

Neighbourhood Bottle Reward Scheme

A pilot scheme on the establishment of a single-use
plastic beverage bottle recycling network

An Industry Support Programme funded by the Recycling Fund (ISP-1920-16-007)



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Many thanks to the Working Group's committees and participants for their support before and during the pilot project. ADM Capital Foundation, on behalf of the Single-Use Beverage Packaging Working Group and with the financial support of the Recycling Fund, has engaged Dr Benjamin Steuer and Wealth of Flows Consulting Limited to carry out an independent research project on the design, operation, and outcomes of 'A pilot scheme on establishment of a single-use plastic beverage bottle recycling network; an Industry Support Programme funded by the Recycling Fund (ISP-1920-16-007)'. Views expressed in this report may not necessarily be the same as the position of ADM Capital Foundation, the Single-Use Beverage Packaging Working Group, or each individual member.

The Recycling Fund aims to promote the recovery and recycling of waste, by facilitating the upgrading of the operational capabilities and efficiency of the recycling industry to achieve the policy objectives of waste reduction in Hong Kong as pledged in the Blueprint and to address some of the bottlenecks and constraints in the recycling industry. The Recycling Fund's Industry Support Programme provides funding support for non-profit distributing organisations such as professional bodies, trade and industry organisations, research institutes and other industrial support organisations registered in Hong Kong to undertake non-profit making projects which can assist the local recycling industry in general or in specific sectors in enhancing their operational standards and productivity.

The Single-Use Beverage Packaging Working Group (the Working Group) is a coalition of beverage manufacturers and importers, waste handlers and recyclers, institutions, retailers and NGOs in Hong Kong. The Working Group's Drink Without Waste initiative seeks to reduce the volume of used beverage packaging going to waste by 70 to 90 percent.

Dr. Benjamin Steuer is an assistant Professor at the Division of Environment and Sustainability within the Hong Kong University of Science and Technology. His main research is centred on the Circular Economy and waste recycling in Hong Kong and mainland China. Active in the field since 2012, he has conducted major research projects in China, in parts financed by the European Union, on ship recycling, e-waste recycling and the informal recycling sector.

Wealth of Flows Consulting is a Hong Kong based consultancy specialised in circular economy, solid waste policy, and environmental strategy. The firm has a strong pedigree in international strategic management consulting, circular economy thought leadership, and turning business and environmental interests into a joint pursuit. Its team is dedicated to helping organisations find the straightest path towards circular models.

Disclaimer

Any opinions, findings, conclusions, or recommendations expressed in this material do not reflect the views of the Government of the Hong Kong Special Administrative Region, or the Advisory Committee on Recycling Fund or the Recycling Fund Secretariat.

The field survey findings presented in this document are those of the author, Dr. Benjamin Steuer, and do not necessarily represent the views or the work of Hong Kong University of Science and Technology R and D Corporation Limited.

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Summary

Introduction

A pilot scheme on the establishment of a single-use plastic beverage bottle recycling network, with a total budget of HKD 5.6 million, was funded by the Industry Support Programme under the Recycling Fund (ISP-1920-16-007). The aim of the scheme was to identify and develop viable collection pathways for plastic beverage bottles in Hong Kong, to facilitate recycling. To that end, it aimed to deliver insights into collector motivations, collection logistics, and workable administrative arrangements that could be used to inform future policy of Producer Responsibility Scheme.

Working under the central premise that there is an opportunity to leverage Hong Kong's existing recycling network and maximise its effectiveness by providing a financial incentive, insights were gained through:

- the recruitment and development of an informed and trained network of street corner shop recyclers/mobile recyclers and informal collectors;
- the trialling of various parameters such as incentive size, required subsidies for handling, and contractual arrangements; and
- the analysis of collection results as well as drivers for success.

Participation of recyclers grew significantly throughout the project, demonstrating stakeholders' confidence in the effectiveness and economic benefit of the scheme. In total,

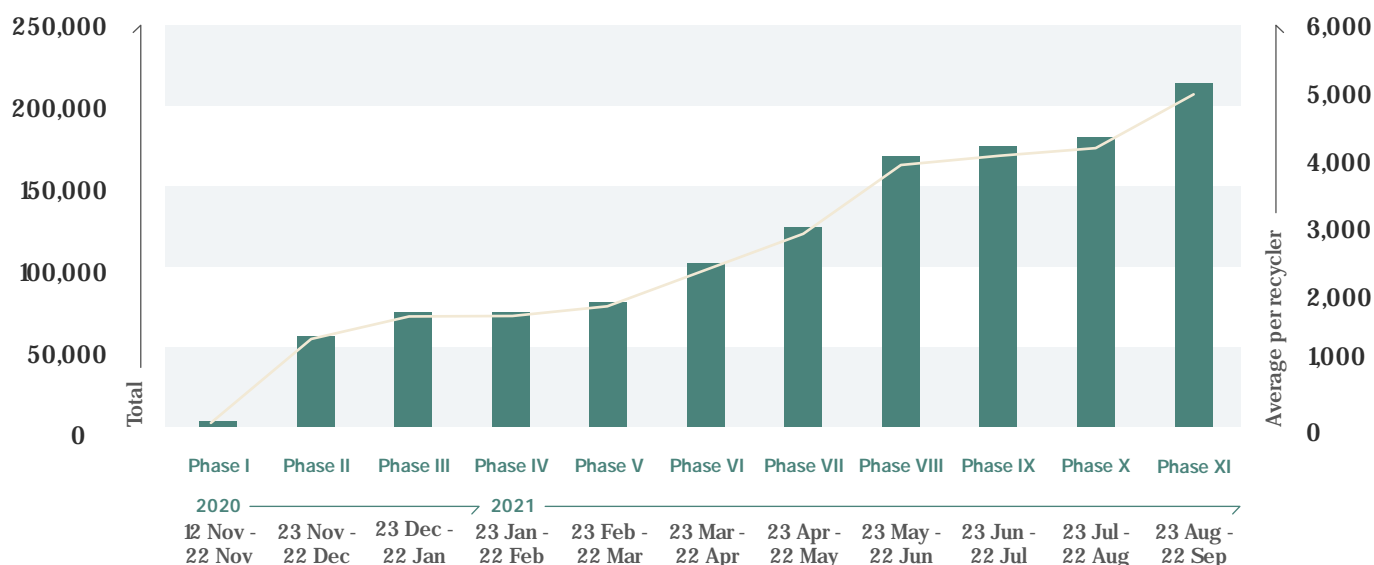
over **1000** cleaners  and **44** recyclers  benefitted from this pilot programme.

Field surveys and exit interviews indicated many would have liked the scheme to continue.

Under the pilot scheme, a total of **HKD 4,183,730** was paid out to the recycling community. Subsidies of five cent per bottle to cleaners and other frontline collectors constituted a total of **HKD 2,461,017** or 59 percent. The other 41 percent went to the participating recyclers in the form of handling subsidies.

Results

Monthly Volume (kg)



The scheme proved highly effective and met and surpassed its collection goals. From mid-November 2020 to mid-September 2021, the scheme subsidised the collection and recovery of more than 1,200 tonnes of plastic beverage bottles or an estimated 50 million bottles—more than double the project recovery target of 500 tonnes.

The scheme can inform the principles and mechanisms of achieving Government's waste management goals. Lessons learned throughout all phases of the scheme can inform many design and execution aspects of policies that Government has already decided on (like Municipal Solid Waste Charging), is actively developing (like the Plastic Producer Responsibility Scheme for Beverage Producers) or considering (like those referred to in the Waste Blueprint 2035).

The scheme illustrates well the immense potential of existing collection networks. Not only did the scheme over-deliver; in its last month, the scheme collected over 210 tonnes, a nearly 20% growth over the previous month. This illustrates that the potential of participating recyclers and collectors was not yet fully tapped. Moreover, since the pilot scheme only covered a fraction of Hong Kong's recyclers and their associated frontline collector networks, further contributions to Hong Kong's recycling needs could also be achieved through expansion of the network.

The scheme demonstrates a cost-effective, robust, and scalable collection model for Hong Kong. The estimated cost per plastic beverage bottle recovered through this scheme was HKD 0.11. This compares favourably with collection programmes in other jurisdictions.¹ 45% of this unit cost consists of the subsidy for the frontline collector, overcoming the barrier of missing economic incentives due to low market value. About one third goes towards the recyclers. Providing compensation for the handling costs of mobile and stationary recyclers is best practice for systems that want to achieve a high level of accessibility for their collectors. The final 23% of the cost associated with each recovered unit stemmed from the management of the project. This last cost component could be managed down in a larger-scale system before high recovery targets start driving up the marginal cost. The programme was not shown to be fraud-prone and managed to deliver large collection volumes for a low unit cost, more so than any other channel in Hong Kong.

Recommendations

The scheme's results make bulk collection through existing networks an obvious candidate for inclusion in any future beverage packaging recycling policy for Hong Kong. Specifically:



Financial incentives are effective. The incentive must be sufficiently high to overcome the opportunity cost. For that reason, even a small incentive can be effective in enticing individuals and organisations to engage in these collection activities. This is especially true for those already formally or informally active in cleaning or recycling related activities.



A producer responsibility scheme for beverage producers and importers (PPRS) could be more effective if an incentive for collectors—whether in the form of a deposit or Value-on-Return—were to be added. Such a PPRS would also benefit from explicit payment for the services of the recyclers, rather than relying solely on the market value of the collected plastics, which tends to be volatile and may lead to recyclers dropping out more readily.



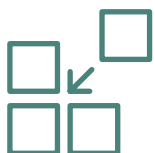
Bulk collection points are required. Household-, building-, and street cleaners are critical agents in the collection network. Building cleaners tend to drop off large volumes (a median of 400 units per transaction) and cannot spend the time to feed individual bottles into a reverse vending machine (RVM) or have them counted one by one manually. A future collection network to support a PPRS should include bulk collection points.



Existing networks of large-volume collectors and recyclers are effective. Through these networks, meaningful volumes of used plastic bottles are collected. This despite the networks' already high to very high utilisation rates. Relationships between the recycler and the cleaners who collect and supply materials, the processors that buy the materials (and the transporters with whom they interface), and with the neighbourhood are already established. While or maybe because frictions do occur, these relationships are tried and tested, and ready to try out new opportunities. Future programmes should explicitly aim to adopt such agents as nodes into the network, in addition to newly developed ones.



Location matters. Since beverages are consumer products, collection points of used packaging must be relatively close to where consumption happens. A balance must be struck between proximity and logistics. Whereas proximity drives up collection rates, it can also be a key driver in high logistics costs, both because of difficulty of access and number of stops. There are also considerable issues with storage space. Those ‘pop-up’ recyclers that set up shop in residential areas but remove all materials by end of day prove to be effective in balancing these various needs.



Space and other support matter. While the collection and processing of beverage bottles can be a profitable and even lucrative for Hong Kong’s processors, recyclers, and collectors, the value chain is fragile. Market prices are volatile, tenancies are short, space is always a scarce commodity. For these reasons, subsidies or remuneration coming in through government; through a producer responsibility mandate; or through voluntary financing by industry, are required. Importantly, support also needs to come from those parties that own and manage spaces in Hong Kong. Often, the commercial space rented or leased is not sufficient to add a bulky activity like plastics collection. The resulting use of common public or private space could be condoned by Property Management Office, District Councillors, FEHD, Lands Department, Housing Authority, and others. This could be facilitated by a regularisation of such uses through the creation of Tolerated Areas for recyclers with a fixed location and Hawker Licenses for mobile recyclers.



A chain of custody benefits all actors. Producing strong recycling outcomes through recycling facilities—locally or after export—that are safe, environmentally sound, and socially correct, is critical. Creating a transparent and verifiable flow of recyclables to reassure the Hong Kong public of what is happening to this material and increase their desire to return beverage packaging to the correct return location. A strong chain of custody for a bulk collection system can therefore also benefit collection channels that have a stronger consumer focus. To that end, based on the insights from the pilot and anticipating significantly scaled-up transaction volumes and participant numbers, any future scheme should feature user-friendly interfaces for record entry; a data room and digital record keeping to facilitate the reconciliation of records and verification of transactions; a programme of field visits to both recyclers and processors; a portfolio of data-driven fraud detection techniques and mechanisms; and strong and nuanced consequence management. Pre-qualifying processing operators is also a necessity, while adding traders to the pool, under the condition that their destinations are known and documented, should be considered. A trip ticket system to facilitate record keeping and system monitoring could also be beneficial.

With this report, the authors hope to provide all actors—those in pursuit of better beverage packaging recycling outcomes for Hong Kong—with access to the scheme’s data and insights so as to inform, expand, and improve future programmes.



1.0

Introduction



1.1

The current state of beverage packaging waste in Hong Kong

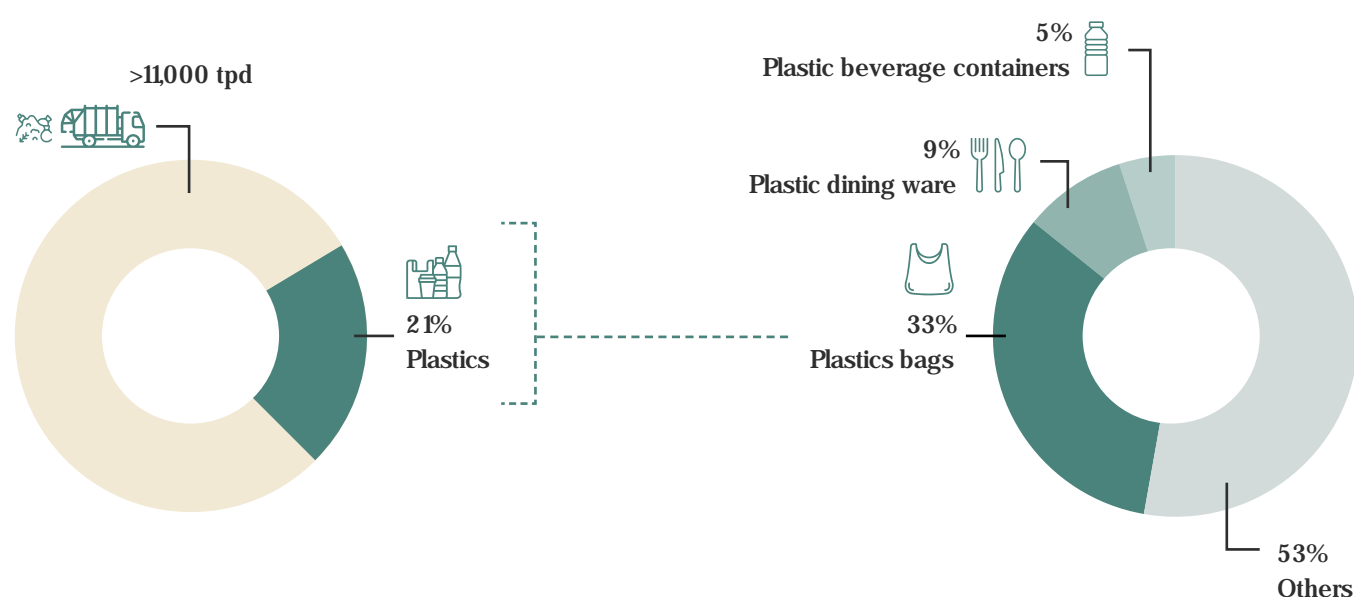
Municipal Solid Waste (MSW) generation per capita in Hong Kong dropped by two percent in 2020 versus the previous year, with its Gross Domestic Product (GDP) and GDP per capita dropping by four and a half and four percent, respectively, over the same period.

The export of recyclables collected in Hong Kong dropped in 2020 by 9 percent versus the previous year, due to challenging market conditions and stricter import controls imposed by nearby jurisdictions.²

Domestically, however, recyclables collection volumes went up by 11 percent, with the amount of plastics collected for domestic recycling going up by 27 percent. Government attributes these growing volumes to the expansion of its community recycling network and the initiating of an all-plastics recycling pilot scheme.³

While beverage packaging does not make up the largest part of Hong Kong's MSW (see for example Figure 1 for plastic beverage bottles, which only make up around 2%), their end-of-life fate should and could be addressed. Packaging waste related to beverages is projected to grow and, with the exception of metal cans (85% according to estimates)⁴, hardly any of it is being recycled today—only 17% of the PET beverage bottles sold in the Hong Kong market in 2019, for example.⁵

Figure 1. Daily Municipal Solid Waste disposal volumes (2019)⁶



There is, however, a unique opportunity to change this picture. A vital piece of legislation for an improved management of Hong Kong's waste—the Municipal Solid Waste Charging bill—finally passed a critical legislative hurdle in 2021. Moreover, from January to March 2021, the HKSAR Environmental Protection Department conducted a public consultation on expanding Hong Kong's producer responsibility legislation to cover plastic beverage bottles, and it is now in the process of drafting.



1.2

Piloting a new collection approach for beverage packaging

A pilot scheme on establishment of a single-use plastic beverage bottle recycling network was funded by the Industry Support Programme of the Recycling Fund (ISP-1920-16-007). The scheme was designed and executed by Designing Hong Kong Limited, on behalf of the ADM Capital Foundation and under the advice of the Single-use Beverage Packaging Working Group. The aim of the scheme was to identify and develop viable collection pathways for plastic beverage bottles in Hong Kong, to facilitate recycling. To that end, it aimed to deliver insights into collector motivations, collection logistics, and workable administrative arrangements that could be used to inform future policy of Producer Responsibility Scheme. These insights were gained through:

- the recruitment and development of an informed and trained network of street corner shop recyclers/mobile recyclers and informal collectors;
- the trialling of various parameters such as incentive size, required subsidies for handling, and contractual arrangements; and
- the analysis of collection results as well as drivers for success.

