The Challenges and Opportunities for Plastic Recycling in Hong Kong

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ABSTRACT

The HKSAR's historic method of exporting and landfilling waste plastic has been severely disrupted by the implementation of China's Operation Green Fence revealing sudden constraints in local landfills. This paper provides an outlook on future opportunities in tackling challenges of landfilling through substituting a sustainable waste management system. The current waste management system shall undergo transformation under the "Waste Blueprint in Hong Kong 2035", through reframing the plastic recycling industry. Methods of MSW source separation have been identified including the potential use of RVMs for the collection of non-contaminated waste plastic. This provides an opportunity for the development of new management systems as an alternative to landfilling, with an emphasis on recycling in creating post-consumer plastic products entering the niche market. Other treatment methods such as the production of RPF and incineration energy recovery aims to eliminate plastic landfilling where recycling capacities fall short. Identified benefits range from economic, social and environmental to the production of products meeting Chinese market demands and exportation following the CEPA agreement.

KEYWORDS Plastic Recycling, Reverse Vending Machines (RVMs), Plastic Recycled Products, Source Segregation
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1. Introduction

In 2023, the HKSAR recycled 126,000 tonnes of waste plastic, an increase of 5.59% from 2022 (EPD, 2024). China's ban on importing 24 types of solid waste and recyclables, called the 'National Sword' or 'Operation Green Fence', fully came into effect in January 2018 to end its established history of accepting scrap paper, plastics and metals for recycling and reuse. There is a critical opportunity to turn unwanted waste plastic into products with market value. Statistics also show that the total value of exported plastics dropped from HKD 171 million in 2017 to HKD 4 million in 2023, indicating the local market that was viable for expansion through the addition of recycled plastics collection (EPD, 2024).

In Hong Kong, municipal solid waste (MSW) is classified into two main categories: domestic waste, and commercial and industrial waste (EPD, 2024). In 2023, 10,884 tonnes per day (tpd) of MSW was landfilled, and the overall MSW recovery rate was 33% (EPD, 2024). Waste plastic alone contributed to 19.5% of the total MSW disposed in landfills in 2023 (Figure 1). Out of the recovered MSW in 2023, only 7% was plastic.

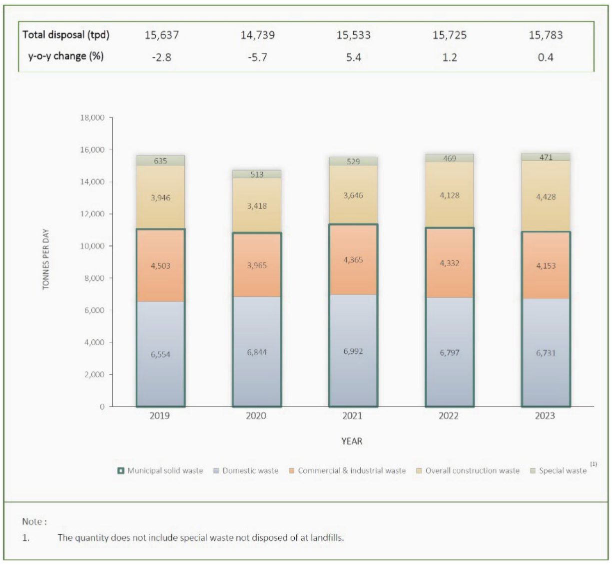
Currently, the major means of waste disposal in the HKSAR is by landfilling. However, due to the land scarcity in the HKSAR, sustainable waste management is highly prioritised on the HKSAR's public and political agenda. With landfill capacity dwindling and delays to contentious waste management alternatives, other options of waste management should be considered as an alternative to landfilling. With this and landfill charging schemes soon to be implemented in the HKSAR, a drive for more sustainable waste management is required.

It is important to reduce the landfilling of waste, which is considered to be the least preferable option in the order of waste management hierarchy. From the HKSAR Government's "Blueprint on Sustainable Use of Resources, 2013 – 2022" (Blueprint), a Five-Pronged Approach was proposed to achieve waste reduction of 40% on a per capita basis by 2022. Clean Recycling is one of the Five-Pronged Approaches proposed in order to achieve long-term sustainable waste management in the HKSAR, where waste segregation and recycling are essential elements for the waste management strategy. In 2017, the HKSAR generated 137 tonnes of PET plastic bottles and 72 tonnes of non-PET plastic bottles per day, yet the recycling rate of plastic bottles was only 10%. With the rising population and solid waste generation, the overflow of landfill capacity is one of the major challenges in the HKSAR.

