

Solutions for Plastic Waste Collection and Recycling in Vietnam

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Abstract

The increasingly prominent issue of plastic waste and the lack of its adequate disposal in the country of Vietnam is one of growing relevance. According to Change VN (2022), a non-profit organisation based in Ho Chi Minh City, Vietnam produces up to 3.83 million tonnes of plastic waste per annum, and despite net waste projected to double by 2030, only 33% of this waste is estimated to currently be recycled (Vietnam Economic News, 2022). To combat this issue, the concept of a circular economy must be explored to develop a comprehensive strategy for Transnational Corporations (TNCs), local companies, consumers, and the government to engage in effective and sustainable plastic collection and recycling practices.

This paper aims to evaluate existing practices and potential solutions for the collection and recycling of plastic waste across industries in Vietnam. This will be done through the surveying of local waste-pickers, as well as numerous interviews with various prominent figures in Vietnam's growing plastic-based industries.

1. Introduction

As detailed in Figure 1 below, the linear economy is a system that is bound to result in high wastage of raw materials, without any feasible methods to reduce this. Figure 2, however, represents the circular economy, a system that targets the flaws of the previous technique and works towards increasing the sustainability of the model. To develop from a linear to a circular economy, the implementation of three main differences will be required - sustainable product design, wider post-use plastic collection, and more efficient recycling methods.

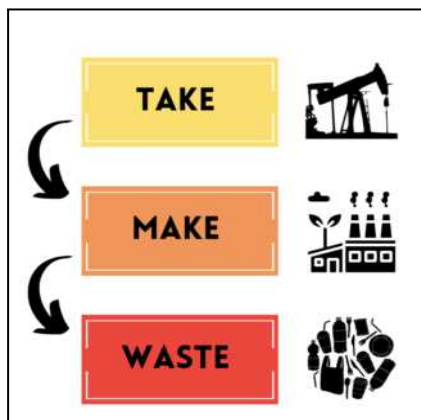


Figure 1: A diagram illustrating the Linear Economy Model



Figure 2: A diagram illustrating the Circular Economy Model

In 2019, the then Prime Minister Nguyen Xuan Phuc stated that “Vietnam needs to take practical, specific actions to control and prevent the generation of plastic waste so that current and future generations can live in a clean, safe, and sustainable environment.” In order to reach this utopia of maintainable harmony, Vietnam's current linear economy must be transformed into a circular economy. To do this, tactics, tools, and solutions must be curated to implement strategies to enable an effective circular economy.

It is important to recognise the fact that, while the solutions currently being implemented and planned in Vietnam are significant contributors to this paper, it is critical that the issues preventing these from already widely taking place are discussed as well.

As a result, the paper is structured into the following sections:

2. Explores the premise of this paper including preexisting laws, antecedent research/ investigations conducted and the importance of this topic
3. Will revolve around a self-made survey and will include its findings
4. Explores the interviews conducted by myself, covering the main points formulated from these conversations. These include issues preventing the mass collection and recycling of waste along with solutions to tackle them
5. This will act as a summary of the paper, providing feasible solutions to solve the matter at hand

Setting a structure as such will allow for a seamless approach to research, understand and solve the lack of collection and recycling of plastic waste in Vietnam.

2. Background

2.1 Past LEPs

The topic of waste management in Vietnam has been attempted to be handled repeatedly through a variety of laws on environmental protection (LEPs), starting with the 2005 law. This ruling provided regulation for environmental protection activities, policies and measures while also detailing the jobs of individuals and firms regarding the issue. More specifically, it stands as the first law to propose the role of collecting and recycling waste to the companies that produce them, even if, at this point, it was a mere suggestion. This stands as the introduction of EPR (Extended Producer Responsibility).

While the country continued developing this law with the implementation of Decisions such as but not limited to: 50/ 2013/ QD-TTg, 16/2015/QD-TTg or 34/2017/TT-TTg, all these updates still shared the same points. They all stood on the idea of providing rough plans for the retrieval and disposal of waste by the government and the handling of manufacturing waste by firms. No developments were made on the severity of EPR for these companies.

This is until the LEP in 2020 introduced a variety of significant changes to the management of waste throughout the country as seen by an extract of the law in Figure 3 (shown below). Firstly, the law looked towards the domestic aspects, stating that before December 31, 2024, all households must sort domestic waste prior to discharge. This motion is essential in improving waste collection in the country by making the sorting process a much simpler and more feasible one.

1. Environmental protection is the right, obligation and responsibility of every agency, organization, residential community, household and individual.

Figure 3: An extract from the Law on Environmental Protection in 2020 (72/2020/QH14)

Additionally, the law also targeted companies by increasing their EPR. This policy emphasises the need for the producer's responsibility for a product to be extended to the waste management stage. This is a critical move towards the mass collection and recycling of waste as companies are forced to donate a set amount in the event they do not efficiently recycle their products post-usage. Hence, whether or not a company is effectively collecting and recycling its goods, the government still receives the funding required for them to do so themselves.

2.2 Previous Findings

Ipsos Business Consulting, a global growth strategy consulting firm, released a report in 2019 demonstrating the fact that plastic consumption has greatly increased in the country of Vietnam over time. The report states that in 1990, the average Vietnamese person solely consumed 3.8kg of plastic per annum, whereas now it has increased to 41.3kg. As a result, it is a necessity for the prevention and control of plastic waste to also develop in retaliation. Without appropriate solutions to alleviate the impacts of plastic consumption, the quantity of plastic waste will inevitably increase.

As stated by VietnamNet (2018), Vietnam has been identified as the 4th largest polluter of plastic in Asia. This statement is supported by the Ministry of Natural Resources and Environment (MONRE) which has estimated that about 80 tonnes of plastic waste are discarded per day in just Hanoi and Ho Chi Minh City.

2.3 Relevance

According to the United Nations Environment Programme (2022), plastic pollution around the world has already drastically affected habitats and natural processes in biomes and ecosystems. As a result, this has reduced areas' ability to cope with climate change, already affecting the lives of more than 59 million people globally (United Nations Human Rights Office, 2022) through struggles with food provision and poorer social well-being. This has continuously led to climate refugees, displaced as a result of a decrease in their quality of living.

Moreover, mass plastic pollution around the world has also led to further damage to marine life, the production of microplastics in water bodies, and the leeching of chemicals into the soil as a result of plastics in landfills. These impacts greatly affect animals and plant life within ecosystems, as well as contaminating water sources for people near or surrounding landfills. The consumption of contaminated water can lead to fertility problems, disease, and death (Healthshots, 2022). In order to prevent these past tragedies from occurring in the nation of Vietnam, it is essential that steps must be taken to reduce the rate of plastic waste dumped into the environment. Hence, these possible effects of plastic pollution further highlight the importance and relevance of this subject.