1.3

Hypothesis & objectives

(Based on the work of and observations by the Working Group)⁷

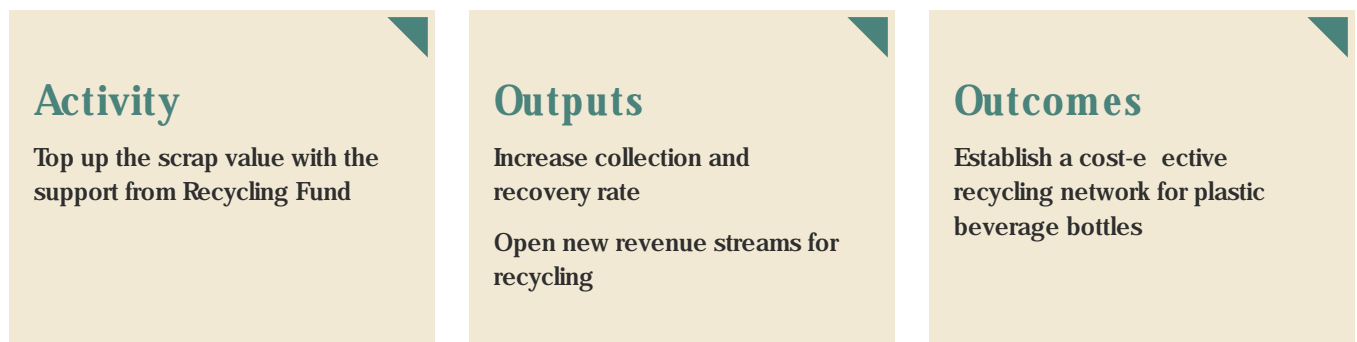
A. Stated scheme hypothesis	B. Stated scheme objectives
1. Lack of a cost-effective collection network of plastic	1. Identify and develop a cost-efficient collection network for plastic beverage bottles by recognising the role of informal sectors e.g. cleaners and frontline collectors.
2. Low motivation and monetary incentive along in the recycling market for plastic recyclables (see Figure 2 for a comparison with other packaging recyclables)	2. Popularise plastic beverage bottles as recyclables and unlock its recycling market in Hong Kong to improve collection and recycling rates.
3. Low capacity in the current recycling chain on plastic recycling and recover	3. Evaluate, support and build capacity in the current recycling chain for plastic beverage bottles.
4. Large fluctuations in recyclables prices; extremely dependent on foreign import policy and commodity market on recyclables	4. Policy recommendation on Producer Responsibility Scheme (PRS) and provide reference for other beverage packaging types.
5. Lack of public confidence in the recycling system and recycling outcomes	

1.4 Theory of change

How did this pilot aim to shift Hong Kong's poor record for plastic bottle recycling? The central premise is that there is an opportunity to leverage Hong Kong's existing recycling network and maximise its effectiveness by providing a financial incentive.

Hong Kong has a thriving collection network for recyclables that bridges the logistics gap between the source of waste and recyclables (consumers and businesses) and their Hong Kong destination (processors or traders). This network includes tens of thousands of collectors: building cleaners, street cleaners, and informal collectors. They may rely on recycling as a primary or supplementary source of income and historically have focused on paper/ board and metals.

The second layer of the network consists of material consolidation points, in the form of recycling shops and mobile recyclers. There are hundreds such recyclers in Hong Kong, some with multiple locations or multiple collection vehicles.

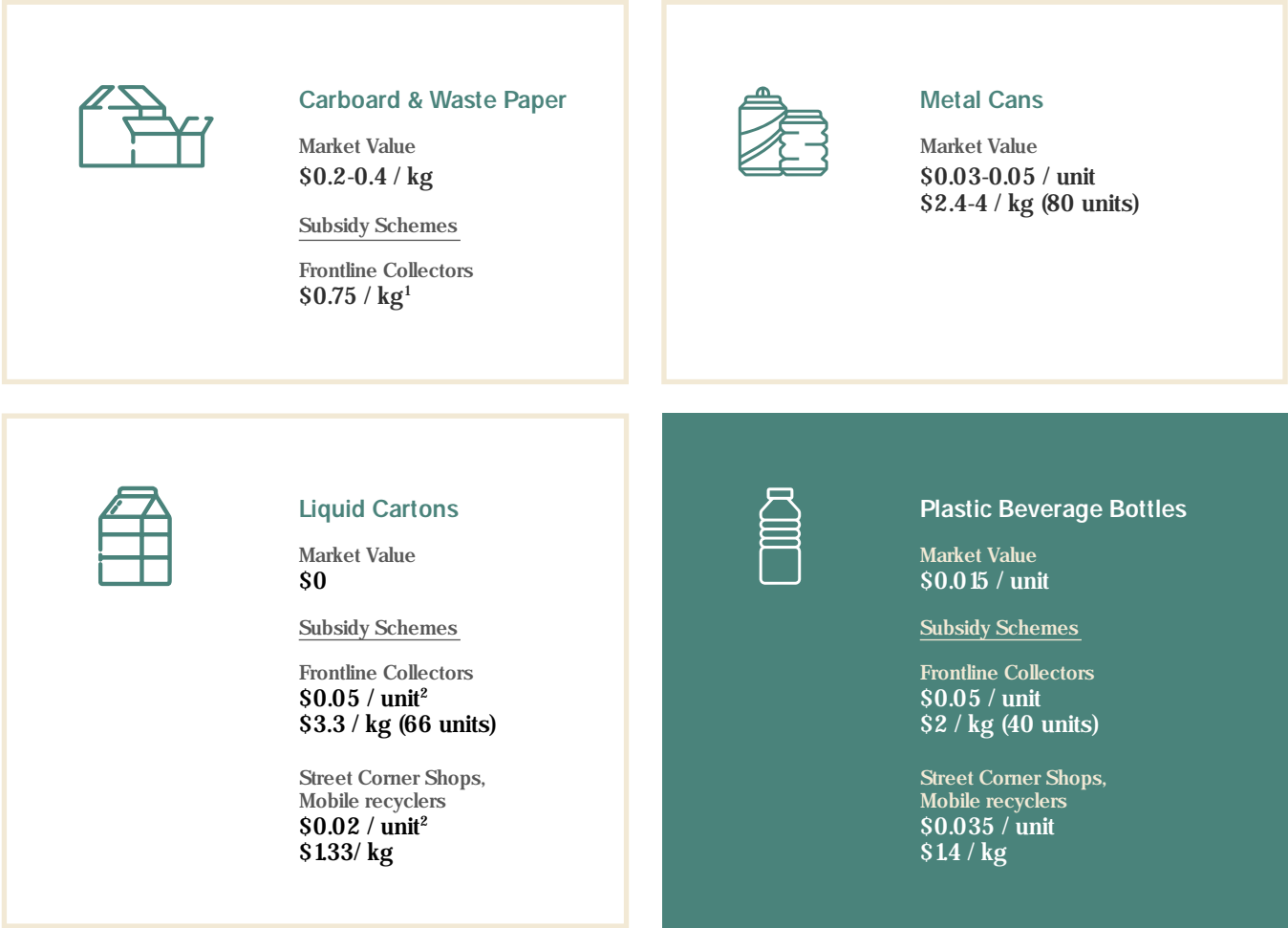


The pilot scheme's ingoing theory was that the main challenge of recovering used beverage bottles through this network, then, was the low economic value associated with those bottles (Figure 2). Compounded by practical challenges for recyclers, cleaners, and other frontline collectors, the resulting opportunity cost proves prohibitive for most.

The lack of local and international market value has been at times also an issue for the collection of paper and board recyclables. This was previously addressed through a pilot programme that was financially supported by the Recycling Fund. In September 2020, after successful completion of the pilot, a government programme titled Waste Paper Collection and Recycling Services was initiated. Collection/trade contractors under this programme, as well as associated partners like recycling shops and mobile recyclers, are required to provide economic incentives to purchase wastepaper that meets the specified quality standard from frontline collectors and other wastepaper producers at a price that is not less than the designated recovery price. This designated price is to be regularly adjusted according to the actual selling price of wastepaper in the market.⁸

Similarly, a pilot was launched by Green Power, a local NGO and financially supported by the Recycling Fund, to collect liquid cartons for recycling. Under this “Drink Cartons Recycling Cash Reward Programme”, frontline collectors were guaranteed HKD 0.05 per carton, equivalent to HKD 3.3 per kilogram, while recycling shops and mobile recyclers would earn HKD 0.02 and exporters or transporters HKD 0.01 per carton.⁹

Figure 2. Offering a subsidy to overcome the recycling incentive barrier that plastic beverage bottles are suffering from ^{10,11}





2.0

Pilot Methodology



2.1 Design

This section describes the scope of the project, its planned and actual timeline, its original and adjusted budget, the team setup, and the governance that was put in place.



Scope

The pilot focused entirely on plastic beverage bottles made of polyethylene terephthalate (PET), high-density polyethylene (HDPE), or polypropylene (PP), for the following reasons:

Beverage packaging:

The initiative was driven by the work done by the Working Group on how to recover and recycle more beverage packaging in Hong Kong. While the team recognised that many elements of the pilot could be replicated, scaled up, or adapted for other packaging too, it decided to retain this scope in order to simplify the pilot and maximise the benefit of the expertise of the Working Group and its members.

Plastic beverage bottles:

The team recognised that non-resealable beverage packaging such as liquid cartons require different collection mechanisms and decided not to complicate the pilot. Moreover, as described in 14, another pilot was being funded by the Recycling Fund, with the explicit aim of collecting liquid cartons with a planned collection period of 1 July 2020 to 31 August 2021.

PET, HDPE and PP:

Together, these resins make up over 90 percent of all plastic beverage bottles on the Hong Kong market. Moreover, recycling and trading options for polystyrene (PS) packaging is currently limited in the market, so it was decided not to focus collection there.



Timeline

Introduction

The project period was confirmed as 31 July 2020 to 30 July 2022 (Figure 3).

Figure 3. Timing of the pilot

	Preparation & Recruitment			Operation Period					
Month	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
	Aug-20	Sept-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21
Collection Target				Collection Target: 0.2m unit/ 5 tonnes of bottles					
				Collection Target: 10m unit/ 250 tonnes of bottles collected					
				Collection Target: 20m unit/ 500 tonnes of bottles					
Recruitment	2 sta s Recruitment								
		Recycling Shop/ Mobile Recycler Recruitment (>30)							
		Steering Committee Recruitment							
			Volunteers Recruitment (1-19)						
Actions & Report Submission				Check at least 5 shops each month; Audit Report (Monthly basis)					
				Visit 7 shops each month; Summary report of spot checks by the end of the period					
Other Tasks		Poster and enquiry hotline ready, and display in the shops							
		2 promotional seminars							

[illegible]

Project preparation and recruitment

The project team was recruited in the first month of the project and consisted of a project officer and a project assistant, who took up their role the same month. The team was recruited by Designing Hong Kong, on behalf of ADM Capital Foundation. Due to the success of the scheme, the project team's workload was higher than anticipated, resulting in more hours worked. This was addressed by a combination of part-time hires and a salary increase from May 2021 onward.

Volunteer recruitment and training: The announcement was circulated in early September 2020 and in the second half of October two training workshops were conducted.

Recycler recruitment took place in two waves. In the first wave, from September to November 2020, 30 recyclers were contacted and 23 were confirmed. By June 2021, that number had more than doubled. In total, 53 recyclers were confirmed for the scheme (see also page 27 & 57).

Operation period

The active collection period was planned for November 20 – October 21 over 12 month-long subsidy periods ('phases'). Because of COVID-19-related concerns, the first subsidy period was delayed by a few weeks.

Because the budget for remuneration was spent earlier due to the success of the pilot, the collection period was shortened to 11 phases. 23 August – 22 September 2021 was therefore the last collection period.

Service period

In September 2021, the project team conducted exit interviews with two-thirds of active recyclers in the scheme as well as with a small sample of participating collectors.

The present consultancy report, for which the Expression of Interest and Request for Proposal briefs were written in the first half of 2021, was meant to be developed from October 2021 until January 2022, but because of the early end to the remuneration component, the fieldwork component was moved forward to September 2021.

The final activity is the public outreach to disseminate the pilot's findings and recommendations, in Q2 2022.



Budget

Introduction

The originally agreed budget was updated several times during the programme to accommodate growing insights. Both the original and final updated budget are included in the Appendix. Key line items in the original budget included the subsidies paid to collectors and recyclers, and project staff salaries. During the project, budget adjustments were made (see next section), most notably the reallocation of the baler budget, and the enlarging and frontloading of the subsidies budget.

Adjustments

The following key change requests were made by the team and approved by HKPC:

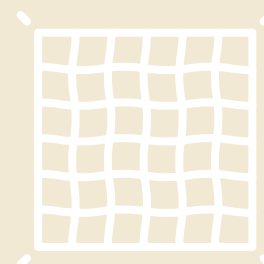
Balers

Interest in the baler offer was limited, with only a few recyclers applying for a fully financed baler. A first change request, to reduce the baler budget by HKD 916,147, down to HKD 505,853, was approved on 19 March 2021. A second change request was made and approved to eliminate the remaining baler budget entirely (i.e., from HKD 504,293 to HKD 0). See page 28 for more details.



Receptacles

In March 2021, a budget of HKD 172,800 was allocated to purchase receptacles ('fishnets') to distribute free of charge to collectors and recyclers and improve collection efficiency; hygiene during handling; storage at the collector's and the recycler's; and fast and transparent transactions between the collector and the recycler. As collection volumes proved significantly larger, and the subsidy payouts therefore higher than anticipated, the budget was reprioritised. The receptacles budget was reduced by HKD 70,000, and the savings reallocated to the subsidies budget.



Services

Volume audit

Change requests were approved to reduce the volume audit budget from HKD 184,000 to HKD 169,000, and then again to HKD 58,800 because the audit service provider was able to reduce their cost.

Consultancy report

A consultancy budget of HKD 140,000 was included after consultation with HKPC, because it was recognised that a scheme this successful could yield insights for future pilots and programmes and that adding a fieldwork component to the study would be useful to measure additional impacts of the pilot.



Sta

- Project Assistant: Budget adjusted from HKD 306,000 to HKD 333,000 to cover a minimum of 30 hours of overtime per month, from May 2021 onward.
- Project Officer: Budget adjusted from HKD 450,000 to HKD 423,000 (savings of HKD 27,000)
- Part-time staff: In April 2021, a budget reallocation was approved to hire part-time staff for enhanced site inspections and monitoring given the strong collection and participation rates. HKD 73,920 was allocated to cover salaries, MPF and transportation allowance.



Remuneration / payout period

Higher volumes than anticipated in the pilot design were collected early on. Therefore, the project team requested and received approval for several reallocations of funds from several other budget items (see above) to the subsidies budget. In addition, the payout period, which because of COVID-19 had been initiated slightly later than planned, was wrapped up after 11 months rather than 12 months because the (augmented) subsidies budget was completely spent.



Table 1. Modifications to the subsidies budget

Original subsidy budget		2,800,000
Feb/March change request for additional subsidies	+	669,427
	to	3,469,427
May/July change request		to pay out HKD 1,295,400 sooner
August change request for additional subsidies	+	684,493
	to	4,153,920
Final change request for additional subsidies	+	60,000
	to	4,213,920

Team setup

ADM Capital Foundation

ADM Capital Foundation (ADMCF) acted as the Financial Administrator and monitored the overall expenditures of the scheme, its progress against milestones and deliverables, as well as the formal reporting to the Government and/or the Secretariat of the Recycling Fund, a role fulfilled by the Hong Kong Productivity Council (HKPC).

Designing Hong Kong

Designing Hong Kong (DHK) executed the scheme on behalf of ADMCF and acted as an implementation agent for the scheme to liaise with recyclers and manage the scheme.

Project team

The project team consisted of a project officer and a project assistant and was later augmented with two part-time staff because of the higher workload due to the success of the scheme. Staff duties included:



Operation monitoring



Liaising with participating parties



Verifying recycling records



Inspecting recyclers (recycling shops and mobile recyclers) and processors



Meeting with collectors and related organisations



Promoting the scheme in the recycling industry and in the community



Experience sharing

The role of the project team will be further discussed in this and the next chapter.

Volunteers

A team of 23 volunteers supported the paid staff. Volunteer duties included outreach visits to recyclers and collectors as well as assistance with spot checks (Figure 4). Two volunteer orientation workshops were conducted in mid-October 2021. Project staff presented the project overview, key messages, suggested visit rundown, and the necessary COVID-19 precautions. The visits were initiated in the first collection period (November), when volunteers conducted 9 sessions over 9 areas, for a total of 18 recyclers.¹² Volunteer visits were suspended in December 2020 because of COVID-19 concerns, and resumed in April 2021, until the end of the scheme. Over the entire project period, volunteers visited a total of 34 recyclers.