In 2021, the HKSAR released the "Waste Blueprint for Hong Kong 2035" with renewed targets including the reduction of the per capita MSW disposal rate by 40-45% and an increase in the recovery rate to 55% with the long-term target of zero landfill.

In 2023, the total quantity of MSW disposal at landfills was around 3.97 million tonnes, which had decreased by 2.2% compared to 2022. The recycling rate for plastics declined from 58% in 2011 to 13% in 2016, which was largely affected by the drop in crude oil prices (West Texas Intermediate) from 2014 to 2016 (Macrotrends, 2019), leading to decreasing prices of virgin plastic and the demand for recycled plastic resin. Referring to Figure 1, plastic recycling has increased steadily since 2019. Sorting of co-mingled waste plastic is one of the major challenges for the plastic recycling sector. Manual sorting methods are relatively time consuming and ineffective. Once the waste plastic is mixed with MSW, it is almost impossible to separate the contaminated plastic from mixed waste in terms of cost and quality.

(a)



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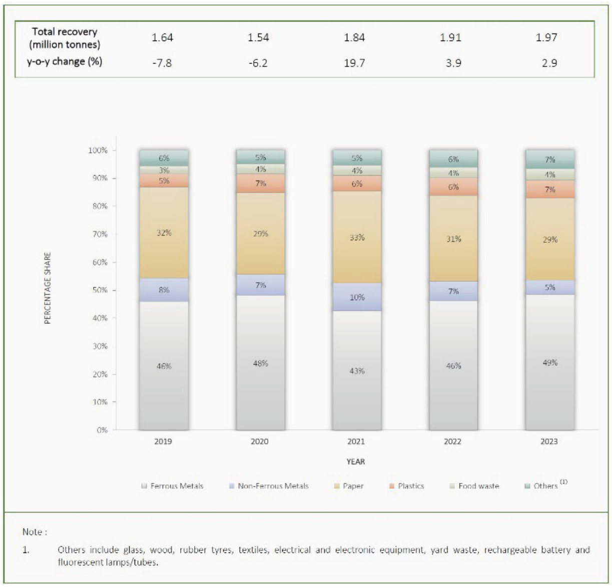

Figure 1. (a) Composition of MSW Disposed at Landfills; and (b) Quantities of Recovered Recyclables (EPD, 2024).

2. Challenges of Plastic Recycling in the HKSAR

2.1. Operation Green Fence

In 2016, the HKSAR exported 118,700 tonnes of waste plastic to other countries. Since 1992, China has imported 106 million Mt of waste plastic, which was the largest importer for waste plastic in the world from 1988 to 2016 (Brooks et al., 2018). According to the waste plastic import records in 2016, the HKSAR contributed 24.9% of the imported waste plastic in China and acted as the top exporter of waste plastic to China. However, since the import ban of the 24 types of solid waste since 1 January 2018, including unsorted paper and low-grade PET used in plastic bottles, export is no longer a viable solution for our waste plastic management without improving the quality and collection mechanism. Hence, it is necessary for the HKSAR to increase the local recycling capacity of waste plastic to respond to the market change and lessen the burden on our landfills. Without new recycling options or plants, the HKSAR will struggle to cope with the rising tide of waste from its citizens and tourists. Operation Green Fence is therefore expected to have an impact on recycling industries on a global level by incentivising domestic recycling and competitiveness, particularly targeting the need for Extended Producer Responsibility (Qu et al., 2019). The long-term effects of this policy call for changes in policy frameworks toward sustainability in all countries which rely on exporting waste plastic.

2.2 Human Factor Constraints

Plastic recycling at the end-of-life stage of products is a consumer-driven framework, largely dependent on the level of participation by the public. Currently, the HKSAR has no consumer-driven incentives to encourage plastic recycling based on the sole ‘good will’ of consumers. The current recycling infrastructure of the HKSAR does not enable the public to conveniently recycle plastic products compared to the accessibility of general refuse bins. The only current legislation on halting plastic use is the plastic bag levy implemented on plastic bag suppliers by the government, and a voluntary ban on straws.

On a global level, the development of consumer-driven plastic recycling incentives has started through the popularisation of RVMs. In 2018, the EPD conducted a consultancy study to evaluate the feasibility of adopting and introducing the producer responsibility scheme on waste plastic bottles to the HKSAR (EPD, 2018a). The concept of RVMs revolves around a reward system based on the action of depositing used plastic bottles by the consumer. This could be in the form of cash or other digitised forms of rewards, such as coupons to exchange goods. The HKSAR has very few reward-incentivised schemes, with only a few RVM infrastructures in place and recycling schemes at Common Green Space (CGS) locations. The development of this system in the HKSAR is still a niche and not appealing to the majority of the public due to the inaccessibility of RVM and CGS locations. The locations of RVMs are shown in Figure 2.

