Film	Prevetti Van Melle	Bogor, West Java, Indonesia	Prevetti Van Melle	Lainatte, Italia
Alpenlibel Eclares	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java	PT. Perfetti Van Melle Indonesia	Bogor, West Java
Antangin	Candy	Multilayer Film	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia
Antangin	Candy	Multilayer Film	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia
Antangin	Candy	Multilayer Film	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia	PT. Deltomed Laboratories	Wonogiri, Central Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Antangin	Candy	Multilayer Film	Deltomed	Ponorogo, East Java	PT Saratoga investa-ma sedaya Tbk	Jakarta
Aqua	Drinks	PET	PT. Tirta Investama	Klaten, Central Java, Indonesia	PT. Aqua Golden Mississipi	Jakarta, Indonesia
Aqua	Drinks	PET	PT. Tirta Investama	Klaten, Central Java, Indonesia	PT. Tirta Investama	Klaten, Central Java, Indonesia
Aqua	Drinks	PET	PT. Tirta Investama	Klaten, Central Java, Indonesia	PT. Tirta Investama	Klaten, Central Java, Indonesia
Aqua	Drinks	PET	PT. Tirta Investama	Klaten, Central Java, Indonesia	Danone	Paris, France
Aqua	Drinks	PET	PT. Tirta Investama	Klaten, Central Java, Indonesia	PT. Tirta Investama	Klaten, Central Java, Indonesia
Aqua	Drink	PET	PT. Aqua Golden Mississipi	Jakarta	PT. Aqua Golden Mississipi	Jakarta, Indonesia
Aqua	Drink	PET	PT. Aqua Golden Mississipi	Jakarta	PT. Aqua Golden Mississipi	Jakarta
Aqua	Drink	PET	PT Tirta Investama	Jakarta, Indonesia	PT Aqua Golden Mississipi	Jakarta Selatan, Indonesia
Bejo Wedang Susu Jahe Merah	Drinks	Multilayer Film	Bintangtojoe A Kalbe Company	Jakarta, DKI Jakar-ta, Indonesia	Bintangtojoe A Kal-be Company	Jakarta, DKI Ja-karta, Indonesia
Beng beng	Wafer	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Beng beng	Wafer	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Big Babol	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Big Babol	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Big Babol	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Big Babol	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Cheetos	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Cheetos	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Cheetos	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Cheetos	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chetos	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Chetos	Chips	Multilayer Film	PT Indofood Suk-ses Matkur Tbk	Jakarta Pusat, Indonesia	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia
Chetos Jag-ung Bakar	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Chetos Jag-ung Bakar	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Chew-chew ball	Candy	Multilayer Film	PT Kino Sentra Insudtrindo	Tangerang, Banten, Indonesia	PT Kino Indonesia Tbk	Banten, West Java Indonesia
Chiki Balls	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chiki Balls	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chiki Balls	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chiki Balls	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chiki Balls	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chiki Balls Coklat	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Chitato	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chitato	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Chitato	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Chitato	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Chitato Barbeque	Chips	Multilayer Film	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia
Chitato Barbeque	Chips	Multilayer Film	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia
Chiz King	Chips	Multilayer Film	PT. URC Indonesia	Bekasi, West Java	PT. URC Indonesia	Bekasi, West Java
Choco Chips	Chips	Multilayer Film	PT. Sima Indosnack Makmur	Bogor, West Java, Indonesia	PT. Sima Indosnack Makmur	Bogor, West Java, Indonesia
Chocolatos sachet	Drink	Multilayer Film	PT Garuda food Putra Putri Jaya Tbk	Jakarta, Indonesia	PT Tudung	Pati, Central Java
Chupa Chups	Candy	PP & HDPE	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Crunch	Chips	Multilayer Film	PT. Savoria Kreasi Rasa	Tangerang, Banten, Indonesia	Société des Produits Nestlé S.A.	Vevey, Switzerland
Dancow	Drinks	Multilayer Film	PT. Nestlé Indonesia	Pasuruan, East Java, Indonesia	Société des Produits Nestlé S.A., Vevey, Switzerland	Switzerland
Davos	Candy	Paper	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia
Davos	Candy	Paper	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia
Davos	Candy	Paper	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia	PT. Slamet Langgeng	Purbalingga, Central Java, Indonesia
Floridina	Drinks	PP Cup	PT. Tirta Alam Segar	Bekasi, West Java, Indonesia	Wings Food	Surabaya, East Java, Indonesia
Floridina	Drinks	PET	PT. Tirta Alam Segar	Bekasi, West Java, Indonesia	Wings Food	Surabaya, East Java, Indonesia
Floridina Orange	Drink	PET	PT Jaya Utama Santikah	Tangerang, Banten, Indonesia	PT Jaya Utama Santikah	Tangerang, Banten, Indonesia
Foxs	Candy	Multilayer Film	PT. Savoria Kreasi Rasa	Tangerang, Banten	PT. Savoria Kreasi Rasa	Tangerang, Banten
Foxs	Candy	Multilayer Film	PT. Savoria Kreasi Rasa	Tangerang, Banten	PT. Savoria Kreasi Rasa	Tangerang, Banten

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Foxs	Candy	Multilayer Film	PT. Savoria Kreasi Rasa	Tangerang, Banten	PT. Savoria Kreasi Rasa	Tangerang, Banten
Foxs	Candy	Multilayer Film	Nestle	Tangerang, Banten	Nestle S.A,Vevey	Switzerland
Frestea madu	Drink	PET	PT. Coca-Cola Bot-tling Indonesia	Bekasi, West Java	PT. Coca-Cola Bot-tling Indonesia	Bekasi, West Java
Frestea madu	Drink	PET	PT. Coca-Cola Bot-tling Indonesia	Bekasi, West Java	PT. Coca-Cola Bot-tling Indonesia	Bekasi, West Java
Frozen	Drink	PET	PT Singamas Indo-nesia	Jakarta Utara, Indonesia	Charoen Pokphand	Jakarta Utara, Indonesia
Fruit tea blackcurrent	Drink	PET	PT. Sinar Sosro	Bekasi, West Java	PT. Sinar Sosro	Bekasi, West Java
Fruit tea blackcurrent	Drink	PET	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java
Fruit tea blackcurrent	Drink	Papper Cup	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java
Garuda Pilus	Chips	Multilayer Film	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia
Garuda Pilus	Chips	Multilayer Film	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia
Garuda Pilus	Chips	Multilayer Film	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia
Garuda Pilus	Chips	Multilayer Film	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia	PT. Garudafood Putra Putri Jaya	Pati, Central Java, Indonesia
Garuda Ting ting	Candy	Multilayer Film	PT Garuda food	Jakarta, Indonesia	PT Tudung	Pati, Central Java
Garuda Ting ting	Candy	Multilayer Film	PT Garuda food	Jakarta, Indonesia	PT Tudung	Pati, Central Java
Ginger Jahe	Candy	Multilayer Film	deltomed	Ponorogo, East Java	PT Saratoga investa-ma sedaya Tbk	Jakarta
Good Day	Drinks	Multilayer Film	PT. Santos Jaya Abadi	Sidoarjo, East Java, Indonesia	PT. Santos Jaya Abadi	Sidoarjo, East Java, Indonesia
Good Time	Chips	Multilayer Film	PT. Arnott's Indo-nesia	Bekasi, West Java, Indonesia	PT. Arnott's Indo-nesia	Bekasi, West Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Good Time	Chips	Multilayer Film	PT. Arnott's Indonesia	Bekasi, West Java, Indonesia	PT. Arnott's Indonesia	Bekasi, West Java, Indonesia