Figure 4. Volunteer outreach at a collection point



Governance

Steering committee

Funding conditions included the creation of a steering committee for the pilot project, a design aspect that was well-aligned with ADMCF's and DHK's desire for high levels of transparency and strong, impartial guidance.

Duties

The following were the duties of the scheme steering committee:

- Oversee the proper implementation of the scheme by accessing relevant data and materials to ensure the fund is used effectively in a targeted manner.
- Agree on the floor purchase price of plastic beverage bottle offered by recycling shops and recycling trucks to collectors.
- Agree on the remuneration rate paid by the scheme to recyclers, taking into account fluctuations in the market scrap value of recycled plastic beverage bottles and the operation cost of recyclers. collectors.
- Any changes in these remuneration rates to be reviewed and agreed by at least 3 of the 5 members of the Steering Committee in advance.
- Assist with the identification of reputable local processing facilities.
- Present the outcomes of the scheme and relevant materials in public occasions, when necessary, for example in a press conference.

To illustrate to what degree the steering committee provided oversight for the creation of the scheme, the list of project mechanisms that was signed off on by the steering committee is provided in Table 2.

Table 2. Project mechanisms

<div><div>● Network setup</div><div><div>● M1 Recruitment Mechanism for Recycling Plants (i.e., processors)</div><div>● M2 Recruitment Mechanism for Recycling Shops and Trucks (i.e., recyclers)</div><div>● M3 Recruitment Mechanism for Volunteers</div><div>● M4 Mechanism for Selecting Recycling Shops to Install Baler</div></div><div><div>● Compensation</div><div><div>● M6 Subsidy Calculations and Disbursement Mechanism</div></div></div><div><div>● Governance and audit</div><div><div>● M5 Internal Verification and External Audit Mechanism</div><div>● M7 Site Inspection Mechanism</div><div>● M8 Penalty Mechanism</div><div>● M9 Mechanism for Complaints Handling</div></div></div></div>	
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Steering committee composition

- Dr. Shan Shan Chung – Senior Lecturer, Department of Biology, Hong Kong Baptist University
- Mr. Hahn Chu Hon Keung – Director of Environmental Advocacy, The Green Earth
- Dr. Rico T.K. Wong – Deputy Chief Executive, The Conservancy Association
- Mr. Samuel Kwong – Senior Sustainability Manager, The Hong Kong Jockey Club
- Mr. Angus Ho Hon Wai – Executive Director, Greeners Action

Meeting schedule

The Steering Committee was set up to meet on an as-needed basis, but with a minimum of three times during the project period. In practice, the Steering Committee met 3 times. The meeting quorum was 3 of the 5 members.



2.2

Setup and preparation

This section describes how, ahead of the first collection period, the different elements of the scheme were put in place along the three reverse value chain steps: collectors, recyclers, and processors.

Collectors

The project team's own efforts to recruit collectors for the pilot programme did not need to be intensive.

An information leaflet for collectors (focusing on materials in scope and pricing) was designed ahead of the first collection period, and tested with a few potential bottle collectors. At the start of the programme, the team reached out to collectors by distributing the information leaflets at the recycler sites.

From there onward, cleaners and other collectors learned about the programme through interaction with the recycler, and through word of mouth—collectors tend to observe their peers and discuss new or changing opportunities with them.

Recycler network

Participation criteria

Application criteria for recyclers (first two lines) as well as rules governing recycler participation were developed, in an effort to achieve programme stability and strong recycling outcomes (Table 3).

Table 3. Recycler application criteria and regulations and rules while participating in the scheme

Criteria	Evidence
A registered business	Business Registry registration
At least 1-year experience in recycling business	Recycling records
To separate plastic beverage bottles from non-beverage-bottles and other recyclables at the site	Spot check
Agree to use the designated price to purchase plastic bottles	Spot check, for details see page 37

Recruitment

The project team sought and managed to recruit recyclers across the HKSAR territory, through the following means:



Recruitment of recyclers did not only happen at the very beginning of the project (see also page 54).

In the initial recruitment round, about one third of shop owners that were approached showed interest. The offered subsidy level was considered attractive. Concerns were voiced around lack of storage space, potential hygiene problems, and potentially low collection rates by collectors. Shop owners also indicated they would prefer for the processors to arrange the logistics.

After the first 15 recyclers were signed up, it became easier to recruit further ones. The scheme's existence and viability had spread by word of mouth, rendering any approaches made by the project team more effective.

A total of 64 applications was received, of which 53 were approved, two were retracted, five were never fully completed, and four applications were rejected because their collectors did not match the project's target group of frontline collectors, nor were they set up to start working with this target group.

Consequence management

While recycler participation criteria were required to guarantee a strong field of Hong Kong recyclers, a simple but nuanced consequence management was developed to deter fraud in the remuneration of collectors (designated price and scale accuracy) and to improve the quality of collected volumes (separation)—see Table 4.



Table 4. Consequence management

Designated price	
First violation	Shop receives warning letter + subsidy cancelled for that phase
Second violation	Shop removed and permanently disqualified + subsidy ceases
Scale accuracy	
First violation	Shop receives warning letter + subsidy cancelled for that phase
Second violation	Shop removed and permanently disqualified + subsidy ceases
Separation	
First violation	Shop receives verbal warning
Second and third violation	Shop receives warning letter + Subsidy deducted based on the number of non-beverage plastic bottles (Amount Deducted = Amount of Subsidy X (number of non-beverage plastic bottles / 40 bottles))
Fourth violation	Shop removed and permanently disqualified + Subsidy ceases

Baling equipment

The project was designed to support 15 selected shops with fully financed balers that are suitable for bottle compression. The aim was two-fold: to encourage participation during recruiting and to enhance the collection capacity of those shops that did enrol in the scheme, by improving operations, better utilising storage space, and reducing transportation cost.

Only three recyclers applied for a fully financed baler. The key reasons were space constraints and/or the presence of a baler (mostly for paper and board). Even if such balers aren't always adequately protected against corrosion from residual liquids, most recyclers preferred frequent pickup transactions over baling.

Ultimately, two of the interested recyclers could not fulfil the project requirements of lands' checking or planning permission for baler installation. The third applicant could not provide the tenancy agreement as required for review. As a result, no baler was delivered or installed, and the planned budget was transferred to other cost items (see page 21 for more detail).

Processors (Buyers)

Role

Processors purchase the bottle materials from the recyclers at market value, i.e., without further scheme subsidies. Processors may or may not cover collection costs; as in recycler-processor relationships outside of the scheme, this is subject to negotiation between the two parties.

Participation criteria

Criteria and requirements

- A registered business regularly
- At least 1-year experience in recycling business
- Capacity to sort different common types of plastic beverage bottles
- Capacity to process plastic beverage bottles into shreds/ pallets/ flakes
- Proper outlets for processed recyclables
- Allow relevant personnel for spot checks and site visits
- Submit recycling records, data and update collection progress

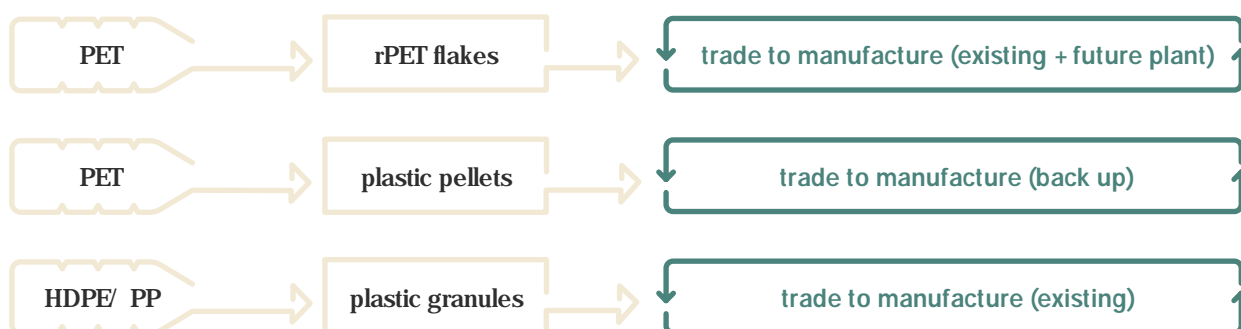
Evidence

- BR registration
- Export records or bill of lading
- • Technological proof
- • Site visit
- • Technological proof
- • Site visit
- Sales contracts or receipt records on recycled materials
- Declaration
- N.A.

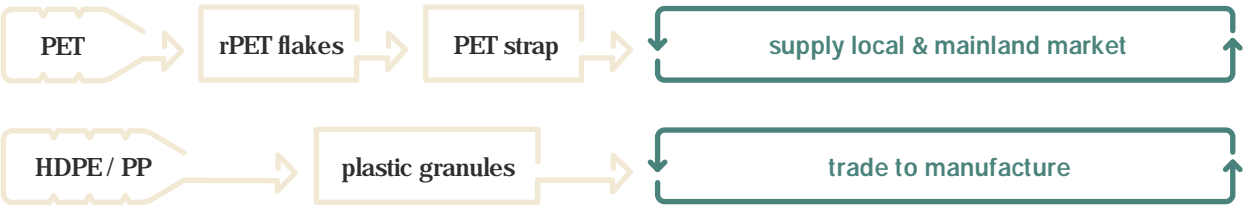
Participating processors

Five processors were selected based on the criteria mentioned above, each with different processing capabilities and end markets.

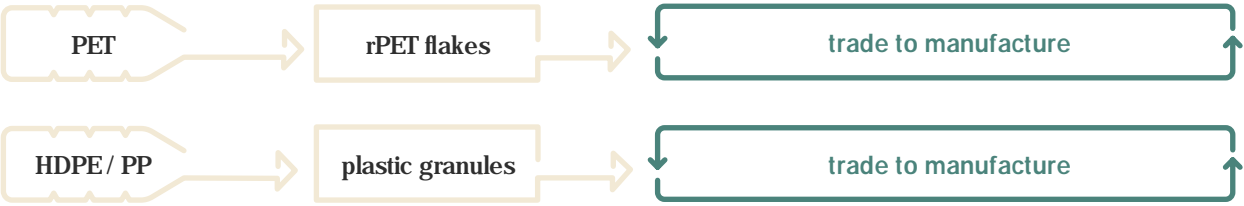
● Lau Choi Kee Papers Company Limited



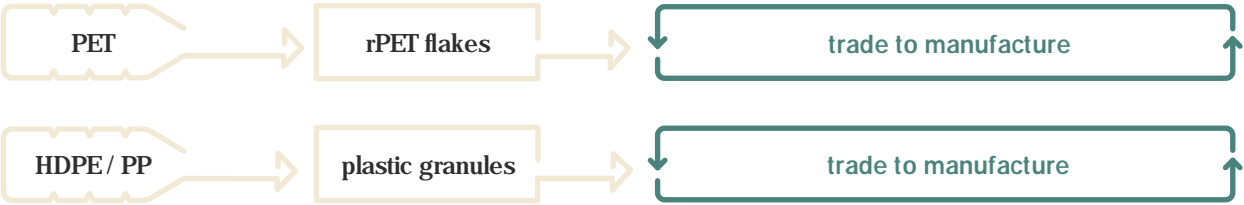
● **Hankang Recycling Limited**



● **Verdant Industrial Limited** (withdrew in February 2021 due to operational changes in the organisation)

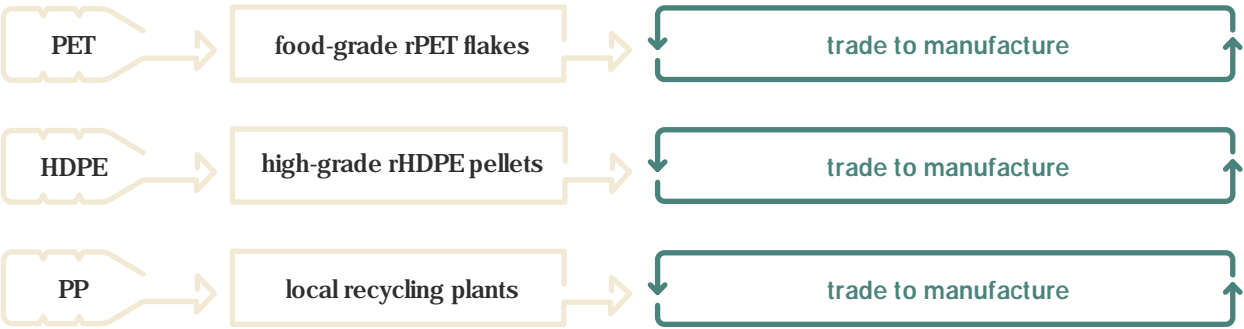


● **Success Grand Environmental Limited** (joined 9 April 2021)



● **New Life Plastics Limited**

Commissioning of the plant has been delayed to Q12022 because of COVID-19 related travel restrictions for construction engineers. In the meanwhile, materials for the plant have been stockpiled at a Baguio yard, awaiting processing at New Life Plastics. The plant will be sorting out and processing two materials, PET and HDPE. It will also positively sort PP, which it will be selling to other local recyclers.



2.3

Execution

Adjusting remuneration

A subsidy review and adjustment mechanism had been set up at the beginning of the scheme (Table 5 and Table 6). The remuneration rate was to be reviewed once every 3–4 months (i.e., at least three times) during the collection Scheme. It was effectively reviewed three times and revised zero times because market parameters did not move outside of the pre-defined window.

Table 5. Subsidy adjustment: mechanism

	Market scrap value	Operation cost	Market response
Monitoring mechanism and scope	<ul style="list-style-type: none">• Conduct survey to at least 5 recycling shops/ trucks• Sample at least 5 recycling records, and enquire the recycling plants for the purchase price	<ul style="list-style-type: none">• Conduct survey to at least 5 recycling shops/ trucks	<ul style="list-style-type: none">• Review participating rates, collection rates, other subsidy scheme and export value etc.
Supporting documents	<ul style="list-style-type: none">• Completed survey• Documentation of the recycling records stated with purchase price, e.g. invoice issued by recycling plants	<ul style="list-style-type: none">• Completed survey	<ul style="list-style-type: none">• Collect supporting documents as needed



Table 6. Subsidy adjustment: illustrations

Case 1: Operation cost of HKD 2000/ tonne

Unit	HKD/ Bottle	HKD/ Tonne					
HKD/ Tonne	Remuneration	Remuneration	Remuneration to Shops/ Trucks	Scrap Value	Remuneration to Informal Collectors	Shop Net Gain	Remuneration to IC/ Remuneration
Scrap Value 0-500	0.100	4000	1600	0	2400	-400	60%
	0.098	3900	1900	100	2000	0	51%
	0.095	3800	1800	200	2000	0	53%
	0.093	3700	1700	300	2000	0	54%
	0.090	3600	1600	400	2000	0	56%
	0.088	3500	1500	500	2000	0	57%
Scrap Value 600-1200	0.085	3400	1400	600	2000	0	59%
	0.085	3400	1400	700	2000	100	59%
	0.085	3400	1400	800	2000	200	59%
	0.085	3400	1400	900	2000	300	59%
	0.085	3400	1400	1000	2000	400	59%
	0.085	3400	1400	1100	2000	500	59%
Scrap Value 1300-2000	0.085	3400	1400	1200	2000	600	59%
	0.083	3300	1300	1300	2000	600	61%
	0.080	3200	1200	1400	2000	600	63%
	0.078	3100	1100	1500	2000	600	65%
	0.075	3000	1000	1600	2000	600	67%
	0.073	2900	900	1700	2000	600	69%
	0.070	2800	800	1800	2000	600	71%
	0.068	2700	700	1900	2000	600	74%
	0.065	1600	600	2000	2000	600	77%

Case 2: Operation cost of HKD 2100/ tonne

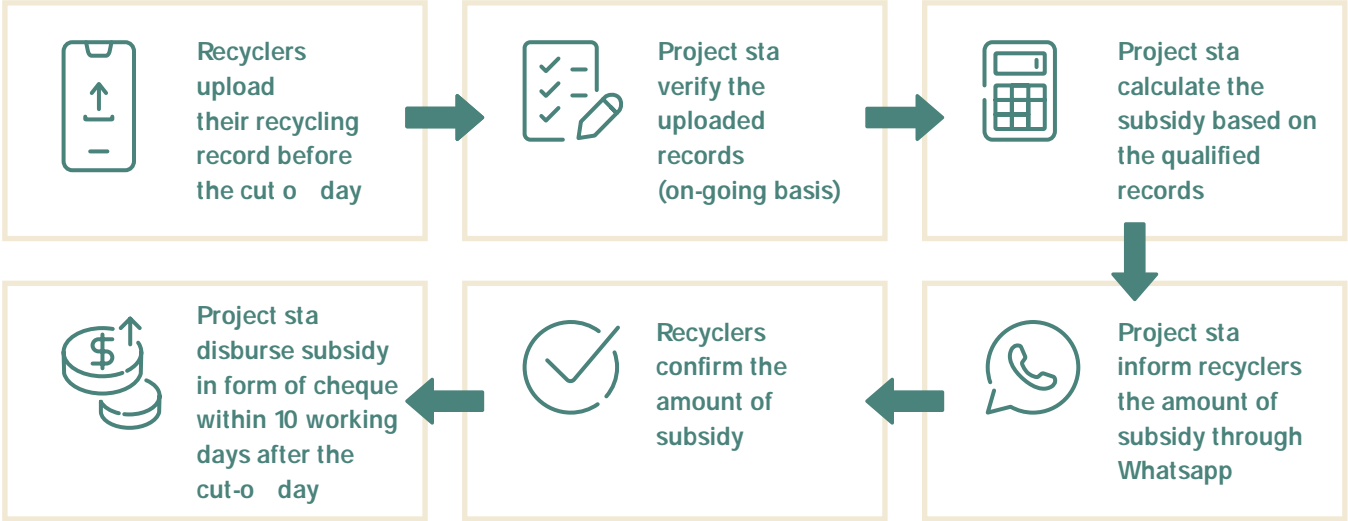
Unit	HKD/ Bottle	HKD/ Tonne					
HKD/ Tonne	Remuneration	Remuneration	Remuneration to Shops/ Trucks	Scrap Value	Remuneration to Informal Collectors	Shop Net Gain	Remuneration to IC/ Remuneration
Scrap Value 0-500	0.103	4100	1700	0	2400	-400	59%
	0.100	4000	2000	100	2000	0	50%
	0.098	3900	1900	200	2000	0	51%
	0.095	3800	1800	300	2000	0	53%
	0.093	3700	1700	400	2000	0	54%
	0.090	3600	1600	500	2000	0	56%
Scrap Value 600-1200	0.088	3500	1500	600	2000	0	57%
	0.088	3500	1500	700	2000	100	57%
	0.088	3500	1500	800	2000	200	57%
	0.088	3500	1500	900	2000	300	57%
	0.088	3500	1500	1000	2000	400	57%
	0.088	3500	1500	1100	2000	500	57%
	0.088	3500	1500	1200	2000	600	57%
Scrap Value 1300-2000	0.085	3400	1400	1300	2000	600	59%
	0.083	3300	1300	1400	2000	600	61%
	0.080	3200	1200	1500	2000	600	63%
	0.078	3100	1100	1600	2000	600	65%
	0.075	3000	1000	1700	2000	600	67%
	0.073	2900	900	1800	2000	600	69%
	0.070	2800	800	1900	2000	600	71%
	0.068	2700	700	2000	2000	600	74%



Payments and accounting

An invoicing and payment process was set up (Figure 5) that aimed for ease of use, transparency, and speedy payout—recycling businesses seek to keep receivables particularly low, to maximise company health and sometimes for pure survival.