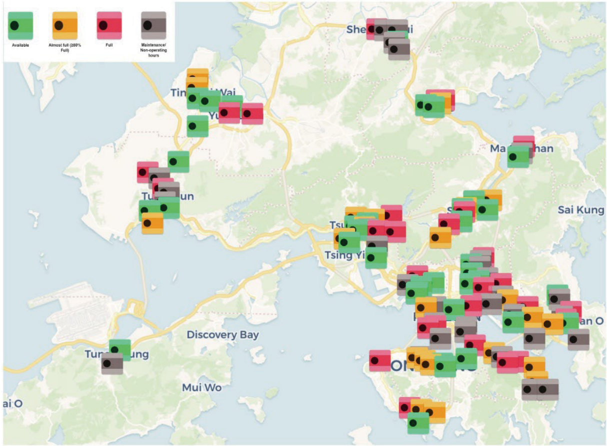

Figure 2. Locations of RVMs in Hong Kong (EPD, 2025).

2.3. Technical Factor Constraints

Overcoming human constraints within the framework of a consumer-driven recycling system requires necessary development of a strong and dependable recycling infrastructure to enable recycling actions. This includes the development of collection facilities, transport infrastructure, high-capacity plastic recycling plants, and the demand for a post-consumer plastics market.

The HKSAR's current infrastructure lacks in all aspects but has a large capacity for development in this area. Beginning with the problem of waste plastic collection, recycling waypoints must compete with the accessibility of current refuse bins to tackle the problem of inaccessible drop-off points. Simply providing a designated plastic recycling bin adjacent to current refuse bins allows a source separation of waste plastic, whether the plastic is contaminated or not. This eliminates the step required for waste plastic recovery — the most labour-intensive part of the supply chain.

In 2017, there were more than 3,500 collection points for recyclables in the HKSAR, and approximately 2,800 of the collection points were recycling bins. In spite of the geographically covered recyclables collection network in the HKSAR, the local recycling rate of plastics declined from 58% in 2011 to 13% in 2016. This indicates the need for new strategy and policy for waste plastic recycling.

In order to ensure the constant availability of waste plastic disposal points, a transport system for waste plastic removal from the source to the sink must be developed. The HKSAR already has a waste collection system in place adapted to general refuse, which can be adapted to fit the plastic collection model. A dedicated recyclables transport system would allow the efficient collection of waste plastic with transportation directly to the plastic recycling plant.

The plastic recycling plants currently operational in the HKSAR are of extremely low capacity compared to the output of waste plastic. In 2023, only 126,600 tonnes of plastic waste were recycled locally whilst 1,600 tonnes were exported for recycling (EPD, 2024), and this accounted for merely 6% of the plastic waste disposed of in Hong Kong. It is crucial to have infrastructure that can process the amount of waste plastic generated at at least an equal capacity, in order to halt the volume of waste plastic generated in landfills. No matter how developed other stages of this supply chain are, it will inevitably be limited by the capacity of recycling plants.

The last stage requires the development of the market for post-consumer plastic goods, which may be local or international. The market includes the secondary output of post-consumer recycled plastic pellets and the final output of manufactured goods. In an ideal situation, the demand for post-consumer plastic goods should exceed the demand for virgin plastic products for this process flow to sustain itself without governmental interventions. Recycled plastic goods must be able to compete with conventional products by having a price lower than or equal to that of its competitor. Initially, this may require governmental intervention through subsidising recycled goods to expand the market. The market should be able to sustain itself after a period of payoff years.

3. Environmental feasibility in the HKSAR

3.1. Source and Amount for the Collection of Waste Plastic

One of the main determining factors for such low recovery rates of waste plastic from MSW in the HKSAR is the inability to create a non-contaminated waste stream of waste plastic. Waste plastic can be intercepted at the point of disposal and rerouted into the recycling stream. Unwanted waste plastics become available for recycling via a variety of routes. These include commercial waste disposed by industry and businesses and waste plastic from the domestic sector. The routes through which waste plastics enter the market for recycling include the following:

3.2. Reverse Vending Machines

As discussed previously, the implementation of consumer-driven RVMs enables source separation of uncontaminated waste plastic. RVMs must be complemented by a regular and reliable transport collection system, as any interruption to the logistic process can result in the vast accumulation of waste. Excess plastic beyond the processing capacity would inevitably lead to waste plastic entering landfills.