Gudang Garam	Cigga-rette	Papper	PT. Gudang Garam Tbk.	Kediri, East Java	PT. Gudang Garam Tbk.	Kediri, East Java
Gudang Garam	Cigga-rette	Papper	PT. Gudang Garam Tbk.	Kediri, East Java	PT. Gudang Garam Tbk.	Kediri, East Java
Gudang Garam Signature	Cigarette	Paper	PT. Gudang Garam	Kediri, East Java, Indonesia	PT. Gudang Garam	Kediri, East Java, Indonesia
Gudang Garam Surya	Cigga-rette	Papper Cup	PT Gudang Garam Tbk	Kediri, East Java	PT Gudang Garam Tbk	Kediri, East Java
Hexos	Candy	Multilayer Film	PT. Konimex	Sukoharjo, Central Java, Indonesia	PT. Konimex	Sukoharjo, Central Java, Indonesia
Hexos	Candy	Multilayer Film	PT. Konimex	Sukoharjo, Central Java, Indonesia	PT. Konimex	Sukoharjo, Central Java, Indonesia
Hot hot Pop	Candy	PP & HDPE	PT. Bronson	Malang, East Java, Indonesia	PT. Bronson	Malang, East Java, Indonesia
Hot Mil	Candy	PP & HDPE	PT. Bronson	Malang, East Java, Indonesia	PT. Bronson	Malang, East Java, Indonesia
Hydro coco	Drink	Papper	PT. Pulau Sambu	Indragiri Hilir, Riau	PT. Pulau Sambu	Indragiri Hilir, Riau
Indomilk Kids	Drinks	Paper	PT. Indolakto	Sukabumi, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Isocup	Drinks	PP Cup	PT. Asia Health Energi Bevereges	Sukabumi, West Java, Indonesia	PT. Asia Health Energi Bevereges	Sukabumi, West Java, Indonesia
Isoplus	Drinks	PET	PT. Tirta Alam Segar	Bekasi, West Java, Indonesia	Wings Food	Surabaya, East Java, Indonesia
JetZ	Chips	Multilayer Film	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Jetz	Chips	Multilayer Film	PT. Indofood Fritolay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Jetz	Chips	Multilayer Film	PT. Indofood Fritolay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Kacang Atom Cap Mamonth	Chips	Multilayer Film	PT Pandowo Utomo Food	Semarang, Central Java	PT Pandowo Utomo Food	Semarang, Central Java

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Kacang Atom Cap Mamonth	Chips	Multilayer Film	PT Pandowo Utomo Food	Semarang, Central Java	PT Pandowo Utomo Food	Semarang, Central Java
Kacang Atom Cap Mamonth	Chips	Multilayer Film	PT Pandowo Utomo Food	Semarang, Central Java	PT Pandowo Utomo Food	Semarang, Central Java
Kis	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kis	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kiss	Candy	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kiss	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kiss	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kiss	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kiss	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kopi susu Abc	Drink	PET	PT. Nestle Indonesia	Pasuruan, East Java	Nestle	Vevey, Vaud, Swiss
Kopikap	Drinks	PP Cup	PT. Tirta Fresindo Jaya	Bogor, West Java, Indonesia	PT. Tirta Fresindo Jaya	Bogor, West Java, Indonesia
Kopikap	Drinks	PP Cup	PT. Tirta Fresindo Jaya	Bogor, West Java, Indonesia	PT. Tirta Fresindo Jaya	Bogor, West Java, Indonesia
Kopiko	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kopiko	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kopiko	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kopiko	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Kopiko	Candy	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Kopiko	Candy	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kopiko	Candy	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kopiko	Drink	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kopiko	Candy	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kopiko	Candy	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Kopiko	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kopiko	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kopiko	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kopiko	Candy	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Kris Bee	Chips	Multilayer Film	PT. Calbee-Wing Food	Karawang, West Java, Indonesia	PT. Calbee-Wing Food	Karawang, West Java, Indonesia