3. Survey

3.1 Overview

In order to analyse the prevalent issues regarding the collection of plastic in Vietnam, I conducted a survey as can be seen in Figure 4 (shown below) with the support of ENDA (Environmental Development Action in the Third World) to local waste pickers around the Thu Duc City in Ho Chi Minh City. Talking with, and then reporting the answers of each worker personally, I believe the results of the survey stand as a fair judgement of the general views of waste collectors in the city.

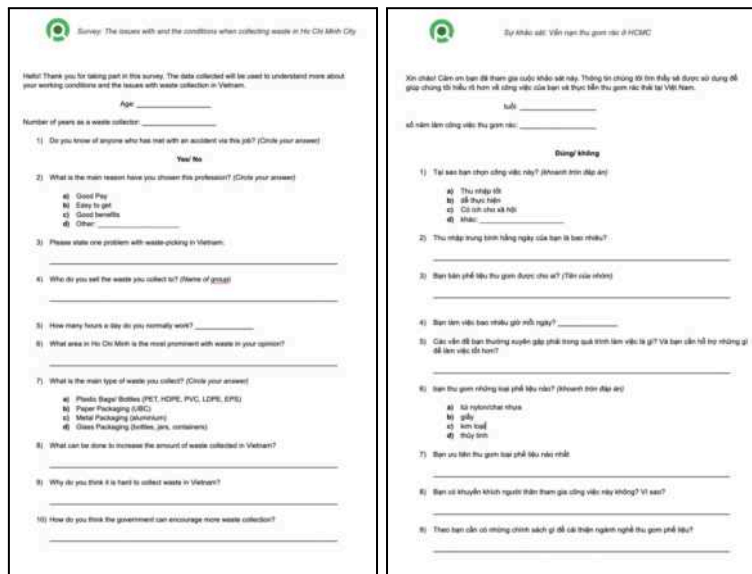


Figure 4: The survey curated for the local waste-pickers of Ho Chi Minh City, translated into both an English and a Vietnamese version

Groups like ENDA are examples of organisations that work toward supporting the lives, health and security of workers (who are officially unrecognised by the government), which are essential components towards the upbringing of a circular economy in the country. The group in particular focuses on providing safety equipment (such as gloves, masks, clothing and appropriate footwear), along with health and accident insurance. With the sponsorship of the World Economic Forum, the group has organised relief activities for more than 2,000 private garbage collectors in Ho Chi Minh City.

These benefits, provided by these groups, contribute to the further incentivisation of prospective workers to become waste collectors. Therefore, the work done by these bodies is crucial to the improvement of waste collection in the country.

3.2 Data Presentation and Observations

The results of the survey have been illustrated below:

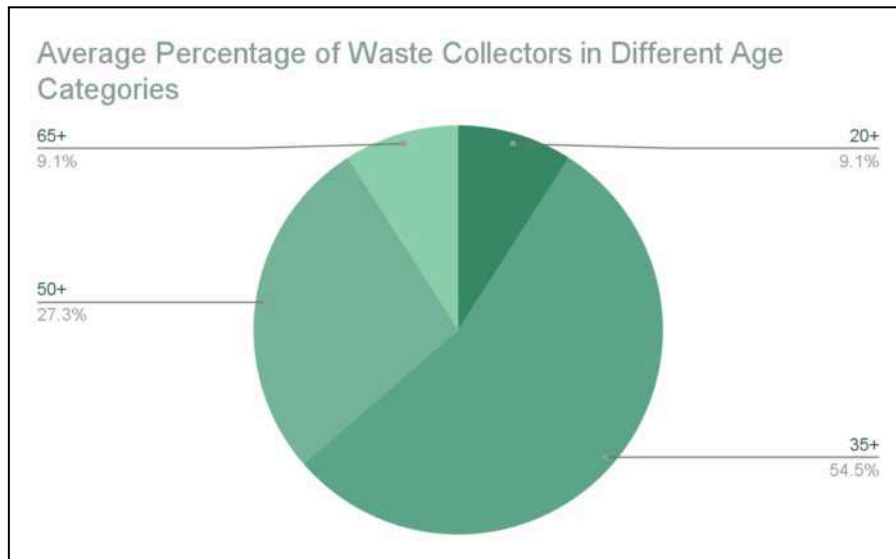


Figure 5: A pie chart showing the average percentage of waste collectors distributed into different age categories

Using the data portrayed in Figure 5, it can be inferred that a large majority of informal waste collectors in Ho Chi Minh City are of an older demographic. This could be because of the fact that younger people are less likely to aim at obtaining a job of this calibre, and would instead prioritise a role with more prestige. Additionally, it can also be seen that a very low percentage of these workers are over the age of 65, supporting the idea that this is a labour-intensive industry unsuitable for those of senior age. It must also be recognised that the retirement age in Vietnam is 60 years and 9 months for men. In addition, it is 56 years of age for women.

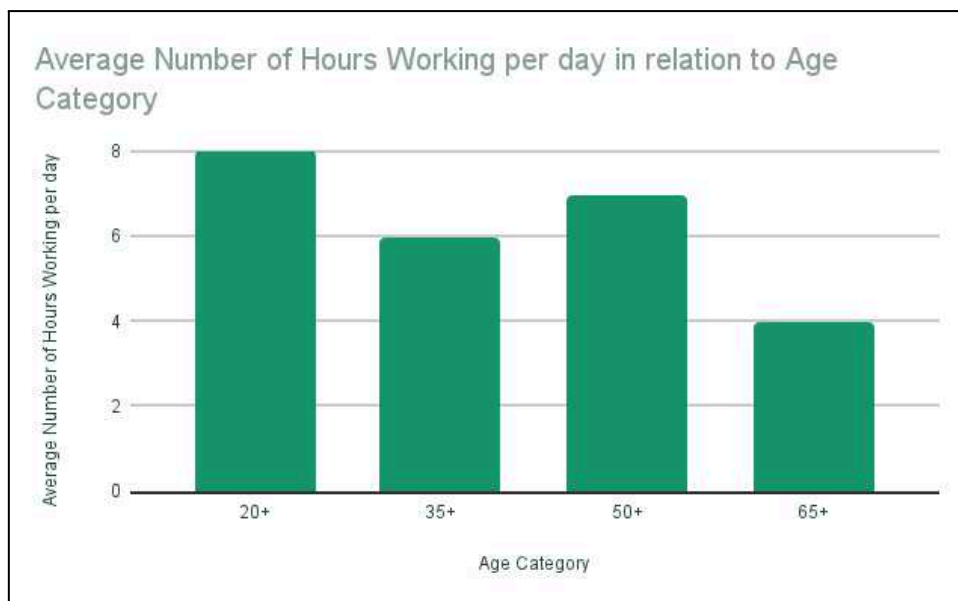


Figure 6: A Bar chart representing the average working hours of waste collectors in

relation to their respective age category

Figure 6 represents the relationship between the age category of a waste collector and the average number of hours spent working per day. It displays the pattern that as workers get older, they are likely to spend less time working per day. This suggests the possibility that, in order to increase the rate/ quantity of waste collected, younger workers should be prioritised as ideal waste collectors.

