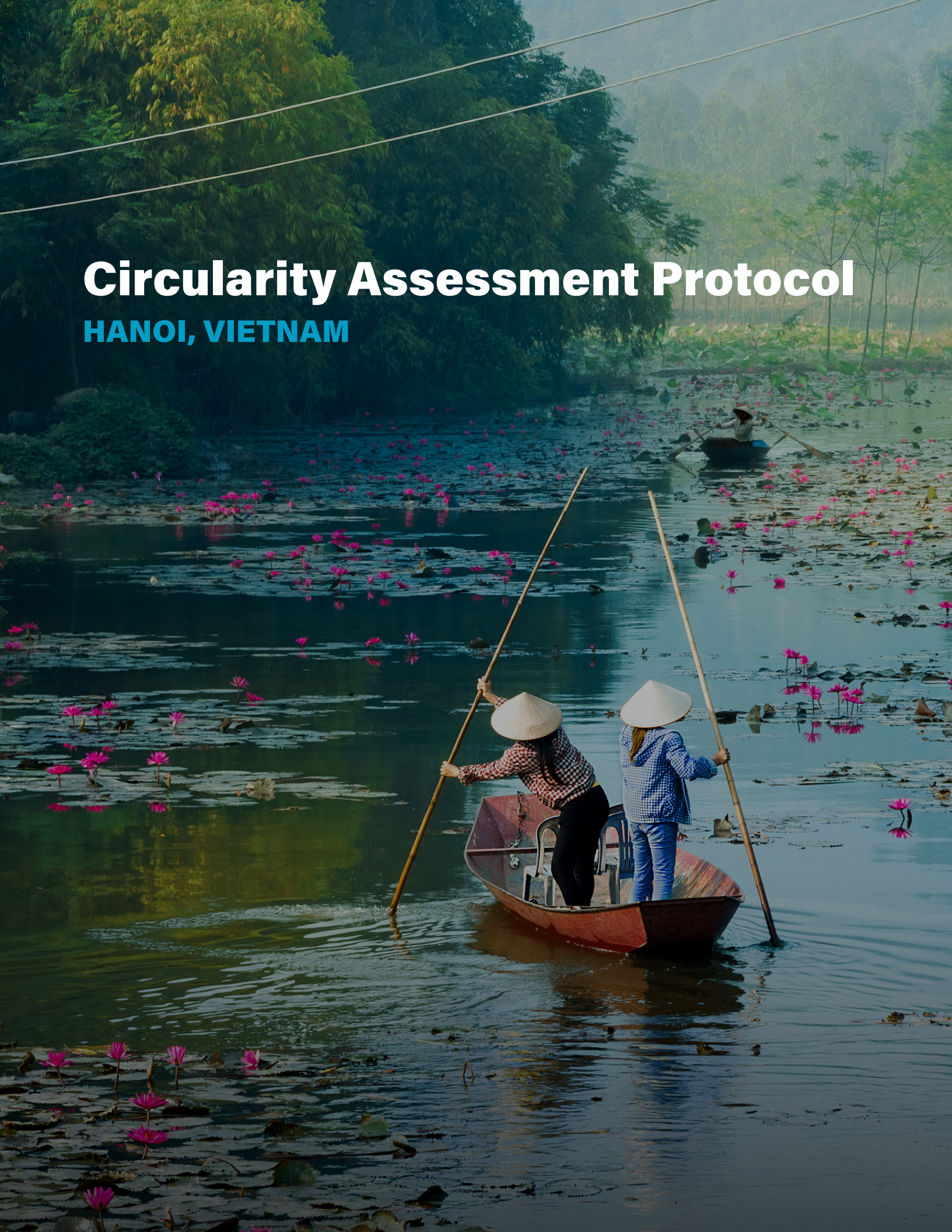


# Circularity Assessment Protocol

## HANOI, VIETNAM



# Foreword

Plastic pollution is one of the greatest challenges facing our ocean today and requires action at all levels — international, national, urban, and individual. Vietnam has emerged as an early leader on the issue, setting ambitious goals to tackle marine debris in one of the world's first comprehensive country-level strategies, its National Action Plan on Marine Plastic Debris. Admirably, when developing its plan, the Vietnamese government showed not only political commitment, but also a determination to use the best available science to inform its actions.

Ocean Conservancy was honored to be included in the consultative process, and as longtime advocates for and investors in the science around ocean plastics, we also saw an opportunity to support the Government of Vietnam in its efforts to generate Vietnam-specific research around the issue. With the generous support of the U.S. Department of State, we teamed up with longtime partners at the University of Georgia's New Materials Institute and the Centre for Marinelife Conservation and Community Development (MCD) in Hanoi to bring Dr. Jenna Jambeck's Circularity Assessment Protocol (CAP) to Vietnam.

The ultimate goal of the CAP is to empower communities to understand their circularity challenges and opportunities. Armed with data, they can make informed decisions on how best to address plastic, litter, waste management, and circular economy challenges in their local context.

In addition to the science itself, the CAP process afforded us an opportunity to further deepen our relationship with MCD, a true leader in the marine debris space in Vietnam. This partnership became even more important when the global pandemic prevented the U.S.-based science team from the New Materials Institute from traveling to Vietnam to participate in the fieldwork. Everyone stepped up to develop an alternate strategy: the U.S. scientists developed the necessary materials to train their Vietnamese counterparts remotely on the CAP methodology, with MCD navigating around the current public health crisis and multiple mandatory lockdowns to conduct all of the fieldwork safely and effectively.

This is the true power of partnerships — the ability to move forward even under adverse circumstances. Ocean Conservancy hopes that the CAP reports for Hanoi and Nam Dinh will spark conversations and innovative collaboration in those cities and elsewhere in Vietnam around the implementation of the country's National Action Plan; and serve as a blueprint for other governments ready to do the same. After all, the ocean — and plastic pollution — know no boundaries, and it's going to take all of us to solve this problem.

**— Chever Voltmer, Director Plastics Initiative, Ocean Conservancy**

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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[www.circularityinformatics.org](http://www.circularityinformatics.org)

Athens, GA, July 2021

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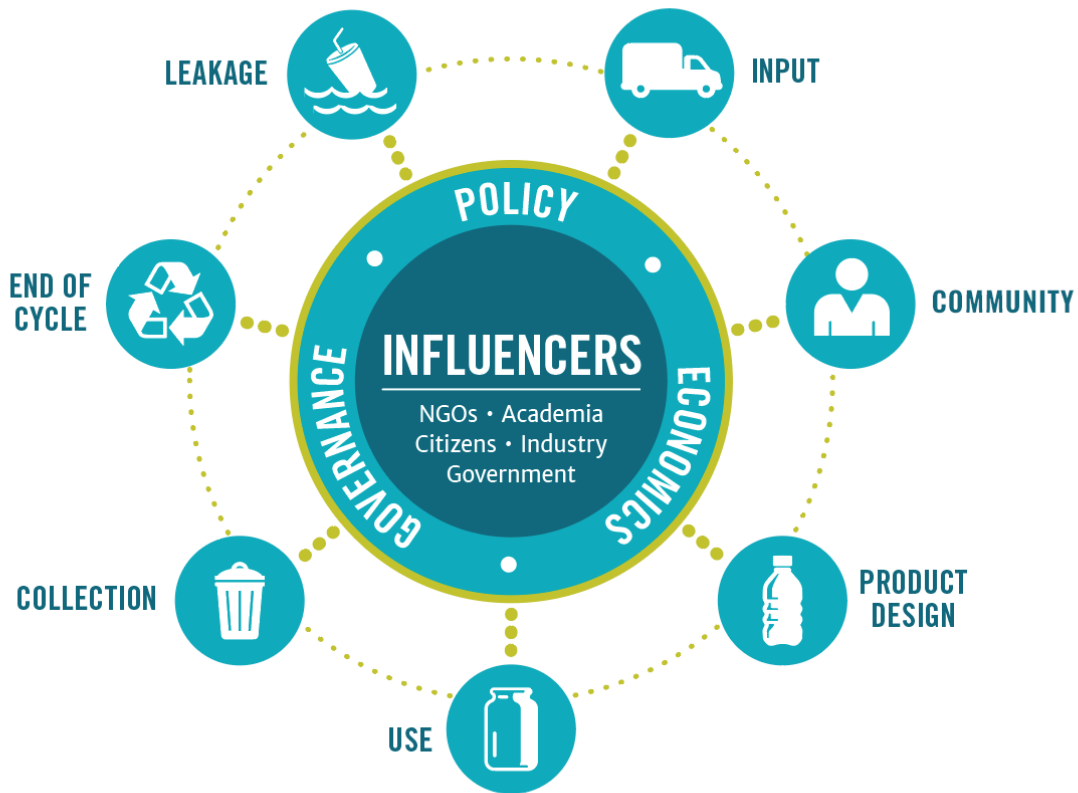
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# Executive Summary

Developed by the [Circularity Informatics Lab](#) at the University of Georgia (UGA), the Circularity Assessment Protocol (CAP) is a standardized assessment protocol to inform decision-makers through collecting community-level data on plastic usage. 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, is composed 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 February 2021 and March 2021, a team from the Centre for Marinelife Conservation and Community Development (MCD), with guidance and support from the Circularity Informatics Lab, conducted fieldwork in the city of Hanoi, Vietnam. The CAP was conducted with support from the city's local government and Ocean Conservancy. Field work 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. Key findings from each spoke are summarized in the table.

## Key Findings and Opportunities

### INPUT



**Findings:** All top convenience store items are in plastic packaging, largely multilayer plastic film which is not readily recyclable. All of the tobacco, beverage, and 91% of the chip products sampled had manufacturers domestic to Vietnam, which may be an opportunity to increase circularity locally.

### Opportunities

- Vietnam is a resource-rich country, and there could be promising business opportunities to locally design and manufacture bio-based and biodegradable alternative plastic products.
- There may be opportunity to work with domestic manufacturers on delivery of products, either to redesign product packaging, promote reuse schemes or bulk sales, or foster EPR strategies.

## COMMUNITY



**Findings:** The city has a strong plan in the coming years to improve waste management and public awareness. Convenience and cost are barriers to behavior change that should be addressed to maximize the effectiveness of new systems. The public seems receptive to interventions from local government to communicate and enforce policies and increase education. According to convenience store owners and food vendors, accessibility and knowledge of plastic alternatives is limited or non-existent, although NGOs and academics shared that alternatives such as reusable tote bags and grass straws are becoming increasingly common.

### Opportunities

- Engage the community in this system through education and outreach.
- Conduct a city-wide baseline assessment on waste collection coverage (and storage at the home and transfer facility level) to help to identify areas that need coverage, guidance, and resources.
- Partners in this program may be able to work together to develop targeted communication campaigns to reach various demographics with clear messaging.
- Communication campaigns can be mindful and take a systematic approach so that all communities across the city can be engaged.

## PRODUCT DESIGN



**Findings:** 100% of the top-brand of chips and 66% of all top products from convenience stores are packaged in multilayer plastic film. All to-go cup and container products from vendors and restaurants were packaged in PET, which is often readily recyclable.

### Opportunities

- Further examination of the recycling of PET could be explored and/or enhanced.
- Entrepreneurial stakeholders developing alternative plastic products or schemes to incentivize behavior change expressed a need for help with information dissemination to effectively communicate their products or services to target audiences.
- Policy implementation continues to be a challenge but is necessary to transform plans into actions.



**Findings:** Several things inhibit change to reuse and use of alternative items. Choices are largely controlled by what is readily available and convenient. Another barrier to change is habit and the established trust in plastic products. Cost and convenience of traditional plastic result in fewer vendors and stores offering alternatives.

### Opportunities

#### USE



- There are opportunities for new reuse and alternative product systems, as well as information dissemination on alternative product availability and use.
- Create a campaign around plastic bags that raises awareness for reusable bags.
- Provide business administration training, mentoring opportunities, and financial loans for women and the younger generation will facilitate their entrepreneurial efforts in starting and sustaining a business that promotes the use of alternative materials.
- The high cost of alternatives and lack of standard regulations around biodegradable items has caused local shops and vendors to not switch from traditional plastic, so there may be opportunities to develop and enforce new rules that would standardize alternative materials.

**Findings:** While household waste collection rates are relatively high and the service is readily available, there is still some confusion around monthly collection fees, daily collection time, and sorting policies. The relatively high number of informal dumpsites in the city may be another indication that people are confused about how to manage their waste or are limited in their choices for management by economics or logistics. Improvements could be made through engaging the public, policy communication and enforcement, and clear methods to maximize sorting and collection for recycling.

## COLLECTION



### Opportunities

- Improvements could be made through engaging the public, policy communication and enforcement, and clear methods to maximize sorting and collection for recycling.
- Design the optimal system in collaboration with the city and both private and informal collectors.
- There may be opportunities to provide additional resources (e.g., electric carts instead of bicycles or easy-to-maneuver pushcarts) and standardize (e.g., collection times and locations) the informal recycling sector so that the informal workers can increase their collection and optimize the recycling system in Hanoi.
- Other working conditions for the informal sector could be explored to determine if other improvements are needed.
- Increase the number of public waste bins in the city, coupled with increased efforts to communicate proper disposal of waste.

**END OF CYCLE**

**Findings:** Plastic is a relatively small percentage of the household waste stream (under 10%), but it is increasing and still often ends up in landfills or open dumps. Composting occurs in the rural areas but there is no existing market for compost. Previous attempts at larger-scale and formalized recycling have also failed due to a lack of market value, but there is a robust informal system of recycling. The one small existing and newly constructed combustion facility (proposed to open September 2021) with more proposed may be a barrier to source separation and recycling.

**Opportunities**

- There could be an opportunity to more strongly connect local food vendors and formal or informal recyclers to manage the waste stream.
- Government engagement with the informal recycling community and further integration of the workers into the more formal and integrated recycling system of the city is an opportunity.
- The tensions in waste treatment and disposal remains a challenge. While expansion of combustion facilities is proposed, more waste segregation and recycling are being encouraged. There is an opportunity to make a citywide and long-term solid waste management plan using an integrated approach.

