



Market Report

Market analysis for rPET factory: feedstock, competitors, buyers

Post-Consumer Resin Market Development Partnership
December 2020

| | |
|---|----|
| 1. Study Objectives | 2 |
| 2. Methodology | 2 |
| 3. Key Definitions | 5 |
| 4. Plastic Waste in Vietnam | 5 |
| 5. Feedstock Market Analysis | 8 |
| 5.1 Industrial PET feedstock | 11 |
| 5.2 Post-consumer PET feedstock | 11 |
| 5.2.1 Current Post-consumer Value Chain | 12 |
| 5.2.2 Current PET feedstock prices | 15 |
| 5.2.3 PET Waste volumes throughout the value chain | 16 |
| 5.3 Imported PET feedstock | 17 |
| 5.4 Corporate Initiatives towards PET collection | 18 |
| Feedstock quality: Food-grade vs. non-food grade | 19 |
| Key Findings | 19 |
| 6. Market competition | 20 |
| Private Investments into the Plastic Sector in Vietnam | 21 |
| rPET Factory Competitors in Vietnam | 22 |
| rPET Factory Competitors Feedstock Supply | 26 |
| Key Findings | 26 |
| rPET Product Competitors in Vietnam | 26 |
| Key Findings | 27 |
| 7. rPET Customers: Identification & Segmentation | 28 |
| rPET Granulate customer segments | 28 |
| rPET Flake customer segments | 28 |
| Other rPET customer segments | 30 |
| Key Findings | 30 |
| 8. Key Takeaways & Recommendations | 31 |
| Appendix 1: Informal Waste Picker Survey Questions | 34 |
| Appendix 2: Aggregator Survey Questions | 36 |
| Appendix 3: Vietnam Plastic Waste Programs Mapping | 37 |

1. Study Objectives

This research was undertaken by **Evergreen Labs Advisory Company Limited** for the **Asia Society for Social Improvement and Sustainable Transformation (ASSIST)** project titled “**Post-consumer Resin Market Development Partnership**” funded by the P4G or Partnering for Green Growth and the Global Goals 2030. This component is part of a multi-stakeholder initiative that aims to gain commitments from consumer product companies in Vietnam to use recycled plastic (known as post-consumer resin) in their packaging materials and products.

Furthermore, this market study is key research for the full investment compendium that is being prepared for building a state-of-the-art plastics recycling factory in Vietnam. This food-grade rPET facility aims to be implemented within a two-year time frame and once established, could result in USD 15-20 million investment in Vietnam’s sustainable plastics economy, ultimately leading to less plastic ending up in oceans and landfills.

Lastly, this project aims to engage multiple stakeholders with diverse expertise from civil society, private and public sector organizations in Vietnam and globally. These include: Asia Society for Social Improvement and Sustainable Transformation (ASSIST), Unilever Vietnam, IAV Global (a Vietnamese plastic recycling company), and Vietnam Business Council for Sustainable Development (VBCSD).

2. Methodology

This study was conducted to fully understand the market ends surrounding the establishment of an rPET factory in Vietnam. Therefore, this research investigated the material input flow (feedstock) and product output (customers, competition, etc) to capture the market potential for such factory. To conduct this study several methods were utilized.

For base analysis, status quo and market understanding firstly desk research was conducted. This method was mostly used to provide detailed background information on the PET value chain in Vietnam and was used to create longlists of various stakeholder groups (public/private sector, rPET factories in Vietnam, etc).

In addition to desk research, primary data was collected from different stakeholder groups to gain first hand accounts of PET waste streams, material flows and outlooks in this industry. The informal sector engagement took place through surveys completed in Danang. In this study 40 informal waste pickers and 19 aggregators were interviewed. After completion of the final survey questionnaire, the in-field study interviews and surveys took place in Ngu Hanh Son and Hoa Vang districts in Da Nang, Vietnam and detailed approaches for each type of data collection is mentioned below. Result: raw, unique data consolidated from various approaches to build a picture of the informal waste sector in Ngu Hanh Son district Danang. The study framework of the informal sector is outlined in **Table 1**.

Table 1. The study framework of the IWP research and infrastructure

| No. | General category | Level | Type | Description |
|-----|------------------|-------|---|--|
| 1 | Aggregation | L0 | Waste picker | Consist of waste pickers who collect waste material from trash bins, dumpsites or landfills and have no input cost. Sometimes L0 aggregators have a method of transportation like a bicycle or motorbike, which they use to cover a larger area and collect more waste. At times, L0 aggregators collect directly from the households as well. They have no shop/ storage space of their own. |
| 2 | | L1 | Collection center (segregation) | These small scrap aggregators who own a shop where they collect, store and minimally process waste material collected from L0 aggregators, households, apartments and small businesses. They typically like to set up shop where they can be guaranteed a constant supply of post-consumer waste – either in residential areas, near industries, or near a landfill. They are material agnostic, and typically buy all material that they deem sellable downstream. They generally sell all the material they collect to an L2 or a larger L1 aggregator in weekly or biweekly cycles. |
| 3 | | L2 | Consolidation center (processing & trading) | Level 2 aggregators: they primarily buy material from L1 aggregators and bulk generators of recyclable waste. To be viable, they have to be able to store much larger volumes of recyclables, and so favour setting up shop on the periphery of the city. Greater specialisation with regards to material is typically found at the L2 aggregator level, in terms of segregation and/or processing. |
| 4 | | L3 | Processor/Recycler | Level 3 aggregators are driven by specific materials, more professionally established and their waste streams are composed of many L2 aggregators. These are typically located within larger cities, such as HCMC where rPET and other recycled goods are processed into other products/materials. |

| | | | | |
|---|-------------------|----|---------------------------|--|
| 5 | Disposal-Dumpsite | D0 | Community collection site | Within streets or communities sometimes organized curbside disposal of waste is taking place in dedicated areas. While some households are typically placing trash in front of their houses in buckets, styrofoam boxes, etc., there are sometimes clear collection points. This has clear intentions by multiple households to be a collection point for the city. |
| 6 | | D1 | Municipal collection site | Municipal collection sites are dedicated locations for waste disposal chosen and managed by the municipal waste operator. These areas have green dumpsters and bins for proper waste disposal from households and small businesses. The municipal waste operator will collect waste with trucks or tricycles (motorbikes with dumpsters attached) on a daily basis. Sometimes these sites also have "walls" enclosing them from the general public to improve city aesthetics and smell. |
| 7 | | D2 | Illegal dump site | Illegal dump sites are areas that are not permitted by the city officially as waste disposal locations. These sites are often filthy, dirty, smelly and waste burning occurs here. As there is no municipal waste management, these sites often overflow with household and small business waste. |
| 8 | | D3 | Temporary dump site | These consist of illegal dump sites that appear temporary in nature. They are typically found in empty land lots and consist of various waste streams including household, construction and small business trash. |

Informal Waste Picker & aggregator survey:

Google Form was used to create an in-depth understanding of the IWPs. Each survey was conducted by one interview team member asking a IWP and filling in the online form. Besides data collected from the form, other stories told by IWP and observations were documented and included in the discussion section below.

The general approach to conducting the surveys was having interview team members driving around in Ngu Hanh Son district in search for random IWPs at work. After introducing our work and the purpose of the survey, each IWP was offered to answer the survey and in exchange for their time, a small stipend would be given. However, it must be noted that this is not the main motivation persuading the IWPs to participate in this interview.

For the surveys used in interviews refer to **Appendix 1-2**. Once surveys were completed the data was consolidated and analyzed.

Verification of draft report findings with relevant stakeholders:

A draft version of this report was used as a discussion base for a comprehensive 3 day conference with relevant stakeholders (outlined in **Appendix 3**) and presented to conference participants two key findings presentations. The feedback from the participants was subsequently incorporated into this report in pull out boxes (as below) to provide third party views on the research findings.

Please note that these are independent statements by representatives of the respective organizations and may include individual opinions and not necessarily reflect the organization's view on the context to the full extent. The value for this report lies in the diversity of the opinions to raise concerns, show alignment or misalignment and to provide different perspectives to the reader.

3. Key Definitions

For clear understanding throughout this report here are some key definitions used within this study.

PET: PET is an acronym for polyethylene terephthalate. The PET polymer is clear, strong, lightweight, safe and recyclable, typically mixed with virgin resins. PET used for packaging accounts for 23% of the global usage of the PET polymer. 54% of all PET production is for fibre, e.g. for the textiles industry, where it is commonly referred to as polyester and other industry uses include the automotive and electronics industries.

rPET: rPET is the acronym for recycled PET. rPET is not to be confused with RefillablePET which is usually referred to as REFPET in short form.

Virgin PET (vPET): raw material resin produced directly from the petrochemical feed-stock, such as natural gas or crude oil, which has never been used or processed before.

Polyester: refers to synthetic fibres made from PET. These are typically used in the textile industry and also can be produced from rPET.

PET material focus of this report: As this report focuses on the feasibility for a food grade rPET facility, the focus lies on PET and rPET from bottles. Besides small exceptions on industrial electronics trays, PET from bottles is also the vast majority of feedstock recovered for recycling. Unless otherwise stated, PET feedstock refers to PET bottles.

Statistics and figures: As Vietnam does not have an official and validated statistical database on waste and waste management, the figures in the report are derived from third party publications and clearly referenced. The methodology of the third party research methodology has been considered as much as possible but the detailed statistics have not been verified for this report, as they are only intended to provide a general framework and are not to be used for a final decision base.

4. Plastic Waste in Vietnam

Today, a third of the waste in Vietnam comes from urban areas and most of the plastic waste is generated by extensive use of PET bottles and single use plastic. Vietnam produces an average of 0.33kg per capita per day according to a study by the World Bank¹. While this number is relatively low in comparison to other countries in the East Asia and

¹ World Bank, 2018

Pacific region, however a study by Jambeck and colleagues in Science ranked Vietnam as the top 5 countries contributing to ocean-bound plastics². In this study it was reported that Vietnam produces 0.79kg per person per day, over double the reported rate in the World Bank study. Furthermore, it states that 11% of waste generated is plastic waste, 88% is defined as mismanaged. With these data points, the study calculates the total plastic waste generated in Vietnam per year is 1.83 millions of metric tons, accounting for 5.8% of that being mismanaged plastic waste².

Taken together, the mean waste generation rate in Vietnam is 0.7kg per capita per day in urban areas and 0.4 kg per capita per day in rural areas. The MSW composition has a high percentage of biodegradable residues of about 60.1%–70.0% by wet weight³. As urban megacities, like HCMC, lie along waterways including the nearby mekong river, it has become one of ten rivers in the world that collectively discharges 95% of plastic debris into the oceans⁴.