L.A. Lights	Cigarette	Paper	PT. Djarum	Kudus, Central Java, Indonesia	PT. Djarum	Kudus, Central Java, Indonesia
L.A. Lights	Cigarette	Paper	PT. Djarum	Kudus, Central Java, Indonesia	PT. Djarum	Kudus, Central Java, Indonesia
Lasegar	Drink	Kaleng	PT Sinde Budi Sentosa	Bekasi, West Java, Indonesia	PT Sinde Budi Sentosa	Bekasi, West Java, Indonesia
Lays	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Lays	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, West Java, Indonesia	PT. Indofood Fritolay Makmur	Tangerang, West Java, Indonesia
Lays Sea-weed	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta
Lays Sea-weed	Chips	Multilayer Film	PT. Indofood Frito-lay Makmur	Tangerang, Banten	PT. Indofood Sukses Makmur	Jakarta

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Lays Sea-weed	Chips	Multilayer Film	PT Indofood Suk-ses Matkur Tbk	Jakarta Pusat, Indonesia	PT Indofood Sukses Matkur Tbk	Jakarta Pusat, Indonesia
Le minerale	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Le minerale	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Le minerale	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Le minerale	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Le minerale	Drink	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Malkist Roma Abon	Chips	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Malkist Roma Abon	Wafer	Multilayer Film	PT. Mayora Indah Tbk.	Tangerang, Banten	PT. Mayora Indah Tbk.	Tangerang, Banten
Malkist Roma Abon	Chips	Multilayer Film	PT Mayora Indah	Jakarta Barat, Indonesia	PT Mayora Indah	Jakarta Barat, Indonesia
Mangga Madu	Drink	PP Cup	CV Anugerah Bumi Persada	Samarinda City, East Kalimantan, Indonesia	CV Anugerah Bumi Persada	Samarinda City, East Kalimantan, Indonesia
Mentos	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos	Candy	Paper	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mentos mint	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Mentos mint	Candy	Multilayer Film	PT. Perfetti Van Melle Indonesia	Bogor, West Java, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Mie Enak	Chips	Multilayer Film	PT Siantar Top Tbk	Sidoarjo, East Java	PT Siantar Top Tbk	Sidoarjo, East Java
Mie Kremez	Chips	Multilayer Film	PT. Tiga Pilar Sejahtera	Sragen, Central Java, Indonesia	Putra Taro Paloma	Bogor, West Java, Indonesia
Mie Kremez	Chips	Multilayer Film	PT. Tiga Pilar Sejahtera	Sragen, Central Java, Indonesia	Putra Taro Paloma	Bogor, West Java, Indonesia
Mintz	Candy	Multilayer Film	PT. Ultra Prima Abadi	Surabaya, East Java, Indonesia	Orang Tua	West Jakarta, DKI Jakarta, Indonesia
Mintz	Candy	Multilayer Film	PT. Ultra Prima Abadi	Surabaya, East Java	Orang Tua	Jakarta
Mintz	Candy	Multilayer Film	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
Mintz	Candy	Multilayer Film	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
Mizone	Drink	PET	PT. Tirta Investama	Bogor, West Java	PT. Aqua Golden Mississipi	Jakarta, Indonesia
Momogi	Chips	Multilayer Film	PT. Sari Murni Jaya	Sidoarjo, East Java	PT. Sari Murni Jaya	Sidoarjo, East Java
Momogi Chesee	Chips	Multilayer Film	PT Sari Murni Abadi	Bogor, West Java, Indonesia	PT Sari Murni Abadi	Bogor, West Java, Indonesia
Momogi Coklat	Chips	Multilayer Film	PT Sari Murni Abadi	Bogor, West Java, Indonesia	PT Sari Murni Abadi	Bogor, West Java, Indonesia