**LEAKAGE**

**Findings:** Litter densities, at an average of 3.11 items/m<sup>2</sup>, were slightly higher in Hanoi compared to other smaller cities across Southeast Asia (Indonesia, Malaysia, and Vietnam) that range from 0.75 to 3.39 items/m<sup>2</sup> with an average of 1.83 items/m<sup>2</sup> (n = 27), as well as slightly higher than litter densities in Nam Dinh City with an average of 2.03 items/m<sup>2</sup>. 12 dumpsites were documented, and only 8 public waste bins and 2 recycling bins were documented within the 2700 m<sup>2</sup>. Food plastic, tobacco products, and plastic fragments together constituted about 60% (by count) of the litter items. Plastic food wrappers, cigarettes, and film fragments were among the top five items in all three population count areas.

**Opportunities**

- Many of the opportunities outlined in the following CAP components could contribute to the reduction of leakage in the city.
- Create educational campaigns around littering that target the most problematic single-use items found in the city and raise awareness for and availability of alternatives and reusable items. This could be coupled with economic incentives that would sustain long-term behavior change among community members and business owners.

Partners on this project included Ocean Conservancy through funding from the US State Department, and a local collaboration with The Centre for Marinelifelife Conservation and Community Development (MCD). The CAP in Viet-

nam's capital Hanoi, which is located along Vietnam's second-longest river, the Red River, provides a data-driven comprehensive overview of Hanoi's circularity of materials, with a focus on plastic packaging. This assessment will help to identify community-driven actions to meet local needs and fuel efforts to reduce plastic pollution on land.

## Meet the Partners

### Ocean Conservancy

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 1987, 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 their Trash Free Seas® program visit [oceanconservancy.org/trashfreeseas](https://oceanconservancy.org/trashfreeseas), and follow Ocean Conservancy on Facebook, Twitter, and Instagram.

### MCD

MCD is one of Vietnam's leading NGOs fighting against marine debris and ocean plastic, having pioneered environmental protection and community development across the country. As the primary in-country partner, MCD brings to the project unique and essential expertise on local waste conditions and cultural context. MCD has spent over 15 years establishing relationships with political leaders at all levels of government and was critical in obtaining formal approval from Vietnamese authorities to conduct in-country work on the current project. In 2019, MCD collaborated with Dr. Chelsea Rochman and her team from the University of Toronto (another sub-recipient on the current project) in performing a baseline assessment of marine debris conditions on the banks and in the Red River. MCD is the local collaborator with Dr. Jambeck and her team on the CAP, which not only provides data essential to the city and Vietnam's NAP goals, but also builds the capacity of local researchers to be able to conduct baseline assessment protocols and monitoring techniques.

# Glossary of Acronyms and Abbreviations

**CAP** – Circularity Assessment Protocol

**C&D** – Construction and Demolition

**CE** – Circular Economy

**CIL** – Circularity Informatics Lab

**LIP** – Local Implementing Partner

**MCD** – The Centre for Marinelife Conservation and Community Development

**NMI** – New Materials Institute

**PE** – Polyethylene

**PET** – Polyethylene terephthalate

**PP** – Polypropylene

**PVC** – Polyvinyl Chloride

**PPE** – Personal Protective Equipment

**PS** – Polystyrene

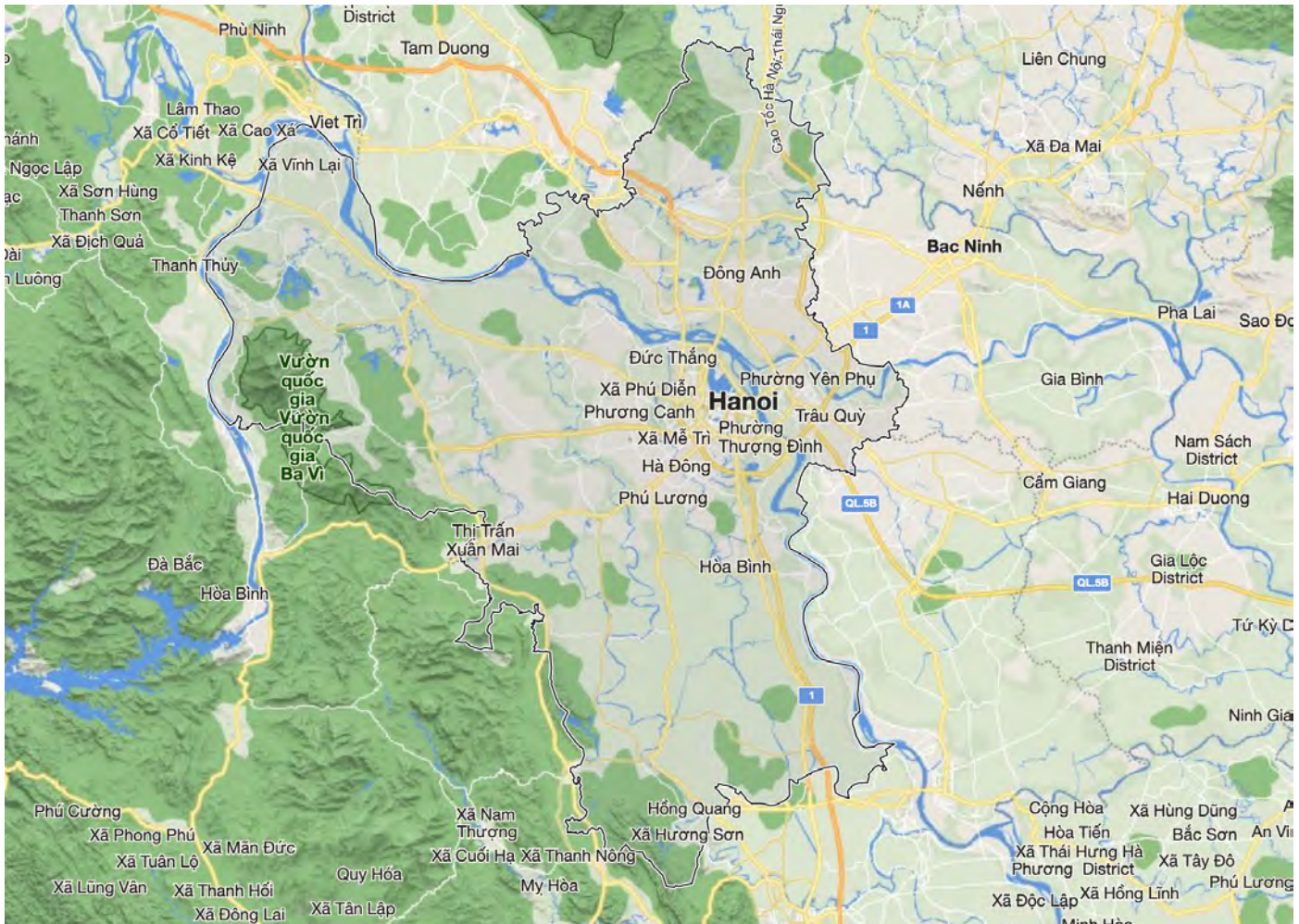
**UGA** – University of Georgia

**URENCO** – Urban Environment Company

## Introduction

Vietnam is home to a population of over 97 million people and has an average per capita waste generation rate of 0.33 kg/person/day (Kaza et al. 2018; CIA Factbook 2020). It has been estimated that the total waste generation in Vietnam may be over 27 million metric tons annually (World Bank, 2018). However, it is worth noting that there are also significant regional variations in waste generation throughout the country. While the major urban centers of Ho Chi Minh City, Hanoi, Haiphong, Da Nang, and Can Tho accounted for 22% of the country's total population in 2017, they were estimated to collectively generate 70% of the country's total waste (World Bank Open Data 2019; Schneider et al. 2017). As for the municipal solid waste collection rate, it has increased from 78% in 2008 to 85.5% in 2017 (MONRE, 2017). In suburban rural areas, towns, and townships the waste collection rate is anywhere from 60-80% (MONRE, 2017), and only 40% in rural areas (World Bank, 2018). Collection services are practically non-existent in most villages and mountainous regions due to distance and financial limitation (Trinh et al., 2021). Where waste collection services do not exist or when community members choose not to participate, community members may get rid of their waste via open burning, burying waste underground, or dumping their waste on vacant land that gradually becomes an unofficial dumpsite for the community. In 2020, it was estimated that about 75% of collected waste is landfilled (Trinh et al., 2021), and only 20% of the 904 estimated landfills in Vietnam are considered to be hygienic. Countrywide, solid waste recycling activities are informal and spontaneous, and the estimated country-wide recycling rate is low at about 10% (World Bank, 2018). Furthermore, plastic processing facilities are poorly monitored and use outdated infrastructure that could be a public health hazard for the employees and nearby community members.

As the capital of Vietnam, Hanoi is the cultural and political center of the country. Hanoi has an estimated population of 8.418 million people (World Population Review, 2021), and the population distribution is heaviest along the Gulf of Tonkin, with the Red River Valley to the north flowing south to the South China Sea. Roughly 6,500 metric tons of solid domestic waste is generated by Hanoi's residents daily (Nga 2019). The Hanoi People's Committee is estimated to manage more than 6,400 metric tons of domestic waste per day (DONRE, 2014). The plastic waste collection rate is about 5-20kg per scrap collector, and each day 50-200 metric tons of scrap are salvaged from the total volume of waste generated (Leroy & Cong 2015). Additionally, it is reported that 89% of the waste generated in Hanoi is landfilled (Nga 2019); and that a small quantity (100 metric tons) is also combusted currently. However, Hanoi announced the construction of four combustion facilities that are expected to reduce waste volumes by 80% whereas the remaining 20% will be landfilled; one facility with a capacity of processing 4,000 tons of waste per day is scheduled to open September 2021. Urban areas comprise just over 12% of Hanoi's total area, yet these urban areas account for over 46% of the city's population and 70% of the total volume of domestic waste (Leroy & Cong 2015).



Hanoi, Vietnam

In partnership with Ocean Conservancy and MCD, Hanoi has set out to characterize and understand its materials flow and waste management systems and identify associated opportunities for collaborative solutions. As a first step in the process, UGA and MCD are collaborating to conduct a CAP in the city.

The Circularity Informatics Lab at the University of Georgia (UGA) developed the CAP in 2018, 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 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 to each other and to life cycle impacts beyond each spoke. The CAP is a framework approach to the flow of materials, in this case 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, the CAP has been conducted in 26 cities in ten countries.

This report documents work conducted by the Circularity Informatics Lab at the University of Georgia (UGA) and The Centre for Marinelifelife Conservation and Community Development (MCD). Background information and a literature review was conducted from May 2020 – September 2020. Field work was conducted in February 2021 – April 2021. The report is split into the following sections of the CAP, which include results and discussion of each: Input, Community, Product Design, Use, Collection, End of Cycle and Leakage, followed by Opportunities for the city to explore ways to increase circularity and decrease leakage of plastic into the environment.

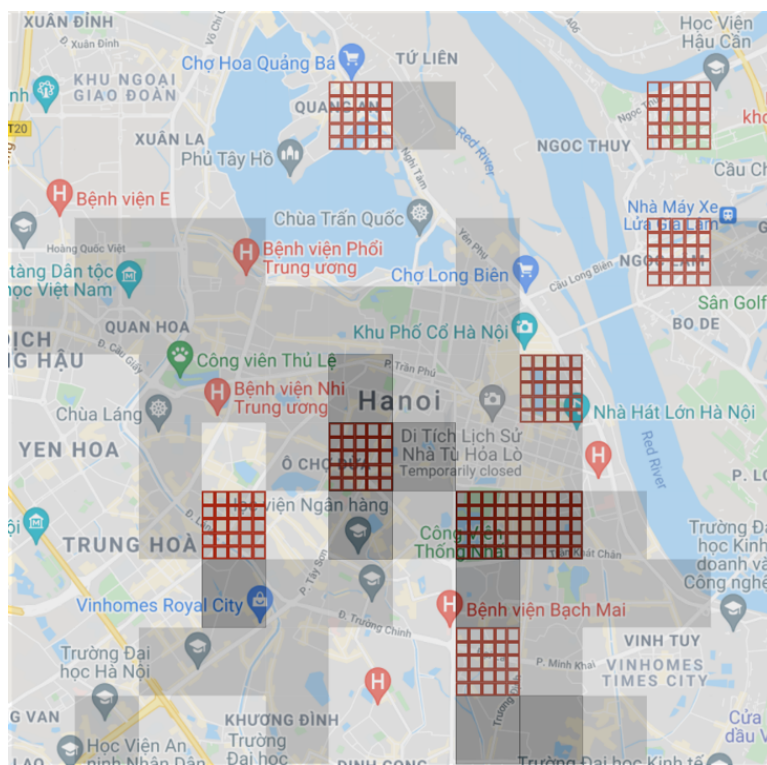


# CAP Results

## Input

The Vietnam Plastic Association reports that Vietnam needs approximately 3.5 Mt/year of virgin plastic including: polyethylene (PE), 30%; polypropylene (PP), 23%; polyethylene terephthalate (PET), 9%; and poly vinyl chloride (PVC), 5.7%, but domestic plastic production can only supply 0.9Mt of it. This only meets 25% of the country's total demand leaving the plastic industry highly dependent on the import of raw materials. Vietnam's plastic industry grew on average 11.6% annually which is almost three times faster than the global growth rate of 3.9% annually. In 2017, the plastic industry volume was estimated at around 15 billion USD which was about 6.7% of Vietnam's GDP the same year (Solhofer et. al, 2021). The majority of the products produced are packaging (37%), household furniture (29%), construction (18%), and electronic appliances (29%) making Vietnam one of the top 20 global plastic product exporters and exports plastic products to more than 55 countries (Daniel, 2020) (Vietnam Plastic Association, 2020). The plastic industry consumed about 5.9 Mt of virgin plastic material in 2017, and the annual per capita consumption of plastic products grew nearly 11 times between 1990 and 2017 from 3.8 kg to 41.0 kg per person (Daniel, 2020, Solhofer et. al, 2021).