Vietnam's National Action Plan on Ocean Plastic Waste Management aims to reduce the amount of plastic waste released into the ocean by 75% by 2030. Prime Minister Decision No. 1746 / QD-TTg (December 4, 2019) further promoted the National Action Plan for Management of Marine Plastic Litter with following targets to be achieved by 2030:

1. Limit single-use plastic products, specifically plastic bags
2. Promote innovation and technology transfer in production, consumption, recycling and reuse of plastic products
3. Strengthen scientific research
4. Disseminate and mobilize active, effective and responsible participation of stakeholders in managing and minimizing plastic waste in general and marine plastic debris in particular
5. Collect and treat 100% of hazardous waste

The Action Plan will contribute to the implementation of the overall Strategy for Integrated Solid Waste Management in Vietnam. Furthermore, drafted in February 2020 a new report from the Ministry of Natural Resources and Environment and other supporting agencies to the Prime Minister to draft a Directive on strengthening reduction, sorting, collection, recycling and disposal of plastic waste. This directive would recognize plastic waste as a valuable resource and stipulates the promotion of plastic waste recycling and building fully circular economies, as well as implementing the reduction and classification of waste at source and public awareness raising campaigns⁵. Taking the current and future legal frameworks into consideration, single use plastic bottles are one of the most crucial parts to reducing plastic waste in Vietnam and the country aims to eliminate production of single use plastic by 2025.

Currently, **the amount of PET plastic collected for recycling in HCMC is 62% and Hanoi is 39%**. Speaking generally across Southeast Asia, the informal sector is responsible for recovering nearly 97% of this waste stream throughout. It is estimated from the plastic flows, an estimated 0.7-1.0 million tons are being recycled back into production while 1.3 million tons are being processed at waste facilities (the quality standards of such facilities is unknown)⁶. Currently, for plastic waste that is not tradeable, landfill or burning is the only option in Vietnam with no treatment plan for plastic incineration or Refuse-derived Fuel (RDF) plants. According to the Ministry of Natural Resources and Environment (MONRE), plastic waste fills approximately 12.36% of landfill capacity in the country. Estimations predict at least 1.38

² Jambeck et. al 2015

³ Schneider et. al 2017

⁴ Schmidt et al. 2017

⁵ <http://nangluongsachvietnam.vn/>

⁶ Vietnam Material Marketplace report, 2019

million tons of plastic waste currently in landfills in Vietnam. In 2030, when Vietnam GDP is predicted to double from 2020, the informal waste workers are likely to switch occupations and therefore putting even more pressure on the recovery and collection of valuable waste⁷. Taken together, the new regulatory improvements and ERP schemes will push corporates to engage in recovery of their post-consumer products which will also increase collection mechanisms in the country.

Conference Findings

Throughout the conference, the various presentations stated statistics from different sources and many of those were questioned by participants. This was important to understand, as it shows that there is no common ground and that opinions and assumptions vary a lot, even within different governmental stakeholders or industry experts.

Report: Plastic waste inputs from land into the ocean

Comments on introductory pamphlet by Assist which referred to the scientific research report published in 2015 in Science - Plastic waste inputs from land into the ocean - Jam Beck 2015.

VCCI: "VN is not the 4th country of plastic waste to the ocean. The 1.8million dât is probably from import waste as well. The EU only has 15% waste recycled. I oppose this report."

CITENCO: "I also disagree with the report. As it is calculated by the produced plastic produce, and particular areas. Even the thin plastic bags are being very well recycled in Vietnam."

Informal Sector Consideration in Official Research Reports:

DONRE - HCMC: "Many have contacted us for the data but our number in the informal sector is very old. This year we want to reinvestigate the CLCs. But will be postponed till 2021 due to Covid19"

General Availability of Reliable Data

CITENCO: "Lack of info and database on plastic waste deters projects like this. However this project can try and build a database that is recognized and contributed by all." comment on reliability of data and suggestion to build common ground.

VCCI: "There is no unified definition of single used plastic" comment on definitions and use of terminology in various reports and the risk of misalignment on research and findings.

VPA: "Recycling is a challenging issue. We don't have concrete data, only approximations." confirming limited data availability in Vietnam, even from the plastic associations perspective.

Monitoring and Reporting of Waste Data

Evergreen Labs: "An improved monitoring and reporting framework as suggested under 'Decree 33 on strengthening the management, reuse, recycling, treatment and reduction of plastic waste' can improve the availability and reliability of data and increase transparency" comment during a discussion on source and reliability of data in the reports.

VCCI: "None of the world's governments can monitor plastic waste. If the government can't monitor it, how can researchers create reliable reports in a couple months?" a comment questioning the reliability of research data in general after increased governmental monitoring and recording of waste was proposed by participants.

Conclusion

⁷ GA Circular report, 2019

The statements above show a consent of various stakeholders in regards to a lack of availability and reliability of data in the waste and particularly the plastic waste space. While some reports are used as benchmarks, other reports are disregarded by certain stakeholders. We also witnessed inaccurate quoting or interpretations of statistics and inadequate use of figures when taken out of contexts. This presents a challenge for potential investors to create reliable business plans and scenario analysis.

5. Feedstock Market Analysis

Although the reviewed and analysed data is often inconclusive, it is estimated that **Vietnam is currently consuming around 300,000 metric tons of PET annually** according to Far Eastern New Century group and PRO Vietnam members. Therefore the potential for feedstock for a rPET factory is considered generally sufficient, however the collection/recovery mechanisms and infrastructure need to be greatly improved.

It is estimated that the national PET collection rate is only 27%, which is being used for further processing including flake, granulate and final product production. In the South, Ho Chi Minh City is currently collecting 62% of PET for recycling, while 29% ends up in landfills and 9% leaks into the environment⁸. The informal sector (described in detail in 5.2.1) is the key driver in collecting PET and plays a significant role in reducing landfill volume pressure for municipalities across the country.

Conference Findings

Discussions on feedstock have not yielded a clear alignment of participating stakeholders with large deviations particularly on potential PET feedstock:

General Feedstock Supply (Domestic) -> guiding comment on general feedstock supply

VPA: “Investors need to prepare a collection system for domestic plastic waste and possibly even need to consider importing waste under legal compliance. At the moment, domestic feedstock collection is surely not enough for large scale facilities. If we collected all the material, it might be sufficient.”

CITENCO: “Only source separation can help long-term on creating reliable feedstock.” ;
“Domestically recovered feedstock, even if pre-processed is less valuable than pre-processed waste from outside of Vietnam” comment on availability, value and quality of feedstock

VCCI” “Vietnam is an exporting country with a lot of plastic waste, there is enough feedstock”

Imported Feedstock

VPA: “Regarding waste imports, a lot of waste is currently stuck at the port as importers fail the legal process.” comment on legal challenges related to imports

⁸ GA Circular Report 2019

CITENCO: “Regulations on importing waste will get stricter and enforcement will increase in the future.” comment on regulation and enforcement of imports

VCCI: “Waste import is very strictly managed as we don't want to be the factory of the world. Developed countries are bringing large amounts of hazardous waste and non-recyclable waste into VN.” comment on Vietnam's stand on waste imports

PET Feedstock and Recovery

VCCI “In Vietnam almost all PET is already collected” comments indicating sufficient feedstock without clarification of sources.

ENDA

“98% of PET and 5% of plastic bags in HCMC are already collected.” statement on recovery rates that were discussed and disputed during the discussion.

Conclusion

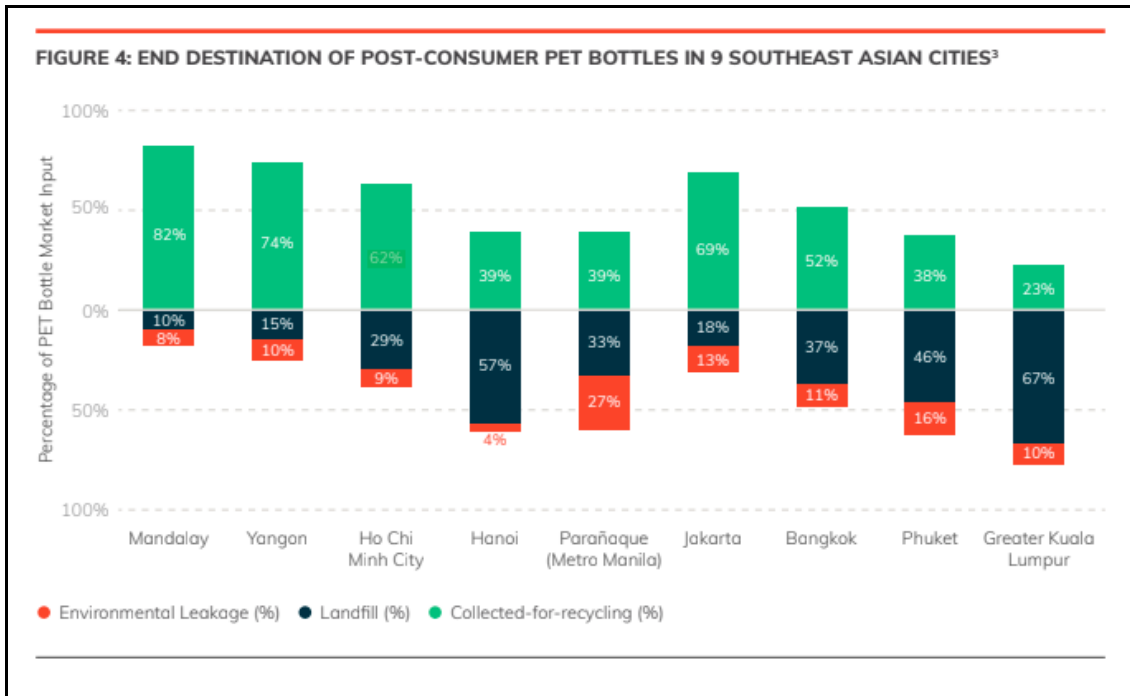
The discussion on general feedstock availability shows a strong misalignment of different stakeholders. While some state that there is sufficient feedstock, others mention low recovery rates and required interventions.

On waste imports, we experience a general alignment, namely that Vietnam will continue to allow waste imports but that regulation and enforcement will become stricter.

On recovery rates and especially PET recovery, the participants state vastly different rates. While some rely on certain research reports, others rely on their own in field experience. On the research reports that were stated, a misinterpretation of figures could be verified in at least one of the cases.

Regarding in-field experience, ENDA presented high recovery numbers of 98%, which may stem from their work with independent waste collectors (IWC), where PET recovery rate can be assumed to be very high as PET bottles are a key income stream for IWCs. However, this may not reflect the city's average as pointed out by CITENCO, without providing an alternative number.

For clarification, this reports refers to a benchmark report focus on PET recovery: GA Circular Report: Full Circle - Accelerating the Circular Economy for Post-Consumer PET Bottles in Southeast Asia)



As Vietnam develops, one trend in collection that may be seen is the reduced recycling collection rates. Typically, in developed regions such as the EU, countries with lower GDP per capita tend to have lower collected-for-recycling rates of PET compared to those with higher GDP. However, this trend was shown to be the opposite in Southeast Asia, including Vietnam, where the collected-for-recycling rate of PET tends to show opposite correlations. For example, in cities with high GDP per capita the collection-for-recycling rate of PET tends to be reduced and is conversely observed as well. In Ho Chi Minh City residents have an average income of US\$250 / month (country GDP of US\$2,564) and 10 informal workers every 10,000 residents. However, compared to large metropolises such as Kuala Lumpur which has an average income of \$688/ month (country GDP of \$11,239) but only five informal waste workers per 10,000 residents.⁹ As cities grow, cost of living increases and typically informal workers can no longer support themselves by collecting anymore and therefore change jobs. These socioeconomic factors need to be considered to create inclusive collection mechanisms for PET feedstock.