Figure 5. Payment mechanism



The cut-o date for handing in transaction records was the 22nd of each month; records submitted after this cut-o date were considered invalid. Any disputes were to be resolved before the next cut-o date.

The process was supported by a smartphone-based application (Figure 6). This software had been previously deployed in another scheme supported by the Recycling Fund and could be deployed for the bottle pilot scheme with minimal adaptations.

The use of the software was largely uncontested, and the project team made e orts to flatten the learning curve for its usage. Nevertheless, a few recyclers repeatedly brought up di culties with the use of the application, and this was even used as a reason for late handing in of the transaction records. Moreover, some recyclers kept relying on project sta for assistance with the uploading of records.

Figure 6. Recyclers can upload and review their recycling records on a web platform



Backend processing was done manually as the size of the project did not warrant automation. Consequently, processing records was a sizable task consisting of record compilation and verification with both recyclers and processors. Payouts were by cheque. This, too, entailed a lot of labour but the size of the pilot did not warrant setting up an e-banking account.

Monitoring and audit

Fraud prevention

Several mechanisms were created to minimise fraud risks associated with claiming subsidies and ensure proper material flows under the scheme.

- Setting a cap amount of 15 tonnes per recycler per month for claiming the subsidy.¹³
- Recruitment & application: recycling shops/ trucks cannot accept any compressed bales of plastic beverage bottles, and it is stated in the declaration that the participating recyclers need to sign upon application.
- Internal verification and volume audit: project staff evaluated every single recycling record (i.e., weigh note) submitted by recyclers with the purpose of collecting subsidies.
- Site inspection and spot check at both recyclers and processors for any case of (suspected) non-compliance (Figure 7).

Details for the latter two are provided in the following sections.

Figure 7. Site inspections and spot checks



In addition to the fraud prevention mechanisms built into the project, EPD and the Recycling Fund, via the Hong Kong Productivity Council, carried out five field visits to check in on different parts of the scheme:

2021
Mar 5
Baguio's collection yard at Fanling
(monitoring the process of a recycling
trucks' delivery of plastic bottles to
Baguio) (also joined by HKPC)

2021
Apr 27
Tuen Mun, Yuen Long
& Tsuen Wan
(3 recycling shops)

2021
May 17
Central & Western District
(2 recycling shops & 1 recycling
area (pop-up or truck))

2021
Jul 7
Tin Shui Wai
(2 recycling pop-ups (trucks))

2021
Aug 23
Kowloon City
(1 recycling shop)

Volume verification

The project team put in place a double volume verification process for target recyclables, in terms of recyclers' input and output volume of plastic beverage bottles. It consisted of an internal verification and subsidy expense summary and an external volume audit. In addition, a log of recycler participation and complaints was kept and updated as needed.

A. Internal verification and subsidy expense summary

- Applies to all participating recyclers
- Every recycling record of the target recyclables for each recycler is verified
- Transaction records must meet the following requirements (Figure 8):
 - The weight note that is uploaded is clear and can be verified
 - The name of the recycler is clearly legible
 - The weight note number entered in the application matches the number stated on the weight note
 - The name of processor is shown; the processor is one of the listed processors
 - The date must be correct and within the payment period
 - The volume of plastic beverage bottles output declared in the application matches the volume stated on the weight note

Figure 8. Example of a compliant weight note

 碧瑤 碧瑤塑料有限公司 BAGUIO Baguio rPlastic Limited Factory: 281-184 Lung Koo Tin, Tsuen Wan, N.T., H.K. Tel: (852) 9190 2561 海寧處區可編號: WBP152	
Copy - Customer 客存	送貨單 DELIVERY NOTE

Code 單號	WH_020
Date 日期	27-08-2021
Time Out 時間	
Truck No. 車牌	0
Product Code 貨號	plastic beverage bottle
District 地區	
Gross Weight (kg) 總重	
Tare Weight (kg) 皮重	
Net Weight (kg) 淨重	562 kg

Customer Name 客戶	
Delivery Address 送貨地址	
Issued By 發單員簽名	
Driver's Signature 司機簽名	
Received By 收貨人簽名	
Memo 備註	



B. External volume audit

The Hong Kong Quality Assurance Agency (HKQAA) was contracted to perform third-party volume audits throughout the collection period. At least five recyclers were to be audited monthly. Each participating recycler was audited once throughout the project period.

For each recycler, the recycling record sample size should be a minimum of ten percent of total number of recycling records, or no less than 30, whichever is lower.

Table 7. Sample audit report (July–August 2021)



As per the coverage period from 23 Jul 2021 to 22 Aug 2021, total 36 recycling shops/trucks submitted the weight note and 30 recycling shops/trucks are being verified, which covered 83.33% of the participated recycling shops/trucks.



All supporting records (Recyclables balance summary, Weight notes issued from downstream distributors and list of recycling shops/ trucks) were duly sampled and verified. There is no discrepancy between the selected samples and the Recyclables balance summary provided by Grantee.



The findings showed that the records were consistent with Requirements on Plastic beverage bottle Volume audit of Designing Hong Kong Limited.



All weight notes represent both input and output record that the recyclables arriving at as well as leaving the participating recycling shops/ trucks are of the forms of plastic beverage bottles. All sampled supporting the above findings and the Recyclables balance summary are enclosed in the report.



In our opinion, total 36 recycling shops/ trucks have, in all recyclables respects, demonstrated conformity to the applicable Requirements on Plastic beverage bottle Volume audit of Designing Hong Kong Limited and attained the collection quantity of 179.754 tonnes of plastic beverage bottle from 23 Jul 2021 to 22 Aug 2021.

Quality

Non-beverage plastic bottles are not eligible for subsidy under scheme. Recyclers are required to sort out plastic-beverage bottles from other recyclables. During spot checks, project sta did random-sampling of 40 bottles; the recycling shops/ trucks were penalised if more than 5 plastic non-beverage bottles were found.

Fairness towards collectors

Two elements were monitored via spot checks to ensure the recycling shop treats the collectors fairly: the price paid and the scale calibration. To verify the designated price was respected, project sta did two things. (a) They weighed the plastic bottles collected by collectors using a luggage scale. Sta would inform the collector of the weight and how much they should be able to receive from recycling shops and trucks. Sta would interview them after they sell the plastic bottles to recycling shop to verify the appropriate amount had been received. (b) Sta also verified the designated signage was placed visibly and contained the correct and up to date price information.

To verify the scale was properly calibrated within a margin of ± 0.5 kg, sta would weigh a calibrated full bag of bottles during spot checks, with project sta taking a photo for record keeping.

Processing plants

One of the volume fraud control mechanisms required cross-checking numbers with the participating processors. This required timely submission of the records. The numbers were always found to check out.

2.4

Closing down

The eleventh and last collection period that qualified for “Recycling Fund—Neighbourhood Bottle Reward Scheme” subsidies was 23 August 2021–22 September 2022. This was one month earlier than originally planned: funding for the subsidies had run out due to the scheme’s collected volumes, which were considerably higher than anticipated.

Participating shops were orally, then in writing notified—with only a week’s notice—that any recycling record uploaded on or after 23 September would not be eligible for subsidy reimbursement. While the scheme had always clearly been positioned as limited in time, the considerable effort to build up the plastic bottle activity and the positive financial contribution it had made for some recyclers, meant that several recyclers expressed surprise at its closing down. Interviews conducted by the project team revealed that 81 percent of actively participating recyclers would have preferred to keep the scheme going and there was general interest in the continuation of successful government programmes.

27 of the scheme’s recyclers were able to transition to the Recycling Fund’s all-plastics ISP scheme and some have continued to collect bottles and send them to the processors they worked with under the Neighbourhood scheme, albeit without subsidy. In addition to the different financial results, these two groups of recyclers expressed discontent over having to communicate different arrangements to the collectors.





3.0

Analysis



3.1

Analysis of collection results

Collected volumes were analysed for trends over time (including seasonal factors), geographical differentiation and the underlying drivers, and type of recycler. For purposes of establishing performance by recycler type and recycler geography only records of active recyclers were included in those particular analyses.

The full dataset is available in the appendices. Results are discussed in Chapter 4.1 and subsequent sections.

3.2

Field surveys

Field surveys were conducted in September and October 2021 at eight different recyclers.

Purpose

The field surveys had a dual purpose:

- First, obtaining comparable insights into collectors' and recyclers' *qualitative patterns*. This pertains to collection routines, distances, individual recycling preferences, material exchange routines etc.
- Second, to extract and compare *quantitative data* on material transactions between collectors and recyclers, with a particular focus on ascertaining changes in PET bottle recovery rates during (September '21) and after (October '21) the pilot scheme.



Sample

The field study sample of participating recyclers (Table 8) was composed along three principles:

- locations that are spread in a meaningful manner over Hong Kong;
- all types of operational models pertaining to the recycler; and
- recyclers achieving small, medium and large recovery volumes.

Table 8. Surveyed recyclers

District	Location	Scheme application No.	Operational model	Mean recovery (tonnes/month)	Visit September	Visit October
Yuen Long District	Tin Shui Wai	DWW 29	Pop-up recycler	14.1		
	Shui Bin Wai	DWW17	Recycling shop	2		
Central & Western District	Kennedy Town	DWW09	Recycling area within shopping mall	2.8		
	Kennedy Town	DWW13	Recycling shop	6		
	Several points	DWW 38	Mobile recycling truck	5.8		
Sha Tin District	Sha Tin Tau	DWW27	Recycling truck	14.4		
	Sha Tin Market	DWW36	Pop-up recycler	3.7		
Kowloon City	Tak Ku Ling Road	DWW37	Recycling shop	6.7		

Methodology

Stakeholders

Two categories of stakeholders were included in the observations and interviews.

- *Owners/Managers* at recyclers are in charge of receiving qualifying bottle deliveries and monitoring the various pre-processing steps (weighing, sorting, baling etc.).
- *Collectors* gather qualifying bottles from various sources and subsequently deliver these to recycler.

Transaction observations

To obtain insights into waste recyclable exchanges at the recyclers, the team recorded and counted collector-recycler transactions during the field survey.

Through phone calls with the recyclers, the team had identified the times of day with more and less frequent plastic beverage bottle transactions. On this basis, the field work was arranged to be conducted during the periods with high and low transaction intensity. The specific time slots for peak and low plastic beverage bottle material exchanges in addition varied depending on the specific operational types of recyclers (recycling shop, pop-up recycler, or recycling truck).

For each transaction, the team recorded the weight, the respective materials delivered (plastic beverage bottles, paper, cardboard, metals, other plastics etc.) and the collector category (informal collector, cleaner, retired resident etc.).

This allowed for the characterisation of transactions, such as (a) total amount of recyclables received by a recycler over the observation period (kg/h); (b) amount of plastic beverage bottles received by a recycler over the observation period (kg/h); (c) amount of plastic beverage bottles delivered over the observation period, averaged out per type of collector (kg/h/capita); and (d) the share of plastic beverage bottles as share of the overall recyclables delivered to each recycler (weight-based percentage).

For purpose of comparison, transactions at recycler were observed twice, in September and October 2021. Across these two observations, day of the week and periods of peak and low material exchanges were kept as constant as possible, except where recyclers had made suggestions for improved observation slots.

Across sampled locations, 177 transactions were observed in September 2021 and a further 297 in October 2021.

In-depth interviews

Interviews were semi-structured and covered qualitative and quantitative aspects of delivery, transaction, storage and pre-processing of beverage bottles in Hong Kong's recycling network (see Appendix for the full questionnaire). In total, 14 in-depth interviews with 8 recyclers and 37 in-depth interviews with frontline collectors were conducted.

As the survey approach adhered to a procedural logic, a set of follow up questions (marked green in the tables in the appendix) were developed for the second survey round, that were based on insights obtained during the first survey interval.



4.0

Insights



In this chapter, the pilot scheme is analysed for both its effectiveness and its efficiency, and its contribution to government and societal goals is discussed.

4.1

The scheme delivered beyond the goals set out for the pilot

An overwhelming success

From mid-November 2020 to mid-September 2021, the scheme subsidised the collection and recovery of 1,245 tonnes of plastic beverage bottles, an estimated 50 million bottles.

This is two and a half times the project's recovery target of 500 tonnes—the project's collection target was met by a very large margin.

It also has produced the other deliverables as outlined in the contract, namely, to investigate and address:¹⁴

- how these networks can be optimally leveraged for a new recycling stream;
- what formalised elements need to be added to strengthen their capacity; and
- what the right financial incentive is to motivate different actors in the network.

Moreover, while 76% of collectors interviewed during the fieldwork indicated they thought the remuneration for returning reclaimed plastic beverage bottles was too low, the surveys also found that there is overwhelming support (92%) for delivering such bottles to recyclers.

In addition to meeting and surpassing the collection volume goals, the scheme also made an important contribution to Recycling Fund's overall goal of capacity building through the projects it funds. Many recyclers were initially incredulous that they could build a profit-making business out of plastic bottle collection. The project team worked relentlessly to help remove barriers, develop operational skills, and share best practices and by doing so, changed recyclers' original perspective.



Development of volumes

After initiation of the scheme, volumes kept rising steadily (Figure 9). Obviously new recyclers were added to the scheme throughout its course, while some dropped out (see Figure 17). But that is not the full picture. The second line in Figure 9 shows the development in the average number of bottles collected monthly per recycler. This number, too, saw a strong growth over the period of the pilot scheme.