The HKSAR can refer to the established RVM system in Norway to improve the local recycling rate and quality of waste plastic (BBC News, 2018). RVMs not only enhance the quality and recycling rate of plastic but promote separation at source whilst incentives are provided as gift rewards or instant credit deposit. According to Yau (2010), the factor of reward systems (in the form of foodstuffs, daily household goods, cash coupons, etc.) was found to have a positive significant relationship ($p=0.001$ at 1%) on the per household weight of recyclables collected, in a study of $N=122$ of private housing estates in the HKSAR. This means that the implementation of reward systems together with accessible plastic recycling points in the form of RVMs should enable a source of reliable waste plastic feedstock to be established.

Several successful examples have demonstrated the application of RVMs in waste collection and segregation (e.g., Norway, Australia and China). RVMs are used as the main approach for plastic bottle collection in Norway. In 2016, Norway's plastic bottle collection rate reached an impressive 97%, while recycling figures reached 600 million plastic bottles (The Guardian, 2018). In Beijing, China, over 5,000 RVMs were operational by 2016, all supplied by Incom Recycle Co., Ltd. (Incom). Incom has expanded its business internationally and domestically since 2013, with joint ventures established with TOMRA and investments reaching RMB 300 million for the company's further development (Incom Recycle Co., Ltd., 2018). Both cases demonstrate RVMs' reliability as a solution for waste plastic segregation and collection, as well as a potential technique to raise the recycler's capacity for effective recovery and recycling of waste plastic in the HKSAR. The viability of plastic recycling is in line with the government's policy undertaken to achieve overall waste reduction by 40% as outlined in the Blueprint.

In 2021, the Environmental Protection Department (EPD) rolled out a pilot scheme in the first quarter to test out the application of reverse vending machines (RVMs) in Hong Kong for collecting plastic beverage containers. Initially, the EPD installed 60 RVMs in phases at locations such as public places, government facilities or shopping centres with suitable foot traffic for the public to try out, with the provision of an instant rebate ($0.1 per plastic beverage container) via e-payment platforms to encourage the public to return used plastic beverage containers. Positive responses from the public were received since the rollout of the pilot scheme. Stage 2 of the pilot scheme was launched in the second quarter of 2022 with the number of RVMs increased to 120. Stage 3 of the pilot scheme commenced in December 2023 and continues to provide enhanced RVM services to the public. All the plastic beverage containers collected are delivered to the government-appointed local contractor, for recycling to ensure the conversion of waste into resources. Over 212 million bottles have been collected through the RVM scheme. However, the lack of promotions and proper incentives does not build capacity and economic strength in the community.

3.3. Mixed Collection

The majority of MSW comes from constant production by commercial facilities. Partnerships between these corporations and the waste plastic recycling stream can be of mutual benefit, as cost savings can be realised from decreasing their waste disposal rate and avoiding waste plastics being hauled to landfills. However, this form of plastic collection requires sorting and decontamination in order to reach the desired quality to produce plastic pellets or recycled plastic goods. Unfortunately, the sorting and decontamination processes are labour intensive and are unattractive and unappealing for the younger generation to enter the workforce. In addition, land is another issue in Hong Kong as land is sparse in Hong Kong. Although automatic waste sorting technology, i.e., "Material Recovery Facilities (MRFs)" is readily available in the market, the high cost has deterred many investors. MRFs can be incorporated into future refuse transfer facilities on a larger scale to increase the recycling rate. In 2023, the Business Environment Council published a report reviewing the need for MRFs in Hong Kong and identified the current market gaps (BEC, 2023). Instead of implementing MRFs as refuse transfer facilities, Japan and South Korea have installed MRFs in building basements operated by building management companies. This approach has several benefits including:

- Reduction of waste disposed at landfills or waste-to-energy facilities;
- Lower transportation, hence, lower emissions; and
- Improved recycling.

3.4. Exhibitions and Indoor and Outdoor Events

Event-generated waste is one of the major sources of waste plastics. Large quantities of waste plastic, such as carpets and backdrops are generated from exhibition functions. These waste sources are uncontaminated and come in large volumes, making them a valuable source of waste able to produce high-quality post-consumer plastics.