The following analysis considered available information and also set out to collect primary data specific and relevant for the establishment of the state-of-the-art rPET factory in Vietnam. To understand the PET feedstock, the limitations and make recommendations for next steps this study conducted informal waste sector research, public and sector interviews. Through our in-depth research, we were able to draw out four main sources of PET feedstock in Vietnam which incorporate both informal and formal stakeholders. These main sources of feedstock include:

- Industrial PET waste streams
- Post-consumer PET waste streams
- Imported PET waste
- CSR or Business initiatives

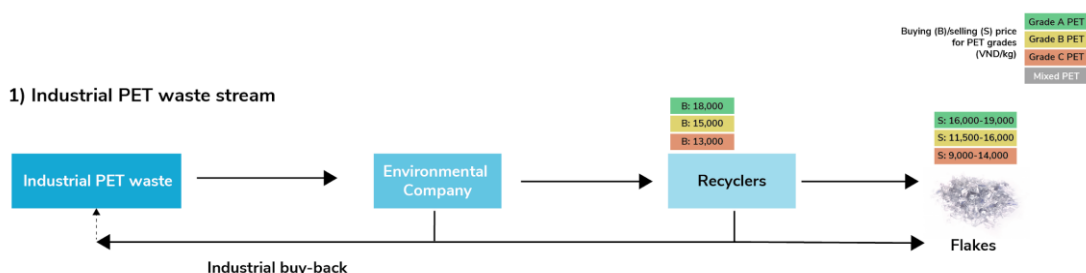
⁹ Based on GA Circular On-ground Research and Analysis (2017-2019). Average Incomes sourced from tradingeconomics.com/

Below we dive into depth on the four main recovery streams in Vietnam, highlighting expert interviews, our informal sector research and public sector feedback. In addition to the below, one may consider “Tools to Drive Material Collection by GA Circular” (summarized in **Appendix 4**).

5.1 Industrial PET feedstock

In Vietnam, there are several key industries with large volumes of PET waste. This waste is typically more attractive to recyclers due to its cleanliness, recoverability and reliability. Recyclers in this industry are typically closely linked to the industrial producer with formal contracts, strict compliance regulations to follow and even buy-back schemes. In these ecosystems, the industrial partner selects recycling partners within close proximity to their production site and often (described in detail in Samsung example below) are mediated by an environmental company as well, although the reasoning for this is unclear it seems to be related to permitting compliance. The formal recyclers are able to trade their output product, usually flakes, externally and also work closely with industrial partners through buy-back mechanisms.

One good example of industrial PET feedstock and recycling comes from the company Samsung. We conducted two interviews with Samsung recycling partners: one a commercial partner, an Environmental Company and the other is a recycling partner, Korean-owned, responsible for producing recycled trays. Both of these partners’ businesses focus on creating a circular economy around Samsung trays that are used to hold the different parts of a Samsung product to be transported within the 10+ factories of Samsung before they get assembled into one finished device. The Producing partner produces and sells these trays to 3-4 factories of Samsung, but also sells flakes and other PET finished products into the market. The factory’s feedstock is the used Samsung trays from the same Samsung factories that are disposed of after wear and tear or when the product’s model is periodically replaced. However, according to Samsung’s policy, a company can not be both Producing partner and Commercial partner, meaning after using the trays, Samsung cannot sell them directly back to the producing partner/tray supplier but only to the Vietnamese Environmental companies with permit to handle waste. The Environmental Companies then can sell back the waste to Samsung’s supplying partners or process the waste to sell flakes to the market.



5.2 Post-consumer PET feedstock

The most challenging and fragmented feedstock to recover in Vietnam is the post-consumer waste. This is mainly due to the informal collection mechanisms, multiple layers of stakeholders involved and opaqueness of the market. As this research aims for a post-consumer resin PET factory, we researched this particular PET feedstock in-depth to highlight the current mechanisms in place, potential barriers and key focus areas for improvements. To understand the informal

PET collection system in Vietnam, primary data was collected in the field. The purpose of this research was to understand the profile of IWPs, uncover their behaviors of waste collection, observe key recovery habits and investigate their networks. After an in-depth research in Da Nang and confirmed by the NGO, Environmental Development Action in the Third World (ENDA) and the municipal waste operator CITENCO in HCMC. Further down the value chain, we interviewed large formal and informal recyclers to complete the full ecosystem assessment.

5.2.1 Current Post-consumer Value Chain

The current PET waste streams, collection and disposal mechanisms in Vietnam involve various stakeholders from both the formal and informal sectors. **The majority of PET recovery and collection is dominated by the informal sector.** Domestic, household waste is not typically source separated meaning tradeable, recyclables are mixed with organic waste and other contaminants. Typically this waste is curbside in front of the business or household directly for collection or placed at a designated dumpsite (which can either be municipally managed or not). The first level where tradeables, including various types of high-value plastics (PET, HDPE, LDPE), paper (mainly cardboard) and metal, gets recovered is through informal waste pickers (IWPs). The IWPs sort through household/ business waste to scavenge any tradeable item and are identifying very specific items based on distinguishing features such as color, size, weight, etc. However, their **scavenging behavior is greatly driven by the selling price of a particular stream on any given day.** In particular, metal has a very high trading price therefore, IWPs prioritize collection of this waste stream over others including PET.

Profile of an Informal Waste Picker (IWP)

The typical IWP is a middle-aged woman on a bicycle going through pre-selected neighborhoods to pick up waste either from her established contacts or randomly from households/businesses, earning between 100,000-200,000 VND/day. She has been working as a waste picker for more than 10 years, and has chosen to do this job mainly because it allows her the time and freedom to attend to other domestic duties at home. It troubles her that some people usually look down on her job and some are less environmentally conscious. At her age, although she wants to quit working or change to a better job, she does not think she would have other options.



Next, the IWP brings their yield to an aggregator, typically referred to as a collection center or junk shops. These collection centers are the first level of aggregation and typically interact directly with IWPs however some buy directly from businesses or are pickers themselves. These centers are the first point of tradeable consolidation in the waste value chain. In Vietnam, collection centers can vary greatly in size, infrastructure and setup depending on an expansive range of factors. Generally speaking collection centers have simple infrastructure in place, trade with IWPs and are family-owned businesses. They are not doing any pre-processing of PET on-site, such as removal of labels, washing or taking off bottle caps.

Moving along the value chain, collection centers consolidate tradeable waste streams and once a particular volume is reached (usually restricted by transport or storage capacity) they trade with consolidation centers. These centers are much larger in size, trading bigger volumes of waste and are operating larger, more established businesses. The main distinguishing feature between the two levels is the size. While some collection centers trade directly with buyers, often consolidators are in between as they collect more volume and own trucks for transportation before selling to other traders, end buyers (e.g. factories).

To identify the stakeholder between the consolidators and the end-buyers, is very complex as most aggregators do not

Network within the informal waste collection system

An established network is the main work resource for any IWPs. As waste picking is not exactly a highly desirable job for most people, IWPs only enter the business with the advising of a trusted contact. While looking for random waste on the street is a common method practiced by most IWPs, households, restaurants, cafes, hotels, bike shops, construction workers, or even MUS workers contacts, etc are the result of years of experience working in the sector that helps lighten the work of IWPs. On the other hand, in rural areas where there is too little waste source, IWPs and local CLCs directly compete against each other to buy waste from the local households and businesses.

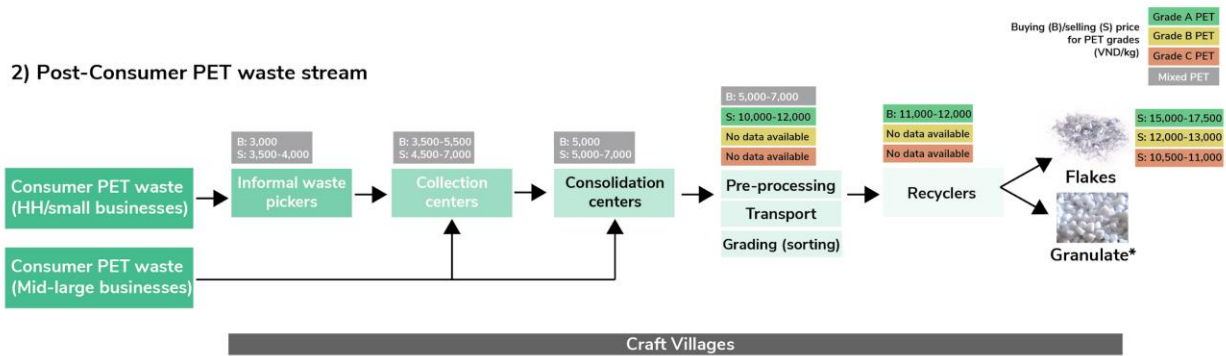


want to disclose their buyers. However, after in-depth research and interviews we were able to piece together the full value chain to offer a more complete picture of the informal sector.

After capturing trading data, the data suggested that there were other stakeholders involved in the value chain after the PET is consolidated. We identified that while this component of the supply chain is flexible and ultimately depends on the end-buyer, it is occurring in the most common cases. Typically after the PET is consolidated there is a preprocessor whose job is to remove the bottle's label, take out caps, etc. Furthermore, at this step or after the pre-processed bottles are further processed the PET is sorted and graded by quality. Typically the Grade A material consists of beverage bottles from bigger brands such as Coca-Cola, Pepsi, Tan Hiep Phat, etc., Grade B and C are bottles from local lesser known packaging facilities or fish sauce, soy sauce or other food containers.

Sorted material is then consolidated by end buyers/ recyclers to process into flakes or granules with quality requested by their customers. These customers include preform factory, industrial factory suppliers, foreign merchants or exporting companies. If the finished products are made in Viet nam, they are usually manufactured into food packaging, yarn or industrial trays (for example those used at Samsung for produce packaging).

2) Post-Consumer PET waste stream



Note: Informal sector pricing based on Danang research only from June 2020

*While most recyclers interviewed have capacity to produce granulate, all are not producing as the price is not competitive and they have no buyers

Besides the informal waste collection system in Vietnam, municipal waste operators are responsible for collection and transport of waste to landfill. They typically have designated collection points throughout the city where households and businesses can drop waste. Additionally, households and businesses leave waste in front of their homes for municipal workers to collect. This is a paid service (beneficiaries of this service fee depend on the municipality in Vietnam) and done typically with a push cart attached to a motorbike for ease of navigating small alleys where large municipal trucks cannot fit. Therefore, after collecting waste per house the municipal worker will bring full carts to the designated municipal collection point which gets serviced by municipal trucks and brought to landfill. Generally, the waste has already been scavenged by IWPs before municipal workers reach the waste and if there are any remaining tradeables the municipal workers sort and trade as well.