**Figure 1: Map of the 10x10 km sample area with Hanoi**



To get a snapshot of the characterization, scope, and source of common plastic packaged items that are entering Hanoi, samples of common convenience items were sampled within nine 1km<sup>2</sup> transects in Hanoi – three within each tertiles of the population count. The Local Implementation Partner (LIP) selected 3 convenience or grocery shops to sample within each 1km<sup>2</sup> transect area, totaling 27 samples. For each shop, the LIP collected the most popular brands of candy, snacks, beverages, and 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 108 product samples total, 27 of which were candy, 27 chips, 27 beverages, and 27 tobacco products. The weight of both the plastic packaging and the product itself were measured for each item using a kitchen scale.

For each of the products sampled, the LIP noted the type of packaging (including polymer, if possible), the brand, and the parent company. 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). Table 1 contains the minimum, maximum and average distance to both the manufacturing facilities and parent companies, Figures 2-4 show maps of both manufacturer and parent company locations.

**Table 1: Distances to Parent Company Headquarters and Manufacturing Facilities for Most Popular Brands**

	Distance Store to Manufacturer (km)				Distance Store to Parent Company (km)			
	Minimum	Maximum	Average	Median	Minimum	Maximum	Average	Median
Beverages	1	5,529	1,286	966	7	13,826	2,980	1,157
Candy	1	10,039	2,557	1,840	1	13,340	4,236	2,743
Chips	1	8,503	1,835	872	92	13,154	4,597	2,202
Tobacco Products	1	1,214	706	1,039	1	13,342	7,270	9,008

\*Note: Distances were projected using an Azimuthal Equidistant projection. Values have been rounded to the nearest km. \*\*Most of the manufacturing locations in Vietnam are at province-level rather than city-level.

Figure 2: Location of parent company headquarters of common brands of convenience products in Hanoi

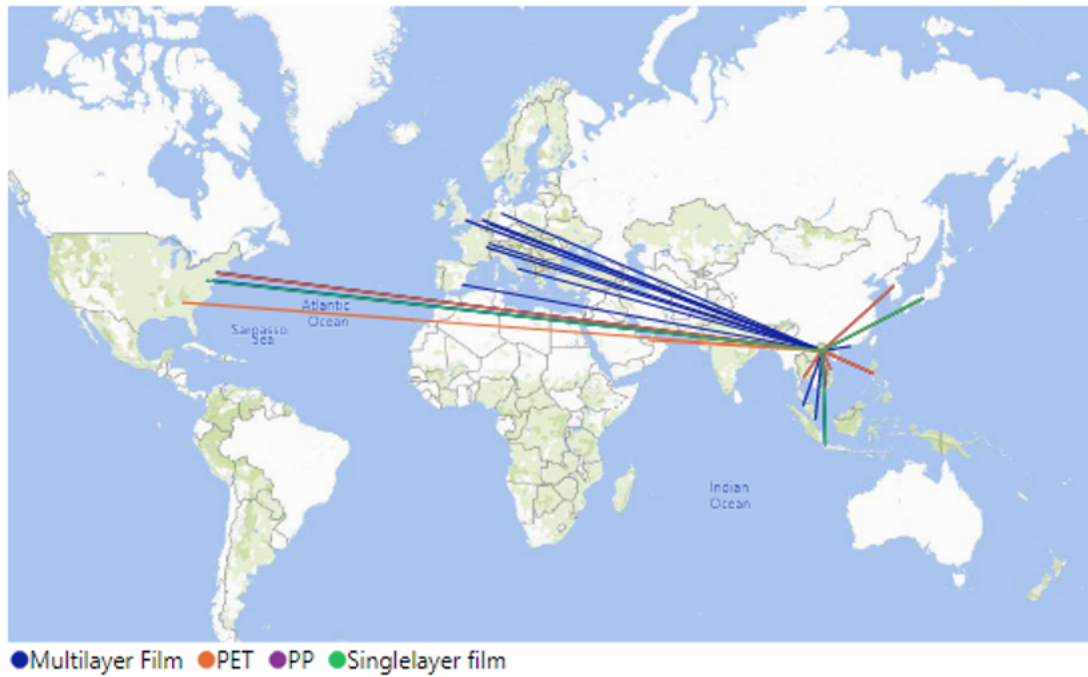
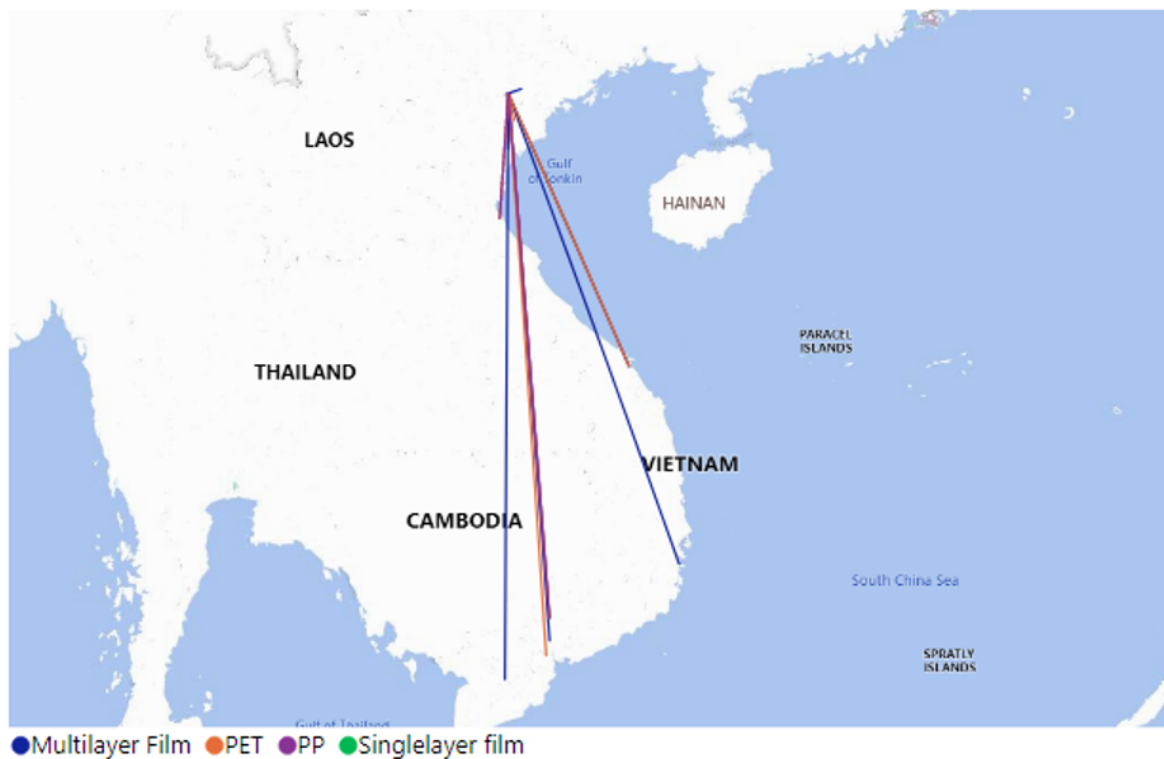


Figure 3: Location of manufacturing facilities of common brands of convenience products in Hanoi



**Figure 4:** Location (in Vietnam only) of manufacturing facilities of common brands of convenience products in Hanoi



As is often the case, parent company locations are further away on average than the manufacturing sites; 65% of the parent companies were located outside of Vietnam (Figure 2). The parent companies and manufacturing facilities for the beverage products are the closest on average, at 2,980 km and 1,286 km away. The parent companies for both candy and chip products are on average 4,200 – 4,500 km away followed by tobacco products at 7,270 km away. The farthest parent companies were located in Europe (Germany, Spain, and the UK) and the USA.

For manufacturing, sites were much closer and 85% of manufacturers were domestic to Vietnam. Tobacco manufacturing facilities were on average the closest at 706 km away (Figure 3). Beverage manufacturing facilities were on average 1,286 km away and chips and candy were furthest away at 1,835 km and 2,557 km, respectively. The locations for manufacturing tobacco and beverage products were all domestic to Vietnam, whereas all chip products sampled except for one that was manufactured in Germany came from Vietnam (Figure 4). Although chip and candy manufacturers were on average more than 1,000 km away, 133 of the total 163 products sampled were still located in the Asia Pacific region.

Of all of the products sampled, all were sold in either single-layer, PET, PP, or multilayer plastic packaging. The LIP also noted that many food products were simply packaged in a plastic bag and sold onsite.

## Community

To understand current attitudes and perceptions of plastic and waste, semi-structured interviews were conducted by the LIP with 23 key stakeholders (Table 2). Among those interviewed, four were convenience store owners, four were food vendors, four were NGOs, three were government officials, three were informal recycling aggregators, two were from academia, one was from a plastic manufacturing company, one was from a plastic alternatives company, and one was from a waste management company (Table 2).

**Table 2: Summary of stakeholder interview list**

Stakeholder Group	Number of Interviews
Convenience Store Owners	4
Food Vendors	4
NGOs	4
Government Officials	3
Informal Recycling Aggregators	3
Academics	2
Plastic Manufacturing Company	1
Plastic Alternatives Company	1
Waste Management Company	1

In Hanoi, most interviewees agreed that plastic waste is a problem within the community. The few interviewees who felt that plastic waste is not a problem in their community cited frequent waste collection as the main mitigator. In contrast, some interviewees who felt that plastic waste is a problem cited a large population density and a lack of policy as contributors to the issue. Other interviewees felt that plastic was a problem because of its presence in the environment and the subsequent health impacts that it has on local people. Examples of these sentiments are below.

**“I think the pollution level in Hanoi is greater than the pollution level in other provinces because Hanoi has a big population of more than 8 million people, according to the population report in 2019. This place has a high concentration of people and a high consumption level of plastic bags and plastic products. In my opinion, Hanoi’s level of pollution will be greater.”**

**“In my opinion, the level of plastic pollution in Hanoi is many times higher than in other provinces. Firstly, we know that Hanoi as well as many other provinces have not had a clear policy and measures to manage plastic waste practically. Secondly, Hanoi's population density is very high. Third, people's high living standards along with daily living conveniences are always associated with plastic products, and this high standard of living is related to consumer behavior or cultural characteristics that we have yet to change.”**

**— Academic**

**“I can see that the reality of the plastic pollution is getting more and more serious, and it's not controlled. It pollutes the air, land, and water and affects human health as well.”**

**— NGO Representative**

**“What I’m seeing is serious. I don’t think we don't have to say much about the impacts because that is too obvious. In general, I think it affects the economy, the environment, and human health.”**

**— Government Official**

Most interviewees felt that community awareness of plastic waste must be increased. A couple of interviewees felt that community awareness was already high, and they stated that this is because their community is frequented by so many tourists who are sensitive to proper waste disposal. More broadly, interviewees tended to suggest that community awareness is a factor that can be improved upon, examples of which can be found below.

**“Although everyone knows that plastic pollution is a problem, shifting from awareness to behavior is a process that we still have to work on. In general, the underlying purpose of the issue is to raise awareness.”**

**— NGO Representative**

**“... The biggest difficulty in management of solid waste in general and plastic waste in particular is how to change the perception of people. That awareness leads to a change in actions... Each individual just needs to change a little, then it will have a great effect in the community if we all work together.”**

**— Academic**

**“The residents haven’t realized yet that they should separate waste at the source due to long-established habits; or due to lack of storage at home to sort recyclable waste.”**

**— Waste Management Company Representative**

**“I think that community stakeholders need to have a clear awareness of the issue of plastic waste management in order to work together to maintain and develop other activities.”**

— NGO Representative

Perceptions of whether plastic alternatives are available to the public were mixed. Various convenience store owners and food vendors agreed that there is very little access to plastic alternatives, while NGOs and academics shared that alternatives such as reusable tote bags and grass straws are becoming increasingly common. Examples of these stark contrasts in opinions are shared below.

**“Not even once. Nobody has come here to introduce any alternatives to plastic products.”**

— (I-4 Food Vendor)

**“Customers really like the grass straw product, especially foreign customers.”**

— (NGO Representative)

**“Along with the increasing awareness of people, businesses, and managers, environmentally friendly products are becoming more and more popular and diversified, especially products that replace plastic. It can be clearly seen in daily life, instead of using disposable plastic bags, we can use reusable bags.”**

— Academic

**“As we all know, in the past two years, many eco-friendly alternatives to plastic products have been invented and manufactured in order to replace plastic products...I think these products are rather friendly to the environment. They are relatively good replacements to plastic products and can be used widely in the community in the future.”**

— (I-1 Academic)

Stakeholders who agreed plastic pollution is an issue gave their thoughts on potential solutions, as well as barriers to solving plastic pollution and effective waste management in Hanoi. From the interviews conducted, the three most common challenges to improving waste management brought up by the interviewees are a lack of community awareness, a lack of policy, and a lack of technology, which can be attributed to the high cost of bringing in newer waste management technologies. Interestingly, community awareness and policy improvements are also the two most cited factors when interviewees were asked about what changes could improve waste management practices. Suggestions for policy improvements included policy to increase awareness of stakeholders, policy targeting the importation of plastic scraps, policy supporting the use of plastic alternatives, and policy to attract or incentivize investors who would be interested in funding newer waste management technology. These are clear ideas from the community on ways to improve going forward, and the general trends of awareness and waste management improvements seem to be increasing at this time.

## Product Design

**Figure 5: Example of Convenience Stores in Ha Noi**



(Photo Credit: MCD)

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 LIP was not able to sample stores and vendors in each of the nine 1km<sup>2</sup> transect areas, as it can be difficult to find them in many of the less urban parts of the city, but they were able to sample 27 stores and 25 vendors in total. The weight of both the packaging and the product itself were collected for all 269 samples and averaged (Table 3).