Figure 9. Evolution of monthly number of collected bottles

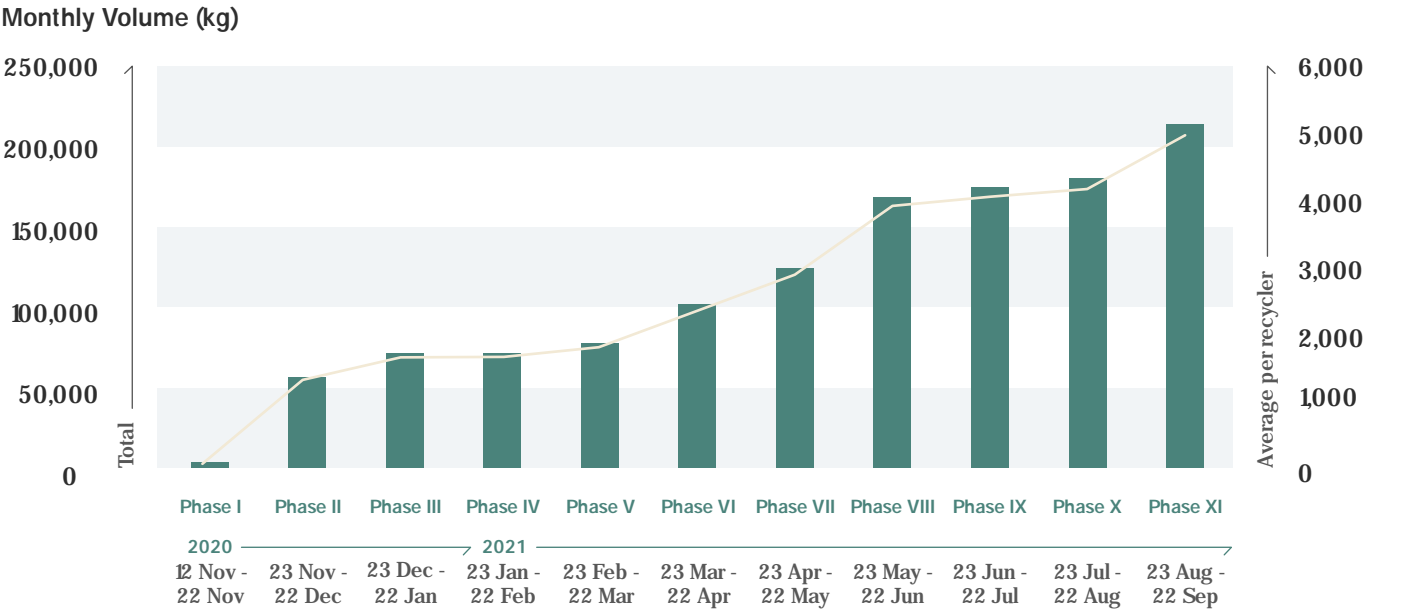
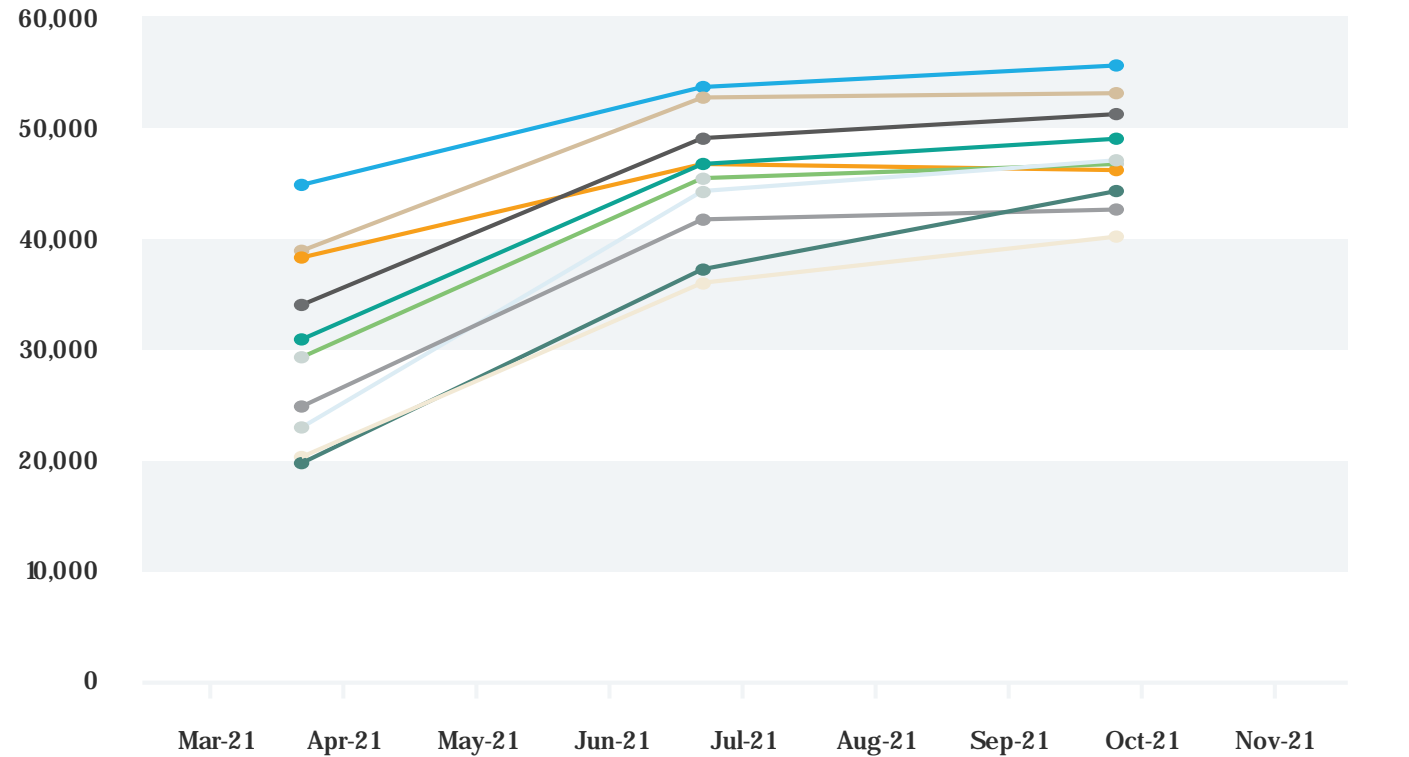


Figure 10. Collected volumes by 10 best performing RVMs in EPD programme¹⁵



Some of this development may be explained by the growing number of beverages sold as the Hong Kong temperatures went up towards the summer. Analysis of a different scheme (Figure 10), however, indicates that consumption patterns may not fully explain initial growth patterns in new schemes.

Ideally, the neighbourhood pilot could have run longer so that the drivers of this development could have been determined with more certainty. But in any case, the available data suggests that most recyclers in the programme were not yet at their maximum collection capacity. This could imply that further growth in per-recycler volumes would be possible without driving up the marginal cost due to for example infrastructure investments. For future programmes, spreading best practices to help recyclers achieve high volumes earlier on could be beneficial.

Moreover, it is clear that Hong Kong's recycling industry needs longer, more permanent programmes rather than a series of experiments that requires them and their networks to ramp up and ramp down too many times.

Effect of the scheme

While the scheme was not in a position to keep systematic track of what volumes were collected before its contracts with the recyclers were initiated or after they were terminated at the end of the last subsidy period, observations and interviews in the field shed some light on this.

On the one hand, field survey responses indicate that nearly three-quarter of the frontline collectors only engaged in recovering plastic beverage bottles after the start of the scheme. Moreover, those recyclers that were already collecting before the start of the scheme, meaningfully increased the volumes they collected. Although there was no controlled experiment to confirm this, it could be deduced that the heightened participation rate is due to the pilot scheme, since there were no other large-scale changes in the recycling landscape around that time.

On the other hand, quantitative transaction records obtained through the fieldwork paint a similar picture for the end of the scheme. Once scheme remuneration ended at the end of September, both the frequency of deliveries and the median volume (kg) of plastic beverage bottles per delivery decreased (Table 9). For a more granular view of changes in collection behaviours, see page 71.)

Table 9. Changes in plastic beverage bottle recovery during (September) and after (October) the pilot subsidy scheme

Recyclers		Transactions that include plastic beverage bottles as share of total transactions		Median volume of individual plastic beverage bottle transactions (kg)	
Location	Type	September 2021	October 2021	September 2021	October 2021
Sha Tin	Pop-up recycler	27%	2%	10.0	7.0
Tin Shui Wai	Pop-up recycler	30%	17%	6.9	4.4
Shui Bin Wai	Recycling shop	14%	17%	4.0	3.6
Kowloon City	Recycling shop	22%	12%	5.0	3.3
Lok Fu	Mobile recycling truck	100%	100% ^B	45.0	40.0

4.2

The scheme can inform the principles and mechanisms of achieving Government's waste management goals

No project that has received funding from the Recycling Fund should be seen as a standalone endeavour but rather as a building block in a more performant and robust waste management infrastructure for Hong Kong.

It is therefore necessary to see in which ways its methods and outcomes contribute to the HKSAR Government's longer-term waste management goals, as laid out in its 2035 Waste Blueprint published in February 2021, the MSW Charging scheme for which the bill was passed by the Legislative Council in August 2021,¹⁷ and the Producer Responsibility Scheme on Plastic Beverage Containers (PPRS) for which the regulatory framework is currently being drafted.¹⁸

The scheme's contribution to the Waste Blueprint for Hong Kong 2035

Resource circulation

The blueprint articulates a triple vision of Waste Reduction, Resource Circulation, and Zero Landfill.¹⁹ The mechanisms that were tested and corroborated in this pilot could make robust contributions to Resource Circulation and hence to Zero Landfill and its underlying 'Areas' of Waste Separation and Industry Support. The principle of bulk collection points could not only be applied to the collection of plastic beverage bottles but also other beverage packaging like liquid cartons, and other plastics, like mixed plastics. This applies to both the physical setup and the administrative infrastructure (including fraud prevention)—assuming the insights for further development (see Chapter 5) are taken on board.

The pilot scheme's mechanisms could contribute to two specific aspects of the HKSAR government's waste policy, consumer engagement and industry support.

Consumer engagement

The latest Waste Blueprint gives a great deal of attention to the importance of consumer engagement in increasing recycling rates.²⁰ What did this pilot project contribute in terms of results or insights?

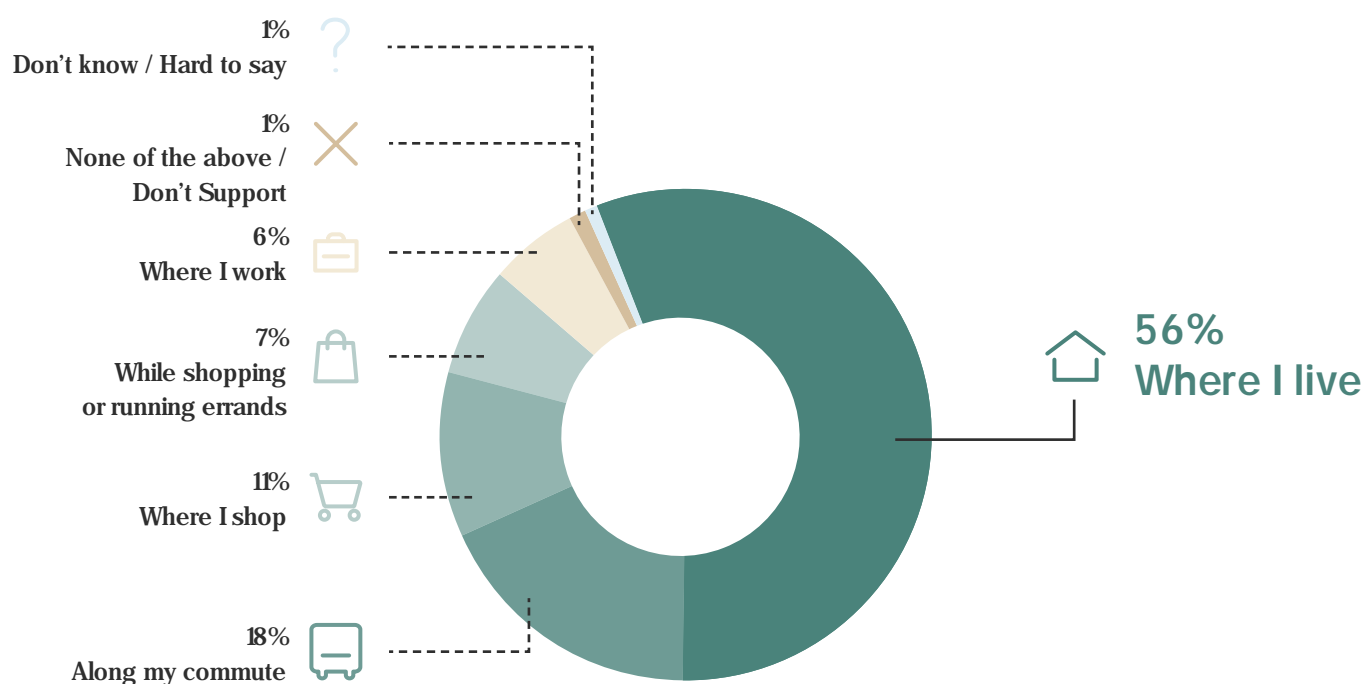
The goal of the project was to test the role of bulk locations and of cleaners and other frontline collectors. As a result, the primary audience of the pilot scheme were the frontline collectors in need of bulk collection locations, which are mostly cleaners (see page 69). In contrast, Hong Kong consumers return recyclables in small volumes—90 percent of respondents do not accumulate more than 10 bottles at a time.²¹

For that reason, the focus of outreach and communication was not on households or individual consumers. The information around the availability, location, and scope of the new network was nevertheless brought to the attention of the public, via the Drink Without Waste Facebook page (Figure 11), and the interactive map that is accessible on the Drink Without Waste website (www.drinkwithoutwaste.org).

Figure 11. Consumer engagement via Facebook and website: map includes scheme's collection points



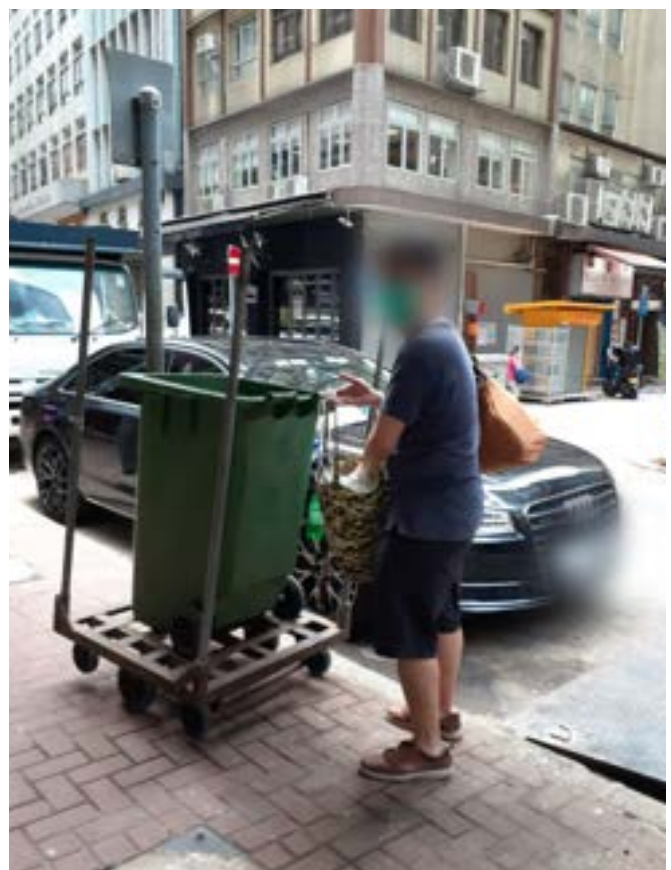
Few consumers use recycling shops in industrial areas, since they seek out locations that are close to their homes, on their way to or from work, or where they run their errands (Figure 12).²² Evidence from both the pilot scheme and the now defunct Community Recycling Centres, however, shows that when a bulk drop-off location exists in a residential neighbourhood or other location with high foot traffic, consumers tend to make use of it. As is the case with GREEN@COMMUNITY locations, not all consumers seek remuneration—they are happy to find a convenient location to support them in their sustainability choices. Some recyclers in the scheme facilitate easy drop-off for consumers, for example by adding a dedicated bin at the front of the store (Figure 13).

Figure 12. Consumers' preferences for bottle return locations²³



If bulk locations were to be considered and supported as key nodes in the future collection network for beverage bottles and other plastics, consumer communication would need to become a key part of the overall strategy. To protect recyclers against a very high volume of micro-transactions that would generate a lot of work for little revenue, future legislation could specify that for remuneration to be paid, a minimum of 10 bottles is required per transaction. The result would be a denser network for the consumer, with both trust-worthy voluntary bottle drops and the possibility to receive remuneration. Stronger consumer participation in neighbourhood bulk locations might also improve the perception of occasional hinderances caused by such recyclers.

Figure 13. A Sheung Wan resident takes advantage of the easy drop-off point created by one of the recyclers in the scheme



Stabilising and growing the sector

Offering an incentive has been an important element in initiating and scaling up the plastic beverage bottle activity. But critically important was also the work done with both frontline collectors and recyclers to help them figure out how to add a bottle collection stream to their operations, which are typically already highly utilised in terms of space, time, and supplier capacity.

Some of that work is relatively easy to replicate and expand in future programmes, for example by comprehensively documenting and proactively sharing best practices. Other aspects, such as the interventions to smoothen relationships between recyclers and transporters, might remain more labour-intensive, unless radically new contractual and financial models are developed.

The scheme's contribution to the MSW Charging policy

When the MSW Charging legislation enters into force, a key driver for the success of its waste diversion goal will be the availability of recycling options.²⁴ Creating a network of existing and dedicated collection points for beverage bottles will be crucial. The pilot's evidence for the effectiveness and efficiency of cleaners and bulk collection locations, both from a consumer and an operator perspective, can be a valuable contribution to the future build-up of a permanent network. Whether such a plastic bottle network is developed standalone or in conjunction with other plastics should also be informed by EPD's other pilot projects and needs to carefully trade off several dimensions:

- **Quality.** More narrowly defined collection programmes typically yield higher-quality—and hence higher-value—recyclables. Simpler definitions result in fewer items getting erroneously included, whereas broader scopes not only cause more confusion about what to include but also tend to gather more dirty items.
- **Efficiency.** Collecting all plastics together can be more efficient for frontline collectors and recyclers if really all plastics are allowed into the collection scheme. If some types of plastics or products are excluded, it requires more attention from all parties, and in that case, it is easier for these stakeholders to have a 'positive list' (e.g., 'all PET bottles') than a 'negative list' to work against and monitor.
- **Volumes.** At the sorting plant, benefits from 'all-plastics' programmes accrue if (a) the plant has high levels of automation supplemented with labour that focuses on quality control and (b) there is a market for the large majority of collected plastics. If (a) and/or (b) are not valid, then such broad collection programmes merely drive up *collection* statistics but not actual *recycling* outcomes.