The current waste value chain in Vietnam has three main endpoints for trash: landfill, environment or recycling. There is still no official, consistent and scientifically based data regarding the recycling rate of any kind of waste at a national level in Vietnam. A National Environment Report published in 2011 estimated the recycling rate of municipal solid waste is approximately 8-12% and mainly taking place by the informal sector in craft villages¹⁰. According to the VPPA and VPA, the amount of plastic scrap recycled in 2018 was between 700-1000 tons. Recycling activities within craft villages are manual, outdated and causing serious environmental and health issues. There are an estimated 302 recycling establishments within Ho Chi Minh City, mainly District 11 and of these 67 are recycling plastic¹¹.

Taken together, there are several key issues in the PET value chain in Vietnam that need to be addressed in order to have a transparent, inclusive and value-added supply chain. Some key interventions to improve this value chain include:

- Full integration of the informal waste sector within the Vietnamese municipal waste operations
- Increased recovery of PET through source separation at household and business levels
- Reformed environmental law to recognize plastic waste as an integral part of “daily life” forcing municipalities to carefully consider the handling of this valuable stream
- Transparent trading recycling ecosystem

¹⁰ MONRE, 2011

¹¹ Ho Chi Minh City DONRE, 2006

5.2.2 Current PET feedstock prices

As outlined above, the **waste recovery ratio of PET is highly driven by price**. When discussing price with the IWPs and aggregators some were confident with the trading rates while others gave more vague responses. In comparison, we took the average of the trading prices per waste stream from each stakeholder group and summarized below in Table 2. It is worth noting that many IWPs and aggregators alike mentioned that pricing has changed over the COVID-19 period. Additionally, pricing, especially for plastics, is highly driven by the end buyer (plastic factories, traders) and therefore if there is demand from a buyer the price changes accordingly. While the waste trading pricing fluctuates over time PET is being traded for around 3,500VND/kg (\$0.15 USD/kg) at the IWP level, where the trading price is nearly doubled once it reaches the consolidation centers with a price of 6,500VND/kg (\$0.28 USD/kg).

Further down the value chain PET is traded up as it gets consolidated and one reaching consolidation centers or pre-processors the PET is sorted by grade. The grading process sets up three pricing brackets for PET down the rest of the value chain. While the values in this research can give an indication of market pricing, note that PET prices can fluctuate greatly depending on several factors mainly:

- Oil prices
- Imports
- Market demand

Table 2. Average waste stream trading prices based on stakeholder group

| Name of stakeholder | PET (VND/kg) Buying | PET (VND/kg) Selling |
|------------------------|--|---|
| Informal waste picker* | 3,000 | 3,500 - 4,000 |
| Collection center* | 3,500 - 5,500 | 4,500 - 7,000 |
| Consolidation center* | 5000 | 5,000 - 7,000 |
| Pre-processors | 5,000-7,000 | 11,000 - 12,000 (grade A bottles only) |
| Recyclers | Post consumers: Grade A bottles: ~11,000 - 12,000 Industrial (Factory waste) <ul style="list-style-type: none"> • Grade A: 18,000 • Grade B: 15,000 • Grade C: 13,000 | Post consumers: <ul style="list-style-type: none"> • Grade A Flake: 15,000 - 17,500 • Grade B Flake: 12,000 - 13,000 • Grade C Flake: 10,500 - 11,000 Industrial (Factory waste) <ul style="list-style-type: none"> • Grade A Flake: 16,000 - 19,000 • Grade B Flake: 11,500 - 16,000 • Grade C Flake: 9,000 - 14,000 |
| Wholesale Trader | | Industrial (Yarn waste): <ul style="list-style-type: none"> • Grade A Granule: 18,100 • Grade B Granule: 16,900 • Grade C Granule: 15,800 |

**average pricing based on Danang informal sector primary research confirmed to match pricing by HCMC consolidation centers and by ENDA*

5.2.3 PET Waste volumes throughout the value chain

Similarly to the trading prices of waste, the total volume recovered either by IWPs or aggregators is diverse and varies greatly depending on the waste picker and center interviewed. Again, this information was difficult for IWPs to recall as they are not keeping track of such numbers, while aggregators were more confident with these numbers. These volume numbers are based on Danang research only to serve as representative data only.

Table 3. Average waste stream trading volume based on stakeholder group from Danang research

| Name of stakeholder | Plastic (kg/day) |
|-----------------------------|------------------|
| Informal waste picker | 12 |
| Collection center | 44 |
| Consolidation center | ~ 366 |
| Recycler (Grade A PET only) | ~ 3,333 - 33,333 |

5.2.4 Formal and Informal PET Recycling in Vietnam

Through this research, we were not able to successfully distinguish formal versus informal recyclers in Vietnam as there are several levels from small family business operations to fully permitted and stock traded companies. Due to unclear regulatory processes, permitting and lack of certification for final products, we combined formal and informal recyclers into one stakeholder group. Together, these recyclers can be composed of local family businesses operating small recycling businesses with decades old processing permits all the way through to large-scale factories with granulation lines and export capacities (rPET competitors discussed in section 6) with municipal licences. The Informal and Formal waste sectors are well connected together. For example, most of the post consumer waste in Vietnam is currently collected by the informal sector, then be sold to the end buyer/recycler which either have an environmental permit to handle waste (formal recycler), or have not had one (informal recycler). However this is a blurred line as most informal recyclers said they can invest in obtaining such permits easily if the demanding customers sign a long-term contract.

After further investigation into the informal recycling system in Vietnam, a main hub for such groups is within Vietnam's plastic scrap craft villages. Some craft villages started to change from their traditional farming economy to waste processing in the 1990s. Hung Yen and Bac Ninh provinces, with close distance to the megacity of Hanoi and nearby industrial zones were the first areas to convert and are where most of the reported villages are located. Some villages have 30%-90% of the household participating in the waste sector with various jobs: from collecting and transporting waste, to consolidating, pre-processing, to flake and granule making and trading. In the Minh Khai village Facebook group¹², unprocessed waste, flake and granule of all types of plastic are advertised and traded daily. However, most of the reports on these villages raise questions about the obvious environmental pollution that the

¹² <https://www.facebook.com/groups/1374466159455642/>

villages are causing due to the lack of adequate production process and waste treatment systems. For example, these villages completely lack waste water treatment and all wastewater is discharged directly into the rivers. This water is not only highly contaminated but has high volume of microplastics and debris.

5.3 Imported PET feedstock

The third recovery stream of PET feedstock in Vietnam is via imports. In response to China's ban on importing waste and scrap in January 2018, MONRE established a September 2018 regulation requiring imported scrap to be examined and verified before being allowed into the country for use. This restriction has produced several months of backup at Vietnamese ports as containers await inspection. Regulatory changes will soon limit import of scrap only by companies that directly manufacture a final product, excluding importers. This new regulation will force enterprises seeking to use recycled plastic to establish their own brokerage capability, putting exceptional strain on small and medium sized companies in the future¹³.

Currently, much of imported waste is being processed at craft villages throughout Vietnam. The Minh Khai village in Hung Yen province is reported to be the biggest waste importer in the country¹⁴. However, recent change on the regulation of scrap import has put tremendous pressure on many businesses in the village by cutting off their cargos of imported feedstock¹⁵. Buying waste from household to household for them, is too much work that does not pay well enough. Further research and stakeholder interviews found that the formal recyclers had a preference toward imported waste rather than using domestic post consumer waste within Vietnam. Formal businesses were not able to compete with craft villages in processing domestic post-consumer waste as these small family businesses are processing waste at home, with low labour cost while not having to follow any regulations on storing and processing imported scrap¹⁶. Recyclers are also hesitant to buy processed waste from the craft villages due to low quality, and prefer to import the scrap themselves¹⁷.

In Clause 29 Article 3 Decree 40/2019/NĐ-CP on Solid Waste and Scrap Management, individuals and businesses can only import scrap to product products and goods (tradable recycled granules is not included), and trading of semi-finished products is not allowed, except for projects and businesses that have been approved to import scrap for granule producing purpose until the end of 2024. However, it was clear that the recyclers are still offering flakes from imported scraps to the market, and even unprocessed waste is still being publicly traded in social media networks of the craft villages (<https://www.facebook.com/groups/1374466159455642/>). Currently, due to COVID-19 and stricter regulations, waste imports have halted and therefore we were unable to get pricing throughout the value chain for this particular feedstock stream. One recycler of imported waste shared with us that the trading price for Grade A flakes for food is 17, 300VND, lower grade is 12-12,500VND (non-food grade) used only to make binding strings.

¹³ Vietnam Materials Marketplace

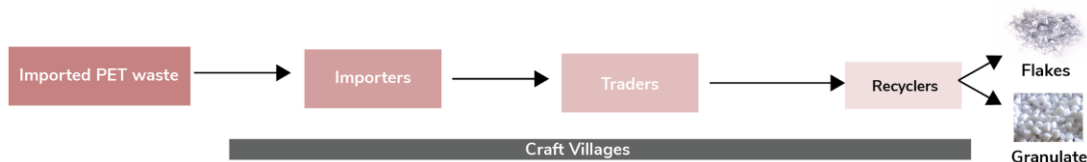
¹⁴ <https://english.vietnamnet.vn/fms/environment/204224/the--billionaires--waste-recycling-village-is-seriously-polluted.html>

¹⁵ <https://www.youtube.com/watch?v=1Nita1w4cVU>

¹⁶ <https://thuvienphapluat.vn/van-ban/tai-nguyen-moi-truong/Van-ban-hop-nhat-09-VBHN-BTNMT-2019-Nghi-dinh-quan-ly-chat-thai-va-phe-lieu-427463.aspx>

¹⁷ <https://tuoitre.vn/siet-chat-nhap-nguon-phe-thai-nhua-vo-toi-va-20190403074535505.htm>

3) Imported PET waste stream



5.4 Corporate Initiatives towards PET collection

The final source of PET feedstock in Vietnam is through corporate initiatives and programs. In this research we identified one PET collection initiative and one non-PET activity. These recovery programs are initiated by the corporate typically for CSR strategic reasons. Through this program a private sector collection partner is established and brought together with a formal recycler to handle the waste processing.

One showcase example of this is with Highlands Coffee, one of Vietnam's largest coffee chains with over 300 shops in 24 provinces across the country. As most coffees in the country are served cold, clear PET cups are used as containers for a wide range of cold served coffee and tea. Currently, Highlands Coffee recycling volume at the Vinh Lac Plastic Ltd is at 20 tons/month, with waste streams coming from larger cities in Vietnam such as Hanoi, Ho Chi Minh, Danang, Hai Phong. In smaller cities, the quantity was reported to be too small that it is not worth the transportation cost. The Recycler is not collecting but only responsible for picking up the 8-9 tons of waste coming from cafe shops in the North from Highland's storage in Hanoi, while the rest of the waste stream from the south is sent to him by truck at the truck station.