Large-scale events organised in the HKSAR are encouraged to implement waste reduction strategies during and after the event, i.e., following guidelines in the "Waste Reduction Guidebook for Large Scale Event Organisers" published by the Environmental Protection Department, EPD, (EPD, 2018b). This guide targets the source separation of non-recyclables from recyclables and further separates recyclable waste into general categories of paper, metals, plastic, food and glass. The inclusion of a recycling contractor responsible for waste collection has also increased the number of recyclables collected and ensures non-contamination. For example, during HK Rugby Sevens 2016, Johnson collected 2.03 tonnes of waste plastic (mainly PET cups/plastic bottles) and delivered recyclables directly to the recycling plant (EPD, 2017).

3.5. Non-Governmental Organisations (NGOs)

NGOs hold regular activities and events that may produce waste plastics. For example, WWF-Hong Kong holds yearly events such as the Walk for Nature and Run for Wild that uses PVC event banners and foamboard signs. Green Power holds an annual Green Power Hike and encourages participants to pick up waste found en route, collecting both event and domestic waste that can be recycled. Friends of the Earth (HK) holds regular events and projects often producing PVC banner waste. The Hong Kong Clean-up has teams picking up waste to be disposed of; however, wastes are diverted to landfills if not separated at source. By creating a plastic 'pickup' service after clean-ups, waste plastic separation can be conducted during the clean-up to be recycled. This event is held on an annual basis and provides a continuous waste plastic source independent of major event frequencies.

3.6. Methods for Re-Processing

Pelletising

The feedstock, i.e., waste plastic, should be transported by local waste collectors, directly to the recycling plant to increase efficiency. Assuming that the majority of source separation has been completed, sorting of plastic can commence by separation into different types of plastic for recycling. The major composition of these sorted plastics are Polyethylene (PE), Polypropylene (PP) and Polyethylene Terephthalate (PET). Non-recyclable solid waste, such as sand and rock, is segregated from the waste plastic by automatic sorting machines, and then collected and handled by a licensed waste collector.

Waste plastic is shredded into small pieces, and washed. After washing, centrifugal dewatering with steam drying and centrifugal separation take place. Plastics of different density are segregated and transferred into the furnace separately. Based on the properties of each type of plastic, the furnace adjusts the temperature and screw extruder speed to thoroughly mix the plastic under the screw extrusion. The major function of this process is to physically mix the plastic and to heat the waste plastic to within a certain temperature range by the electric furnace. The melted plastic is extruded into strands, solidified along the water tank, dried (i.e., yarn formation within water, temperature of the yarn to be controlled, water is reused via circulation without discharge and with the regular addition of make-up feedwater), pelletised into recycled plastic pellets, and finally packaged for dispatch. Typically, a pelletising plant is capable of handling 48 tonnes per day.

Centralised vs. Distributed Mechanical Recycling Systems

Large environmental impacts differ depending on whether the process of extrusion and pelletisation occurs in the source plant or the recycling plant. Distributed systems with internal pelletisation processes have a larger environmental impact compared to centralised systems, due to higher impacts associated with the extrusion and pelletisation process (85% of the total global warming potential), compared to just 60% in centralised systems. This is under the assumption that no fillers and additives are used. The addition of fillers and additives into a centralised recycling system has been found to contribute to 60% of the environmental impact (Gu and et al., 2017). The HKSAR currently has 184 private plastic recyclers registered on the EPD's directory, meaning that the current framework comprises multiple distributed systems in place at low capacities. There is a large potential for the government to establish a system of centralised recycling by expanding the currently established recycling plants and collection networks, rather than continued development of individual recycling plants. This not only increases the recycling efficiency but paves the way towards normalised recycling infrastructure.

Alternatives to Mechanical Recycling

Alternatives to the current recycling structure of mechanical recycling with a high rate of material and quality loss are available.

NF Board Production

A study by Chen et al. (2011) showed that NF board production has the highest potential for reducing greenhouse gas emissions compared to other forms of recycling methods such as the production of waste plastic syngas and use of plastic as a reductant in iron blast furnaces. NF boards have the potential to reduce emissions by 254 $ktCO_2eq$ per year, assuming 210 kt of waste plastic collection per year. Between 2009 and 2017, 3.7 million NF boards had been sold in Japan (JFE, 2025).