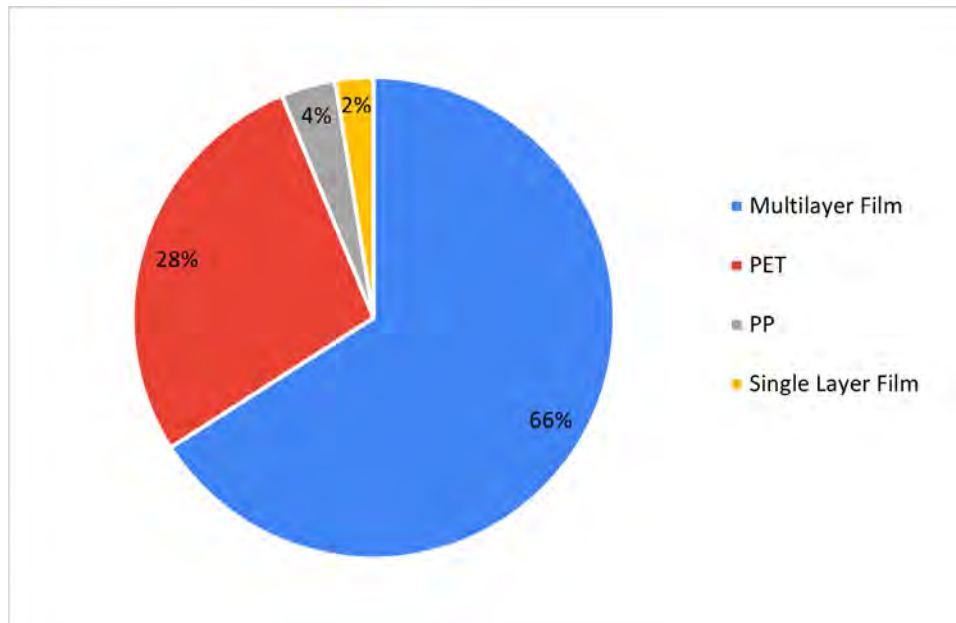
**Table 3: Average weight of products and their plastic packaging for common convenience items**

Product Type	Count of Product	Average Weight of Plastic Packaging (g)	Average Quantity of Product (g)
Beverages	81	22	379
Candy	81	4	81
Chips	81	5	44
Tobacco Products	26	4	23

All (81 items) of the top chips purchased from convenience stores in Hanoi were packaged in multilayer film plastic. In addition, 86% of candy products were also packaged in multilayer film plastic, and the remaining 7% were packed in either single layer film (~5%) and or PET (~2%). Of the beverage items, 93% were in PET packaging and 7% were in PP packaging. A majority of the items sampled were packaged in multilayer film (66%) which is low-value and not readily recyclable in Vietnam (Figure 6).

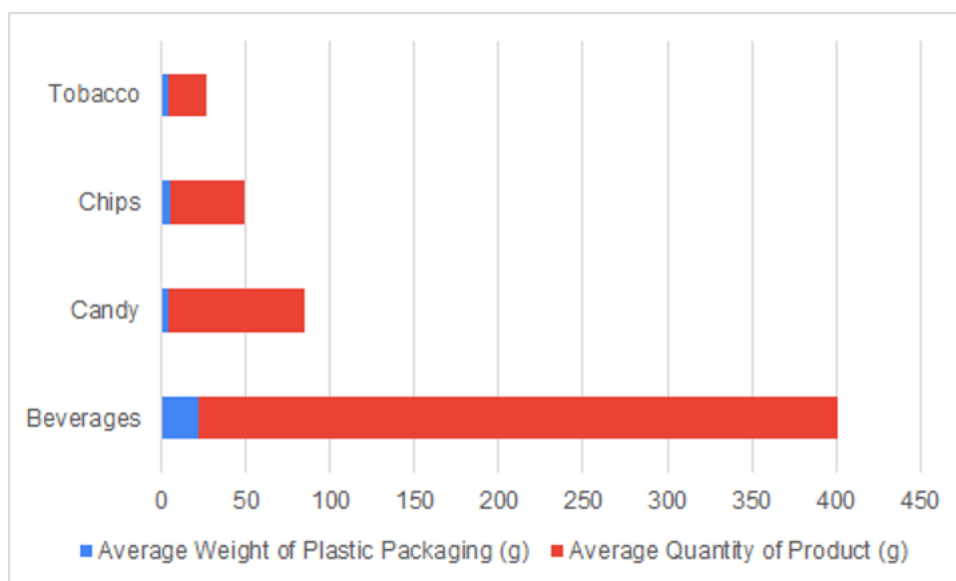


**Figure 6: Material Breakdown of Top Convenience Store Items**



Beverage products on average had the highest packaging and product weight, though they had the smallest ratio of packaging weight to product weight (Figure 7). Tobacco products had a higher ratio of packaging weight to product weight. Candy and chips had similar ratios of packaging weight to product weight. For example, for a smaller amount of product purchased by the consumer, the higher the packaging to product ratio. Buying larger quantities of product, when possible, or designing minimal packaging for desired quantities of product makes product delivery more efficient. In addition, packaging with more weight is typically more recyclable, but can have a higher carbon footprint for transport.

**Figure 7: Convenience Store product to plastic ratios**



shown in grams

**Figure 8: Example of Food Vendors in Hanoi**

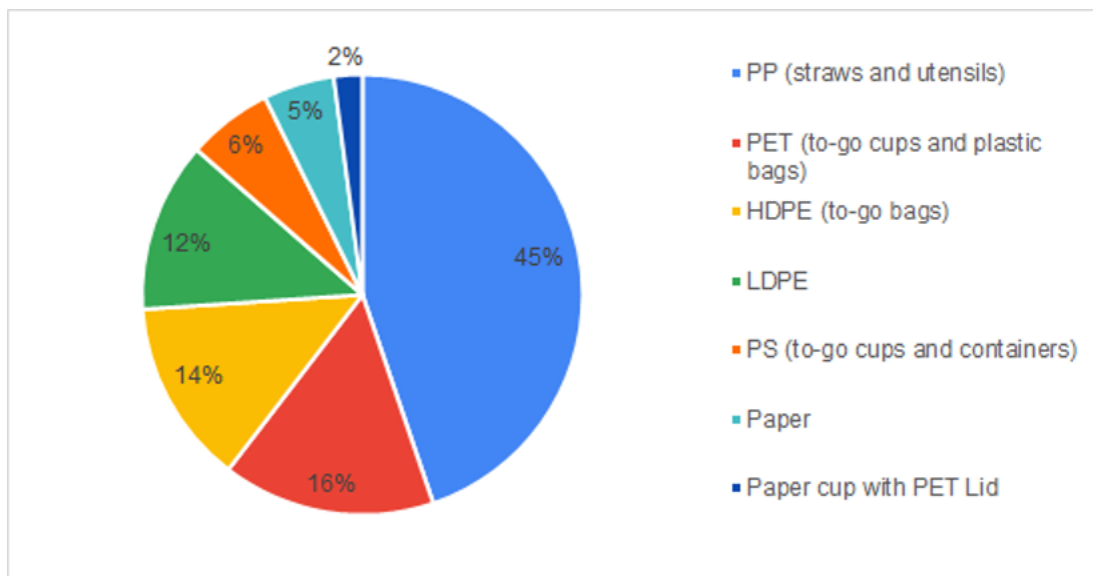
(Photo Credit: MCD)

Within each of the selected nine 1km<sup>2</sup> sampling areas in Hanoi, the LIP also visited up to 3 randomly selected food vendors or to-go restaurants to sample the food packaging and utensil types that were being distributed, totaling 25 vendors sampled (Figure 8). The LIP collected to-go containers from those vendors and documented their weight, material type, and brand, where possible (Table 4).

**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)
PP (straws and utensils)	43	5.19
PET (to-go cups and containers)	15	11.28
HDPE (to-go bags)	13	5.31
LDPE	12	3.96
PS (to-go cups and containers)	6	7.67
Paper	5	5.00
Paper cup with PET Lid	2	16.00

In contrast to the products observed in convenience and grocery stores, the majority (~60%) of products sampled from food vendors and restaurants consisted of a combination of PET and PP packaging (Figure 9). It was also noted by the LIP that some higher-priced coffee shops will sell their coffee in to-go paper cups with a PET lid and will then wrap those plastic cups in plastic film or a plastic bag so that they can be taken by the consumer and transported via motorbike, which is a common practice in the Vietnamese cities.

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

Biodegradable plastic bags manufactured by Opec Plastics Co. or Nam Thai Son Co., Ltd. were provided by four vendors for sampling and weighing as the only alternative to plastic. The LIP noted that these vendors had no plastic option available, and the biodegradable bag was provided at no extra cost.

It was also noted in an interview with a plastic alternative producer, that Vietnam has put into place a policy to incentivize the manufacturing of alternative materials.

**“In fact, in Vietnam, there is a policy regarding tax exemption for environmentally friendly products. For example, manufacturing nylon will have to pay a tax of 45,000 VND/kg under the law ... [alternative plastic company] products meanwhile are tax-free because they are not nylon, not plastic. However, the enforcement of this tax law in Vietnam is also very superficial. Normally, manufacturers of plastic bags can circumvent the law, so they don’t have to pay tax.”**

— alternative plastic producer rep.

**“It is necessary to have it enforceable and not overlooked so that small businesses cannot evade taxes. Then the game will be fair. But now, neither environmentally friendly nor not environmentally friendly ones have to pay taxes. Then the environmentally friendly product industry will not be able to have a competitive advantage in price.”**

— alternative plastic producer rep.

It was also noted in an interview that Vietnam currently has no clear policies on classification standards of eco-friendly products.

**“We may have proposals related to a set of standards for environmentally friendly products, standards that all parties must comply with. Because in the current market, everyone is declaring themselves. Brands can say that they are environmentally friendly but there is not a single department that sets a standard forcing them to pass a test or something to be labeled as eco-friendly. That's the first thing.”**

— alternative plastic producer rep.

It was also noted that raw materials used for making alternative materials to plastic were often exported to regions that already had plastic bans in place.

**“We focus on two channels: export and domestic. At present, the export channel accounts for more than 90%. It focuses on the markets where disposable plastic is prohibited such as Europe in the summer of 2021, some states and cities in the US. In addition, we also export to some countries in Asia like Japan, Korea, Taiwan, Hong Kong and India.”**

— NGO rep.

When alternatives are available, they often come at a much higher cost to vendors as compared to plastic products, which is another deterrent to transition.

**“In the process of making or distributing the product, in the beginning, I also had some difficulties. I did not have much experience in production, so the product loss was considerable. Besides, we have to pay the costs for the material which is from nature and contribute to creating jobs for farmers, so the price of the product will be a bit higher compared to [other eco-friendly alternative products]... organic products are always high on the market ... [company] is trying to automate its processes. In order to proceed with the automation, cost optimization can reduce the price to the best and also give more access to more restaurants, hotels, and more users. Then, my solution can spread widely and reduce a lot of plastic.”**

— NGO rep.

## Use

Among the 27 convenience stores and 25 food vendors sampled in Hanoi, all of them offered plastic as their main type of bag. The average weight of the plastic bags sampled was 7.0g. Plastic bags were often cited as an item that is both critical and difficult to replace for consumers, but also often ends up in the environment due to its difficulty in collection and lack of value in recycling.

Habit and convenience seem to be strong inhibitors to change in the manners of reuse and use of alternative items.

People tend to be in a routine of using plastic as the default option and are not aware of alternative options to single-use products. It was noted that, even if people are indeed aware of the negative impacts of plastic pollution and want that to change, they are often not able to make a change themselves because plastic is convenient and cheap and there are no incentives or policies to encourage alternatives.

**“Third, about the policy, our current policy still favors the production of traditional plastic bags because it's cheaper. There aren't many policies that support eco-friendly or biodegradable plastic products. However, I want to say that biodegradable plastic may not be that good.”**

— Government official

**“Firstly, we know that Hanoi as well as many other provinces have not had a clear policy and measures to manage plastic waste practically, suitable to the situation as well as each locality. Current measures only stop at the activities of collection, burial and recycling, but lack consistent propaganda measures to change behavior in the process of using plastic materials.”**

— Academic Rep.

In Hanoi, habits and lack of awareness of alternative materials seem to be stronger than efforts made by education and government campaigns, and are largely controlled by what is most convenient, readily available as well as the established trust in plastic products. Plastic bags are irreplaceable in this way; the alternatives must be as convenient and reliable as the plastic material option. The LIP noted in an interview that consumers typically purchase and use plastic items for convenience, and because they are not familiar with or trusting of other options. There is opportunity here to inform businesses and individual buyers of alternative products that are readily available to them in Vietnam, and in many cases, are products made in Vietnam that contribute to the country's economic growth.

**“Many provinces don't know much about [alternative products]. If we have the opportunity to participate in the events of [NGOs], we will have the chance to access and implement this [alternative products] faster and more effectively instead of us doing it ourselves, which makes people unwilling. People will be hesitant to receive our information or our products, but through organizations like [well known NGOs], the related departments, agencies and consumers will feel more secure when learning about our products.”**

— NGO rep

**“Not even once. Nobody has come here to introduce any alternatives to plastic products.”**

— convenience store owner

The current alternatives to plastic products are also more costly, and thus, are not widely available options in the markets. Finances typically are a large barrier in switching from plastic to sustainable materials, and it was noted that domestically only the most affluent among the population and some international buyers were able to purchase and use alternative material products produced in Vietnam. Often consumers only switched to reusable products

after they could fully and comfortably afford them or are incentivized via financial gain. In the business sector, owners can only give customers plastic alternatives when their profits allow, and most alternative and reusable options were discontinued during the COVID-19 pandemic to prevent contamination of the virus.