The scheme's contribution to the Producer Responsibility Scheme on Plastic Beverage Containers (PPRS)

Government proposes a producer responsibility scheme for plastic beverage bottles to ensure that relevant stakeholders will play their part in contributing to the proper and effective treatment of such packaging. The consultation paper also points out that to facilitate the proper management of single-use plastic beverage packaging, many jurisdictions have a dedicated system to handle and collect them separately from other waste plastics for recycling.²⁵

Neither in the PPRS consultation document nor in other published documents like its annual Monitoring of Solid Waste in Hong Kong reports has the Government set or mentioned a target collection or recycling rate for plastic beverage bottles. It is therefore hard to say in absolute terms how effective the pilot scheme or similar schemes was or could be in meeting Government collection goals.

There are, however, several observations to make about contributions towards the various elements laid out in the consultation document (in the following, numbers refer to the sections of the consultation document):²⁶

Incentive insights

- **Deposit scheme (rebate, 4.2).** Government proposes to incentivise recycling of beverage bottles by paying out a rebate for every qualifying bottle returned. As demonstrated in other jurisdictions,²⁷ bulk collection locations are a workable and useful contribution to collection networks under such schemes. Most if not all existing systems, however, would contain a manual or automated counting component, either on-site or at a centralised location (in which case payment might be either delayed until or corrected after counting). Counting would also increase the required manpower and/or space, both of which are in short supply in Hong Kong's recycling industry. If, however, the correlation between weight and unit count can remain relatively stable when scaled up, a future system may be able to handle the absence of unit-based accounting for incentive payout through bulk channels.
- **Incentive size (4.3).** As to the size of the rebate, the pilot scheme has demonstrated the effectiveness of even small remunerations. It would therefore be prudent to start small and optimise all system parameters before working towards even higher collection rates through higher rebates. If small remunerations were to fail to motivate a high share of consumers to hang on to their bottles until they have found a suitable rebate-distributing drop-off location, the concept of financial value could still motivate a larger share of the population to not dispose of them in the garbage bin and rather keep them separate and hand them over to one 400,000 frontline collectors in Hong Kong (as is the case for cans).

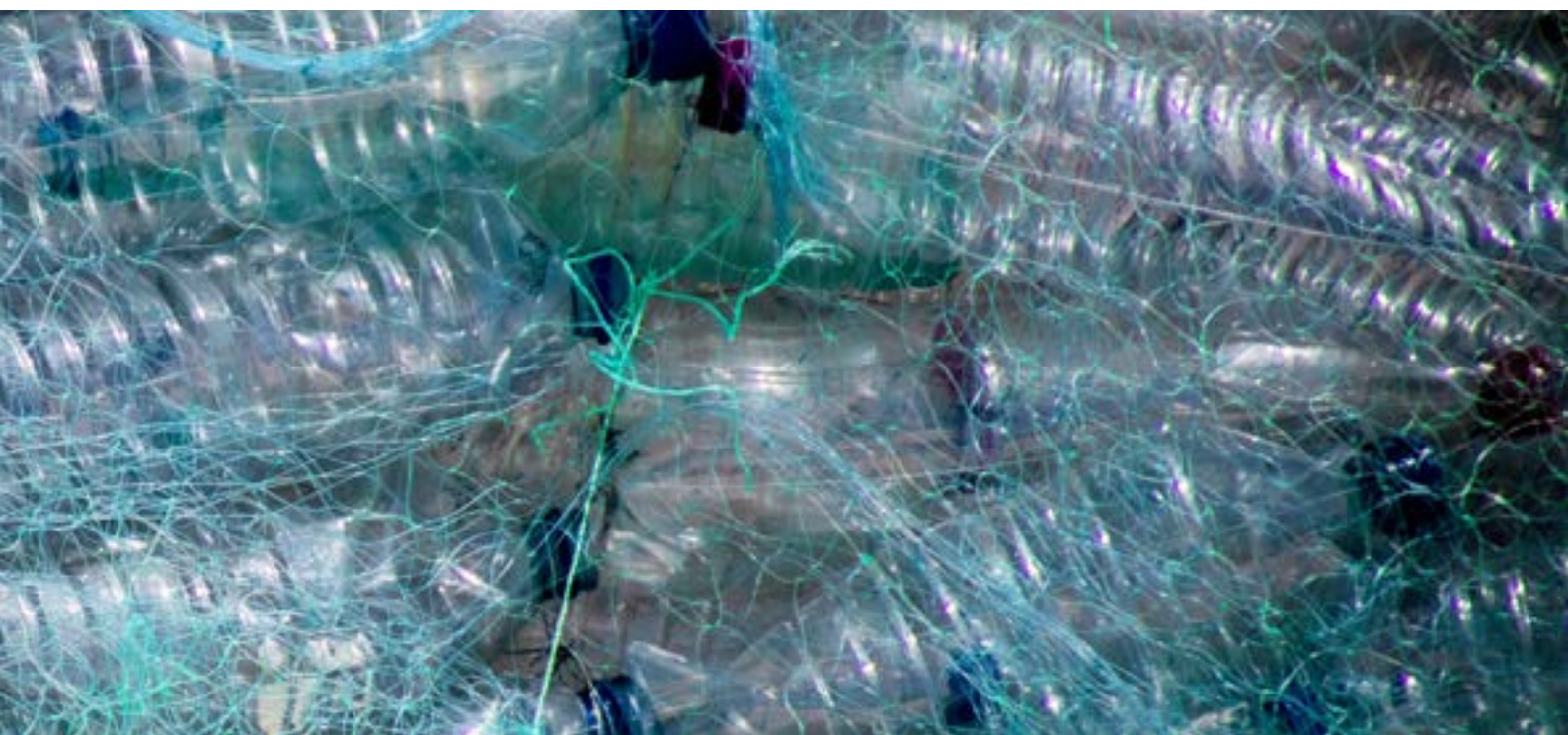


Collection network insights

- **Reverse Vending Machines (RVMs, 4.1).** Government suggests the use of RVMs to enhance collection efficiency and facilitate the provision of rebates. RVMs can be useful in attracting and educating consumers, reducing fraud risk, and facilitating on-site operations. Current best-in-class bulk models could receive up to 100 bottles per minute. RVMs as currently piloted by the EPD, however, do not have a bulk function, nor are the piloted machines accepting large volumes: a limit of 30 bottles per day and per payment account is imposed. This is suitable for most Hong Kong consumers²⁸ but not for those engaged in collection on a daily basis, as a source of income. In absence of an automated bulk solution, the manual bulk locations as piloted in the neighbourhood scheme can be an excellent solution for cleaners and other collectors that have access to large volumes of materials and limited time available for transactions.
- **Role of retail (2.6 and 4.5).** Government proposes deploying collection points at retailers that sell bottled beverages. Such a network would certainly need to be complemented with other types of drop-off locations. Dedicated bulk return points would keep large-volume collectors away from retail locations and limit the inconvenience caused for retailers and shoppers.

PRS scope insights

- **Materials (3.6).** As to the material scope of the proposed PPRS, the pilot scheme has demonstrated that manual bulk locations can handle a predefined scope. Although both collectors and recyclers indicated they would have preferred including a broader range of plastic bottles, this is likely driven by a sense of missed opportunity, rather than the ability to keep out 'unauthorised' packaging: none of the quality spot checks executed over the course of the pilot resulted in payment refusal due to too many unauthorised bottles.
- **Size (3.3 and 4.4).** Regarding the bottle sizes proposed in the PPRS, the pilot demonstrates that bulk locations could without difficulty handle large as well as small bottles since there are no physical constraints. Government's concern regarding the larger operational burden of a PPRS that includes bottles with sizes that cannot be accepted by RVMs, is therefore a moot point if bulk or other manual return locations are added to the network. One concern remains, however. Government proposes a flat rebate rate regardless of the size of the beverage packaging. At bulk return points without counting equipment, as was the case for all recyclers in the pilot, take-back might be based on weight rather than on number of bottles. As a result, in a fully scaled-up PRS, returns of large volumes of larger, heavier containers could result in an accounting imbalance in the compliance mechanism's books—since revenues would be based on number of items. The proposed PRS may therefore want to adjust for weight.



4.3

The scheme illustrates the potential of existing collection networks

An explicit goal for the pilot was to see how well Hong Kong's existing network of recyclers and the cleaners and other frontline collectors they work with, could be leveraged for the collection of plastic beverage bottles. This section therefore looks into the recycler network, the network of collectors around each recycler, and the processors.

The recycler network

Intense recycler recruiting and onboarding effort

Collection shops in the pool were already known to some members of the team. Recruiting was nevertheless resource intense:

- Recyclers need convincing. This will be easier in future programmes since now there is evidence that this collection model can work from a recycler perspective, and that it can be profitable (as evidenced by the later shops easier to recruit).
- Once signed up, there is no guarantee that recyclers will actually initiate the activity or sustain it. Accompanying the recyclers early on as well as throughout is required.

Knowing now what the main concerns and actual barriers are that were faced by the recyclers, any future programmes could anticipate them and address them proactively in their recruiting drive—both in terms of information and in the form of a non-financial support offer. Mechanisms like the volunteer field workers could be scaled up, codified, and supported with certain management mechanisms.

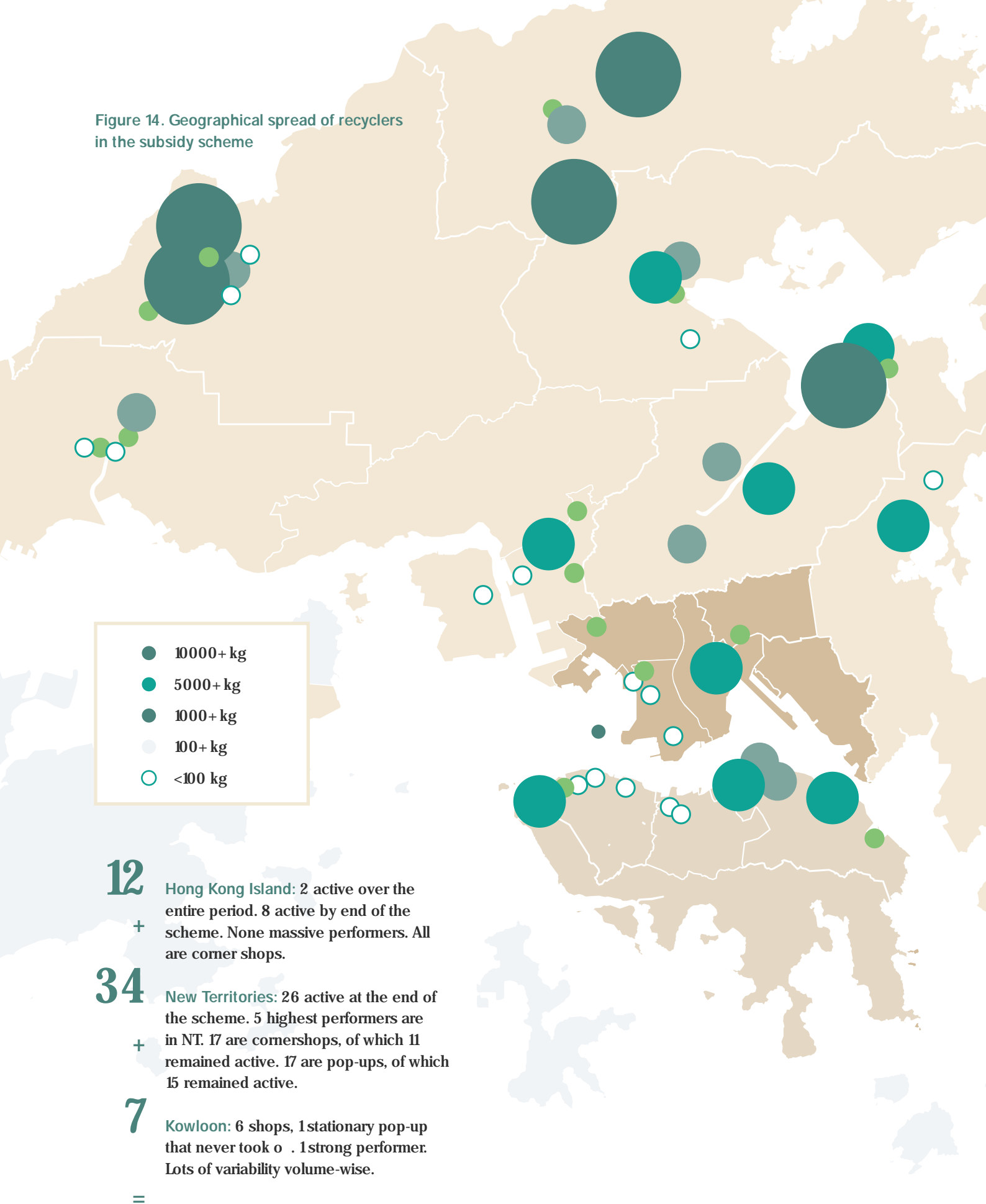
Geographical spread

The network was well spread out across the Hong Kong territory (Figure 14) but left, mainly due to the size of the project, some blind spots.²⁹ While the participation of Hong Kong Island recyclers was similar, the bottle scheme attracted relatively less Kowloon and more New Territory recyclers than was the case for the paper subsidy scheme.³⁰ This could be the consequence of the relative tighter premises that Kowloon recyclers operate from, resulting in a stronger reluctance to take on a bulky, light recycling stream.

The fieldwork interviews and exit interviews with recyclers did not yield any concerns about too much competition; this is likely an indicator that maximum viable density had not yet been achieved. From an inbound logistics (i.e., collectors') perspective, an even spread is usually more attractive, since it keeps walking distances and logistics complications within limits. From an outbound logistics perspective, however, a higher concentration is of more interest since it keeps pick-up costs down.

Since only certain districts got to enjoy the benefits of participating recyclers, and since most participating recyclers had not yet reached their maximum ability and capacity, **a future scheme should benefit from a network that is both extended and densified.**

Figure 14. Geographical spread of recyclers in the subsidy scheme



Total: 53 recyclers

Nature of the recyclers in the network

35 of the recyclers that signed up for the project were operators of so-called recycling shops, i.e., operators with permanent premises where recyclables are being collected (Figure 15). 17 were operating non-permanent locations (so-called pop-ups) but at mostly pre-determined times (Figure 16).

Figure 15. Example of a recycling shop



Figure 16. Examples of pop-up recyclers

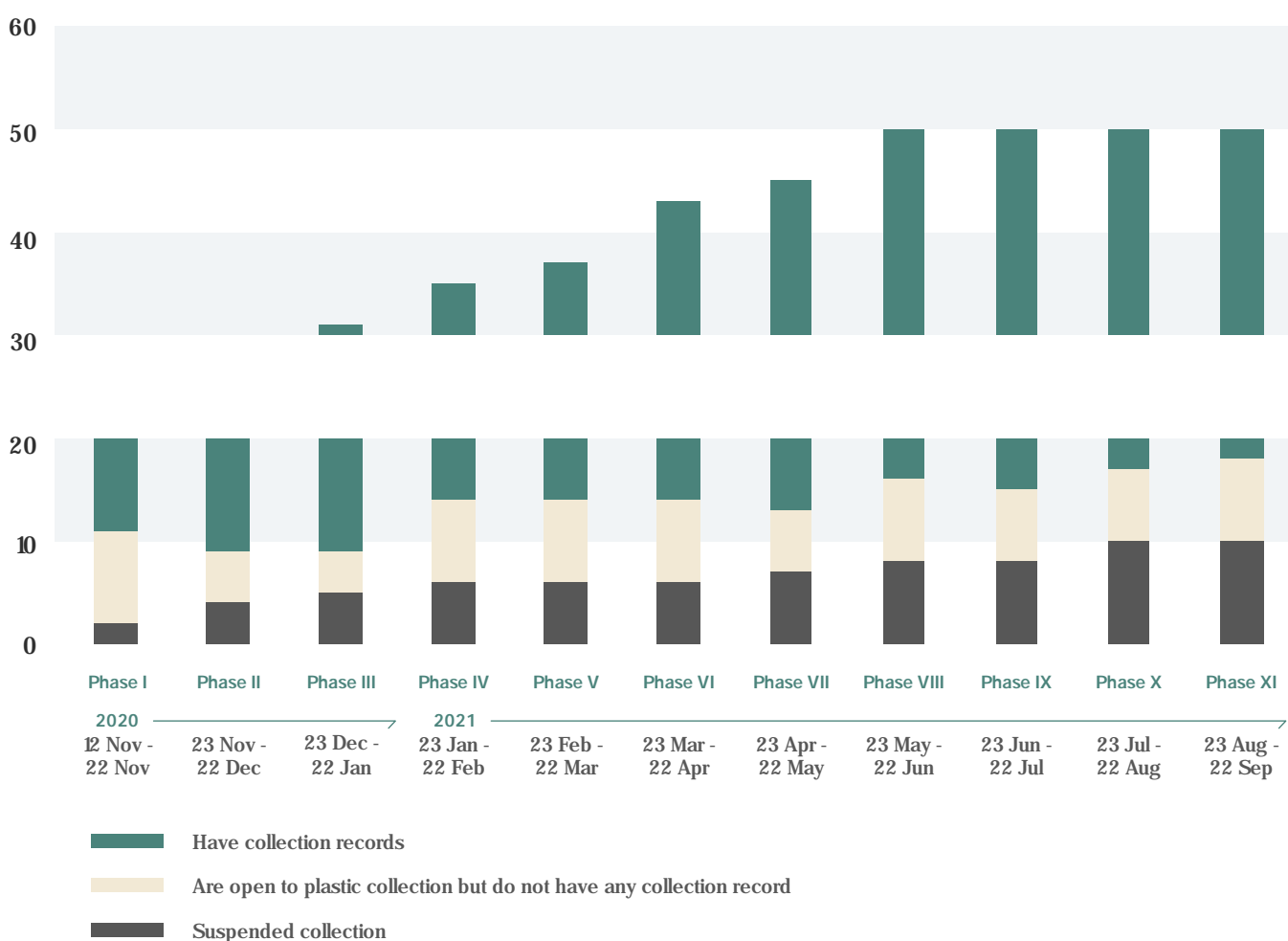


Evolution of the recycler network

It remained difficult to keep recyclers in the programme and actively collecting, even after they signed up (Figure 17).