Highland's collector is NHC Network - an organization founded by start-up Revival Waste. Beside collecting for businesses, NHC's public awareness work involves schools, retailers, businesses and even individuals into creating a network of drop-up points of used milk cartons as well as training on storing waste for children and organizing environmental events. To be collected by NHC, milk cartons need to be flattened, sealed of the straw hole or cut open and cleaned first.

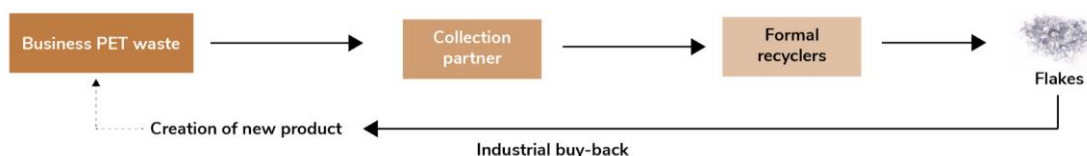
Highland's waste is cleaned and turned into granulate at Vinh Lac, then sent to Highland's cup manufacturer to be moulded into new cups and is not available to be sold outside the circle. Although Highland's flakes are internally sorted at Grade B due to low quality feedstock and the contamination and deterioration happening during consumption and transporting, the recycler confirms that Highland's flakes are more expensive than other same quality flakes with better feedstock source due to higher processing cost, without disclosing the price saying that "with that amount of money we can buy something better".

Beside the domestic feedstock, this recycler is also importing material from Japan to make his A1 granulate. His other product, A2 granules are the material for the packaging supplier of Kinh Do - one of Vietnam's largest confectionery manufacturers. Another customer is buying A1 and A2 to produce Australia-exported food packaging.

This type of initiative has also been successful with other material types such as multilayer packaging. A CSR program setup by the packaging company TetraPak established a collection of TetraPak containers (mainly milk containers) and

processing into paper pulp and polymer aluminium (PolyAl) boards. This partnership was formed between a collection partner, Lagom Vietnam, and the paper and recycling company Dong Tien to create a circular approach.

4) CSR/Business Initiatives



Feedstock quality: Food-grade vs. non-food grade

After analyzing the PET feedstock market in Vietnam, it became apparent the lack of clear understanding of food-grade quality material. While Vietnam's food plastic packaging requirements do not specifically limit the use of recycled content in food-contact packaging as long as the criteria covered in the food packaging regulation QCVN 12-1:2011/BYT are met, the quality of the recycled material is not regulated.

A recycler reported that currently there is not yet an existing regulation on the management of recycled plastic. Typically, each recycler comes up with their in-house grading criteria, depending on the feedstock and machinery that are used in the process. Due to lack of regulation, recycled flakes are not required to meet any official standards, even when they are graded safe enough to be processed into food packaging, until they are turned into the final products. Buyers of the recyclers also do not seem to require proof of quality from the recyclers, as two of the larger recyclers stated that testing of quality from an official agency (QUATEST) can be done if the buyer agrees to pay for the extra fee. Buyers are also fully responsible for the quality of flakes. When questioned why their grade A flake is so expensive, the recyclers confirmed that they can produce with whichever price the buyers are willing to pay, however the quality of flake will be compromised accordingly.

An unnamed competitor disclosed that their feedstock used are Samsung trays and the output is flakes. When asked if his output could be used to produce food packaging, he said that people usually get the food-grade certificate for their product with 100% vPET at first, then afterward they can mix 50% vPET + 50% rPET to reduce cost. The product is not as nice as the 100% vPET bottle, and he is not sure of the process but some of his customers can even export with the certificate.

Key Findings

- While some data on volume and pricing was collected from the informal sector, **the data is not reliable as many respondents had a difficult time recalling this type of information.** This was seen across the value chain but most challenging with IWPs.
- There are several levels of tradeable waste segregation through residential and commercial waste by the informal sector, however these **workers are prioritizing the waste stream they scavenge based on price. This means PET is not the first choice for recovery because it is light (therefore one needs to collect more) and it is traded at half the price in comparison to metal.**
- The **integration of the formal and informal waste sectors** will be vital for the recovery of sufficient feedstock of rPET in Vietnam and other relevant waste streams.

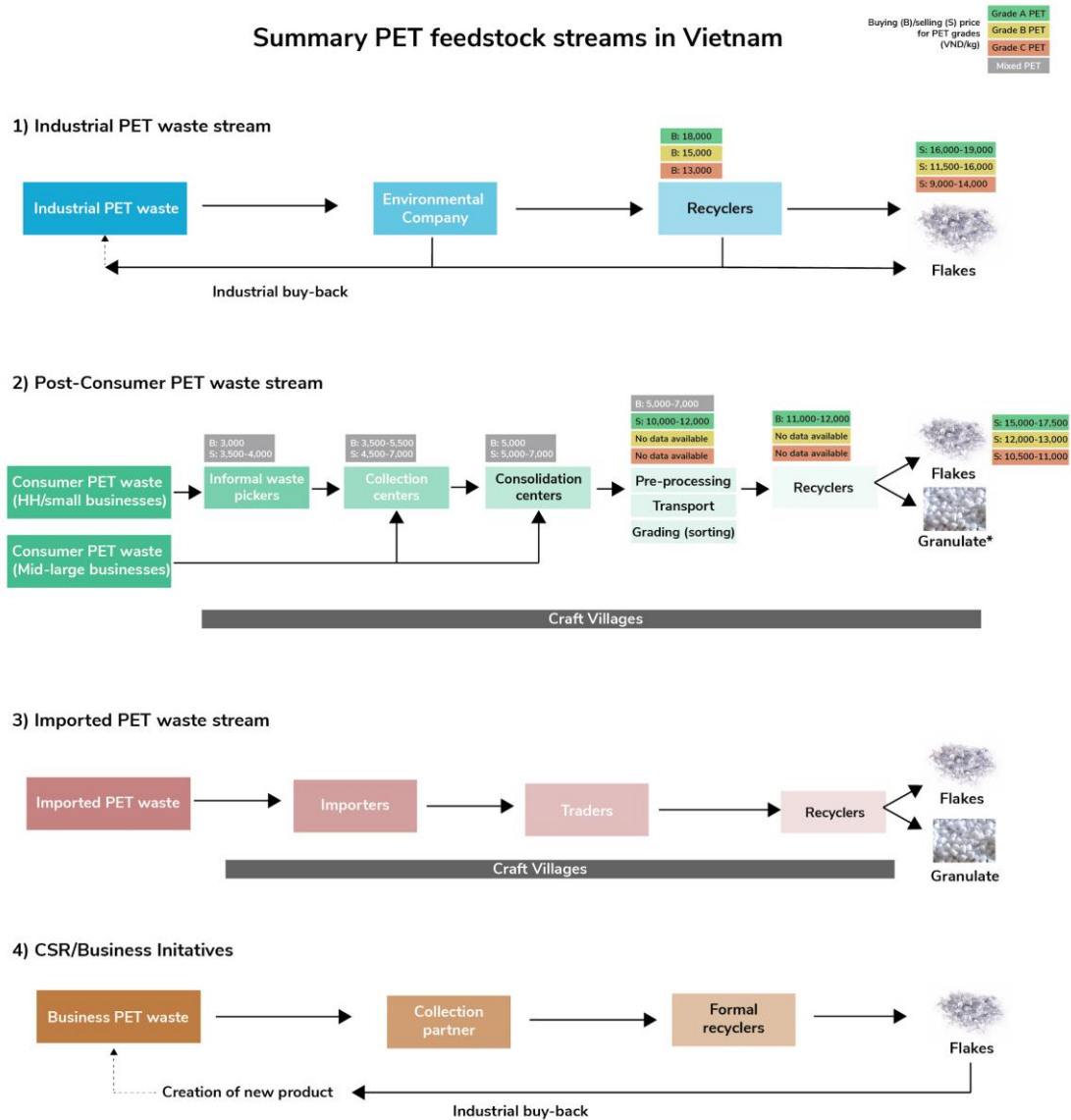
- The four main PET feedstock streams in Vietnam highlight the **naivety of the recycling market** and **need for improvement on collection and recovery mechanisms/infrastructure**.
- **Regulatory reform** needs to be made in order to **accommodate and support formalized recycling** in the country and **certify material quality**, specifically food-grade.
- **Post-consumer PET is a complex feedstock stream** due to the involvement of the informal sector, lack of transparency, low consumer awareness and complete absence of source separation.

6. Market competition

The plastic consumption in Vietnam has increased more than 10 times since the 1990's with an annual growth rate between 16-18%. In the 1990's the average plastic consumption per person was only 3.8kg/year and after 20 years it has reached nearly 41kg/year/person in 2015. Of all plastic products being produced packaging is the highest volume. The Vietnam Plastic Association (VPA) and Chemical Master Plan stated that by 2023 the volume of plastic input for production will be 10 million tons, where only 2.6 million tons (26%) is from domestic sources. In 2018, Vietnam imported 6.5 million tons of plastic resin and scrap to produce 8.3 million tons of products. In the future, Vietnam's plastic sector aims to be less dependent on imported scrap which aligns with the national policy of not importing plastic scrap for production by 2024¹⁸.

¹⁸ Vietnam Material Marketplace, 2019

figure 1. Summary of PET feedstock streams in Vietnam



Private Investments into the Plastic Sector in Vietnam

These regulatory changes have shifted towards domestic production of virgin and recycled plastic. For example, Nghi Son Oil Refinery officially started operation in 2018 to produce 400 thousand tons of (virgin) PET plastic pellets per year. In fact, there are 7 new plastic investment projects being established across Vietnam (Table 3). Throughout our research, we continuously found new articles and information about plastic investment projects entering the market. This suggests a shift towards recycling within the country, which may cause certain bottlenecks (i.e. feedstock supply) but if implemented correctly, can dramatically change Vietnam’s environmental pollution and plastic waste management.

Table 3. List of Official Plastic Investment Projects in Vietnam (list only includes officially recognized and published projects and may not be complete as the reporting is voluntary and updates are not frequent)

| No. | Project | Location | Capacity (1000 ton per year) | Investment (million USD) | Timeframe |
|-----|---|----------------|---|--------------------------|-----------|
| 1 | Southern Chemical Complex | Vung Tau | 800 PE; 450 PP; 400 VMC; 96 EDC; 80.5 Butadiene | 4500 | 2011-2018 |
| 2 | PVC Company | South | 300 | 200 | 2016-2020 |
| 3 | PP Company | North | 300 | 200 | 2016-2020 |
| 4 | PS Company | North | 60 | 70 | 2016-2020 |
| 5 | Chemical complex from coal to PP, butadiene | North, Central | N/A | N/A | 2021-2025 |
| 6 | PET Company | Central | 300 | N/A | 2021-2025 |
| 7 | PS, ABS Company | N/A | 100 PS; 100 ABS | N/A | 2021-2025 |

While most of the investments are going into virgin resins, recently there have been factories established focused on recycled materials (see “rPET Factory Competitors in Vietnam”). Regardless of the new projects and investments being made in the plastic sector, in 2020 the domestic supply for plastic material is expected to meet 44% of current demand. The demand for input plastic materials is high, especially for recycled materials due to the lower price compared to virgin plastic (\$350/ton). These market economics make for a favorable case to establish a rPET facility in Vietnam.

rPET Factory Competitors in Vietnam

After performing in-depth research including desk research, phone interviews and verification from authorities when possible, we identified a total of 15 PET recyclers that are currently in operation in Vietnam (excluding craft villages). Data on the recycler's feedstock origin, output, volume, the potential of final products from their output, as well as buyers has been documented and summarized in Table 4 below. This list is not a comprehensive long-list of all PET recyclers in the country but rather a curated overview of the largest and direct competitors to the future rPET factory.