To efficiently do so, incentives should be provided in order to attract this more capable workforce. These could include the introduction of higher collection fees by large waste-collecting groups/ aggregators. Additionally, the country should, as suggested by several respondents in the survey, continue to officially recognise the independent local waste collectors through the formation of government-supported cooperatives. This would further allow for the workers to be protected without the need for help from groups like ENDA or PROVN but instead from the government through the possible creation of welfare services.

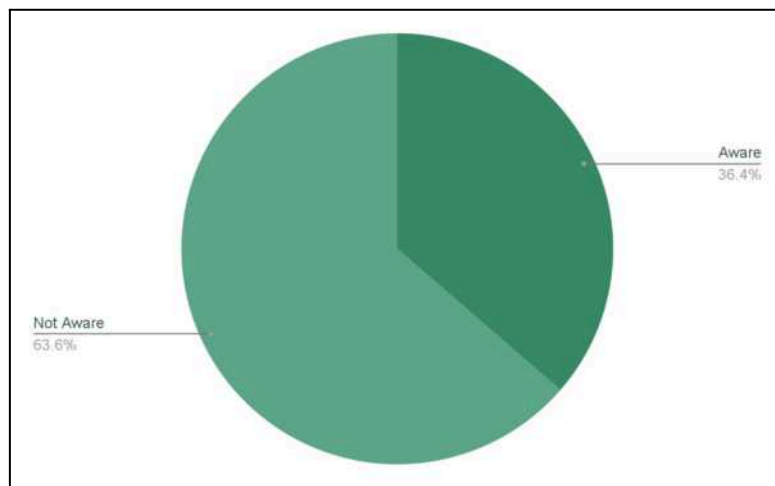


Figure 7: A Pie chart presenting the percentage of respondents who are aware of a waste picker meeting an accident as a result of their chosen profession

Figure 7 displays the fact that, while the majority of waste-pickers are not aware of a fellow member of their field experiencing an injury as a result of their job, there is still a significant population who is. This alarming discovery symbolises the fact that these workers require protection. Working as informal waste pickers leaves these citizens vulnerable to accidents, without the means to protect themselves from them. Without appropriate insurance or safety equipment, local waste collectors are not well incentivised to continue working in this field, decreasing the rate of indispensable waste collection in Vietnam.

3.3 Summary

As a result of the questionnaire with the local waste collectors of Ho Chi Minh City, I was provided with an insight into the issues with the wider collection of recyclable materials through the eyes of the collectors themselves. These include the simple fact that these workers are members of the Vietnamese society who are unofficially entrusted with a vital role in the upbringing of a circular economy.

Without the step of collecting the wasted materials, recycling cannot take place. It is for this reason that these workers hold such an essential job. A key solution raised by many respondents for the increase in the rate of collection is for these workers to be provided welfare services by the government in the event of an accident. By the provision of this insurance, the government can also encourage a growing number of these waste pickers. This can lead to an increasing rate of recyclable material collected in the country, decreasing the quantity of waste in landfills or water bodies.

Additionally, another key point found via this investigation is that either a younger demographic or a larger amount of waste collectors is needed. This can be seen through Figures 5 and 6, which demonstrate that not only are there higher levels of older workers but that these workers are less efficient on average in comparison to their younger counterparts.

Finally, it has also been found through this survey that these informal waste pickers require the benefits trying to be provided by groups like ENDA. This is seen through Figure 7 which highlights the alarming amount of workers aware of accidents taking place in this industry. Therefore, safety equipment, food, medical and accident insurance are all vital benefits that the government, or any other employers, should be providing upon the hiring of these waste collectors.

4. Interviews

4.1 Nguyen Van Tuan, *Member, Thu Duc Waste Collection Cooperative*

Upon meeting him during the conduction of the aforementioned survey, I was given the understanding that Mr Nguyen Van Tuan was well suited to discuss and explain the situation of waste collection in his neighbourhood found in the Thu Duc City of Vietnam.

At the age of 52, Mr Tuan worked as an informal waste collector for 5 years, solely working with his family on a specific street. Equipped with a self-bought cart that was attached to his family motorcycle, his wife and him worked daily towards the collection of waste. Only now has Mr Tuan come to the understanding that he was not aware of the safety hazards that came with his job. Being uneducated on the health implications of the collection of waste on his street, he lacked masks, Personal Protective Equipment (PPE), and adequate education in safety precautions.

This is until 2018 when the non-profit organisation of ENDA came to Mr Tuan's community and helped form the cooperative of waste management for Thu Duc City. Created with a culmination of independent waste collectors, ENDA began their mission of providing education, equipment, and support to these workers. Most importantly, they created a community. Communication between these individuals made it so that they were no longer considered independent, and, due to the fact that they were members of a cooperative, they were officially considered legal waste pickers (under Vietnamese law, independent waste pickers are not recognised), lacking government support but gaining their recognition.

Mr Tuan further detailed the importance of community for local waste-pickers as, in December of 2022, the Thu Duc governance mandated that all waste pickers must only use four-wheeled trucks for the collection of waste. This left his family's source of transport unacceptable for use, forcing him to go out of his way to purchase a new vehicle, similar to the kind shown in Figure 9 (below).

Mr Tuan informed me that these trucks cost roughly 500 million VND (roughly 21,000 dollars) and without wanting to have the overhanging fear of interest obtained from a loan, his local community came together to support the purchasing of a number of these trucks for their local waste-pickers. This protected not only his job but the jobs of many others in his area.



Figure 9: Image showing the four-wheeled trucks used for the collection of waste in Thu Duc City

Currently, Mr Tuan is working with his wife and his friend on the collection of waste in his street. All equipped with protective gear/ clothing provided by the NGOs PROVN and ENDA, his group and he work toward collecting and separating waste in his neighbourhood. While his friend drives the vehicle, Mr Tuan collects large buckets of waste and empties them into the back of his truck for his wife to then separate into piles. These are based on recyclability and material type. This can be seen in Figure 10 (below).



Figure 10: An image of Mr Tuan and his wife collecting and separating waste from around his neighbourhood

When asked what he believes to be a major factor halting the mass collection and recycling of all recyclable materials in Vietnam, Mr Tuan informed me about the process of payment for these waste-pickers.