The main challenge voiced was about the interactions with external parties. On the one hand, **transport timing and conditions were a continuous point of friction**—critical to the recycler who is running out of precious storage space, but not easy to afford by the processor, especially when volumes are relatively small. On the other hand, **the use of public space to complement the limited on-site storage space led to irritations within the neighbourhood**. Fines for road and sidewalk blockages were issued on multiple occasions.

Figure 17. Evolution of the number of recyclers in the programme



The project team made efforts to help smoothen these transactions and relationships, for example by reaching out to processors and by talking things through with the relevant district councillor. Nevertheless, over the duration of the project, four recyclers suspended their activities or dropped out of the subsidy scheme altogether because of fines and altercations with the neighbourhood.

Some recyclers never got the bottle collection activities off the ground. Some of these explained that it was because of a complete lack of interest on the part of their frontline collectors—this could not be confirmed nor refuted. An additional five recyclers initiated collection but subsequently suspended the programme due to low incoming volumes.

Volume collected per recycling shop

The field survey interviews provide insight into the importance of the plastic beverage business to recyclers. For recycling shops, plastic beverage bottles constitute 6–10% by weight of what they recover in a month. Stationary pop-up recyclers reported this share to be 45% and mobile recycling trucks 64% (with one truck focusing exclusively on the plastic business).

The scheme’s transaction records show a clear upward trend in the volumes collected per month per recycler (see for example the monthly results of the highest-performing recyclers in the scheme, Figure 18 or of the least-performing ones, Figure 19). On a more granular basis, recyclers themselves perceived volumes to be quite variable from week to week. Generally, the lowest weekly recovery quantities were reported by recyclers to be around 35% lower than their highest quantities, with one recycler claiming weekly volumes ranged from 0.25 to 7.50 tonnes.

Figure 18. Monthly volumes (kg) of the top 20 recyclers (when ranked by average monthly volume over active period)

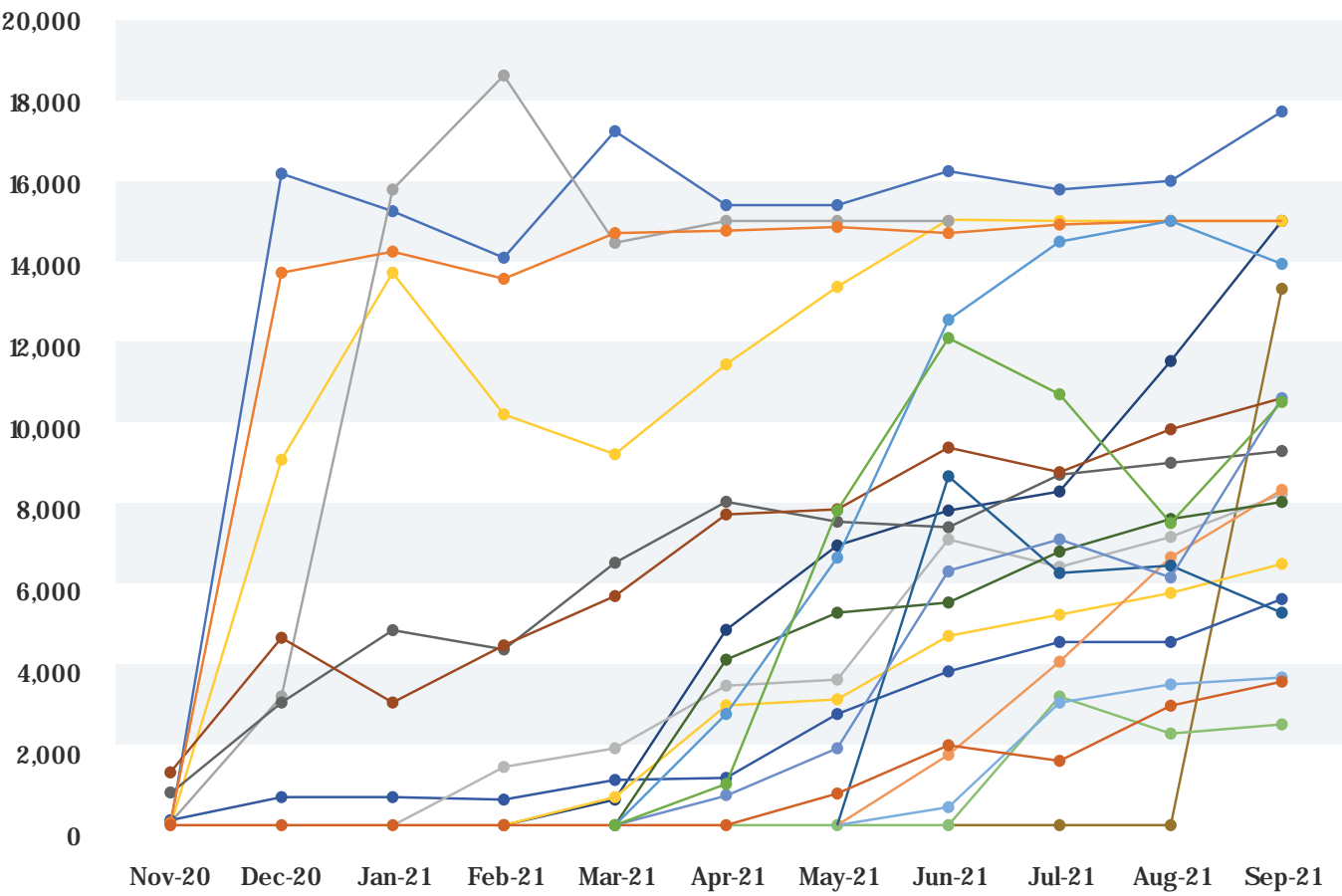
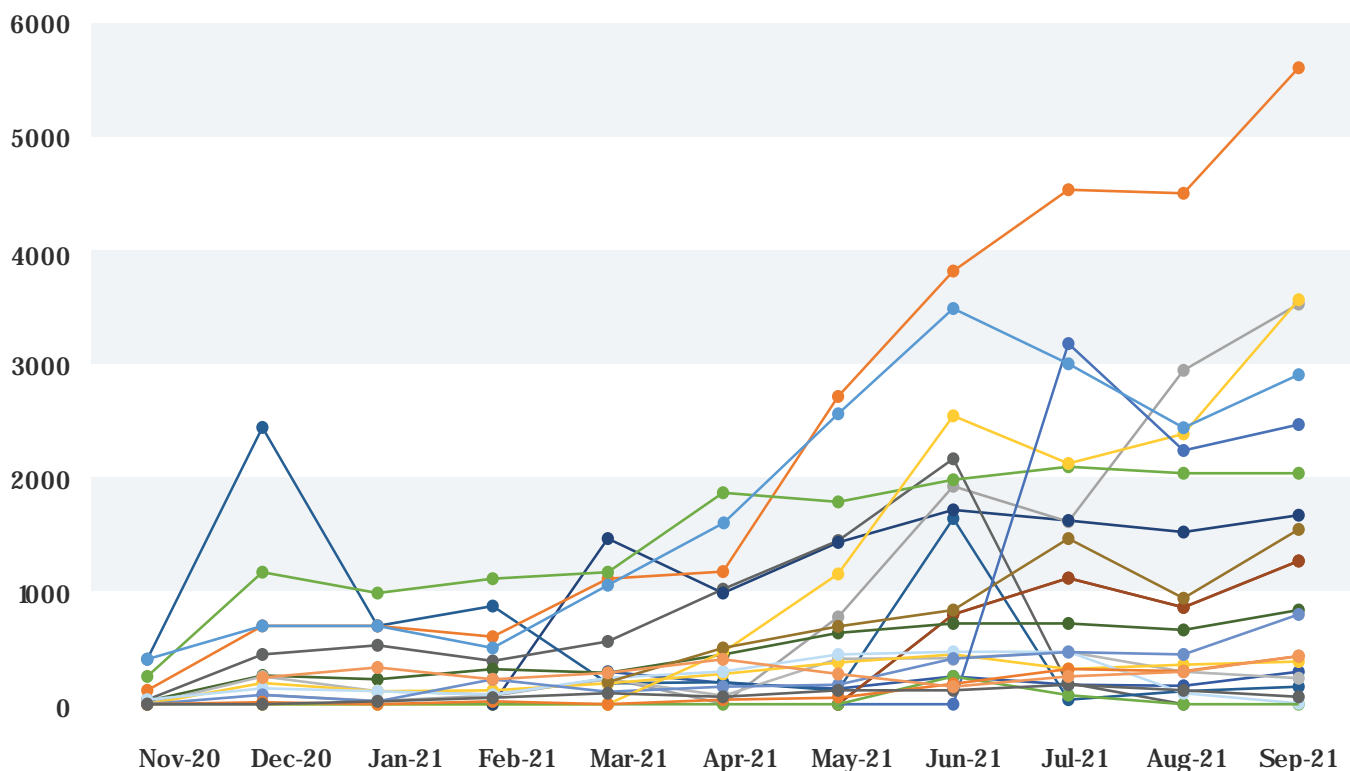
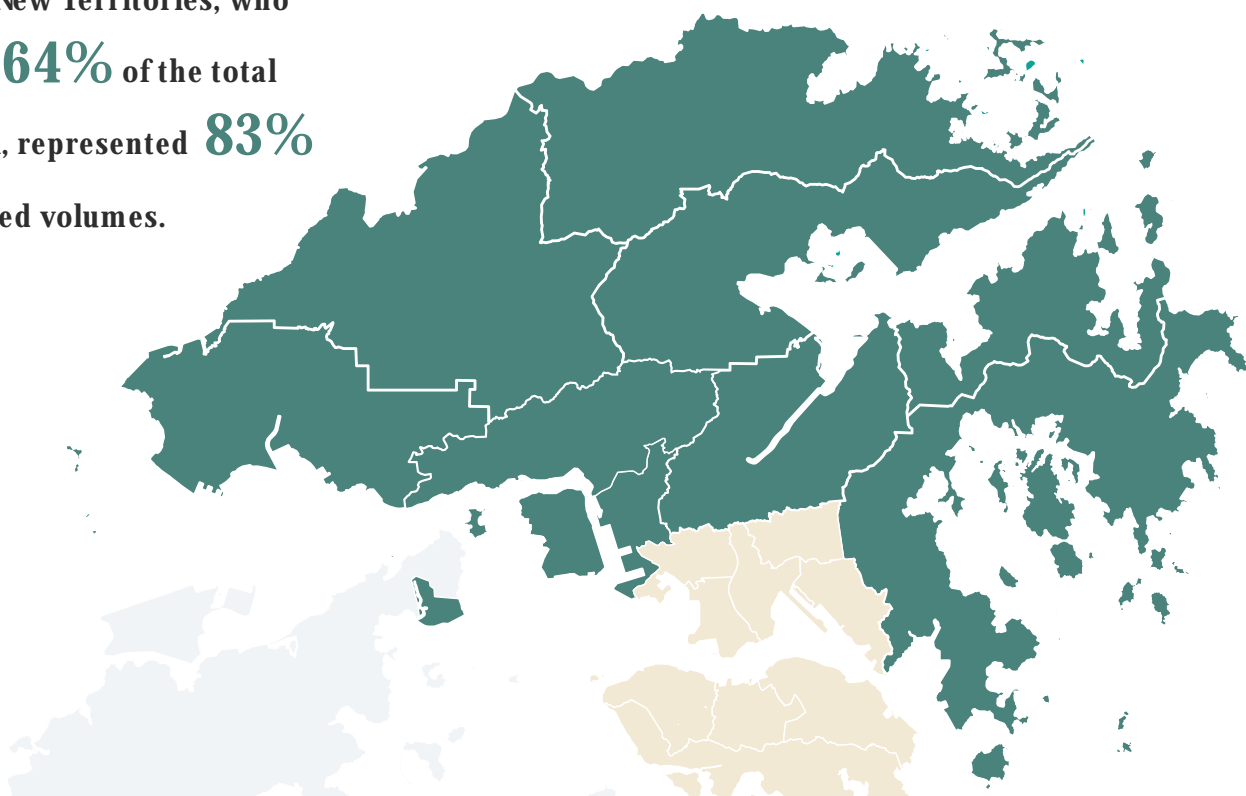


Figure 19. Monthly volumes (kg) of the 20 least-performing active recyclers (when ranked by average monthly volume over active period)



As with recycler participation rates, geographical location—and hence likely space restrictions—may have played a role in individual recycler performance. For example, of the ten recyclers in Yuen Long and North that remained active from the moment they joined the scheme, four collected each over 10 tonnes per month and two of those operated at or near the maximum allowed monthly volume of 15 tonnes. In contrast, across Eastern and Central & Western districts on Hong Kong Island, none of the eight recyclers that remained active throughout the scheme's subsidy period, reached a monthly average of 10 tonnes (see Appendix).

Recyclers in New Territories, who represented **64%** of the total recycler pool, represented **83%** of the collected volumes.



Profit

A total of

1,722,712

HKD was paid out to the recyclers in the form of handling subsidies.

The rate was HKD 0.035 per bottle, subject to changing conditions. Over the collection period, market values did not drop sufficiently, nor did operation costs go up to a degree that would have warranted a subsidy adjustment under the scheme's pre-agreed revision mechanism.

On the subject matter of profits that recyclers derive from plastic beverage bottle recovery, responses acquired during the field survey were understandably reserved.

Some recyclers were concerned that scaling up and fully incorporating this waste stream into daily operations would require capital investments that would yield comparatively low profits. Despite the fact that the scheme had offered to finance balers for qualifying recyclers, baling was specifically pointed out as a barrier. Baling of plastic bottles requires different machinery than what is traditionally used for wastepaper. **Attempts to use paper-designated compactors for plastic beverage bottles resulted in malfunctions and additional cost from repairs.**

One recycler felt that the low market value of plastic beverage bottles is not (yet) compensated by any quantitative abundance and the potential of operational upscaling.

Another complaint pertained to changing market dynamics.³¹ A recycler explained that most plastic beverage bottles he received were delivered by cleaners but 40%, still an important share, came from informal waste collectors (this share is lower at most other recyclers). He accused some downstream processors of attempting to monopolise collection channels by incorporating and formalising informal collectors. This, so the interviewee, has negatively impacted collectors' delivery frequency and quantity arriving at his collection location.

Multiple recyclers thought the government has too long neglected plastic beverage waste management, shifting instead the organisational burden to them and processors.

The pilot scheme itself received a relatively positive approval rating among recyclers (3.9 out of 5).³² Concerns included:

- A perception that the pilot scheme engaged with recyclers that feature neither operational capacities nor experience;
- The duration of the scheme being too short;
- The scope being too limited "(PS, PP and PVC excluded)" resulting in missed revenue opportunities; and
- Insufficient direct financial benefit for recyclers.

As for expenditures, recyclers indicated that vehicle operation and labour costs are the highest ranging items. One recycler, whose bottle-related activities represented about one tenth of total activities (by weight), estimated his cost across all recycling streams as follows:

- Truck maintenance approximates around HKD 15,000/ year, while fuel costs are about HKD 300/ day/ truck.
- Labour costs are slightly more variable and were stated to lie between HKD 7,000 and 15,000/ cap/ month when hiring around 3–4 labourers.

Operational challenges

Apart from concerns pertaining directly to profits and expenditures, in-depth interviews revealed some further challenges (Table 10).

Table 10. Recyclers' reported challenges

Operational challenges	Rating (5=max)
Taxation and subsidies	4.1
Infrastructure	3.4
Regulation (including fines and standards)	2.8
Storage	2.7
Delivery routines of collectors	2.7
Competition from other recyclers	1.4

Taxation and subsidies. It comes as no surprise that **fiscal matters (i.e., taxation and availability of subsidies)** are most important to recyclers, who operate in a low-margin sector whose wellbeing is often dependent on government support measures that directly affect finances.

Storage. As relayed during spot checks and field interviews, recyclers sought improvements for storage conditions. Some managers stated that plastic beverage bottles tended to occupy one third to half of designated storage space, which understandably hindered regular operations, which had already been optimised for the limited in- and outdoor space that recyclers have access to. To improve the situation, recyclers used public space (Figure 20), resorted to increasing downstream logistics frequencies. The latter increased overall operation costs or, for those whose transport costs were covered by processors, increased friction with the processors.