**“Actually, customers really like this product [alternative plastic product], especially foreign customers.”**

— Freelance business owner

**“Or for the bamboo straw, its price is a bit high and secondly, it is used many times. So, it will be unhygienic at the time of epidemic when we must not share the same thing with other people. So, this product [plastic straw] also has some advantages compared to other products on the market.”**

— Freelance business owner

**“It’s about aiding offshore fishermen in ocean waste collection by helping them to bring their trash back... people bring along many necessities such as beer cans, soft drinks bottles, drinking water, etc. However, when they are done, they throw their trash straight into the ocean instead of bringing it back. That is why we want to create an incentive, a mechanism, to help them to bring the trash back to the mainland to be treated... we must create an economic incentive mechanism to support fishermen. Their vessels do not have much space because they still need to keep fish. So, it may take space and their own efforts to be able to bring trash back... when the fishermen return to the shore, they can exchange the trash that they have brought back for necessities to be used in their next trips such as rice, fish sauce, soft drinks, milk, and beer. Those can be exchanged through a mobile-phone app. They can accumulate reward points on [their personal account in] the app and then exchange them for such necessities [e.g., food or supplies]”**

— Government official

It is promising to hear in the interviews that several initiatives have recently been started in the Hanoi region led by a wide range of groups from women and youth to NGOs and government, to foster environmentally minded behavior and use of alternatives. There is opportunity here for innovative business models in the city that could propel alternative material usage as commonplace and promote behavior change in the future.

Legislation to create solid waste management systems that are protective of the environment has existed since 1999 when Vietnam’s Environmental Protection Law was first introduced and has been revised numerous times thereafter, but implementation remains a challenge. In 2018, the Prime Minister announced The National Strategy on Integrated Solid Waste Management until 2025, with a Vision up to the Year 2050, and in 2019 introduced a National Action Plan on Marine Plastic Debris Management until 2030. As part of the plan, the city aims for 80% of tourist areas, destinations, tourist accommodation service providers and other tourist services in coastal areas to transition from single-use plastics bags and non-biodegradable plastic bags that are difficult to decompose to environmentally friendly alternative material (NAP, 2019).

## Collection

**Figure 10:** Examples of waste receptacles in Hanoi



(Photo credit: MCD)

Collection begins with community members either leaving their waste on the sidewalk in front of their home or business in a personal bin, plastic bag, or basket, or dropped in a communal bin for pick up. In Hanoi, collection is usually carried out by the informal or formal sector or a combination of both sectors using equipment such as pushcarts, wheeled bins attached to the back of a motorbike, direct truck collection, or some other form of container (Figure 10). Pushcarts are typically used in narrow alleyways since waste trucks will not fit through them. Currently single stream is the main method of disposal. A few pilot programs existed that utilized waste separation at source but have generally not been replicable on a large scale (Nguyen, 2015). However, the city recognizes that waste segregation at source is a fundamental step towards closing the loop and thus issued the Decree No. 38/2015/ND-CP that stipulates that waste separation at source is one the most important tasks to improve waste management and the value of materials for recycling.

Waste collection typically occurs at least once a day, seven days a week. As soon as the waste collector's cart is full, they then transport it to a transfer station, which can sometimes be far away, to be emptied into a compaction truck and transported to a waste management facility thereafter.

In Hanoi, waste collectors work and carry out their operations in sync with a Public-Private solid waste management company called Urban Environment Company (URENCO). URENCO is the primary company in charge of collection,

transportation, and treatment of municipal solid waste that operates mainly in Hanoi (Truong, 2018). Households who do not have access to these services or hiring an informal waste collector use their own means of waste disposal which often results in waste dumped in nearby rivers or lakes or discarded at sites near their home or treated by open burning (Tanh et al., 2012).

A survey in Hanoi in 2011 found that plastic waste accounted for 9.6% of household waste (Kawai et al., 2016). Recycling activities are mainly implemented by informal sectors; individual waste pickers collect high-value plastic such as polyethylene terephthalate (PET) bottles, while plastic with little or no value is landfilled. Currently, minimal efforts are being made to collect and recycle low-value plastic since few buyers exist.

**“And now in Hanoi, we are also implementing initiatives on reducing plastic waste to serve the circular economy of resources. Currently we are focusing on Nam Tu Liem district and Hoan Kiem district. For those two areas, we will focus firstly on the waste classification model at source. Then we will mobilize the community to sort out low-value waste — since no one will collect low-value waste. Actually, Solid Waste does collect it but they will bring it to landfills to bury. But we will collect the waste and classify it into resource waste as salable waste, which is officially sold to recycling facilities...”**

— NGO Rep.

The interviews clearly highlight the value of the informal sector’s work and the important contributions they provide to the city, as well as the financial challenges they face to make ends meet.

**“The informal group in the waste value chain has contributed a lot to collecting waste, which helps to reduce sorting expenses for the state since they have classified it already. Reducing the volume of waste transferred to landfills also means reducing CO<sub>2</sub> and the issue of climate change, right? So, my group really wants to raise their voice, the voice of the informal group in that chain”**

— NGO Rep.

**“I think it is a good, meaningful job because I can clean the environment while making a living. My life depends on this environment, so I need to keep it green, clean, and beautiful while allowing myself and my family to earn our living.”**

— Informal Recycling Collector

**“There are days when I get nothing, and there are days when I get three to five kilograms.”**

— Informal Recycling Collector

When asked why they did the work, an Informal Waste Collector replied, “To make some money besides farming.”



While there appears to be a consensus that the majority of people in the urban centers have access to waste management services, it was noted in interviews that there can be confusion around collection and selling rates, the specific timing for collection, sorting policies, and what items will or will not be accepted. While the information on the policy is available, it has not effectively been communicated to the general public. This may be leading to a system that is not maximizing collection of household waste. There appears to be large variability in the prices that informal recyclers are given for plastic at the market or local junk shop, which also makes collection challenging.

**“All types of plastic have the same price. There’re many types of paper like student notebooks, cardboard, scrap paper, etc., whereas there is only one type of plastic which is the plastic used for chairs or bottles.”**

– Informal Recycling Collector

**“[when asked the selling price for plastic] Oh my God. How can I know that? It depends. It could be 500 VND or 1,000 VND, for example.”**

– Informal Recycling Collector

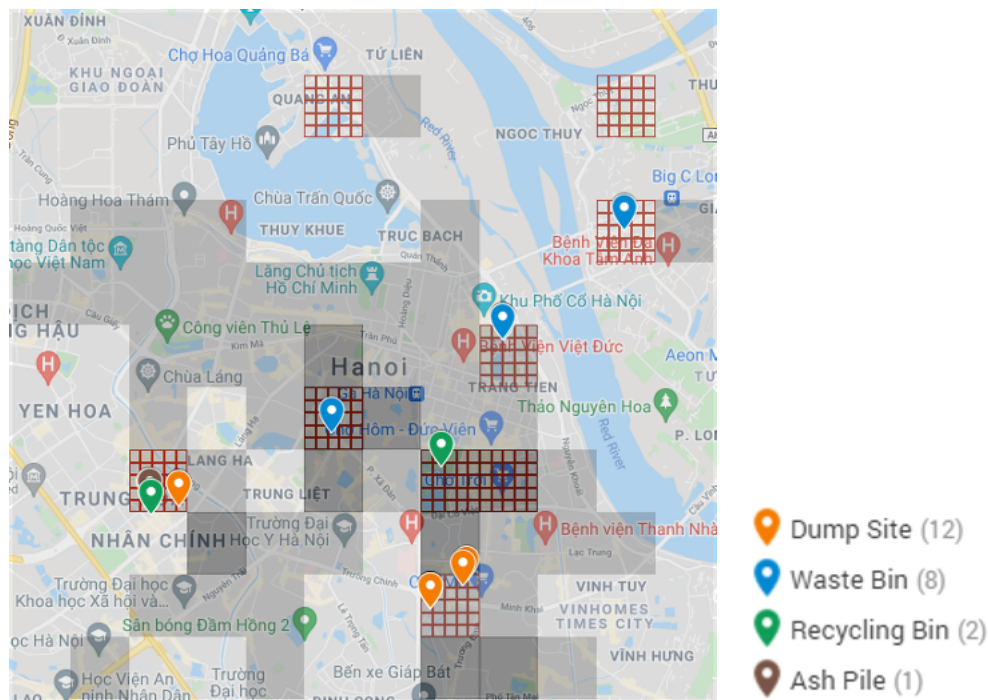
**“[when asked about monthly income] I don’t make a lot from going to the market, so I also clean houses.”**

– Informal Recycling Collector

Furthermore, it was noted by the LIP that there can be some confusion around waste collection policies and regularity in the city, and political boundaries seem to confuse things even further within the community on whose responsibility it is to collect. Some stakeholders expressed frustration in regard to who was responsible for mismanaged waste in their local community.

**“Take another example, when we went to bed the other night, someone from the other side threw something and then two waste collectors – That is Dong Tam ward, and this is Truong Dinh ward. They kept laying the blame on each other. Suppose that they threw a tree like that. I did not know it because I was sleeping.”**

Additionally, Hanoi is committed to upgrade its regulations and policies on solid waste management, modernize its waste treatment facilities, and study advanced technologies for solid waste treatment. As part of decision no. 491/QD-TTg signed in 2018 by the Vietnamese Prime Minister to revise the National Strategy on Integrated Solid Waste Management to 2025 and Vision to 2050, the city has a goal of collecting 100% of non-household waste and 85% of household waste by 2025.

**Figure 11: Locations of public waste receptacles in Hanoi from LIP survey**

From a visual survey conducted by the LIP during litter transects (a total of 2700 m<sup>2</sup>), it was noted that there were only 8 public waste bins, 1 recycling bin, 22 of the 27 1km<sup>2</sup> areas did not have any public waste receptacles available at all along the sampled transects (Figure 11). In addition, the 2700 m<sup>2</sup> area contained 12 illegal dump sites and 1 ash pile from burnt waste. This relatively high number of informal dumping areas in the city may be another indication that people are confused about how to manage their waste or limited in their choices for management by economics or logistics.

## End of Cycle

Previous studies have found that the majority of the solid waste in Vietnam ends up in landfill or open dump (MONRE 2011). Regionally, Hanoi landfills about 90% of its domestic waste, and 34.5% of households reported that they have left waste on a pavement or a temporary dumpsite (Kawai & Osako, 2013).

During interviews, a Hanoi URENCO worker was asked about the current rates of waste and landfilling in the city. He reported that for the entire city, there is a waste generation rate of about 6500-7000 tons per day. The worker also mentioned that there are only two sanitary landfills in operation that receive waste from the city: Nam Son and Xuan Son.

The Nam Son Landfill, located in the Soc Son district, is 84 hectares in total with an urgent need to expand its processing capacity. There have been plans to alleviate the overflow problem by converting the domestic waste landfill

into a combustion facility with energy recovery by 2021. Xuan Son is 13 hectares, receiving the rest of Hanoi's collected waste. In 2015, it was reported that this landfill had a capacity of 250 metric tons per day (Leroy & Cong 2015). More recently in 2021, it was reported to receive almost 1,700 metric tons of waste per day (Hanoi's Landfills, 2021). Of this, the first 100 metric tons are combusted, but the other 1,600 metric tons are buried.

Beyond these two landfill sites, there are composting facilities in Cau Dien and Kieu Ky regions (Thang, 2017) as well as numerous dump sites. Unfortunately, many dumpsite locations are large enough to be easily spotted on satellite imagery throughout Hanoi (Thach That, 2020; Ha, 2019; Duc, 2019). Other data on these dumpsites - such as size and composition - are rare.

Recycling is mainly informal and decentralized. "Craft villages" carry out the processing and recycling of materials such as paper, glass, plastic, and metal. The village of Trieu Khuc specializes in plastic recycling as well as Minh Khai, which processes 650 metric tons of waste per day (Leroy & Cong, 2015; EJ Atlas, 2020). There are about 10,000 scrap collectors just within Hanoi. Previously, about 700 waste pickers a day would sort through waste at the Nam Son Landfill (Leroy & Cong, 2015), but the URENCO worker that was interviewed also reported that these pickers are no longer permitted due to safety concerns.

There is one prominent formal recycling facility: Phuong Dinh in the Dan Phuong district. An interviewed NGO representative suggested why there may be so few official recycling facilities:

**"... since no one will collect low-value waste. Actually, Solid Waste does collect it but they will bring it to landfills to bury. But we will collect the waste and classify it into resource waste as salable waste, which is officially sold to recycling facilities..."**

— NGO Representative

Fortunately, informal waste pickers are willing to sort out the lower-value waste that URENCO cannot. Each picker recovers about 58 grams of material per capita per day (Kawai et. al, 2012). They also recycle about 25.5% in weight of container and packaging waste that comes from households (Leroy & Cong, 2015). Still, some stakeholders in Hanoi do not approve of the informal pickers' way of life:

**"Spontaneous scrap facilities negatively affect the environment and the city's aesthetic"**

— Solid Waste Worker

To make use of the plastic waste saved from the landfill, organizations have developed creative solutions:

**"It can be recycled into bricks or asphalt. They have treatment facilities in Haiphong and recycling factories where they turn plastic waste into asphalt, you know it. They can turn it into pallets."**

— NGO Worker

This Vietnamese NGO collects the low-value waste such as plastic bags and collaborates with recycling companies to ensure the waste will be used in new products. In addition to bricks, asphalt and pallets, recycling companies can also create roof tiles.

The city government also has plans on intercepting waste at its end-of-life. As mentioned above, Hanoi URENCO is working to separate waste for power generation at a combustion facility. Waste treatment by combustion can reduce the volume of waste to be landfilled by 90% and generate energy; however, combustion of some materials (e.g., PVC plastic) can release toxic chemicals such as dioxins. While it is unknown if residents have protested the construction of the combustion facility, it raises some concerns for public health (Viet Nam News, 2019).

Outreach to the community has been implemented in addition to new technology. In September of 2020, the city launched a program in which citizens could receive gifts for turning in their sorted waste (Kiet, 2020). The Hanoi Youth Union has organized environmental campaigns such as "Green Summer" and "Green Sundays" in which the members conduct litter clean-ups (Youth Union, 2019).