Upon sorting the waste, they travel to their aggregator (the person who purchases the materials) who pays them their collection fee. This fee is dependent on the type of material, its availability, its value, and the weight that Mr Tuan brings them.

This allowed me to understand the reason why some materials are so scarcely collected/ recycled. Materials like Low Density Polyethylene (LDPE), which are often used for the production of coloured plastic bags, have a poor ratio between the collection fee and the quantity/ weight supplied. As a result of this, a major issue regarding the collection of all recyclable materials is that waste collectors are simply not incentivised to go out of their way and collect high amounts of some materials for a low payment.

In order to solve this problem Mr Tuan believes that firstly, the aggregators should take the onus of the situation and increase the collection fee for rarely collected materials. This is because he is sure that all waste-pickers in Vietnam would then proceed to gather more of them. Secondly, he believes it is the job of the producers to improve product design.

As one of the three priorities in the bringing of a circular economy is a sustainable product design, it must be taken into consideration that a major solution to decrease scarcely collected plastic waste like coloured LDPE is simply for the producers to make changes in material and/ or colour.

4.2 Nguyen Thi Hoai Linh, *Director, ENDA Vietnam*

Working with Ms Linh as a representative of ENDA for the interviewing of Mr Tuan, I was not only fortunate enough to understand the practices of the group she works for but also her own awareness of the waste collection situation in the entirety of Vietnam.

Taking note of her close relationship with the cooperative head of Thu Duc, I understood that Ms Linh (with ENDA) stood as a key player in the foundation of numerous other cooperatives across Ho Chi Minh City. She explained to me that the first cooperative established in the city (by ENDA) took 2 years to organise, legalise, and approve. This is the cooperative for waste-pickers in District 6 of Ho Chi Minh City. Her NGO has directly supported the growth of 17 so far, not only supporting the individual workers but acting as union representatives to support the community of these waste-pickers as a whole.

According to Ms Linh, the informal sector stands as one of great importance in the nation of Vietnam as, after the 2020 LEP enforcing increased EPR, large TNCs and local companies require the means to organise the mass collection of their used products. To do this, companies like Coca-Cola, Tetra Pak and La Vie have begun discussions with NGOs on the implementation of partnerships with local cooperatives.

This is because CITENCO, the sole company that works toward the collection of waste on behalf of the Ho Chi Minh City government, only collects 30-35% of domestic waste according to Ms Linh. The remainder is completely collected by the independent waste-pickers. The difference between the two groups, however, is that CITENCO not only receives the collection fee that the informal sector solely receives their funding from, but the group also collects government payment for transport. On the contrary, Ms Linh stated that

individual collectors are forced to pay for their transport and gasoline themselves, which is currently estimated at 100,000VND per day to power a truck.

Hence, the collaboration between these large companies and the informal sector would be a win-win situation with the achievement of their EPR for the producers and the provision of a sustainable source of income for the waste collectors. However, communications have been difficult for ENDA to organise.

Through the example of Tetra Pak, it can be seen that these profit-maximising companies must prioritise low costs, therefore solely suggesting low collection prices for their materials. For the collection of 1kg worth of Tetra Pak the firm has suggested the payment of 2,500VND. This has not been supported by the informal sector, which is negotiating an increase to 4,500VND. The conflict shown here is representative of the current relationship between the majority of large corporations and local cooperatives.

She explained that ENDA has led meetings between not only the different cooperatives and government officials but also the cooperatives and large firms to provide a medium to raise the voice of independent collectors in negotiating a higher collection fee. This platform for negotiations has proven effective through the example of Decision 38 which, in 2018, was passed and partly aimed at increasing collection fees.

This achievement stands as a major solution to the problem of simply not having enough workers to achieve the level of collection for all recyclable materials needed in the country of Vietnam. The ability to bargain collection fees would further influence prospective waste-pickers into collecting recyclable materials. Therefore, this would lead to an increasing level of collection which, in turn, could lead to an increasing level of recycling. Hence, laying the foundation for a circular economy in Vietnam.

4.3 Hoang Roan Quy, *Former Member, Thu duc Waste Collection Cooperative*

Through the opportunity to enter Mr Quy's home, I truly found value in the relevance of this topic. Aged 43, Mr Quy had his entire life structured around his job. His home, approximately 30m², had his waste collection truck using the majority of the space. The remaining area was used for his bed, a table, a sink, and an area to store bags of recyclable materials. With a young son and a wife, this job had been providing for his family for 6 years. Collecting recyclable materials in the corner of his home until he had enough to fill his truck, Mr Quy would travel to his Aggregator every few weeks and sell the materials, receiving his collection fee.

On June 15th of 2023, while emptying buckets of waste from his neighbourhood into his truck, Mr Quy slipped and fell off the truck, landing on his side. Breaking his collarbone, shoulder blade (as seen in Figure 11), and badly bruising his leg. Immediately being sent to the



Figure 11: An image of Mr Quy post-surgery showing me his remaining scarring and bruises

hospital, Mr Quy told me how neither he nor anyone he knew of had any medical insurance as a waste picker.

Additionally, without the provision of welfare benefits for his job in society, he said he had no source of income to pay off the 27 million VND for his surgery. Only receiving approximately 5.5 million a month through both his and his wife's work, he feared the possibility that he may never be given the chance at recovery. Thankfully in his case, Mr Quy had been a member of a cooperative which had been formed in collaboration with PRO. They were alerted of his situation and paid for his medical fees. Mr Quy is due for his second surgery next year, after which he will hopefully be able to work once more.

When asked what he believes should be done in order to increase the collection of all recyclable materials in Vietnam, Mr Quy told me that he simply believes independent waste-pickers of the informal sector should be recognised and supported by the government. Due to the significance of their job in the bringing of a circular economy, he believes it is only fair that a welfare protection program be implemented to support others in his field of work in the event of an accident like his.

He also informed me that he was aware of how lucky he was that PROVN came to support him and that he was worried about the many other waste pickers across the country who may not be given the same privilege in the future. In his opinion, if a welfare program was initiated by the government, more workers would be willing to work toward the collection of recyclable materials as they would have confidence in the government's ability to support them should they ever need it.

4.4 Le Anh, *Sustainability Director, Duy Tan Plastics*

After 33 years of being one of Vietnam's leading plastic producers for household and bottling plastics, Duy Tan Plastics began work in 2018 to start their journey of also becoming one of Vietnam's leading plastic recyclers. Le Anh, the Sustainability Director of the company, kindly agreed to an interview in discussing the work done by his firm, the government, and what should be done in the future concerning the collection and recycling of plastic waste in Vietnam.