Momogi keju	Chips	Multilayer Film	PT. Sari Murni Jaya	Sidoarjo, East Java	PT. Sari Murni Jaya	Sidoarjo, East Java
Nabati Chese Wafer	Chips	Multilayer Film	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java
Nabati Chese Wafer	Wafer	Multilayer Film	PT Kaldu Sari Nabati Indonesia	Bandung, West Java	PT Kaldu Sari Nabati Indonesia	Bandung, West Java
Nabati Chese Wafer	Wafer	Multilayer Film	PT Kaldu Sari Nabati Indonesia	Bandung, West Java	PT Kaldu Sari Nabati Indonesia	Bandung, West Java
NutriSari	Drinks	Multilayer Film	PT. Nutrifood Indonesia	Bogor, West Java, Indonesia	PT. Nutrifood Indonesia	Bogor, West Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Oky Jelly Drink Big Strobery	Drink	PP Cup	PT Triteguh Manunggal Sejati	Tangerang,Banten	PT Garuda food	Jakarta, Indonesia
Oky Jelly Drink Big Strobery	Drink	PP Cup	Tri Teguh Manunggal Sejati	Bandar Lampung, Lampung	Garuda food	Jakarta, Indonesia
Oreo	Chips	Multilayer Film	PT Kraft Ultrajaya Indonesia	Bandung, West Java	PT Kraft Ultrajaya Indonesia	Bandung, West Java
Oreo Soft Cake	Chips	Multilayer Film	Nort Kinh Do One Member Company Limited	Ban Yen Nhan Town, May Hao District, Vietnam	Mondelez Kinh Do Vietnam Join Stock Company	Binh Duong Province, Vietnam
Pelangi	Drink	Multilayer Film	CV. Tirta Makmur	Semarang, Central Java	CV. Tirta Makmur	Semarang, Central Java
Pelangi Mineral Water	Drinks	PP Cup	CV. Tirta Makmur	Kab. Semarang, Central Java, Indonesia	CV. Tirta Makmur	Kab. Semarang, Central Java, Indonesia
Permen Kacamata	Candy	PP	PT. Pusan Manis Mulia	Tangerang, Banten, Indonesia	PT. Pusan Manis Mulia	Tangerang, Banten, Indonesia
Permen Kacamata	Candy	PP	PT. Pusan Manis Mulia	Tangerang, Banten, Indonesia	PT. Pusan Manis Mulia	Tangerang, Banten, Indonesia
Permen Yogurt	Candy	Multilayer Film	PT Union Confectionery	Medan, North Sumatera, Indonesia	PT Union Confectionery	Medan, North Sumatera, Indonesia
Permen Yogurt	Candy	Multilayer Film	PT Union Confectionery	Medan, North Sumatera, Indonesia	PT Union Confectionery	Medan, North Sumatera, Indonesia
Permen Yogurt	Candy	Multilayer Film	PT Union Confectionery	Medan, North Sumatera, Indonesia	PT Union Confectionery	Medan, North Sumatera, Indonesia
Piatos Snack Kentang	Chips	Multilayer Film	PT URC Indonesia	Bekasi, West Java, Indonesia	PT URC Indonesia	Bekasi, West Java, Indonesia
Piattos	Chips	Multilayer Film	PT URC Indonesia	Bekasi, West Java, Indonesia	Universal Robina Corporation	Quezon City, Philippines
Pocari Sweat	Drink	PET	PT. Amerta Indah Otsuka	Pasuruan, East Java	Otsuka Pharmaceutical Co., Ltd.,	Japan
Prima	Drink	PET	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java
Pusan King Bubble	Candy	Paper	PT. Pusan Manis Mulia	Tangerang, Banten, Indonesia	Pervetti Van Melle Benelux B.V.	Netherlands
Relaxa	Candy	Multilayer Film	PT. Agel Langgeng	Bekasi, West Java, Indonesia	PT. Agel Langgeng	Bekasi, West Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Relaxa	Candy	Multilayer Film	PT. Agel Langgeng	Bekasi, West Java, Indonesia	PT. Agel Langgeng	Bekasi, West Java, Indonesia
Relaxa	Candy	Multilayer Film	PT. Agel Langgeng	Bekasi, West Java, Indonesia	PT. Agel Langgeng	Bekasi, West Java, Indonesia
Relaxa	Candy	Multilayer Film	PT. Agel Langgeng	Bekasi, West Java, Indonesia	PT. Agel Langgeng	Bekasi, West Java, Indonesia
Relaxa	Candy	Multilayer Film	Angel Langgeng	Bekasi, West Java, Indonesia	Angel Langgeng	Bekasi, West Java, Indonesia
Richeese Nabati Coklat	Chips	Multilayer Film	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java
Riry Snack	Chips	Multilayer Film	PT. Damarus Food Industri	Banyumas, Central Java, Indonesia	PT. Damarus Food Industri	Banyumas, Central Java, Indonesia