## Leakage

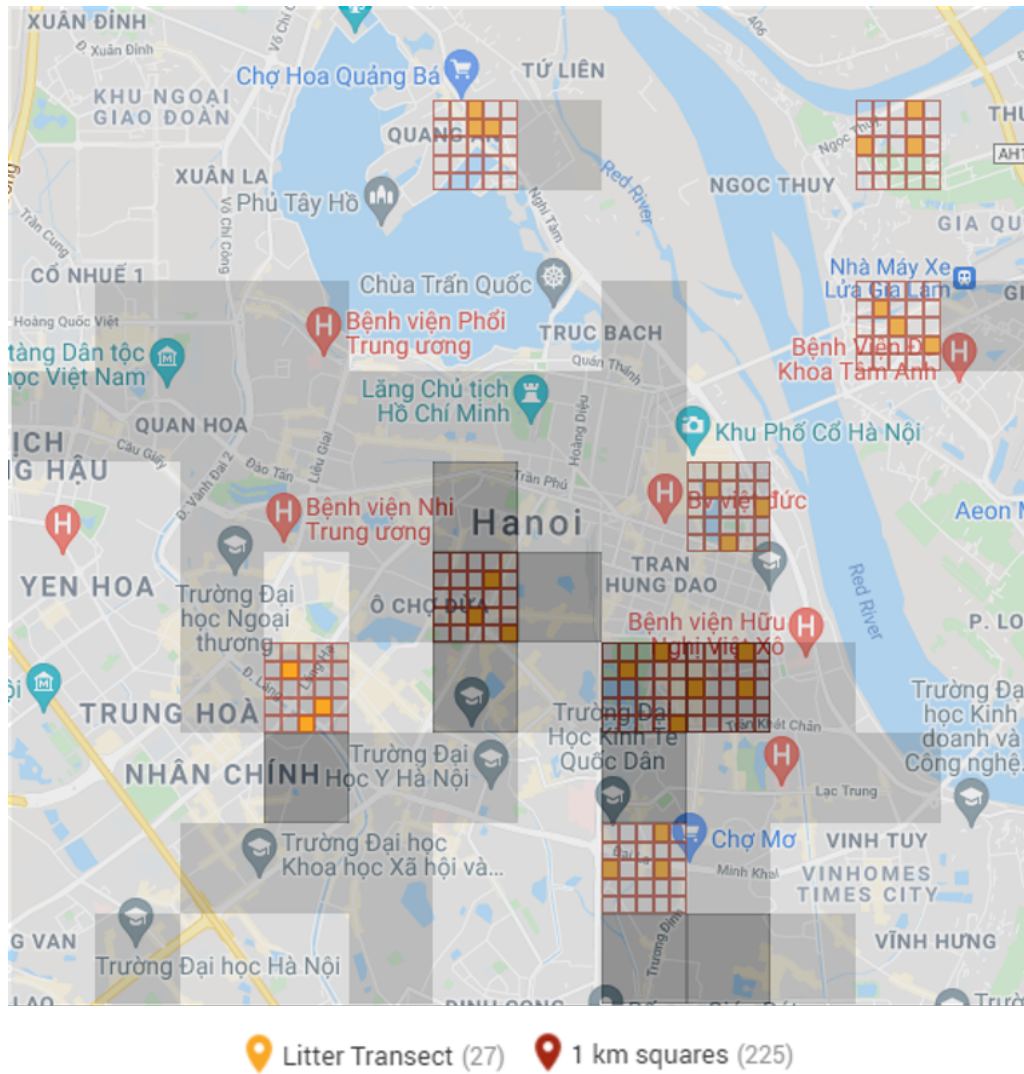
### Figure 12: Examples of litter transects walked in Hanoi

In total, 8,400 litter items were recorded across 27 100m<sup>2</sup> transects in nine different square kilometer areas sampled between October 2020 and January 2021 (Figure 12). Litter transect locations were selected using a stratified random sampling method, in which transects were randomly selected in nine square kilometers which were 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.



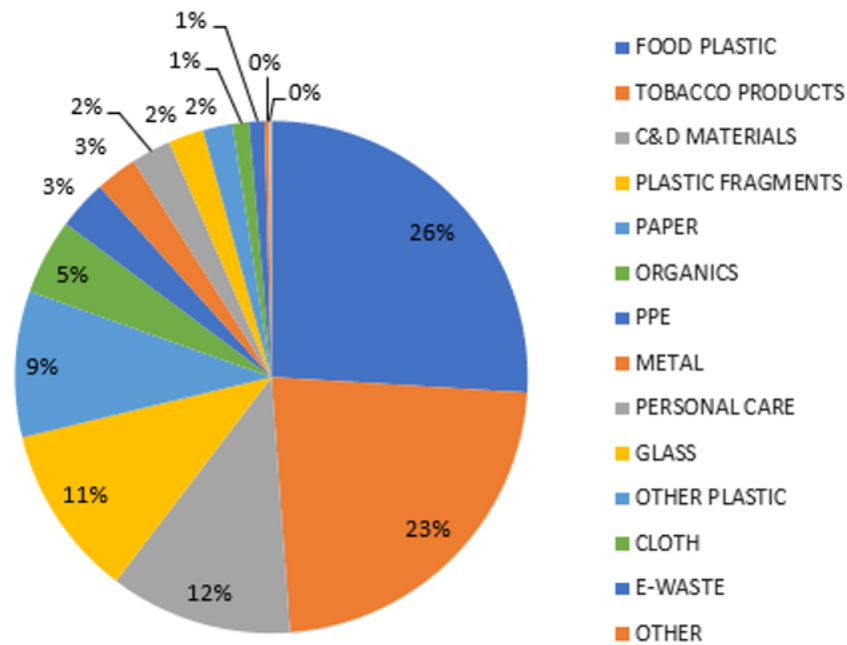
(Photo Credit: MCD)

**Figure 13: 100-meter litter transect sample areas in high (dark grey), medium (medium grey), and low (light grey) ambient population distribution 1 km squares**



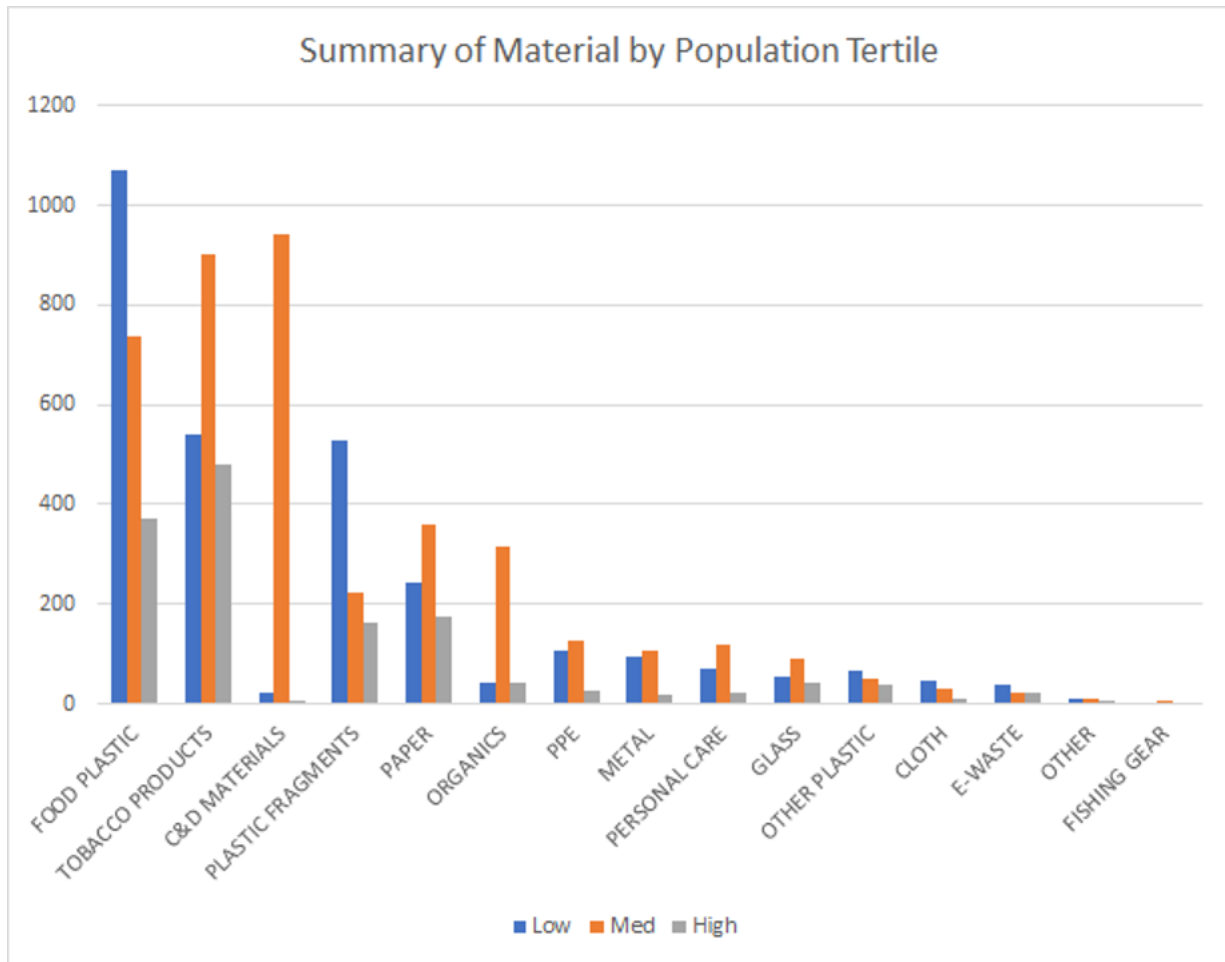
Across all 27 transects, the largest percentage by category of litter items was food plastic, followed very closely by tobacco products. Paper, other plastic, glass, and PPE comprised between 4% and 8%, while all other material categories including plastic fragments, organics, C&D materials, personal care, metal, e-waste, cloth, fishing gear, and other waste formed 2% or less of the total litter count (Figure 14). The total percentage of common plastic items (the sum of food plastic, other plastic, PPE, plastic fragments, and personal care items) found was 47% of the total items.

**Figure 14: Material types of litter collected in Hanoi across all transects**



When examining the litter characterization based on the population count, we see some distinctions can be seen between the three groups (Figure 15). In the middle population count area, tobacco items are by far the majority of litter items found, whereas in the lower population count areas food plastic represented the majority. In the middle population count area, we see the percentage of Construction and Demolition (C&D) waste is considerably higher in these areas than we see in either of the other population count areas. Plastic food packing and tobacco products were among the topmost littered items for all population counts. Fishing gear was also only identified in the medium population count area. In each of the areas, PPE comprised around 3% of the litter items found, but even though wearing face masks is common practice in Vietnam, this percentage could have been lower prior to the COVID-19 pandemic; thus, this likely represents a new type of land-based litter that may be worth monitoring in the future.

**Figure 15: Proportion of most common plastic items in low (inner), mid (middle), and high (outer) population count areas**



It was noted in the interviews that there is a regulation on littering that currently exists for the city of Hanoi, but it's not readily enforced, and most people are not aware of it or feel there are any consequences associated with littering. Some interviewees noted neighborhood inhabitants do not intentionally litter but littering from those who live outside of the community or passersby motorbikes has been an ongoing issue for many years and continues to be an issue in Hanoi today.

**“Those garbages are littered by people from somewhere else — like over there. See? They keep throwing trash there. There should be a trash can here... It would have been better and cleaner if they threw trash in the trash can and waste collectors would collect it once a day. But now that they don’t do this, there is nothing we can do.”**

— convenience store owner

**“The government cannot fine them because we cannot catch them red-handed. We don't know when they litter. Also, they ride motorbikes...then they throw, [laugh] they do it while riding on their motorbikes. "Bang." Then they're gone.”**

— convenience store owner

**“Garbage is not guilty, right? In essence, garbage itself is not guilty. It is due to human behaviors for many purposes.”**

— NGO, rep.

**Table 5: Litter density and top litter items from all transects in Hanoi**

Population Tertile	Top 5 Litter Items	Litter Density (count/m <sup>2</sup> )
Low (0 - 20,469 persons 1km square person)	1) Plastic Food Wrappers, 2) Cigarettes, 3) Film Fragments, 4) Plastic Grocery Bag, 5) Hard Plastic Fragments	3.28
Medium (20,470 - 40,938 persons/ sq km)	1) Cigarettes, 2) Building Materials, 3) Lumber, 4) Plastic Food Wrapper, 5) Organic Waste	4.49
High (40,939 - 61,408 persons/sq km)	1) Cigarettes, 2) Plastic Food Wrapper, 3) Film Fragments, 4) Paper, 5) Foam or Plastic Cups or Lids	1.58

The litter density was calculated for each of the three-population count tertiles (Table 5). The density of litter per square meter was highest in the lowest population count areas and lowest in the middle count areas. Plastic food wrappers, cigarettes, and film fragments were among the top five items in all three population count areas, and some of the top litter items overall.

Litter densities across other countries in South Asia (e.g., India and Bangladesh) range from 0.5 items/m<sup>2</sup> to 15 items/m<sup>2</sup>, with an average of around 4-5 items/m<sup>2</sup> (n = 40) (Youngblood et. al, In Revision). Litter densities across South-east Asia (Indonesia, Malaysia, and Vietnam) range from 0.75 to 3.39 items/m<sup>2</sup> with an average of 1.83 items/m<sup>2</sup> (n = 27) (Urban Ocean). The litter densities in Hanoi are just under the SE Asia average for the high population count areas and higher for both the medium and low count areas (as well as over the current maximum for the medium count areas). All of the areas in Hanoi are greater than a city in South Vietnam where litter densities range from 0.75 to 1.2 items/m<sup>2</sup> and the medium and low count areas are higher than the densities found in Nam Dinh (1.86 to 2.24 items/m<sup>2</sup>) a city where the CAP was completed in tandem with Hanoi.



## Opportunities and Challenges

Vietnam's National Solid Waste Management Strategy and Hanoi's Solid Waste Management Plan are being implemented with their visions and goals for the city in the coming decades. With population growth and waste generation projected to increase, it will be important for infrastructure, public awareness, and policy enforcement to continue to grow with any new initiatives that will be implemented.