The newfound mission of Duy Tan Plastics, according to Mr Le Anh, is to contribute to the betterment of the environment. After years of experience in the plastic production industry, he detailed the fact that the company took notice of the drastic effects of plastic pollution in their country. This wake-up call made the firm take action in 2018 through the formation of a research team focused on recycling technology. The following year, the group began the construction of their internationally recognised recycling plant, beginning operations in 2021.

Already partnered with leading TNCs such as Nestle (LaVie), Coca-Cola, Tetra Pak, Unilever, Suntory Pepsico and others, Duy Tan Plastics has been internationally recognised for the initiative they have taken. Being Vietnam's only bottle-to-bottle recycler, the group has implemented their recycling technology (imported from Europe) into their production plants as well. They convert Polyethylene Terephthalate (PET) and High-Density Polyethylene (HDPE) plastics into plastic resin, then, at the same venue, use this to

produce new plastic products. This revolutionary method has allowed Duy Tan Plastics to be the largest self-recycled plastic producer in the country.

When asked what he believes to be a major factor preventing the recycling of all recyclable plastics in Vietnam, Mr Le Anh informed me of two issues. Firstly, the simple fact that, along with the majority of other recyclers in Vietnam, Duy Tan Plastics lacks the scale required to collect and recycle the amount of plastic that is produced by the Vietnamese society per annum. He alerted me to the fact that Duy Tan Plastics is estimated only to be able to sustain 100,000 tonnes of plastic a year, solely covering roughly 3% of the nation's output. This highlights the issue that, without government support toward the recycling industry, it would simply be impossible to grow it to the extent necessary for the complete recycling of waste.

Hence, a possible solution for an increase in the quantity of plastic waste recycled is simply for the government to subsidise the industry, fund further research on plastic recycling, and for EPR to include an investment in the development of new recycling plants.

The second issue brought up by Mr Le Anh is the issue of collecting and separating plastic waste. With only 40,000 tonnes of plastic currently being collected by Duy Tan Plastics, it has been recognised that 60,000 more tonnes can be recycled in the plant. However, the problem lies in the fact that separating recyclable waste from non-recyclable waste is a time-consuming process that halts the mass collection of recyclable materials.

Mr Le Anh believes that, to solve this concern, more investments must be made by the government for the treatment and cleaning of waste. This should be for Duy Tan Plastics and other waste recycling/ collecting groups to experience an easier, faster plastic collection process. In turn, this would result in a greater input of plastic waste for recycling, therefore resulting in a greater output of recycled plastic while reducing the amount of plastic pollution in the surrounding environment.

4.5 Zheng Yikang, *Director, Mekong Fiber*

The director of an internationally recognised plastic-to-fibre recycling firm, Mr Zheng Yikang presented me with an insight into the issues faced by the Vietnamese recycling industry in relevance to the theme of this paper.

Solely working in relation to the recycling of PET plastic, Mekong Fiber is a firm that began operations in 2018 to work towards not only supporting their local environment but also making profitable goods. They have done this by firstly, enforcing the fact that they must collect 100% domestic PET waste. This is in order to put their country's welfare as a priority. The firm's recycling plant manages a maximum input capacity of 280-300 tons and an output of 250 tons per day.

To ensure that all PET received is domestically collected, the firm solely works with aggregators and collectors based in Vietnam. They do so in order to take pride in being a Vietnamese company, furthering the well-being of their country as a representation of this.

Using the PET collected, Mekong Fiber uses technology researched and produced in China to melt, stretch, separate and smoothen the plastic into individual fibres. A part of this process can be seen in Figure 12 (shown below). Large amounts of these are then machine-packed into large parcels as seen in Figure 13 (shown below), for the purpose of being sold. Mr Zheng informed me of the fact that the primary market for these plastic fibres is the USA and Europe. As a result of this, sales for the company have decreased by 30-40% so far in 2023. This is due to international conflict which has severely decreased demand for the goods of his firm. In order to combat this and bring back the expected revenue of the company, the primary focus of Mekong Fiber is now international marketing.



Figure 12: An image showing machinery during the process of stretching plastic into fibre (Source: Mekong Fibre)

Additionally, to prevent the lack of feasibility for the continuation of the company, Mr Zheng believes that the VEPF (Vietnam Environment Protection Fund) should financially support his, and any other recycling firms affected by this global situation. This is due to the fact that the work done by these companies do benefit the Vietnamese environment. This support could be through the provision of subsidies or decreased interest rates.

Moreover, Mr Zheng mentioned that a major issue in the recycling industry as a whole is the lack of concern as to where waste is coming from. He detailed that most recycling firms are profit-maximising, meaning they tend to import plastic waste. This is because of two main reasons. Firstly, imported waste tends to come at much cheaper costs.

Secondly, they are also treated and cleaned before they are received here in Vietnam. This serves as a major benefit to Vietnamese recycling companies due to the reduction of an added cleaning/ treatment step. The problem, however, is the appallingly large quantities of recyclable waste in Vietnam that are therefore not being recycled. They also cannot be exported as foreign recyclers would not be willing to do the additional work either.

To solve this, Mr Zheng believes that the government should implement clearer/ stricter rules and operational policies to better guide recycling companies like his own. He thinks that this will increase



Figure 13: An image showing the final product, packaged, and ready for shipment

awareness as to why companies should prioritise the recycling of domestic waste over the slight profit made through the difference in cost.

4.6 Cao Thanh Phong, Director, Bao Ngoc UBC/ Paper Collector

Working as the bridge between independent waste pickers and recycling plants, Bao Ngoc is a local UBC (Used Beverage Cartons)/ paper collection group in Ho Chi Minh City led by Mr Cao Thanh Phong. The primary focus of this group is to collect these materials from around Vietnam and then sell them to local recycling companies. The group does this through the collection of smaller quantities of these materials from partnerships with local cooperatives of independent waste pickers. They also receive some of these through the purchasing of unused beverage cartons/ paper from factories as industrial waste. In comparison to independent waste collectors, these damaged goods are cheaper sources of the materials.

Bao Ngoc then inputs these into a large Baler as seen in Figure 14 (shown below) which works towards the compression of the waste. The machine produces box-shaped bales as can be observed in Figure 15 (shown below) to easily distribute the waste to recyclers.



Figure 14: An image showing a worker at Bao Ngoc UBC/ Paper Collector inputting paper waste into a baler for its compression



Figure 15: An image displaying the bales of paper waste released from the baler post-compression

The Bao Ngoc group solely focuses on the collection and compression of UBC and paper waste into bales as shown in Figure 16.