Table 4. Verified rPET Recyclers in Vietnam

| Recycler's Name | Location | Feedstock Origin | Output | Volume | Product Potential |
|---|----------|--|---|--|--|
| | | Industrial / Post consumer/ CRS/Business initiative/ Imported | Flakes / Granulate / Finished Product | Grade A/B/C in Tons / month | Food Packaging/ Preform/ Industrial products/ Yarn |
| VIETNAM SUNFLOWER INVESTMENT & DEVELOPMENT LTD Công Ty TNHH Đầu Tư Phát Triển Sunflower Viet Nam | Ha Noi | Industrial waste | Flake | A: 300+, as much as demanded. | Food packaging |
| MINH PLASTIC | Ha Tay | Industrial waste (yarn) Post consumer waste | Flake Granulate | 1500+ | Food Packaging Preform |
| VINH LAC PLASTIC LTD Công Ty TNHH Nhựa Vĩnh Lạc | Ha Noi | Post consumer waste CSR / Business initiative waste Imported waste | Granulate Flake | Total capacity: 250 A1: 50-100 | Food Packaging Preform |
| SUWON VINA IMPORT EXPORT JOINT STOCK COMPANY | Hung Yen | Industrial waste | Flake Finished products: Samsung trays, food packaging (flim, food tray) | Total Capacity: A: 100 B: 250 C: 500 Available stock for sell: A: 100 B: 200 C: 300 | Industrial products Food packaging |
| DHS VINA PLASTIC LTD Công ty Nhựa TNHH DHS Vina | Bac Ninh | Industrial waste | Flake | A: 100 - 150 | Industrial products Food packaging |

| | | | | | |
|---|------------|---|--------------------|---------------------------------------|------------------------|
| LOC PHAT KINH BAC JSC Công ty CP Lộc Phát Kinh Bắc | Bac Ninh | Industrial waste | Flake | A: 100 B and C: a few hundred tons | Food packaging |
| HAN VIET MANUFACTURING AND TRADING LTD CÔNG TY TNHH SẢN XUẤT THƯƠNG MẠI HÀN VIỆT | Quang Ngai | Post consumer waste | Flake | -- | Yarn |
| PHAN LÊ HƯNG FAMILY BUSINESS | Quang Nam | Post consumer waste | Flake Bale | 500+ | Non-food grade product |
| FORMOSA HUNG NGHIEP LTD Công Ty TNHH Hưng Nghiệp Formosa | Dong Nai | Post consumer waste | Yarn | -- | -- |
| MS. HANH TRAM'S FAMILY BUSINESS | HCMC | Post consumer waste | Flake | 500+ | Food Packaging Preform |
| DUNG VAN PLASTIC RECYCLING LTD Công Ty TNHH Tái chế nhựa Dũng Văn | HCMC | Post consumer waste Industrial waste | Flake Granulate | 500+ | Food Packaging Yarn |
| TUẤN HANH'S FAMILY BUSINESS | HCMC | Post consumer waste | Flake | 1000+ | Food Packaging |
| HIEP PHAT TRADING AND MANUFACTURING LTD Công Ty TNHH SX TM Nhựa Hiệp Phát | HCMC | Post-consumer waste via CSCs | Flake | A: 300 | -- |
| MR. PHÁT'S FAMILY BUSINESS | Long An | Post consumer waste | Flake | 30 | -- |
| DUY TAN PLASTIC JSC Công ty CP Nhựa Duy Tân | Long An | Post consumer waste | Finished products | 1667 | Bottle |

As described above in the CSR initiatives' feedstock section, **Vinh Lac Plastic Ltd**, one of the bigger PET recyclers in the market confirmed that they are currently recycling for Highland Coffee. Waste from large cities such as Ho Chi Minh, Ha Noi, Da Nang, Hai Phong is collected and processed at his factory, while the volume of waste from other cities is

just too small to justify the transport cost. Due to the deterioration during usage (contact with hot liquid), storing period and color printing on the feedstock, Highland's rPET is classified as Grade B. The factory classifies Grade A1 PET as granulates with some form of crystallization, with feedstock mainly coming from Japan. They are soon to import A0 grade feedstock from South Africa. The A0 rPET consists of rejected material directly from vPET factories. When addressing the capacity, they were confident 250 tons / month of all types of waste, and somewhere between less than 100 to only 50 tons / month of Grade A1 should be the threshold for most recyclers in Vietnam, as the supply source is simply not that vast.

Another prominent competitor that has been identified during the research is **Formosa Hung Nghiep LTD**. The Taiwanese factory is located in Southern Vietnam, and has already exported rPET yarn with Global Recycle Standard (GRS) certificate as well as food grade vPET to the EU and US. It is carrying out market research on demand for food grade rPET for the plan to extend the factory's operation. No information was gathered on the factory's capacity, however an informal recycler (Tuan Hanh's family business) confirmed that they are selling their grade A flake to Formosa at 17,500 VND/kg including transportation. Other department of Formosa also mentioned that they have PVC food film as well as POVC on offer.

Furthermore, a more recent development in July 2020, **Duy Tan Plastic JSC** - Vietnam's largest plastic producer - announced that their own recycling factory will be ready for production and products will be introduced to the market in the 4th quarter of 2020. The project's total Investment value is \$60mn, with 3 phases and max capacity at 100,000 ton/year. In the first of three phases, Duy Tan will focus on PET and HDPE with capacity of 20,000 ton/year and potentially enter the bottle-to-bottle model with FDA quality with undisclosed support by HSBC green credit scheme.

In a presentation at the PRO anniversary in June 2020 by Far Eastern Polytex Vietnam, part of the **Far Eastern Group** via Far Eastern New Century, and during a follow up discussion, the Far Eastern mega factory in Binh Duong already started virgin production of polyester yarn as well as recycling for yarn production. Far Eastern's food grade rPET strategy follows a 'buyer first' approach, in which the local management and sales team builds demand and once demand is at a capacity that justifies increased focus, Far Eastern would service the Vietnamese market first from its existing facilities in Japan, China and Taiwan. During this time, the domestic production can be established. Currently, the timeframe for a domestic food grade rPET facility is estimated to be within the next 2-3 years at a capacity of 20-30,000 tons per year.

Veolia, a France headquartered global operator in the waste industry with strong rPET activities, also presented its potential market entry strategy to Vietnam. While still very agnostic, without a dedicated country presence or team, Veolia started initial collaboration discussions with Coca-Cola for a closed loop bottle-to-bottle approach. A decision of initial plans will be furthered is expected for the end of 2020. The implementation time was estimated at around 2 years.

After a successful partnership model in Hong Kong with a local waste management operator and Swire Group, one of the leading bottling companies in Asia, **Alba Group** has entered the Vietnamese market with a dedicated business development team to evaluate the market potential and possibly replicate a similar model as in Hong Kong in Vietnam within the next few years. The envisioned capacity lies between 15-30,000 tons per year and an integrated feedstock recovery is considered to ensure quality inputs and reliable supply.

rPET Factory Competitors Feedstock Supply

While most of the recyclers identified in Northern Vietnam get their feedstock from industrial waste, the Southern operators do source from post-consumer PET bottles, some are even buying from CSCs in northern provinces directly. Recyclers in the north seems to have more professional marketing tool with Facebook or Websites listing their products, and only trade the flake that they produce themselves, while even the larger recyclers in the south, with the exception of Formosa, still seem to be operation in family business type, with little information available to attract potential buyers on the internet. Interestingly, they still have a network of business acquaintances, many of them say that if large contracts are signed exceeding their facility's capacity, they would still be able to get help from other recyclers friends to meet the target volume. While buyers of formal recycler in the north are suppliers of recognized name such as Samsung, Highland coffees, Kinh Do, one of the largest recyclers in the south - Dung Van Plastic said that his buyers are usually local unnamed preform and food packaging factory, larger plastic producers such as Duy Tan also occasionally buy from him, but it is too little to mention.

Key Findings

- The **recycling landscape in Vietnam is changing** as more investments are being made into the sector.
- Currently **there are rPET factories operating in the country** with varying capacities, feedstock streams and customer base.
- The **formality of recyclers in terms of permits, compliance and production quality is unclear** as there are no regulations being enforced to manage the recycled outputs or factory compliance under environmental law.
- While a majority of rPET competitors interviewed in this study had the capacity to produce granulate, **all focused on the production of flakes due to market demand and pricing.**
- New projects are developing in the market regularly, therefore **there will be a shortage of feedstock in the future** as projects continue to enter the market.
- Therefore, **collection mechanisms, separation and basic waste management infrastructure need to be established to ensure sufficient feedstock.**

rPET Product Competitors in Vietnam

There are several products rPET can be manufactured into depending on the final buyer. Currently, a majority of rPET is being traded as resin or flakes with European or North American buyers, while domestic demand is increasing especially after import restrictions. The most common uses of rPET include reblowing into water bottles. Of course for this end product the rPET has to be clear and food-grade quality. Another rPET product is packaging and depending on the use this may also need to be food-grade quality. Lastly, rPET can be used in the textile industry to make recycled polyester yarn and fabric. For this use, the quality of the rPET depends on the final buyers but typically can be lower quality.

During our research, some important characteristics of flakes and granulate was reported to explain current market preference:

| | Flake | Granule |
|----------------------|--|--|
| Advantages | <ul style="list-style-type: none"> -Low production cost -Can be melt and processed into film/preform/yarn without extra step of making granule -Less crystallization occurring in the final product | <ul style="list-style-type: none"> -Easy transport -Accepted as recycled material and not waste when imported into certain countries |
| Disadvantages | <ul style="list-style-type: none"> -Some countries with strict regulation consider flakes as waste and do not allow import. -Space consuming when transported | <ul style="list-style-type: none"> -High production cost and machinery -All PET waste has to be turned into flake first to become granule -More crystallization occurring |

Currently in Vietnam, flake output is prioritized over granulate due to the above mentioned characteristics. The main reason is the low-cost machinery required, and as environmental law in recycling is unclear in Vietnam this means there's lower investment cost risk. A common product stream is the transformation of flakes into granulate via Chinese traders.

One of the largest buyers, pre-COVID, of rPET that most recyclers mentioned are Chinese traders. Due to importing difficulties, Vietnamese recyclers do not export themselves. Instead, Chinese traders buy flakes from the recyclers and process it themselves into granulate before shipping it to China. Furthermore, some traders are equipped with a handheld testing device that is reportedly worth 800mn VND to test the quality of rPET right at the spot.