Sampoerna A Mild	Cigarette	Paper	PT Hanjaya Mandala Sampoerna	Surabaya, East Java, Indonesia	PT Hanjaya Mandala Sampoerna	Surabaya, East Java, Indonesia
SiiP	Chips	Multilayer Film	PT. Kaldu Sari Nabati Indonesia	Majalengka, West Java, Indoneisa	Snac International	USA
Slai Olai	Chips	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Smax Ring	Chips	Multilayer Film	PT. Pacific Food Indonesia	Tangerang, Banten, Indonesia	PT. Pacific Food Indonesia	Tangerang, Banten, Indonesia
Sprite	Drink	PET	The Coca Cola Company	Atlanta, Georgia, Amerika Serikat	The Coca Cola Company	Atlanta, Georgia, Amerika Serikat
Sugus	Candy	Paper	Wrigley Jr.	Chicago, Illinois, USA	Wrigley Jr.	Chicago, Illinois, USA
Sugus	Candy	Paper	Wrigley Jr.	Chicago, Illinois, USA	Wrigley Jr.	Chicago, Illinois, USA
Sukro Oven	Chips	Multilayer Film	PT Dua Kelinci	Pati, Central Java, Indonesia	PT Dua Kelinci	Pati, Central Java, Indonesia
Superstar	Chips	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Taro	Chips	Multilayer Film	PT. Tiga Pilar Sejahter Food Tbk.	Jakarta	PT. Tiga Pilar Sejahter Food Tbk.	Jakarta
Taro	Chips	Multilayer Film	PT. Tiga Pilar Sejahter Food Tbk.	Jakarta	PT. Tiga Pilar Sejahter Food Tbk.	Jakarta

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Taro	Chips	Multilayer Film	PT Tiga Pilar Se-jahtera	Sragen, Central Java	PT Tiga Pilar Se-jahtera	Sragen, Central Java
Taro Net	Chips	Multilayer Film	PT. Tiga Pilar Se-jahtera	Sragen, Central Java, Indonesia	PT. Putra Taro Paloma	Bogor, West Java, Indonesia
Taro Net	Chips	Multilayer Film	PT. Tiga Pilar Se-jahtera	Sragen, Central Java, Indonesia	PT. Putra Taro Paloma	Bogor, West Java, Indonesia
Taro Net	Chips	Multilayer Film	PT. Tiga Pilar Se-jahtera	Sragen, Central Java, Indonesia	PT. Putra Taro Paloma	Bogor, West Java, Indonesia
Taro Net	Chips	Multilayer Film	PT. Tiga Pilar Se-jahtera	Sragen, Central Java, Indonesia	PT. Putra Taro Paloma	Bogor, West Java, Indonesia
Taro Net	Chips	Multilayer Film	PT. Tiga Pilar Se-jahtera	Sragen, Central Java, Indonesia	PT. Putra Taro Paloma	Bogor, West Java, Indonesia
Teh Cangkir	Drinks	PP Cup	Fa. Perusahaan Teh Cangkir	Pekalongan, Cen-tral Java, Indonesia	Fa. Perusahaan Teh Cangkir	Pekalongan, Central Java, Indonesia
Teh Gelas	Drinks	PP Cup	PT. CS2 Pola Sehat	Pasuruan, East Java, Indonesia	Orang Tua	West Jakarta, DKI Jakarta, Indonesia
Teh Gelas	Drinks	PP Cup	PT. CS2 Pola Sehat	Pasuruan, East Java, Indonesia	Orang Tua	West Jakarta, DKI Jakarta, Indonesia
Teh Pucuk Harum	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Teh Pucuk Harum	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Teh Pucuk Harum	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Teh Pucuk Harum	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Mayora Indah	Tangerang, Bant-en, Indonesia
Teh Pucuk Harum	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia
Teh Rio	Drinks	PP Cup	PT. Tirta Alam Segar	Bekasi, West Java, Indonesia	Wings Food	Surabaya, East Java, Indonesia
Teh Zegar	Drinks	PP Cup	PT. Tang Mas	Depok, West Java, Indonesia	PT. Tang Mas	Depok, West Java, Indonesia
The Botol Kotak	Drink	Papper Cup	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
The Botol Kotak	Drink	Papper Cup	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java
The Botol Kotak	Drink	Papper Cup	PT Sinar Sosro	Bekasi, West Java	PT Sinar Sosro	Bekasi, West Java
The Gelas	Drink	PP Cup	PT. CS2 Pola Sehat	Tangerang, Banten	Orang Tua	Jakarta
The Gelas	Drink	Multilayer Film	PT. CS2 Pola Sehat	Tangerang, Banten	Orang Tua	Jakarta
The Gelas	Drink	PP Cup	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