Figure 16: Images displaying the output of UBC and paper bales from Bao Ngoc's compression system

Upon discussing the major issues faced by Bao Ngoc for the gathering of waste, Mr Phong introduced me to the 3 main problems of collecting UBC.

Firstly, along with it being more expensive to treat, clean and recycle, UBC is also significantly harder for collection groups like Bao Ngoc to gather in comparison to paper. This is because these independent waste pickers lack incentivisation to collect the material. As explained by Mr Phong to myself, waste collectors will always tend to collect paper over UBC because they receive a higher collection fee per kg of the material. Due to the fact that these workers solely work for the payment received, they will most definitely tend to solely collect paper without an incentive convincing them to do otherwise.

The second challenge faced during the collection of UBC is that it is much harder to collect and store large quantities of them in comparison to paper. As these waste collectors are paid by kg of material, an important factor influencing the type of material gathered is how easy it is to collect and store. As UBC are small and light, these waste pickers will be required to collect large quantities of the cartons to match the fees they would be paid for the collection of a low amount of cardboard (which is larger, heavier and easier to store large volumes of). Therefore, this would result in a low collection of the material as these waste collectors will prioritise paper due to efficiency and ease in waste collection.

Finally, Mr Phong detailed the third issue which is that the material is never properly disposed of by the public. In fact, a major reason for the low collection of this waste is that the Vietnamese population has not been educated on how to properly dispose of these recyclable products. Hence, the cartons are improperly discarded with liquid remaining inside them. Noting that a majority of beverage cartons sold in Vietnam contain milk, the contents inside UBC are often quick to spoil. This makes its collection all the more difficult for waste collectors who would then have to deal with the strong smell released along with the possibility of sickness.

When asked how best he believes the government can combat these three areas of difficulty, Mr Phong curated a few possible solutions. First of all, an added value must be present for the collection of UBC to waste collectors. While Non-Profit Organisations like PROVN are currently supporting groups like Bao Ngoc with funding for the provision of incentives to local waste pickers, more must be done. These groups cannot be the sole source of funding for the incentivisation of UBC collection to every independent waste

picker in the country. Instead, Mr Phong believes the government should make it their responsibility to ensure that UBC are collected in the country. He is suggesting that they take up the mantle of providing incentives to independent waste collectors who choose to collect the material.

Additionally, he believes that wider public education is vital toward the increase in UBC collection. Through the implementation of teaching programs in schools as well as widescale marketing, he believes that a greater population will be aware of how best to discard goods. Moreover, he believes that along with education on how to clean beverage cartons prior to disposal, the public must also learn why the material must be separated from other waste. To make use of this, however, the government must also increase the accessibility of separated waste bins in the country. This change will allow for the quick collection of clean UBC, leading to a much higher collection rate for the material.

4.7 Ngo Duc Hoan, *Director, Thuan An Paper*

With its primary mission being to recycle and produce industrial paper, Thuan An Paper is a firm in Vietnam focusing on the recycling of paper and UBC. Through the use of three separate facilities, the group has a storage capacity of 42,000 tons of waste. Due to the generosity of the firm and Mr Hoan, I was given the opportunity to tour the Binh Phuoc plant which recycles 1300-1400 tons of it per day.

He also detailed the fact that the company imports roughly 60,000 tons of paper and UBC waste every month from around the world. These include countries like New Zealand, the USA, France, the UK, Japan and Norway. Additionally, Thuan An Paper receives most of their funding, technology and equipment from China. Hence or otherwise, they also sell 80% of the recycled product to the country, as well as to Saudi Arabia, Indonesia, the Philippines, and others. The 20% of the paper remaining is sold domestically to local factories for the production of cardboard cartons. The product is sold at 480 USD per ton. As a result, Mr Hoan informed me that the three plants receive approximately 45 million USD in revenue from all three plants every month.

In order to recycle the wasted paper and UBC, the group follows a series of calculated steps replicated in all three plants.

Firstly, the group unpacks the large UBC/ paper bales shown in Figure 17 (below) bought from aggregators (similar to the aforementioned Bao Ngoc collector). They then use large construction vehicles to push the waste onto a conveyor belt as seen in Figure 18 (shown below) that takes it up and into the second stage of recycling.





Figure 17: An Image of the Thuan An Paper waste collection area

Figure 18: The conveyor belt used for the transport of waste

Thereafter, the waste is led to a large structure used for the stirring of the materials with water. With a large quantity of water input into the machine, the paper will then begin separating from the other materials found. It will travel through a sieve, leaving the other materials within the container as displayed in Figure 19. A machine then lifts out all the unused material as can be seen in Figure 20. These include plastics, aluminium, and others. When asked what the group does with these items, Mr Hoan told me that they burn them in accordance with government regulations, making sure to use the heat released for a later step in the process. This not only reduces the energy consumption of the recycling plants but also ensures that the residual waste is made use of.



Figure 19: Container used for separating paper from other materials after the process is complete



Figure 20: Residual Waste removed from container

Next, all the dissolved paper that previously travelled through the sieve is then relocated via a pipe to a series of machines. These work toward drying the paper and ridding it of moisture. After this step, the dried paper is sent to a machine which inputs the necessary chemicals. These work toward not only specifying the colour of the paper but also bonding the smaller pieces together. This forms longer pieces of paper fabric.

Subsequently, heat and pressure are added to then break these connected pieces of paper fabric into a powder-like substance. The machine for this can be seen in Figure 21. The powder is then sent to large storage containers as observed in Figure 22.



Figure 21: A machine adding heat and pressure to create paper powder



Figure 22: Large storage containers used for paper powder

In the next step, the paper powder is sprayed and pressed at a very high speed and temperature. This forms a thin paper sheet which is then machine-rolled into large rolls of paper shown in Figure 23 (below). This step is monitored carefully and continuously through the use of a quality control lab.



Figure 23: The large rolls of paper produced

The large rolls are then cut into smaller rolls which is the final product. Using a conveyor belt they are then sent down to the warehouse where they are prepared for distribution. This is seen in Figure 24 (below).



Figure 24: Image showing the final product being sent to the warehouse

Upon being asked what he believes to be a major factor making the recycling of all UBC harder, Mr Hoan explained that the cost for UBC recycling is simply too high. Along with the fact that there's a lack of technology available to recycle aluminium and plastic from UBC, the input quality found in Vietnam is also far too low. This is due to the moisture within the cartons along with the dirty conditions they are found in. Moreover, the

recycling of all materials in UBC requires much higher energy and water consumption, making it quite unfeasible.

Hence, in order to overcome this issue, Mr Hoan provided me with three possible solutions. Firstly, recycling plants should efficiently make use of the aluminium and plastic discarded during the recycling process by replicating what is done at Thuan An Paper. Burning the residual waste for the utilisation of the heat released. It must be noted, however, that this is an unsustainable method due to its mass release of Carbon Dioxide. As a result, this method would simply lead to further support of the enhanced greenhouse effect.