At the moment, there are a few recyclers that claim to have granulate production machines, and one trader confirmed that his food-grade rPET granulate is 100% processed in Vietnam. However, recyclers state that grade A feedstock is usually not processed into granulate but only into flake, because the crystallization occurring in granulate is much more damaging to the aesthetic of the finished product than that in flakes, beside a much higher processing cost. In Vietnam, food-grade rPET is only turned into granulate when it is 100% meant for the export market. Although Formosa said that they are only in the research phase to extend to food grade production, a different recycler confirmed that Formosa is the only one in the market with the machinery to produce EU-standard granulate.

Key Findings

- The two key rPET outputs include flakes and granulate.
- **Flakes are heavily preferred by Vietnamese recyclers** in the market due to low-production costs, market demand and quality.
- Most identified Vietnamese **recyclers do not have sufficient technology to process granulate into high-quality products as demanded by international buyers.**
- Vietnam-produced rPET flakes are **typically sold to Chinese traders who granulate themselves before exporting to China, with very few Vietnamese recyclers having the capacity to granulate.**

7. rPET Customers: Identification & Segmentation

Currently the domestic plastic materials market for industrial manufacturing meets only 20% of the demand (both virgin and recycled) and therefore 80% of the input materials for manufacturing is being imported. If all projected investment projects start operation by 2025, Vietnam can provide up to 4 million tons of virgin resin, however the demand in 2018 was already 6 million tons. In 2018, 8.3 million tons of plastics were produced from 6.9 million tons of resin and approximately 1.4 million tons of recycled plastic scrap¹⁹. Taken together the domestic demand for recycled plastics, in particular PET, is growing in Vietnam and in combination with import restrictions and corporate sustainability strategies more companies are seeking to source local rPET supply chains.

In our research, we reached out to several private sector partners who may be potential buyers of rPET in Vietnam and internationally. As we already predefined a set of interested investors for this project, after in-depth discussions they already bring strong customer connections for granulate, mostly in the EU. Therefore, this study focuses on other products to diversify the factory product portfolio and discussed with several potential customers for other product streams mainly polyester yarn. This product was also selected as the quality of rPET can be lower, which in the initial phases of the rPET factory may be vital until sufficient high quality, food-grade PET can be recovered. Furthermore, international trading platforms of recycled materials were researched as potential other market access points.

rPET Granulate customer segments

The main customer segment for the proposed food-grade rPET factory would include international corporates with commitments towards recycled material content within their products. International beverage and preform companies such as Parle Agro (India), Vilsa (Germany), Wellman Packaging (Australia) are just examples of those that have stated their commitment to keep their PET product 100% recycled. In Asia, some countries have also mandated a specific percentage of rPET must be included into products (Singapore, Hong Kong), which will also open new markets regionally for food-grade rPET granulate.

Currently, the domestic demand for rPET granulate is low. In Vietnam, although other types of plastic are regularly recycled into granulate, most producers only buy flakes when it comes to rPET. While granulate can have advantages for long distance transportation, recyclers in Vietnam are not equipped with equipment and machinery that can guarantee better or even equal crystallization rate to compete with flake. Additionally, granulate manufacturing costs between 2,000-3,000 VND higher than rPET flake.

rPET Flake customer segments

The demand of rPET flakes in Vietnam is low although some preprocessors in Southern Vietnam claimed they had traded rPET with preform making factories, all other recyclers stated that currently there is **no demand on the market**. Some traders have inquired about rPET flakes but are only willing to pay very little which was not possible for rPET recyclers. The post consumer feedstock at the moment is mainly soda bottles (grade A) and still unsweetened bottles (500 VND cheaper). No other lower grade PET waste is being pre-processed as no one wants to buy them. The domestic market demand for rPET is low and can be attributed to decreasing oil prices (meaning virgin material prices are also decreasing), insufficient quality and lack of regulatory frameworks committing to recycled content in products.

¹⁹ Vietnam Materials Marketplace report, 2019

Through this research we were able to identify one committed company towards rPET in their production. Ngọc Nghĩa Plastic, one of Vietnam’s largest PET producers and the supplier for international beverage brands, confirmed in the 2019’s annual report their commitment to increase the ratio of rPET in production, and the possibility of producing rPET themselves in the 2020-2021 period. No other information could be found on the internal rPET production.

Currently, the demand for food-grade rPET in Vietnam is low. However, international beverage and bottling companies are planning to integrate rPET into their production and this will shift demand of rPET in the county. In terms of local, Vietnamese packaging companies, we contacted 20 random food packaging and container companies, 14 (70%) answered that they use virgin PET in their products, 6 (30%) said they do not use PET at all but instead use other types of plastic. **Four of the companies that are using vPET said they might consider rPET if the quality and price is reasonable or if they have specific orders from clients.** Only one company said that they are using 50% vPET and 50% rPET in their production.

Table 5: Potential domestic buyers

| Name | Location | PET Usage |
|--|----------|---------------------------------|
| HIGHTECH PLASTIC LTD Công ty TNHH SX - TM - KT Nhựa Hightech | HCMC | vPET only but may consider rPET |
| TAN HIEP HUNG PLASTIC LTD Công Ty TNHH Sản Xuất Thương Mại Dịch Vụ Nhựa Tân Hiệp Hưng | HCMC | vPET only but may consider rPET |
| TAN DAT PLASTIC LTD Công Ty TNHH MTV Sản Xuất Thương Mại Nhựa Tấn Đạt | HCMC | vPET only but may consider rPET |
| SONG AN PLASTIC PACKAGING LTD Công Ty TNHH Bao Bì Nhựa Song Ân | Ha Noi | vPET only but may consider rPET |
| TAN PHU MIEN TRUNG JSC Công Ty CP Nhựa Tân Phú Miền Trung | Nghe An | vPET and rPET |

The reason for such low consumption rate of rPET can be attributed to:

1. **Oil prices:** very low oil price leads to cheap vPET and rPET cannot compete with this pricing. While this factor will likely shift as pricing changes, this is not the only determining factor.
2. **Quality control:** majority of recovery through to recycling is occurring in the informal sector with little to no quality control of the output product of flakes and granulate. While the price will continue to fluctuate and oil prices will likely increase again, improving quality control and the reputation surrounding recycled materials will be the challenge. Some companies specifically state that they do not use rPET in their food grade products because they do not trust the quality. Without systematic change from both the higher policies maker and the private sectors, rPET in Vietnam would still be of low quality and poorly reputed for the foreseeable future.

Most countries flag flakes in the waste category, therefore making imports more and more complex. While there are still countries that allow the import of rPET flake, the regulation can change quickly with increasing pressure on the governments to work towards banning waste imports. An Acumen research study on the global rPET market has listed

the names of the countries where in-depth studies were performed to analyze the market potential for rPET (flakes and granulate). Asia-Pacific and Latin America were identified as growing hotspots in both producer and consumer roles of the industry. Furthermore, this research also mentioned companies such as Libolon (Taiwan) and Zhejiang Anshun Pettechs Fibre Co. Ltd (China), among others, which are two large fiber manufacturers and could be the potential international buyers of the project²⁰.

Other rPET customer segments

Recycled polyester yarn is manufactured from rPET granulate and as many major brands are switching towards the utilization of more recycled yarn in their products. According to the World Trade Organization, in 2016 Vietnam's textile and clothing exports totaled \$28 billion (84% were clothing), which represented 16.0% of Vietnam's total merchandise exports. Globally, Vietnam was the world's third largest apparel exporter in 2015, after China and Bangladesh²¹. Therefore, for this study, we interviewed key players in this sector to gauge their interest and demand in rPET.

- **Ikea:** with major production occurring in Vietnam and a global mandate to improve local supply chains of all materials, they were generally interested in utilizing rPET yarn and textile in their production process.
- **Saitex:** a garment manufacturer in southern Vietnam producing mainly jeans for large international brands also plans to incorporate recycled polyester into their production at scale. Furthermore, they are in the planning phase for their own mill to produce their own recycled yarn, meaning they could potentially be a direct buyer of rPET granulate.

International trading platforms are another potential market access point to diversify customers and access new markets. We identified two large material trading platforms that the factory output could easily be placed onto including:

- [Oceanworks Co:](#) Oceanworks® is the global marketplace for recycled ocean plastic materials and products.
- [Plastic Bank:](#) Work with partners to collect material and sell under Social Plastic® which is reintegrated into products and packaging of multi-national companies.

Key Findings

- There is an international rPET market demand and customers with the **domestic market still in its infancy.**
- However, **international corporations will drive the use of rPET in Vietnam as global mandates will shift the use of vPET to rPET** in the coming years.
- Besides granulate and flakes, there is **demand for rPET in textile and garment** industries and several players in Vietnam interested in buying quality rPET.
- International trading platforms for high-quality recycled plastic materials are being established making **market access connections easier.**

Conference Findings

Comments on market and market potential in general reflected the research findings and participants were largely aligned on challenges and potential.

General market challenges and potential

²⁰ <https://www.acumenresearchandconsulting.com/recycled-polyethylene-terephthalate-rpet-market>

²¹ WTO, 2016

Swire: “Food grade rPET price right now is twice as high as vPET, but at the moment there still is very high demand for food grade rPET, especially from the EU”.

CITENCO: “Virgin plastic is much cheaper than recycled plastic at the moment, which hurts many countries on the way to achieve the goal of increasing % of recycled plastic in product. Building a market for recycled plastic is very important in Vietnam

Discussion on local use of rPET by international bottlers

DONRE - HCMC: “We are surprised that Coke can’t buy rPET from VN.”

Swire: “Coca-cola requires quality to be higher than that of FDA.”

8. Key Takeaways & Recommendations

Through this research we highlighted key potential markets, feedstock access points and potential barriers that will be encountered for this future rPET factory. Taken together, there are several key constraints that must be addressed in order to reach sufficient feedstock recovery mechanisms in Vietnam. These barriers can be overcome via multi-stakeholder, collaborative approaches, infrastructure financing and sector transparency.

Current packaging design: The design feature hindering the maximum collection of PET is the use of colored PET. It has been calculated that the value difference between a clear PET bottle versus a colored PET bottle is \$84USD/ton²². If all of this PET was clear instead, an estimated additional 11,700 tonnes per year would be collected in Vietnam. This would be an additional value of nearly \$2,600,000 that would be unlocked by simply changing the coloration²³.

Dominance of the informal sector in plastic recovery: Not only is the informal sector a major contributor to domestic recycling of PET, this sector is responsible for the majority of its collection. Given the low-grade technology being used, lack of waste treatment infrastructure and no enforcement of environmental laws, these practices are causing significant harm to the environment and those who work in the sector. Furthermore, formal recyclers struggle to obtain steady, quality feedstock from this sector due to lack of transparency.

Poor quality and quantity of PET feedstock: The quality of feedstock immediately reduces at the household level in Vietnam as the majority do not source separately. Additionally, most municipal waste operators do not have sufficient infrastructure to sort, bail or recycle waste collected which leads to highly contaminated feedstock supply.