The Gelas	Drink	PP Cup	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
The Gelas	Drink	PP Cup	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
The Gelas Botol	Drink	PP Cup	Orang Tua	Jakarta Barat, Indonesia	ABC Holding	Jakarta, Indonesia
The Kotak Jasmine Tea	Drink	PP Cup	Ultrajaya Milk	Bandung, West Java	Ultrajaya Milk	Bandung, West Java
The Zegar	Drink	PP Cup	PT. 2 Tang	Depok, West Java	PT. 2 Tang	Depok, West Java
Tiara	Chips	Multilayer Film	CV. Sumber Sari Pangan	Gresik, East Java, Indonesia	CV. Sumber Sari Pangan	Gresik, East Java, Indonesia
Tiara	Chips	Multilayer Film	CV. Sumber Sari Pangan	Gresik, East Java, Indonesia	CV. Sumber Sari Pangan	Gresik, East Java, Indonesia
TOP	Chips	Multilayer Film	PT. Perusahaan Indonesia Ceres	Bandung, West Java, Indonesia	PT. Perusahaan Indonesia Ceres	Bandung, West Java, Indonesia
Tora Cafe	Drinks	PET	PT. Tirta Fresindo Jaya	Pasuruan, East Java, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia
Torpedo	Drink	PP Cup	PT Asia Healty Energy Beverage	Sukabumi, West Java, Indonesia	PT Asia Healty Energy Beverage	Sukabumi, West Java, Indonesia
Tuton	Cigarette	Paper	CV. Pusaka Hidup	Semarang, Central Java, Indonesia	CV. Pusaka Hidup	Semarang, Central Java, Indonesia
Tuton	Cigarette	Paper	CV. Pusaka Hidup	Semarang, Central Java, Indonesia	CV. Pusaka Hidup	Semarang, Central Java, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Ultra milk coklat	Drink	Papper	Ultrajaya Milk	Bandung, West Java	Ultrajaya Milk	Bandung, West Java
Universal Mineral Water	Drinks	PP Cup	CV. Priority Inti Raya	Semarang, Central Java, Indonesia	CV. Priority Inti Raya	Semarang, Central Java, Indonesia
Viper Red	Cigga-rette	Paper	PT. Mercu Pantura Industry	Kudus, Central Java, Indonesia	PT. Mercu Pantura Industry	Kudus, Central Java, Indonesia
Viper Red	Cigarette	Paper	PT. Mercu Pantura Industry	Kudus, Central Java, Indonesia	PT. Mercu Pantura Industry	Kudus, Central Java, Indonesia
Vita Jelly Drink	Drinks	PP Cup	PT. CS2 Pola Sehat	Pasuruan, East Java, Indonesia	Orang Tua	West Jakarta, DKI Jakarta, Indonesia
Wafer Nabati Chese	Wafer	Multilayer Film	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java	PT. Kaldu Sari Naba-ti Indonesia	Sumedang, West Java
Wafer Nabati Chese	Wafer	Multilayer Film	PT. Kaldu Sari Nabati Indonesia	Sumedang, West Java	PT. Kaldu Sari Naba-ti Indonesia	Sumedang, West Java
You C-1000	Drinks	PET	PT. Djojonegoro C-1000	Sukabumi, West Java, Indonesia	PT. Djojonegoro C-1000	Sukabumi, West Java, Indonesia
You C-1000	Drinks	PET	PT. Djojonegoro C-1000	Sukabumi, West Java, Indonesia	House Wellness Foods	Japan
Yupi	Candy	PP	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia
Yupi	Candy	PP	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia
Yupi	Candy	PP	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia	PT. Yupi Indo Jelly Guna	Bogor, West Java, Indonesia
Yupi burger	Candy	Multilayer Film	PT. Yupi Indo Jelly Gum	Bogor, West Java	PT. Yupi Indo Jelly Gum	Bogor, West Java
Yupi heart	Candy	Multilayer Film	PT. Yupi Indo Jelly Gum	Bogor, West Java	PT. Yupi Indo Jelly Gum	Bogor, West Java
Yupi Heart	Candy	Multilayer Film	PT. Yupi Indo Jelly Gum	Bogor, West Java	PT. Yupi Indo Jelly Gum	Bogor, West Java
Yupi Milky Moo	Candy	Multilayer Film	PT. Yupi Indo Jelly Gum	Bogor, West Java	PT. Yupi Indo Jelly Gum	Bogor, West Java
Yupi moo	Candy	Multilayer Film	PT. Yupi Indo Jelly Gum	Bogor, West Java	PT. Yupi Indo Jelly Gum	Bogor, West Java

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Zupper Keju Susu	Chips	Multilayer Film	PT. Mayora Indah	Tangerang, Banten, Indonesia	PT. Mayora Indah	Tangerang, Banten, Indonesia

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