Waste to Energy: Refuse Plastic Fuel (RPF)

RPF can be in the form of fuel or syngas depending on the method used to treat the waste plastic. RPF is used extensively in developed countries all across the world since it can produce an equal or even higher amount of heat than coal can and RPF has been widely used in Japan for over 30 years (DECOS, 2025). Two main methods exist for treating waste plastic—pyrolysis (turning into fuel) and gasification (turning into syngas) (Khoo, 2019). RPF has the highest potential in reducing fossil fuel consumption, saving 1.66 $ktce$ per year when used as an alternative. The implementation of these two strategies together can further decrease greenhouse gas emissions by 93 $ktCO_2eq$ per year and 12 $ktCO_2eq$ per year. Not only is this method energy efficient, but it eliminates the issue of large waste volumes being directed to landfills. Currently, there is no RPF facility in Hong Kong. In Asia, Vietnam is adapting RPF whilst Lotte and Resonac's new plant for the chemical recycling of used plastic packaging via gasification commenced operation in October, 2025 (Resonac, 2025).

Waste to Energy: Integrated Waste Management Facilities (IWMF)

An alternative to plastic recycling and conversion to RPF is the direct energy recovery from the incineration of unsorted waste plastic, including plastic in unsorted MSW. This method eliminates the requirement for pre-treatment and allows energy recovery from otherwise landfilled waste. With the HKSAR's construction of the Integrated Waste Management Facilities (IWMF) (Phase 1), to be in operation by 2025, it shall serve as the route for remaining non-recoverable plastics for energy recovery. This route is the least favourable compared to the various recycling methods, as it does not eliminate the demand for plastic production (and crude oil). Despite the inability to recycle, the IWMF will be crucial to the diversion of MSW from landfills. The implementation of recycling strategies such as RVMs or existing/planned plastic recycling infrastructure, will not meet the capacity required for tackling or reducing the overwhelming amount of waste plastic produced in the HKSAR. Thus, the IWMF and plastic recycling should not be mutually exclusive as the IWMF does not participate in the post-consumer plastic market. The IWMF should be the last route chosen in waste plastic recovery.

The above three strategies were chosen as they are highly applicable in the HKSAR. Regarding NF boards, the construction industry accounted for 5.1% of GDP in 2017 (Census and Statistics Department, 2019). The introduction of RPF serves as an alternative to the primary source of energy derived from coal (38% in 2017) (CLP, 2017). The IWMF can treat 3,000 tonnes per day of MSW from landfills in the form of energy, and about 19.5% is plastic. Hence, these alternatives have a large potential to be integrated into the current framework.

4. Environmental and social benefits

Plastic usage influences the environment both upstream (where raw materials are acquired and processed) and downstream (waste disposal impacts and reprocessing into end products). Recycling unwanted waste plastics reduces this impact.

4.1. Impact of Waste Plastic on a Global Level

Although marine plastics are not officially classified under the planetary boundary of novel entities due to data gaps in confirming its disruptive effect on Earth's system processes, it has already created a source of pollution that is almost impossible to reverse and is visible on a planetary scale (Villarrubis-Gomez, et al., 2018). The presence of plastic has penetrated the deepest place on Earth, i.e., the Mariana Trench (Gibbens, 2018), and formed the Great Pacific Garbage Patch from Japan to California (National Geographic, 2014). The ingestion of waste plastic has already been normalised in our current marine environment where over 2/3 of global fish stocks have plastic in their systems, in addition to direct ingestion by sea and land birds (Rainbow Light, 2015). The management of waste plastic therefore requires the large-scale implementation of action to prevent the crossing of this boundary by first halting the further worsening of plastic pollution. It is therefore a prerequisite to create a recycling pathway for waste plastic in HKSAR which creates products of value from discarded materials. The diversion of plastic away from disposal into landfills minimises leakage into our environment.

4.2. Reduced Waste and Pollution

The diversion of waste plastic from landfill streams to a recycling stream not only halts the volume of plastic pollution generated but reduces the pressure on the limited landfills in the HKSAR. The nature of landfills with minimal exposure to light also prevents plastic from biodegrading. According to Earth911, 5.65m^3 of landfill space is saved per tonne of recycled plastic.

4.3. Conservation of Fossil Fuels and Energy

Recycling plastic reduces the demand for virgin plastic, which is produced from crude oil fossil fuels. The substitution of virgin plastic pellets with recycled ones saves up to 50% reduced greenhouse gas emissions by 45,830 tonnes CO_2eq and the consumption of 52,528 tonnes of oil equivalent in 2016 for China (Gu, et al., 2017). In addition to the ability to offset the use of fossil fuels, the recycling process itself is significantly less demanding. Studies have shown that the energy required to produce recycled PET resin flakes is 16% of the energy required to produce the equivalent amount of virgin PET resin flakes (Franklin Associates, 2011).