Secondly, he believes there must be increased funding from stakeholders or the government for the development of technology designed to recycle plastic and aluminium. He also thinks that the government should support recycling plants like his through an increase in the volume of UBC available and a decrease in cost for it.

Lastly, he thinks that recycling plants must develop their facilities in order to manage larger capacities of UBC than what is currently recycled. This is being done by his recycling firm, which is currently undergoing construction in their Binh Phuoc plant which is due to finish by the end of 2023. Upon the beginning of operations for this extension, the plant is expected to handle twice the previous capacity, also resulting in a doubled output.

4.8 Pham Minh Tuan, *General Director, Vikohasan JSC*

As the head of the largest PET-to-fibre recycling company in Vietnam, Mr Tuan has been running all three of the Vikohasan recycling plants for three out of their four years in operation. With an output quantity of 150-200 tons of polyester fibre produced daily (4500-6000 tons per month), the firm has proven to be a reliable supplier for the textile industry. The primary buyers of the product, as stated by Mr Tuan, include both domestic and international buyers. The USA, Europe, Mexico, South Korea, and Japan are examples. To ensure a reliable and continuous input of the PET, Vikohasan has partnered with PET aggregators from within Vietnam as well as countries like Japan, South Korea, Bangladesh and others. This is because of the low costs of purchasing waste from certain areas of the world.

Plastic bottles received are crushed into plastic flakes, with the Polypropylene (PP) bottle caps being machine-separated and sent to PP plastic recyclers. The PET flakes are cleaned as seen in Figure 25 and then inputted into the recycling process. The differentiating factor that separates Vikohasan from other recycling firms in Vietnam is that the group works toward recycling different types of PET, rather than just bottles.



Figure 25: An image of the PET flakes post coldwater cleaning, separation from non-PET plastics, warm water cleaning and chemical treatment.

Hence, they also work toward inputting the plastic wrap/sheets in Figure 26 (below) into their machines because they are PET plastic. However, before this, the sheets must be formatted to suit the machines. As a result, the group produces 'PET popcorn' as seen in Figure 27 (below). This is then inputted into the recycling system.



Figure 26: Image of the PET plastic sheets



Figure 27: Image of the 'PET Popcorn'

An issue highlighted by Mr Tuan was the recycling of the plastic bottle labels. While the bottles themselves are made from PET, in Vietnam the cap and the labels are not. Instead, they are made from PP and Polyvinyl chloride (PVC) resin respectively. While there are numerous PP plastic recyclers found in Vietnam, the thin PVC labels cannot be recycled here at an affordable cost. This is due to the fact that the country simply lacks the technology necessary. As a result, instead of being recycled, they are sent to be burnt for the energy released. This is an inefficient method as the burning of plastic waste furthers the enhanced greenhouse effect.

Another issue faced by Vikohasan, for 2023 in particular, is the increase in the cost of PET domestically. To combat this, the group has worked with Coca-Cola and organisations like PROVN to support them via the provision of funds. Additionally, the firm applied for (and received) an importing license allowing them to begin accessing foreign suppliers of PET.

In the future, to resolve issues like such, Mr Tuan believes the government should implement clearer and stricter policies than what is currently put in place. Moreover, he thinks that they should also provide funding to further the development of recycling technologies. This should be for recycling centres, producers, and other relevant bodies in the recycling industry.

5. Conclusion

In summary of the paper, it can be concluded that the issues of collecting and recycling waste in Vietnam go hand-in-hand. Without adequate support of independent waste collectors, be it from the government or producers, waste cannot possibly be recycled to the extent that it needs to be even if the necessary technology is accessible. Additionally, it can also be concluded that without the appropriate machinery available to recycle said waste, it is simply impossible to amend the structure of Vietnam's waste management strategy into that of a circular economy.

Therefore, to achieve this system and disregard the need for landfills or waterbody pollution, I have personally curated the following solutions. Taking into consideration the information gathered via the sources of this paper, these are the most feasible ideas that I urge the consideration/ would recommend the implementation of by the Vietnamese government:

1. The recognising of local waste pickers through the formation of government-supervised and supported cooperatives. This should be done through ways such as but not limited to:
 - a. Basing the size of these cooperatives on geographical location/ land designation/ land use. For example, creating the Yen Truong Waste Management cooperative for the village of Yen Truong. This will consist of local, previously independent waste pickers preexisting in the area.
 - b. Providing all members of these cooperatives with appropriate equipment/ benefits including:
 - i. Sun protection (hats)
 - ii. Full-body PPE
 - iii. Footwear

- iv. Accident Insurance to cover medical bills in the event of an injury while working
 - v. The payment of wages per month to all waste collectors apart of the cooperative. The exact wage per worker must be determined through means such as:
 - vi. The installation of a ‘head of waste management cooperative’ to organise and look over the work done by the involved waste collectors, keeping track of hours spent working and efficiency/ quantity of waste collected.
 - vii. Considering the money obtained for the government by the individual over the span of 1 month
 - viii. Ensuring that the base wage (the wage not including the additional payment based on individual collection) for all members of the cooperative adheres to the current minimum wage for labour contracts set by Decree 38/2022/ND-CP
 - ix. Paying individuals an additional payment on top of the aforementioned base wage. This will be determined by the ‘head of waste management cooperative’ by taking into consideration the quantity of material collected by an individual and the collection fees gained from them.
- c. The implementation of government supervision for these cooperatives by methods including:
- i. Creating a ‘provincial head of waste management cooperatives’ role. This will be a job within the provincial government aimed at supervising the totality of waste management cooperatives for the province. This will mainly involve collecting data from every ‘head of waste management cooperative’ and ensuring that government support is used efficiently.
 - ii. Creating a ‘Vietnam Head of Waste Management’ role within the government aimed at supervising the work done regarding waste management around the country. They will be in charge of ensuring all provinces are reducing land pollution to a suitable amount through the collection of data from every ‘provincial head of waste management cooperatives’ for each province. They will also be involved in the allocation of funding from the government to each area, ensuring that it is of an appropriate amount and that it is being used effectively.
- d. The organisation of monthly meetings between the ‘heads of waste management cooperative’ for each of the cooperatives for the province, and the ‘provincial head of waste management cooperatives’ to allow for the local waste pickers to have a medium of letting their voice and opinion be heard. Information gathered from these meetings must be used to further improve waste management strategies in the respective provinces.
2. The enforcement of sustainable product design as an addition to EPR. Currently, EPR solely works toward placing responsibility on producers and importers to manage waste caused by their products. This solution aims at furthering this responsibility to the manufacturing stage. Materials like LDPE, which is commonly used for the production of coloured plastic bags, have low collection fees for waste pickers. As a result, they are left in the environment without being recycled/ properly discarded. Sustainable product design should be developed by producers to combat issues like this. Additionally, in order to enforce this on producers, the government should use methods such as but not only:

- a. Implementing a decision banning the production of coloured LDPE plastic bags within the country of Vietnam. This is because of reasons like:
 - i. The issues held by recycling plants with the recycling of coloured materials.
 - ii. The fact that, regardless of whether the LDPE plastic products are white, colourless or coloured, the cost of production remains roughly the same. Hence, preventing the production of coloured plastic would not affect the cost when producing alternative products.
 - b. Creating a government role aimed at supervising the work done by all major producers currently holding EPR on the R&D of sustainable product design. This should be done through the following method:
 - i. Organizing individual bimonthly meetings between producers and the government (represented by this supervisor) for the presentation of evidence on work done/ implemented for increased sustainability in product design. This can include either a reduction in material used for the product, an increase in ease of recycling, or research done on easier, feasible recycling methods for all materials in their product.
 - c. Increasing the funding required to be paid to the VEPF by producers for a lack of work done on the collection/recycling of waste or R&D on sustainable product design.
 - d. Using money in the VEPF to further research on methods of sustainably designing and manufacturing a variety of different types of products. This can be done in ways similar to:
 - i. Establishing the Vietnam Research on Sustainable Product Design Agency (VRSPDA) to test methods of increasing the recyclability of different materials/ reducing the quantity of material used per product without affecting quality/ usage.
 - ii. Consulting foreign research centres to understand the preexisting techniques/ ideas already curated around the world.
3. The implementation of the usage of separated recycling bins throughout the country. While I understand that in some areas this has already begun to be executed, the country as a whole requires the mass production and installation of separated garbage bins to ease and increase the rate of the waste separation process. This should be done through means such as:
- a. Working with waste management cooperatives to:
 - i. Calculate an adequate quantity of bins required for their area
 - ii. Spreading out these bins appropriately around their area
 - b. Working with garbage bin producers to begin mass production of government-provided bins with three separate compartments for four categories of waste:
 - i. Organic
 - ii. Plastic
 - iii. Aluminium Cans/ Paper
 - iv. Other (Recyclable)
 - c. Raising public awareness on the importance of separating waste using this discarding system through ways such as but not only:

- i. Creating posters/ pamphlets for presentation around cities, rural areas, and single-material bins
 - ii. Promoting using billboards around cities
 - iii. Creating video advertisements for television and social media like Facebook, YouTube, Tik Tok, etc.
 - iv. Initiating an education program across the nation regarding the benefits of reducing and separating waste to raise awareness amongst the youth as to why they must prioritise this waste management system.
 - v. Working with Vietnamese content creators popular among the youth to create content regarding the benefits of separating waste.
 - d. Working with CITENCO (Ho Chi Minh City Urban Environment Company), URENCO (Hanoi Urban Environment Company) and other currently partnered with waste collecting groups to collect the waste from these bins and proceed to distribute it to reliable/well-developed recycling plants that the government must establish partnerships with.
4. The increase in collaboration between the government and NGOs like PRO, ENDA, Vietnam Zero Waste Alliance and others to further discuss and create possible solutions to be implemented in the future. This could be done through means such as:
 - a. The arrangement of semiannual meetings between NGOs and the aforementioned 'Vietnam Head of Waste Management' to discuss possible issues that have come with past LEPs and also new solutions that have been brainstormed.
 - b. The formation of the annual Vietnam Waste Management Conference aimed at welcoming relevant NGOs from around the country, as well as foreign government supervisors of waste management. This will aim to stimulate discussion and allow for the creation of new waste management techniques.
5. The provision of financial support from the VEPF to recycling plants in Vietnam, in the form of subsidies and low-interest rates for loans. This is for reasons such as:
 - a. To support the growth of these plants for them to handle and recycle a greater quantity of waste.
 - b. To allow for further incentivization of these recycling firms to continue working toward reducing the quantity of plastic ending up in landfills/ waterbodies.
 - c. The publicisation of these subsidies allows for a better public opinion on the issue of a lack of recycling. This will be a result of the fact that the government is showing support for the industry.
 - d. To influence plastic producers to:
 - i. begin using recycled plastic resin as it would be suggested that with a greater input of support to the recycling industry by the government, the quality of the plastic resin output would increase
 - ii. incentivize them to also become plastic recyclers
 - e. To induce the formation of new recycling plants/ new recycling firms
 - f. To support further research/ development of new technology for the recycling of a variety of different recyclable materials

6. The promotion of recycled products to the public to increase awareness on why they should be prioritised and how users can recycle them post-use through means such as:
 - a. Creating posters/ pamphlets for presentation around cities, rural areas and supermarkets
 - b. Promoting using billboards around cities
 - c. Creating video advertisements for social media like Facebook, YouTube, Tik Tok and others.
 - d. Initiating an education program across the nation regarding the benefits of recycled products to raise awareness among the youth
 - e. Working with Vietnamese content creators popular among the youth to create content regarding why they should prioritise recycled products
 - f. Working with NGOs and recycling companies to further verify and contribute to the information advertised, aiming to increase awareness of the importance of using recycled goods
7. The implementation of stricter and clearer policies against the import of waste through ways such as:
 - a. Further amendments to the most recent LEP relating to the import of waste (Presently No. 13/2023/QĐ-TTg)
 - b. The construction and approval of a new, more detailed decision which acts as a road map to:
 - i. include further improvements toward the banning of imported waste
 - ii. detail methods of domestic waste collection as an alternative to importing
8. The provision of incentives to independent waste pickers and recycling research centres for the collection/ recycling of some recyclable materials. These could include UBC, coloured LDPE, flexible packaging, and others which are undercollected and under-recycled in the country. This should be done in ways such as:
 - a. Providing financial incentives to aggregators which must be used for increasing the collection fees of the materials specified. This can be orchestrated through methods like:
 - i. Supervising that the money is used appropriately through the use of monthly meetings between a government supervisor and the aggregator in which they will display evidence of aid usage.
 - ii. Allocating different amounts of financial support based on the quantity of the material collected by the aggregator per month
 - b. Providing financial incentives to recycling research centres which must be used for further research and production of recycling technology. This is to increase the ease of recycling the specified materials within Vietnam. Methods to do this include:
 - i. Supervising that the money is used appropriately through the use of monthly meetings between a government supervisor and the recycler in which they will display evidence of development in their research.
 - ii. Providing different amounts of financial aid based on the efficiency/ usefulness of the work done by the group.

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