The following opportunities may be able to expand and enhance circularity while overcoming some of the identified challenges (challenges in italics):

- It appears that both *littering and dumping of waste is a challenge* to address in Hanoi. The leakage from litter in Hanoi is mostly above average for the region. In addition, 12 recorded dumpsites were found in the 9 km<sup>2</sup> area that was assessed for the CAP; this is more than the amount of waste and recycling bins combined. Many of the opportunities outlined below could contribute to the reduction of leakage in the city.
- *Community members report some confusion about waste collection and management*, which could lead to localized dumping and mismanagement. So there appears to be a large opportunity to 1) optimize and expand the collection system in collaboration with the city and both private and informal collectors and 2) to engage the community in this system through education and outreach. Conducting a city-wide baseline assessment on waste collection coverage (and storage at the home and transfer facility level) could help to identify areas that need coverage, guidance, and resources.
- The percentage of plastic in the waste stream is under 10% (relatively low in comparison to the global average of 12%), but *it is predicted to increase over time*. A majority of the food plastic packaging is manufactured in Vietnam so there may be opportunity to work with domestic manufacturers on delivery of products, either to redesign product packaging, promote reuse schemes or bulk sales, or foster EPR strategies.
- As reported by stakeholders, Vietnam is a resource-rich country, and there could be promising business opportunities to locally design and manufacture bio-based and biodegradable alternative plastic products. Interviewees already reported that some products made in Vietnam are exported to countries with plastic bans and restrictions, as well as places with people who just want alternatives to plastic products. This industry could bring economic development and jobs, and Hanoi, being the country's capital, could pioneer a nation-wide or even global movement towards using alternative materials that are proudly made in Vietnam.
- There is a desire for enhanced local awareness campaigns and more effective communication to the public both about existing waste management systems and regulations, and upcoming improvements. *It was noted that information exists but is not reaching everyone in an impactful way*. Partners in this program may be able to work together to develop targeted communication campaigns to reach various demographics with clear messaging. Communication campaigns can be mindful and take a systematic approach so that all communities across the city can successfully implement tasks with the information given to them.
- One common theme was that women and youth groups are enthusiastic about initiatives that reduce single-use

plastic and increase the use of alternative and reusable items, which may lend itself to opportunities to invest in new businesses. Providing business administration training, mentoring opportunities, and financial loans for women and the younger generation will facilitate their entrepreneurial efforts in starting and sustaining a business. This not only promotes the use of alternative materials but may provide living-wages and a better quality-of-life.

- Entrepreneurial stakeholders developing alternative plastic products or schemes to incentivize behavior change expressed a need for help with information dissemination to effectively communicate their products or services to target audiences.
- *Plastic bags were readily identified as a high convenience item that is difficult to replace*, but people typically try to reuse them. There could be an opportunity to create a campaign around plastic bags that raises awareness for reusable bags.
- *The high cost of alternatives and lack of standard regulations around biodegradable items has caused local shops and vendors to not switch from traditional plastic*, so there may be opportunities to develop and enforce new rules that would standardize alternative materials. There is a tax in place for nylon, for example, that tries to make alternative materials cost-competitive, however it is reportedly not enforced.
- Food vendors and restaurants offered a high percentage of PET packaging, which typically can be readily recycled - recycling may present an opportunity to more strongly connect local food vendors and formal or informal recyclers to manage that waste stream.
- There may be opportunities to provide additional resources (e.g., electric carts instead of bicycles or easy-to-manuever pushcarts) and standardize (e.g., collection times and locations) the informal recycling sector so that the informal workers can increase their collection and optimize the recycling system in Hanoi. Other working conditions for the informal sector could be explored to determine if other improvements are needed.
- Government engagement with the informal recycling community and further integration of the workers into the more formal and integrated recycling system of the city is an opportunity.
- *Policy implementation continues to be a challenge* but is necessary to transform plans into actions.
- *The tensions in waste treatment and disposal remains a challenge*. While expansion of combustion facilities is proposed, more waste segregation and recycling is being encouraged. There is an opportunity to make a city-wide and long-term solid waste management plan using an integrated approach.

## References

CIA Factbook Open Data 2020

Daniel, W. (accessed on 25 October 2020) Plastic Item Export by Country. Retrieved from <http://www.worldstopexports.com/plastic-item-exports-country/>

Duc, C. (2019, December 18). Huge "smuggled" landfill close to Thang Long Avenue. Retrieved 19 September 2020, from <https://vovgiaothong.vn/bai-rac-%E2%80%9Cclau%E2%80%9D-khong-lo-sat-dai-lo-thang-long>

Ha, N. (2019, July 4). Waste black spots in Thanh Tri district: Not been treated completely. Retrieved 19 September 2020, from <https://hanoimoi.com.vn/tin-tuc/Ban-doc/939278/diem-den-rac-thai-tai-huyen-thanh-tri-chua-duoc-xu-ly-triet-de>

Hanoi's landfills struggle to deal with increased garbage. (2021). VietNamNet. Retrieved 2 July 2021, from <https://vietnamnet.vn/en/sci-tech-environment/hanoi-s-landfills-struggle-to-deal-with-increased-garbage-726363.html>

Environmental Justice Atlas (EJ Atlas), 2020. Incineration and hazardous informal recycling in Hanoi, Vietnam. (2020, May 12). Retrieved 21 September 2020, from <https://ejatlas.org/conflict/incineration-and-enclosure-of-waste-threaten-informal-recycling-in-hanoi-vietnam>

Kawai, K., Huong, L. T. M., Yamada, M., & Osako, M. (2016). Proximate composition of household waste and applicability of waste management technologies by source separation in Hanoi, Vietnam. *Journal of Material Cycles and Waste Management*, 18(3), 517-526.

Kawai, K., & Osako, M. (2013). Advantages and disadvantages of a municipal solid waste collection service for citizens of Hanoi City, Vietnam. *Waste Management & Research*, 31(3), 327-332. <https://doi.org/10.1177/0734242X12471099>

Kawai, K., Osako, M., Matsui, S., & Dong, N. T. (2012). Identification of junk buyers' contribution to recycling of household waste in Hanoi, Vietnam, through a physical composition analysis. *Waste Management & Research*, 30(7), 681-688. <https://doi.org/10.1177/0734242X12444895>

Kiet, A. (2021). Hanoi sorts rubbish at source for recycling. Retrieved 2 July 2021, from <http://hanoitimes.vn/hanoi-sorts-rubbish-at-source-for-recycling-314113.html>

Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development; Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/30317> License: CC BY 3.0 IGO.

Leroy, M.L.N. and Cong, V.C. (2015, November 30). Solid Waste Typology and Management in Hanoi. Retrieved 15 September 2020, from [https://umr-selmet.cirad.fr/content/download/4052/29638/version/3/file/IMV\\_REPORT\\_WASTETIPOLOGY\\_HANOI.pdf](https://umr-selmet.cirad.fr/content/download/4052/29638/version/3/file/IMV_REPORT_WASTETIPOLOGY_HANOI.pdf)

MONRE, 2011, National Environment Report for 2011.

MONRE, 2015, National Environment Report for period 2011-2015.

MONRE. (2017) National Environmental Report for 2017 in Waste Management Resources and Environment: Hanoi 2017

Nga, M. (2019, July 18). Major cities grapple with garbage problem. Retrieved 15 September 2020, from <https://e.vnexpress.net/news/news/major-cities-grapple-with-garbage-problem-3952863.html>

Nguyen, T. T. P., Zhu, D., & Le, N. P. (2015). Factors influencing waste separation intention of residential households in a developing country: Evidence from Hanoi, Vietnam. *Habitat International*, 48, 169-176.

Salhofer, S., Jandric, A., Soudachanh, S., Le Xuan, T., & Tran, T. D. (2021). Plastic Recycling Practices in Vietnam and Related Hazards for Health and the Environment. *International Journal of Environmental Research and Public Health*, 18(8), 4203.

Schneider, P., Anh, L. H., Wagner, J., Reichenbach, J., & Hebner, A. (2017). Solid waste management in Ho Chi Minh City, Vietnam: moving towards a circular economy? *Sustainability*, 9(2), 286.

Thach That District, Hanoi: New Rural Commune is still flooded with rubbish. (2020, July 1). Retrieved 15 September 2020, from <https://congnghepmoitruong.vn/huyen-thach-that-ha-noi-xa-nong-thon-moi-van-ngap-trong-rac-6387.html>

Thang, N.T. (2017, November). Country Chapter: State of the 3Rs in Asia and the Pacific. Retrieved 16 September 2020, from [https://www.uncrd.or.jp/content/documents/5696\[Nov%202017\]%20Vietnam.pdf](https://www.uncrd.or.jp/content/documents/5696[Nov%202017]%20Vietnam.pdf)

Trinh, L. T. K., Hu, A. H., & Pham Phu, S. T. (2021). Situation, Challenges, and Solutions of Policy Implementation on Municipal Waste Management in Vietnam toward Sustainability. *Sustainability*, 13(6), 3517.

Truong, N. (2018). Solid Waste Management in Vietnam: Current Situation, Challenges and Strategies for Development. Retrieved 17 August 2020, from <https://pdfs.semanticscholar.org/1f24/1d964e060464f6bf599d28e6e6e66c-4c17c9.pdf>

Vietnam Plastic Association Homepage (2020). Plastic Industry Overview 2010–2015. Vietnam Plastic Association; Ho Chi Minh City, Vietnam.

Viet Nam News. (2010, February 2). Waste is a Burning Problem, but Burning's no Solution. Retrieved 7 July 2021, from <https://www.chinadailyhk.com/articles/11/165/28/1549070867212.html>

World Bank. (2018). Solid and Industrial Hazardous Waste Management Assessment Options and Action Area to Implement the National Strategy. Retrieved from <https://documents1.worldbank.org/curated/en/352371563196189492/pdf/Solid-and-industrial-hazardous-waste-management-assessment-options-and-actions-areas.pdf>

World Population Review. (2021). Retrieved from <https://worldpopulationreview.com/world-cities/hanoi-population>

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.

Youth Union Office. (2019, January 21). Retrieved 2 July 2021, from <http://english.hnue.edu.vn/About/p/youth-union-office-133>

## Appendix

**Table 6: Convenience Store Top Product Manufacturers and Parent Companies**

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Oishi	Crisps	Multilayer Film	Liwayway Vietnam JS company	Bình Dương Province, Vietnam	Liwayway Holdings Company Limited	Philippines
Lay's	Crisps	Multilayer Film	Suntory Pepsico Việt Nam	Bình Dương Province, Vietnam	PepsiCo, Inc	New York, USA
Chickky	Crisps	Multilayer Film	Công ty TNHH URC Hà Nội	Bình Dương Province, Vietnam	Universal Robina corporation	Quezon, Philippines
Alpenliebe	Candy	Multilayer Film	TNHH Perfetti Van Melle Việt Nam	Bình Dương Province, Vietnam	Perfetti Van MELLE	Lainate, Italy, and Breda, Netherlands
Gollia	Candy	Multilayer Film	TNHH Perfetti Van Melle Việt Nam	Bình Dương Province, Vietnam	Perfetti Van MELLE	Lainate, Italy, and Breda, Netherlands
Xylitol	Candy	PET	Công ty TNHH Lotte Việt Nam	Bình Dương Province, Vietnam	Lotte Confectionery Co.	Seoul, South Korea
Nutri boost	Beverages	PET	Coca - Cola Việt Nam	HCMC, Vietnam	Coca-Cola Company	Atlanta, Georgia, USA
ICE+	Beverages	PET	Công ty TNHH Nước giải khát Kirin Việt Nam	Bình Dương Province, Vietnam	Công ty Cổ phần Thực phẩm Quốc tế	Biên Hòa, Đồng Nai, Việt Nam
Trà xanh 0 độ	Beverages	PET	Công ty TNHH Number One Hà Nam	Hà Nam, Việt Nam	Công ty TNHH Number One Hà Nam	Hà Nam, Việt Nam

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Thang Long	Tobacco	Multilayer Film	Công ty Thuốc Lá Thăng long	Hanoi, Vietnam	Công ty Thuốc Lá Thăng long	Hanoi, Vietnam
Pocca	Crisps	Multilayer Film	Suntory Pepsico Việt Nam	Bình Dương Province, Vietnam	PepsiCo, Inc	New York, USA
Cool air	Candy	Multilayer Film	Công Ty Cổ Phần Phú Trường Quốc Tế	HCMC, Vietnam	Mars & Wrigley	Mclean, Virginia, USA
Chupachup's	Candy	Multilayer Film	TNHH Perfetti Van Melle Việt Nam	Bình Dương Province, Vietnam	Perfetti Van MELLE	Lainate, Italy, and Breda, Netherlands
Keo lac	Candy	Singlelayer film	Bánh Kẹo Tràng An	Hanoi, Vietnam	Bánh Kẹo Tràng An - Công Ty Cổ Phần Tràng An	Hanoi, Vietnam
Coca-cola	Beverages	PET	Coca - Cola Việt Nam	HCMC, Vietnam	Coca-Cola Company	Atlanta, Georgia, USA
Sting	Beverages	PET	Suntory Pepsico Việt Nam	HCMC, Vietnam	PepsiCo, Inc	New York, USA
Craven	Tobacco	Multilayer Film	Công ty Công nghiệp Sài Gòn	HCMC, Vietnam	Carreras Limited	London, UK
AFC	Crisps	Multilayer Film	Mondelez Kinh Do Vietnam JS co.	Bình Dương Province, Vietnam	Mondelez Global LLC,	East Hanover, NJ, USA
Swing	Crisps	Multilayer Film	Công ty TNHH thực phẩm ORION VINA	Bắc Ninh Province, Vietnam	Orion Confectionery	Seoul, South Korea
Camel	Crisps	Multilayer Film	Seng Hua Hng Foodstuff PTE LTD	Singapore, Singapore	Seng Hua Hng Foodstuff PTE LTD	Singapore, Singapore
M&M's Milk chocolate candies	Candy	Multilayer Film	Mars China, INC.	Jiaxing, China	Mars Wrigley	Mclean, Virginia, USA
Oishi Guava candy	Candy	Multilayer Film	Liwayway Vietnam JS company	Bình Dương Province, Vietnam	Liwayway Holdings Company Limited	Philippines
Parago (Milk chewcandy)	Candy	Singlelayer film	PT. International food	Jakarta, Indonesia	PT. International food	Jakarta, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
lavie	Beverages	PET	Công ty TNHH La Vie	Tân An, Long An, Vietnam	Công ty TNHH La Vie	Tân An, Long An, Vietnam
twister	Beverages	PET	Suntory Pepsico Việt Nam	Bình Dương Province, Vietnam	PepsiCo, Inc	New York, USA
Wake-up 247	Beverages	PET	Masan MB Co., Ltd	Nghệ An Province, Vietnam	VinaCafé Biên Hòa JS company	Biên Hòa city, Dong Nai, Vietnam
O'star	Crisps	Multilayer Film	Công ty TNHH thực phẩm Orion VINA	Bắc Ninh Province, Vietnam	Orion Confectionery	Seoul, South Korea
Bibica (ginger candy)	Candy	Multilayer Film	Bibica Biên Hòa limited company	Dong Nai province, Vietnam	Bibica Biên Hòa limited company	HCMC, Vietnam
Xylitol	Candy	Singlelayer film	Hamada shokuhin kogio co.ltd	Osaka, Japan	Hamada shokuhin kogio co.ltd	Osaka, Japan
Oishi	Crisps	Multilayer Film	Vietnam Liwayway Joint Stock Company	Bình Dương Province, Vietnam	Vietnam Liwayway Joint Stock Company	Bình Dương Province, Vietnam
Honey Butter Chips	Crisps	Multilayer Film	Haitai confectionary and food Co., Ltd	Hanoi, Vietnam	Haitai confectionary and food Co., Ltd	Seoul, South Korea
TH True rice	Beverages	PP	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam
Marlboro	Tobacco	Multilayer Film	Vinataba Co., Ltd	Cần Thơ, Vietnam	Philip Morris Brads Sarl	Neuchatel, Switzerland
Pomsticks	Crisps	Multilayer Film	Lorenz Bahlsen Snack - World GmbH Co	Hankensbüttel, Germany	Lorenz Bahlsen Snack - World GmbH Co	Hankensbüttel, Germany
Goldbears	Candy	Multilayer Film	Haribo confectionery company	Kessenich, Bonn, Germany	Haribo confectionery company	Kessenich, Bonn, Germany
Playmore	Candy	PET	Guangdong xinle foods Co.,ltd	Guangdong, China	Evermore Co., Ltd	Bangkok, Thailand



Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Doublemint	Candy	Multilayer Film	Công Ty Cổ Phần Phú Trường Quốc Tế	HCMC, Vietnam	Mars & Wrigley	Mclean, Virginia, USA
Cojo	Beverages	PP	Nam Viet Foods and beverage Co., Ltd	Bình Dương Province, Vietnam	Nam Viet Foods and beverage Co., Ltd	Bình Dương Province, Vietnam
good mood	Beverages	PET	Suntory PepsiCo Vietnam Beverage	Bình Dương Province, Vietnam	Suntory holdings limited	Osaka, Japan
Kokozo	Beverages	PET	Choke Mahachai beverage Co., Ltd	Bangkok, Thailand	Choke Mahachai beverage Co., Ltd	Bangkok, Thailand
Canyon	Tobacco	Multilayer Film	Khataco tobacco factory	Nha Trang, Vietnam	AK international Co., Ltd	Osaka, Japan
Parago (Milk chewcandy)	Candy	Multilayer Film	PT. International food	Jakarta, Indonesia	PT. International food	Jakarta, Indonesia
TH True rice	Beverages	PP	Nam Viet Foods and beverage Co., Ltd	Bình Dương Province, Vietnam	Nam Viet Foods and beverage Co., Ltd	Bình Dương Province, Vietnam
PuraFrutta	Beverages	PET	IBFI	United Arab Emirtes	IBFI	United Arab Emirtes
Kent	Tobacco	Multilayer Film	Vina-BAT vietnam Co.,Ltd	HCMC, Vietnam	British American tobacco inc.,	Delaware, USA
Dynamite	Candy	Multilayer Film	Công ty TNHH URC Hà Nội	Bình Dương Province, Vietnam	Universal Robina corporation	Quezon, Philippines
Xylitol	Candy	PET	Hamada shokuhin kogio co.ltd	Osaka, Japan	Hamada shokuhin kogio co.ltd	Osaka, Japan
Tea break	Beverages	PP	Kirin Vietnam	Bình Dương Province, Vietnam	Interfood JS co.	Bien Hoa city, Dong Nai, Vietnam
twister	Beverages	PET	Suntory PepsiCo Vietnam Beverage	Bình Dương Province, Vietnam	Suntory holdings limited	Osaka, Japan
7 ups	Beverages	PET	Suntory PepsiCo Việt Nam	HCMC, Vietnam	PepsiCo, Inc	New York, USA

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Toonies	Crisps	Multilayer Film	Orion Vina Food Co. Ltd	Bắc Ninh Province, Vietnam	Orion Confectionery	Orion Confectionery
Snack vị cua	Crisps	Multilayer Film	Mondelez Kinh Do Vietnam JS co.	Bình Dương Province, Vietnam	Mondelez Global LLC,	East Hanover, NJ, USA
Chip Hai Ha	Candy	Multilayer Film	Haitai confectionary and food Co., Ltd	Hanoi, Vietnam	Haitai confectionary and food Co., Ltd	Seoul, South Korea
Saigon Virginia	Tobacco	Multilayer Film	Saigon Tobacco Company	HCMC, Vietnam	Saigon Tobacco Company	HCMC, Vietnam
Pillows	Crisps	Multilayer Film	Liwayway Vietnam JS company	Bình Dương Province, Vietnam	Liwayway Holdings Company Limited	Philippines
Playmore	Candy	Multilayer Film	Guangdong xinle foods Co., ltd	Guangdong, China	Evermore Co., Ltd	Bangkok, Thailand
TH True juice	Beverages	PET	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam
	Plastic bags		Nam Thai Son Co., Ltd	Hanoi, Vietnam	Nam Thai Son Co., Ltd	Hanoi, Vietnam
Vidal jelly bananas	Candy	Multilayer Film	Vidal Golosinas S.A	Murica, Spain	Vidal Golosinas S.A	Murica, Spain
Senjaku	Candy	Multilayer Film	Ogontoh Co., Ltd	Nara, Japan	Ogontoh Co., Ltd	Nara, Japan
Morning rice	Beverages	PET	Woongjin	Chungnam, South Korea	Woongjin Foods Co., Ltd	Seoul, South Korea
Winston purple	Tobacco	Multilayer Film	Thanh Hoa tobacco Co., Ltd	Hà Trung, Thanh Hóa, Vietnam	JT International	Geneva, Switzerland
	Plastic bags		Opec plastics company	Hanoi, Vietnam	Opec plastics company	Hanoi, Vietnam
Kẹo lạc	Candy	Multilayer Film	Bánh Kẹo Tràng An	Hanoi, Vietnam	Bánh Kẹo Tràng An - Công Ty Cổ Phần Tràng An	Hanoi, Vietnam

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Chew Hai Ha	Candy	Multilayer Film	Haitai confectionary and food Co., Ltd	Hanoi, Vietnam	Haitai confectionary and food Co., Ltd	Seoul, South Korea
Aquafina	Beverages	PET	Suntory Pepsico Việt Nam	Bình Dương Province, Vietnam	PepsiCo, Inc	New York, USA
O'star	Crisps	Multilayer Film	Công ty TNHH thực phẩm orion VINA	Bình Dương Province, Vietnam	Orion Confectionery	Seoul, South Korea
Xylitol	Candy	Multilayer Film	Hamada shokuhin kogio co.ltd	Osaka, Japan	Hamada shokuhin kogio co.ltd	Osaka, Japan
Calbee	Crisps	Multilayer Film	Calbee four seas co. LTD	Hong Kong	Calbee four seas co. LTD	Hong Kong
Orion	Crisps	Multilayer Film	Công ty TNHH thực phẩm orion VINA	Bình Dương Province, Vietnam	Orion Confectionery	Seoul, South Korea
Skittles	Candy	Multilayer Film	Mars China, INC.	Guangzhou, China	Mars Wrigley	Mclean, Virginia, USA
Mini cocktail gummy	Candy	Multilayer Film	EVERMORE co.LTD	Bangkok, Thailand	EVERMORE co.LTD	Bangkok, Thailand
Play candy	Candy	Multilayer Film	JJW Foodstuff industrial Co., Ltd Fujian	Jinjiang, China	Play candy Thailand	Bangkok, Thailand
TH True water	Beverages	PET	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam	Công ty TNHH Nước tinh khiết Núi Tiên	Nghệ An Province, Vietnam
Fuzetea+	Beverages	PET	Coca - Cola Việt Nam	HCMC, Vietnam	Coca-Cola Company	Atlanta, Georgia, USA
Lipton	Beverages	PET	Suntory Pepsico Việt Nam	HCMC, Vietnam	PepsiCo, Inc	New York, USA
Toonoes	Crisps	Multilayer Film	Công ty TNHH thực phẩm orion VINA	Bình Dương Province, Vietnam	Orion Confectionery	Seoul, South Korea
GINGERBON	Candy	Multilayer Film	PT agel langgeng	Agel Langgeng, Indonesia	PT agel langgeng	Agel Langgeng, Indonesia

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
RIH RIH WANG	Candy	Multilayer Film	MANZALIM FOOD INDUSTRIES	Pulua Punang, Malaysia	MANZALIM FOOD INDUSTRIES	Pulua Punang, Malaysia
Thuốc lá thẳng long	tobaco	Multilayer Film	Công ty Thuốc Lá Thẳng long	Hanoi, Vietnam	Công ty Thuốc Lá Thẳng long	Hanoi, Vietnam
C2	Beverages	PET	Công ty TNHH URC Hà Nội	Hanoi, Vietnam	Universal Robina corporation	Quezon, Philippines
Cocacola	Beverages	PET	Coca - Cola Việt Nam	HCMC, Vietnam	Coca-Cola Company	Atlanta, Georgia, USA
Tea+plus	Beverages	PET	Suntory Pepsico Việt Nam	HCMC, Vietnam	PepsiCo, Inc	New York, USA
O'star	Crisps	Multilayer Film	Công ty TNHH thực phẩm orion VINA	Bắc Ninh Province, Vietnam	Orion Confectionery	Orion Confectionery
Poca	Crisps	Multilayer Film	Suntory Pepsico Việt Nam	Bình Dương Province, Vietnam	PepsiCo, Inc	New York, USA
Xyliton	Candy	Singlelayer film	Hamada shokuhin kogio co.ltd	Osaka, Japan	Hamada shokuhin kogio co.ltd	Osaka, Japan
Play more	Candy	Multilayer Film	Guangdong xinle foods Co., ltd	Guangdong, China	Evermore Co., Ltd	Bangkok, Thailand
Kẹo Socola M&M's Minis	Candy	Singlelayer film	Mars China, INC.	Beijing, China	Mars Wrigley	Mclean, Virginia, USA
Marlboro	tobaco	Multilayer Film	Công ty TNHH Vinataba - philip morris	Cần Thơ, Vietnam	Philip Morris International	New York, USA
Water Melon	Beverages	PET	Công ty CP - DV - TM - Tổng hợp vincommerce	HCMC, Vietnam	Vingroup	Long Biên, Hanoi, Vietnam
Vfresh	Beverages	PET	Vinamilk	HCMC, Vietnam	Vinamilk	HCMC, Vietnam
Nước gạo buổi sáng (morning rice)	Beverages	PET	Woongjin	Chungnam, South Korea	Woongjin Foods Co., Ltd	Seoul, South Korea
Saigon silver	Tobacco	Multilayer Film	Saigon Tobacco Company	HCMC, Vietnam	Saigon Tobacco Company	HCMC, Vietnam

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Xylitol	Candy	Multilayer Film	Công ty TNHH Lotte Việt Nam	Bình Dương Province, Vietnam	Lotte Confectionery Co.	Seoul, South Korea
C2	Beverages	PET	URC Vietnam Co., Ltd	Bình Dương Province, Vietnam	Univeral Robina Cooperation	Quezon city, Philipins
Jojo	Crisps	Multilayer Film	Pham-Asset Joint Venture company	HCMC, Vietnam	Pham-Asset Joint Venture company	HCMC, Vietnam
Mini (dry wages)	Candy	Multilayer Film	Haitai confectionary and food Co., Ltd	Hanoi, Vietnam	Haitai confectionary and food Co., Ltd	Seoul, South Korea
Mevius	Tobacco	Multilayer Film	Thanh Hoa tobacco Co.,Ltd	Hà Trung, Thanh Hóa, Vietnam	JT International	Geneva, Switzerland
Marine Boy	Crisps	Multilayer Film	Orion Vina Food Co. Ltd	Bắc Ninh Province, Vietnam	Orion Confectionery	Orion Confectionery
Carven	Tobacco	Multilayer Film	Công ty Công nghiệp Sài Gòn	HCMC, Vietnam	Carreras Limited	London, UK
Tea Plus	Beverages	PET	Suntory PepsiCo Vietnam Beverage	Bình Dương Province, Vietnam	Suntory holdings limited	Osaka, Japan
Indo chips!	Crisps	Multilayer Film	Lwayway Vietnam JS company	Bình Dương Province, Vietnam	Lwayway Holdings Company Limited	Philippines
Marty's	Crisps	Multilayer Film	Lwayway Vietnam JS company	Bình Dương Province, Vietnam	Lwayway Holdings Company Limited	Philippines
Oishi Tomati	Crisps	Multilayer Film	Lwayway Vietnam JS company	Bình Dương Province, Vietnam	Lwayway Holdings Company Limited	Philippines
Sumaki (ginger candy)	Candy	Multilayer Film	Bibica Bien Hoa limited company	Dong Nai province, Vietnam	Bibica Bien Hoa limited company	HCMC, Vietnam

Brand	Product	Material	Manufacturer	Manufacturing Location	Parent Company	Parent Company Location
Keo lac	Candy	Multilayer Film	Bánh Kẹo Tràng An	Hanoi, Vietnam	Bánh Kẹo Tràng An - Công Ty Cổ Phần Tràng An	Hanoi, Vietnam

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