5. Economic feasibility in the HKSAR

5.1. Market Opportunities and Incentives

The plastic recycling market is large and growing despite a declining growth rate, due to the impacts of Operation Green Fence. The price of plastic recycling has increased due to rises in production costs regarding fuels, energy and logistics. Despite the constraints, the demand for recycled plastic products is projected to drive the future growth of the plastic recycling market. Major factors determining the demand for plastic recycling include:

- Inherent value of plastic: the opportunity cost of landfilling or incinerating plastic is estimated at 495 Euros per tonne of waste plastic (Gradus et al., 2017). Coupled with the development of a cost-efficient recycling infrastructure, the cost of recycling has the potential to drop substantially from the current rate of 767 Euros per tonne.

- Our reliance on plastic: a majority of daily necessities and goods consist of plastic; hence the demand for plastic is not expected to decline.
- Endless supply of plastic resources: plastic is one of the most prominent sources of waste, often discarded with remaining value in the product. The burden of waste plastic is especially severe in the HKSAR, where landfills are scarce. Plastic recycling allows plastic production while halting the net increase in plastic volume, thereby reducing environmental pressure.
- Conservation of energy and natural resources: the process of recycling plastic is more energy and resource efficient than the production of virgin plastic, as explained in Section 2.3.3. Plastic recycling is able to reduce the use of natural resources including cellulose, coal, natural gas, salt and crude oil that would otherwise be used in the production of virgin plastic.
- Clearing up landfill space: the redirection of waste plastic away from landfills increases its capacity to be allocated for other non-recyclable wastes. The reduction in landfilled plastics also reduces the landfill gas emissions associated with the release of toxic fumes during plastic degradation. The effects of toxic fumes include lung and skin diseases.

Table 1. SWOT Analysis.

Strengths	Weaknesses
Environmentally friendly	Lack of funding for recycling
Environmental benefits	Poor public participation
Reduction of virgin resource consumption	Undeveloped markets for post-consumer plastic products
Mature recycling technologies	Lack of local expertise in plastics recycling
Readily available	Unavailability of pelletising machinery
Demand for recycling plastic	Lack of labour
Reduces plastic pollution	Low recycling rate
Well-developed transportation	Higer cost compared to virgin materials
Conservation of resources	Cross-contamination of materials
Increased employment	
Opportunities	**Threats**
Occupies a niche market where the effects of disruptive innovation are likely to be felt	Disruptive innovation is likely to create negative relationships with dominant market players such as virgin plastic producers
Competitive pricing will shift public demand towards post-consumer plastic products	New environmental legislation and regulations
Employment opportunities	Local and global competition
Collaboration with users	Economic downturn
New recycling technologies	Accident / spillage potential
Regulations and policies	Dominance of virgin materials
Change in consumer behaviour	Infrastructure gaps
	Negative perception of recycled plastic

5.2. Potential Post-Consumer Plastic Products

Targeting the Design of Plastic Products

The effectiveness of the recycling industry concerns stages beyond the disposal and recycling stages of waste, where source separation of plastics will not be enough to achieve maximum levels of recycling. It also requires the initial design and production of plastic products to be easily treated at their end of life stage in order to create a closed loop system. The ability of creating high-quality polymers from waste plastic determines what product can be produced from feedstock, i.e., the issue of downcycling. Products should be well designed by avoiding black pigmentation and mixed plastic layers. Only pure forms of plastic should be used, i.e., all PET or all PP. It was found that improving the recyclability of products potentially increases recycling rates by up to 23% (Eriksen & Astrup, 2019).

Building Materials

Several studies have demonstrated the potential use of recycled waste plastic in the construction industry, such as concrete, resin binder, fine aggregate and wood plastic fibre (Okeyinka et al., 2015; Perera et al., 2022; Almohana et al., 2022; Yildirim & Yanilmaz, 2023; Das & Ali, 2025; Kareem et al., 2025). Waste plastic can be transformed via transesterification reactions and then used in the production of plastic-reinforced concrete. In comparison with conventional Portland cement concrete, plastic reinforced concrete demonstrates improved tensile and flexural strength. By applying chemical treatment, the compressive strength of plastic-reinforced concrete can be improved as well (Sharma & Bansal, 2016). The rapid urbanisation and industrial development in China have given rise to significant demand for aggregates and other construction materials. In 2018, the global market for construction aggregates had a value of USD 360 billion. The market is projected to grow with a compound annual growth rate of 4.6% from 2019 to 2025 and generate approximately USD 490 billion by 2025 (Zion Market Research, 2019), where the Asia Pacific region is expected to dominate the future global market. The continuously growing construction market in China provides a potential market for use of recycled waste plastic.