Lack of local, developed end markets for rPET: While the rPET industry exists in Vietnam, due to poor quality feedstock collected locally, most formal recyclers have resorted to imports to meet their feedstock requirements. The shift towards imports has left local collection systems underdeveloped and therefore local markets do not have strong end-use markets²⁴. However, recent import restrictions have been implemented in Vietnam, this is expected to change.

²² Based on GA Circular On-ground Research and Analysis (2017-2019)

²³ GA Circular Report, 2019

²⁴ GA Circular Report 2019

Lack of funding for waste management or recycling infrastructure: Although there is a lot of donor money being poured into the plastic waste sector, no one is supporting infrastructure to be built. In Vietnam, municipal waste fees are collected per household and are not sufficient to cover costs and it's been reported that charges cover less than 60% of total waste management costs and as low as 20-30% in some municipalities. Therefore, international aid needs to be at the forefront of supporting these developments and/or the private sector who can implement and operate such assets²⁵.

While these barriers will likely need to be addressed before the implementation of a state-of-the-art rPET facility can be established in Vietnam, committed, early movers are willing to put in the capital and capacity to build this local supply chain of reliable rPET feedstock.

Taken together, more investments into solid waste management infrastructure need to be made such as sorting, collection and secondary processing capabilities to produce higher quality feedstock for recyclers with very low contamination rates. Additionally, more investments should be made into domestic processing and recycling capacities. Lastly, there is a need for increased domestic collection of post-consumer PET, higher collected-for recycling rates and more developed end-use markets for domestic post-consumer PET.

Conference Findings

Additional recommendations and statements by conference participants and in particular supportive statements in regards to the inclusion of the informal sector are well aligned with the recommendations throughout the study and the general stand on inclusive recovery models by the PCR program and its implementers.

General Comments on Collaboration Potential

CITENCO: "We consider the private sector as partners and we want to collaborate with them."

Comments on Including the Informal Sector in Investment Considerations

CITENCO: "It's not that the informal sector don't want to comply with regulations, but that the financial burden is stopping them."

VCCI: "Informal waste collection is helping the entire system and is important for poor people."; "Investors's responsibility is to collaborate with the very developed informal sector of Vietnam"; "Most PET operations in Vietnam are using simple PET recycling machines that can just cut the feedstock into flakes and then export to China. That can make around 50million VND profit for the small business."

Swire: "It is our clear goal to collaborate with existing stakeholders and the informal sector and we are willing to invest to improve the recovery infrastructure."

DONRE HCMC: "PET is already collected by informal waste workers that we do not want to eliminate from their jobs."

²⁵ United Nations Centre for Regional Development, State of the 3Rs in Asia and the Pacific, 2017

Conclusion

It is well understood among all stakeholders that a collaborative integrated approach is needed to successfully work within Vietnam's recycling industry. The use of existing infrastructure as well as the collaboration with established stakeholders was mentioned throughout the conference and the integration of informal workers and the use of informal systems and mechanisms was recommended repeatedly.

While the social inclusion is agreed upon by all, discussions on the extent of inclusion and protection of the informal sector were inconclusive, especially when touching upon environmental compliance, the lack of law enforcements, the inclusion of non-value adding stakeholders or the formalization of informal workers.

When touching upon COVID19 circumstances, and in particular the exclusion of informal waste workers from the governmental COVID19 relief fund, all stakeholders agreed that the consideration and support of informal workers should be addressed quickly..

Appendix 1: Informal Waste Picker Survey Questions

| General Questions | | |
|-------------------------------|----|---|
| Demographic | 1 | What is your name? (if not comfortable sharing its OK) |
| Demographic | 2 | May we have your phone number to contact you in the future regarding the project and other opportunities? (if not comfortable sharing its OK) |
| Demographic | 3 | Select gender of interviewee -Female -Male -Other |
| Demographic | 4 | How old are you? |
| Socioeconomic | 5 | How long have you been working as a waste picker? (years) |
| Demographic; Socioeconomic | 6 | Where are you originally from? |
| Socioeconomic | 7 | How many family members do you live with? |
| Socioeconomic | 8 | How many children are part of your family? |
| Waste Trading activities | | |
| Behavioral | 9 | Where do you purchase most of your waste from? -I go to each household to ask -I have hotels/business I often go to with scheduled time -I have someone call me everytime their hotel has waste -I just go around the neighborhood and check out the trash bins |
| Location; Behavioral | 10 | How many collection centers/traders do you work with / sell to? How often do you work with / sell to them? |
| Location; Behavioral | 11 | Where are the collection centers located that you trade with? |

| | | |
|------------------------------|----|---|
| Behavioral, Waste | 12 | What types of materials are you currently picking/trading? -Metal - Papers -Plastics (describe types) -Glasses -Others (specify) |
| Waste | 13 | Are you collecting the same type of plastics or does it changes over time? |
| Waste | 14 | How much plastic waste do you trade (daily, weekly, monthly)? Specifically how much PET? (if possible) |
| Waste | 15 | Are you pre-processing the waste before you trade it (rinsing, removing caps, etc)? |
| Waste | 16 | What is the trading price for PET currently? Does this price stay the same or does it change? (if possible) |
| Socioeconomic, Waste | 17 | What is your average daily income from waste picking? (VND) |
| Reflective questions | | |
| Behavioral | 18 | What is good and bad about your job? |

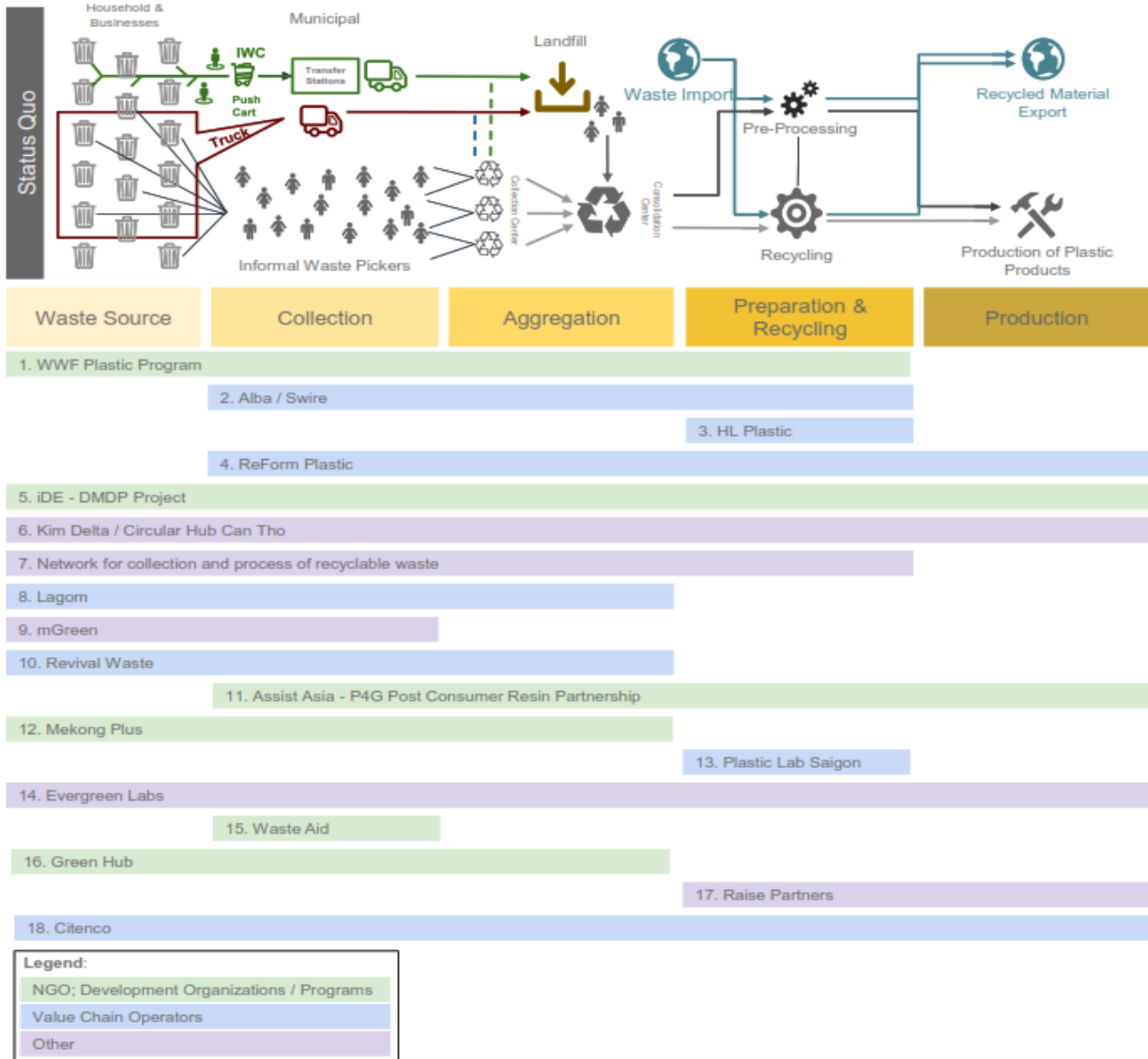
Appendix 2: Aggregator Survey Questions

| General questions | | |
|------------------------------|----|---|
| Demographic | 1 | What is your name? (if not comfortable sharing its OK) |
| Demographic | 2 | May we have your phone number to contact you in the future regarding the project and other opportunities? (if not comfortable sharing its OK) |
| Demographic | 3 | Note the location of center and drop a pin for coordinates |
| Demographic | 4 | Select gender of interviewee -Female -Male -Other |
| Socioeconomic | 6 | How many people work at the center? (gender differentiation if possible) |
| Waste | 7 | What materials are you currently trading? |
| Waste | 8 | How many pickers are currently trading with your center? |
| PET Trading activities | | |
| Waste | 10 | Are you doing any pre-processing of the PET such as removing caps, labels, rinsing, etc? |
| Waste | 12 | What month/ period of the year,/ events do the waste pickers collect much more rPET? |
| Waste | 14 | What is the trading price for PET currently (be as specific as possible if there are different types)? |
| Waste | 15 | Who is currently purchasing the PET from you or what happens to the PET after you trade with a picker? |
| Waste | 16 | How many kg of PET are you trading (daily/weekly/monthly average is ok)? |
| Reflective questions | | |
| Behavioral | 17 | What is their opinion to plastic waste? and how is their initiatives to control the plastic waste into the sea and in the planet? |
| Behavioral; socioeconomic | 18 | What is good and bad about your job? |

Appendix 3: Vietnam Plastic Waste Programs Mapping

Working Group Session, 12 January 2021, HCMC

Chart 1: The stakeholder map matched against the status quo of collection scheme. The aim is to avoid the overlapping in the implementation among programs and potential collaborations to be realized.



Working Group Session, 12 January 2021, HCMC

Chart 2: The proposed solutions (process, infrastructure, technology) matched against the plastic value chain.