Using shredded PET plastic bottles as sand substitution aggregates in cementitious concrete composition was also demonstrated by an experimental study (Sharma & Bansal, 2016). The successful application of plastic-reinforced concrete, including bush roads, tunnel supports and bridge piers has been shown in Japan. In Kanagawa Prefecture, a bush road with a length of 20 metres and a width of approximately 5 metres was paved with plastic-reinforced concrete (Ochi et al., 2007). The composites not only provide consistent properties in construction material with relatively low cost, but also act as one of the solutions for the increasing amount of waste plastic in the HKSAR. With the continuously increasing demand for residential housing, waste-plastic-reinforced concrete offers a low-cost construction material to meet the growing demand for construction materials in the HKSAR and China's markets (Turner & Townsend, 2018).

Picking and Harvest Baskets

The operating revenue for plastic crates in China has grown from USD 11,773 million in 2008 to USD 22,498 million in 2012. This is projected to continually grow to USD 32,196 million by 2020 (Statistica. 2018). The compound annual growth rate of the Asia Pacific Region (excluding Japan) is projected to be 7.2% from 2018 to 2028, which is the highest among all regions (Future Market Insights, 2018). The primary target industry of this product is agriculture, including usage in supermarkets. These industries have continued to expand, together with the demand for baskets. The gross output value per RMB 100 million in total agriculture has increased each proceeding year from 2013 to 2017 (National Bureau of Statistics of China, 2017). This product also targets the growing industry of online supermarkets, which is projected to grow by 286% by 2023, accounting for 11.2% of China's total grocery market (IGD, 2018).

Plastic Pallets

The demand for plastic pallets is expected to grow with the market for e-commerce and Third-Party Logistics (inventory and shipments). In 2015, China's online retail market accounted for 35% of the global online retail market, which was projected to increase to 50% in 2019 (Deloitte, 2016). Although not a primary challenge, the problem of logistics costs, construction and efficiency are one of the nine main strategies among the development of mobile applications, cross border e-commerce and developing information systems, in the online retail business model. The recycling industry may choose to supply plastic pallets during booms in the online retail industry.

Plastic Trash Bags

The global market for plastic bags (including sacks and trash bags) had a value of USD 19,867 million in 2017. This is projected to increase at a compound annual growth rate of 3% from 2018 to 2026 (Transparency Market Research, 2018). The Asia Pacific Region (excluding Japan) holds the largest market share for plastic bags in which High-Density PE (HDPE) materials are chosen over Low-Density PE (LDPE) or bio-degradable materials. HDPE plastic bags are therefore the most suitable material for China's market. The market for trash bags is also expected to remain stable in the future as the use of bio-degradable plastics is still at a non-disruptive level.

CEPA Agreement

Mainland China charges tariffs, valued added tax (VAT, on almost all products) and consumption tax (on some products) on their imports. Following the Mainland and HKSAR Closer Economic Partnership Arrangement (CEPA) signed in 2003, exceptions were included to the usual customs procedures and allowed for tariff-free importation. This brings benefits to both business enterprises and the HKSAR economy as a whole.

Under CEPA, HKSAR-manufactured products can be imported to Mainland China tariff free, provided that manufacturers request this tax-free treatment and agree to the CEPA Rules of Origin (ROO) to ensure that everything is made in the HKSAR.

6. Conclusion

The challenges of the HKSAR's waste plastic recycling were evaluated in this study. Recycling of the HKSAR's waste plastic has largely relied on exports. With Operation Green Fence, the export of waste plastic is no longer a viable management method. The HKSAR may increase the local plastic recycling capacity to respond to the market change, while lessening the burden on the landfills, in addition to increasing consumer-driven incentives for source segregation systems for mixed solid waste. RVMs are identified as one of these solutions, which can promote separation at source using incentives of instant bonus gifts upon deposit.

After the collection of waste plastic and transportation to the recycling facilities, waste plastic can be reprocessed using mechanical plastic recycling to manufacture a wide range of recycled plastic products, such as building materials and picking and harvest baskets. Other treatment methods include NF board production, the production of RPF and energy recovery.

The development of waste plastic recycling infrastructure is crucial to handling the sheer volumes of waste produced, in addition to taking advantage of the growing plastic recycling market in the forthcoming years.

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