Figure 20. Use of public space



Local regulations. Storage restrictions as well as transportation-related challenges resulted multiple times in conflicts with recyclers’ surroundings. As described earlier in this chapter, complaints were made by nearby citizens, sometimes via district councillors. This greatly affected the recyclers: penalties and fines were charged by FEHD and other government departments, e.g., a parking ticket of HKD 320 and a Public Cleanliness and Obstruction of HKD 1500 (Figure 21). This resulted in four recyclers stopping their collection activities, and the enthusiasm of several others being tempered. Regularising their use of public space was therefore mentioned by multiple interviewees as a necessity going forward (Table 11).

Figure 21. Fines received by participating recyclers



Delivery routines of collectors. While recyclers hold overwhelmingly positive views on frontline collectors (4.6 out of 5),³³ concerns were voiced regarding training of and communication with this group. Collected statements during the survey periods indicate that systemic changes such as those introduced by a subsidy programme would have to stay in practice for a certain amount of time for frontline collectors to fully adjust their collection and transaction routines. Future programmes could consider offering more frontline collector training, but even more importantly, they need to offer stability in terms of scope and collector-related procedures.

Competition. Maybe less expected is that competition between recyclers is considered as the lowest operational challenge, indicating that there is room to considerably densify the network.

Table 11. Recyclers’ reported wishes

Suggestions/ requests	Emphasised by # of recyclers
Subsidy extension/ tax reduction	5 of 7
Improving regulations	3 of 7

Fishnets. To address some operational challenges, 3900 so-called fishnets were distributed to 44 shops and trucks. Each bag could contain 280 bottles (7kg). The bags were easily recognised by scheme participants. A third of participants requested more nets.



The benefits of using such visible, standardised bags included:



● For frontline collectors:

- Aid collection, storage and transportation
- Reduce the use of plastic bags (saving money and the environment)



● For recyclers:

- Facilitate on-site storage
- Establish repeatable operational practices



● For both types of participants as well as the system administration:

- Minimise fraud by offering a triangulation point (weight vs volume)
- Minimise fraud by facilitating visual content checks
- Support branding & advocacy purposes

Initially the bags were also considered for transport to recycling plants. This idea was abandoned because the limited number of potential cycles would render such nets unaffordable and wasteful. At the collector and recycler side, however, many participants successfully integrated the nets into their daily routines.

Figure 22 Use of standardised bags for transportation and storage



Collector relationships

The field survey provides some insights regarding recyclers' attitudes towards frontline collectors. The general sentiment towards frontline collectors' practices was relatively neutral (2.7 out of 5).³⁴ In terms of communication and relationship building, **frontline collectors were perceived very favourably** (4.6/ 5).³⁵ This hints to a relatively well working relationship within the plastic beverage bottle exchange and recovery network, which is crucial for the resilience of recovery structures.

Pop-up operations

17 registered recyclers (of which 15 active) in the scheme ran operations at locations that were not formally or permanently allocated to their activities. These recyclers organise collection of multiple materials along roads and car parks (Figure 23), or nearby the refuse collection point (RCP) of properties (Figure 24), usually at regular days and times. Nine out of 17 were fully mobile, truck-based collection operators.

Figure 23. Pop-up recycler operations on a roadside parking lot

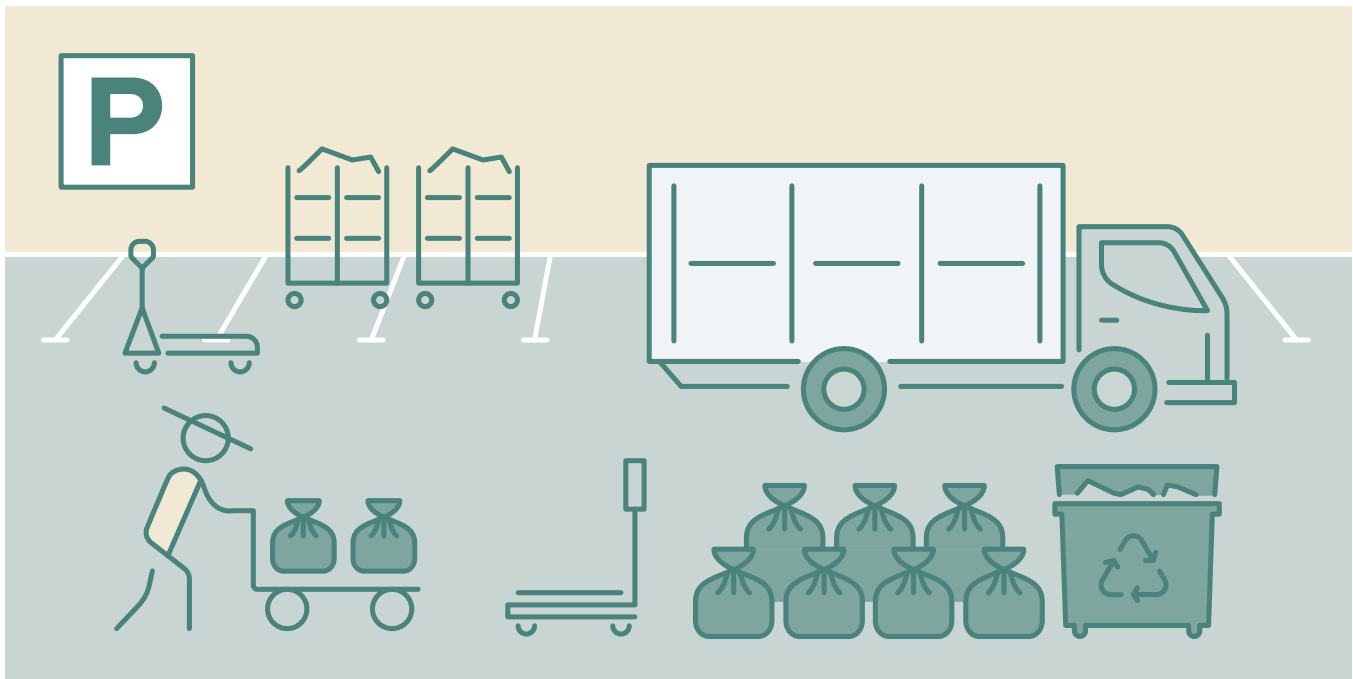


Figure 24. Pop-up recycler operations in the vicinity of a Refuse Collection Point



7
out of

top

10

recyclers are pop-ups.
(by monthly average)



There are multiple reasons why this type of pop-up recycling operation is so successful (Figure 25):

● Close to material sources

- Private and public RCPs are near and sometimes at the centre of meaningfully sized catchment areas like public housing estates
- Cleaners tend to have access to recyclables at the buildings or specific floors they are responsible for
- While several cleaners reported pulling the majority of plastic bottles from the mixed waste they collected, there is an indication that a growing number of households keeps the bottles separate for the cleaners, as they already do for paper and cardboard—an increase in small, floor-based recycling bins could further stimulate such behaviours

● Easy access for frontline collectors

- RCPs are already frequented by building cleaners to dispose of mixed waste
- Access for frontline collectors without hindering others

● Ample and flexible use of space

- Parking areas and RCPs have unused space
- Space to sort into different fractions
- Space for storage until pickup
- Access for collection vehicles for transport to a storage facility or directly to a processor

● Effectively operates like a small Material Recovery Facility (MRF)

- Allows frontline collectors to bring multiple recyclable fractions to a single location, offering a one-stop solution that is valuable for frontline collectors that are short on time and want to maximise total revenue
- Often provides additional on-site sorting, facilitating or even bypassing larger, mechanised sorting operations

Figure 25. Pop-ups work well for cleaners, recyclers, and logistics providers



Drink Without Waste has estimated the number of potential pop-up and small MRF locations to nearly 18,000, across housing estates and three-nil buildings; shopping malls, commercial buildings and industrial buildings; and public facilities such as refuse collection points, wet markets and cooked food centres, and community halls.

While not all of these will turn out to be suitable, there is likely significant potential to expand the bulk network with these effective, efficient locations, especially if Government, local politicians, and PMOs actively support their development. No doubt, best practices from other jurisdictions can be helpful here too. Korea, for example, has a thriving system of such small, often residential MRFs (Figure 26).

Figure 26. Small MRFs in Korea³⁶



The collector network

Swift recruiting and onboarding

Over 1000 cleaners and other frontline collectors participated in the scheme. The project team distributed A4 flyers to cleaners, informal collectors, and residents during outreach activities (Figure 27). The leaflets provided an overview of the packaging in scope, the remuneration offered.

Figure 27. Flyer distribution



Most frontline collectors, however, have fairly fixed patterns when it comes to visiting recyclers. It was therefore observed by the project team that new recyclers usually only required about one week to inform the frontline collectors of the new pilot scheme. After one week, most recyclers already started receiving bottles.

After that period, spot checks indicate that recyclers tended to no longer actively promote the pilot, but frontline collector recruiting may have continued for some time through word of mouth between the frontline collectors. Throughout the collection period, both mobile and stationary recyclers were required to keep the information banner (Figure 28) visibly displayed. While the primary goal was to keep collectors abreast of current prices, this may also have served the purpose of alerting additional frontline collectors to the opportunity.

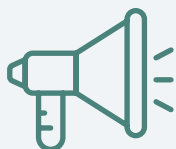
Figure 28. A3 banner for display at recyclers explaining the scheme



Communication between recyclers and frontline collectors seems to have been the main source of specifics on in-scope recyclables streams. In the field interviews, some recyclers indicated that the managers themselves frequently had to provide frontline collectors with (additional) instructions as to what to collect.

Given these communication dynamics, it could be useful for future schemes to centre their information campaigns at recyclers and rely on their disseminating capacity to instruct frontline collectors for direct execution.

Could more cleaners and other frontline collectors have been enlisted through better awareness of the programme?



- **Awareness** amongst collectors was already high, as gauged during site visits during and after the project period. Given the strong relationship between the frontline collectors and the recycler, and the strong collector awareness of the programme, it seems that the methods applied in the pilot—a brief and limited campaign in the beginning of the scheme, and clearly posted information throughout the pilot—is sufficient in terms of awareness building and recruitment.



- **Remuneration** seems to have been the more decisive (but not only) element for collector participation. While the pilot's collector remuneration of HKD 0.05 per bottle was sufficient to mobilise a significant network of frontline collectors around the bulk recycling points, there was a segment of the frontline collectors for whom the remuneration was not sufficient to shift activities (opportunity cost) or to compensate for barriers encountered (e.g., time to collect or distance to recycler).



Collector demographic

The prevalence of different types of frontline collectors was determined through the fieldwork's transaction observations and described in Table 12. While the share of cleaners remained stable, the presence of informal collectors diminished and that of retired residents went up with the end of the scheme.

Table 12. Composition of collectors transacting plastic beverage bottles during the field survey

Observed presence at recycler	September 2021		October 2021	
	# persons	Proportion	# persons	Proportion
Cleaners	33	18.9%	53	18%
Household assistants ('helpers')	0	0%	3	1%
Retired residents	29	16.6%	89	30%
Working residents	13	7.4%	34	11%
Residents younger than 19 years	0	0%	0	0%
Informal waste collectors	82	46.9%	106	36%
Others	18	10.3%	12	4%

While the number of observations may be too low to be conclusive on this demographic shift, the pattern might be related to the broadly shared perception among informal collectors that the monetary value associated with the plastic beverage bottles is too low. The ending of the scheme might therefore have induced this frontline collector group to re-shift their focus to wastepaper and other recyclables that yield higher turnovers.

In-depth interviews with a subset of frontline collectors following the records of individual waste transactions shed light on the age composition (Table 13). Overall, the elderly are over-represented, with 43 percent of collectors over 65 years old.

Table 13. Age distribution of key plastic beverage bottle collector demographics

n=37	36-45	46-55	56-65	>65
Retired residents	0%	11%	33%	56%
Cleaners	5%	18%	45%	32%
Informal waste collectors ³⁷	17%	0%	17%	67%

Independent of the pilot scheme, this could pose a critical problem for recycling in Hong Kong. With collection being the most decisive factor for achieving a high recovery rate (Graedel and Reck, 2014), a system that relies so heavily on older generations incurs constraints on its long-term sustainability.³⁸ It remains to be seen whether current collection patterns will be perpetuated given that younger Hong Kong residents may increasingly recycle their own waste but do not readily engage in recycling collection as a gainful activity.³⁹

The in-depth interviews gauged frontline collectors’ income levels across all sources of income (Table 14). In general, reclaiming and returning waste plastic beverage bottles as an activity (rather than merely returning bottles from own consumption) is done by the lowest income groups in Hong Kong. As was found in mainland China,⁴⁰ waste recyclables collection is also practiced by groups *above* the minimal wage level, to supplement incomes. It is no wonder, then, that monetary considerations play a key role in motivating frontline collectors and a guaranteed payout—as offered for example in the pilot scheme—is beneficial when striving for higher collection rates.

Table 14. Monthly collector income (HKD) across sources of income

n=37	< 5,000	5,000–10,000	10,001–15,000
Retired residents	78%	22%	0%
Cleaners	9%	5%	86%
Informal waste collectors ⁴¹	67%	17%	17%



Collection patterns

While many frontline collectors report regular deliveries and transactions of beverage bottles, the small set of field observations in Table 15 make clear that the number of bottle transactions is meaningfully lower than transactions of other recyclables. The pop-up recycler at Lok Fu Estate is specialised in plastics, hence the 100% share of plastics vs total transactions. Together with economic interest and stronger habits, more frequent trips may simply be necessary because of the sheer weight of cardboard and other recyclables.

Table 15. Number and proportion of bottle transactions compared to overall recyclable transactions at recyclers

Recyclers location	September 2021		October 2021	
	# of bottle transactions	% bottle vs. other recyclable transactions	# of bottle transactions	% bottle vs. other recyclable transactions
Kowloon City	9	28%	6	10%
Lok Fu Estate	5	100%	4	100%
Shui Bin Wai	5	14%	4	17%
Tin Shui Wai	15	32%	9	15%
Sha Tin	15	27%	2	2%
Kennedy Town	n/a	n/a	2	4%



The field work team also looked at delivery frequency variations across the working day (Table 16). The general trend for each station is to have one peak period before noon and one in the late afternoon. These peak or high-intensity exchange intervals tend to last for around one hour in each instance. 36% of instances of peak hours occur before noon, whereas 64% of instances occur in the afternoon.

Based on the table below, the following dynamics can be discerned: (1) frontline collectors observed in the survey tend to prefer delivering their materials rather in the afternoon than in the morning; (2) this pattern has not changed over two months, i.e., it is independent of the implementation of the pilot scheme.

Future schemes should take spatial and temporal collection and transaction patterns of various collector demographics into account when designing the scheme's infrastructure and operations.

Table 16. Transaction frequency

Recycler location	Delivery intervals (rounded up)	September 2021		October 2021	
		# of deliveries	peak vs. low	# of deliveries	peak vs. low
Kowloon City	08:00–9:00	19	peak	19	peak
	09:00–10:00			8	low
	16:00–17:00	13	peak	12	low
	17:00–18:00			19	peak
Lok Fu Estate	8:00–9:30	5	peak	4	peak
Shui Bin Wai	8:00–9:00	10	peak		
	08:30–09:30	4	low	7	peak
	09:30–10:30			1	low
	15:00–16:00			7	peak
	15:30–16:30	8	peak		
	16:00–17:00			9	peak
	17:00–18:00	12	peak		
	18:00–19:00	3	low		
Tin Shui Wai	10:30–11:30	25	peak	10	low
	11:30–12:30	10	low	18	peak
	15:00–16:00			12	low
	16:00–17:00	12	peak	19	peak
Sha Tin	8:00–9:00	19	peak	15	low
	09:00–10:00	14	low	34	peak
	10:00–10:30			3	low
	14:30–15:30			18	low
	15:30–16:30			25	peak
	16:30–17:30	19	peak		
	17:30–18:00	3	low		
Kennedy Town	12:30–13:00			16	low
	15:00–16:00			20	low
	16:00–17:00			21	peak

Volume per frontline collector

Typical volumes range from 5kg or 200 bottles per transaction for retirees, to 10 kg or 400 bottles per transaction for cleaners (Table 17).

The large majority of interviewed cleaners retrieved bottles from bins in residential buildings and building complexes. Cleaners reported having few restrictions in accessing that feedstock, but cleaners in both the fieldwork interviews in September and October 2021 and the interviews during the ride-along said that they retrieved a good share of the bottles from the residential mixed waste bins on each floor, rather than from the residential recycling bins. One cleaner estimated that only 20% of the volume she collected was from the recycling bins.

Still on the topic of accessing feedstock, informal collectors may have developed some relationship with those that generate plastic beverage packaging waste, or on whose premises such waste is generated. This is supported by field observations and could explain their willingness to cover distances of over 3 km to collect and deliver bottles for what they experience to be a comparatively low reimbursement (see page 77).

The field work's small sample revealed substantial decreases in the transaction size between September and October 2021, when the scheme had ended (Figure 29). This is not surprising, since 76% of interviewed frontline collectors had also stated that (the lack of) remuneration was their primary reason for not collecting larger quantities.

Most notably, maximum delivery volumes returned by the three most prominent frontline collector groups decreased by 50%, 60% and 96% for cleaners, retired residents, and informal waste collectors respectively.

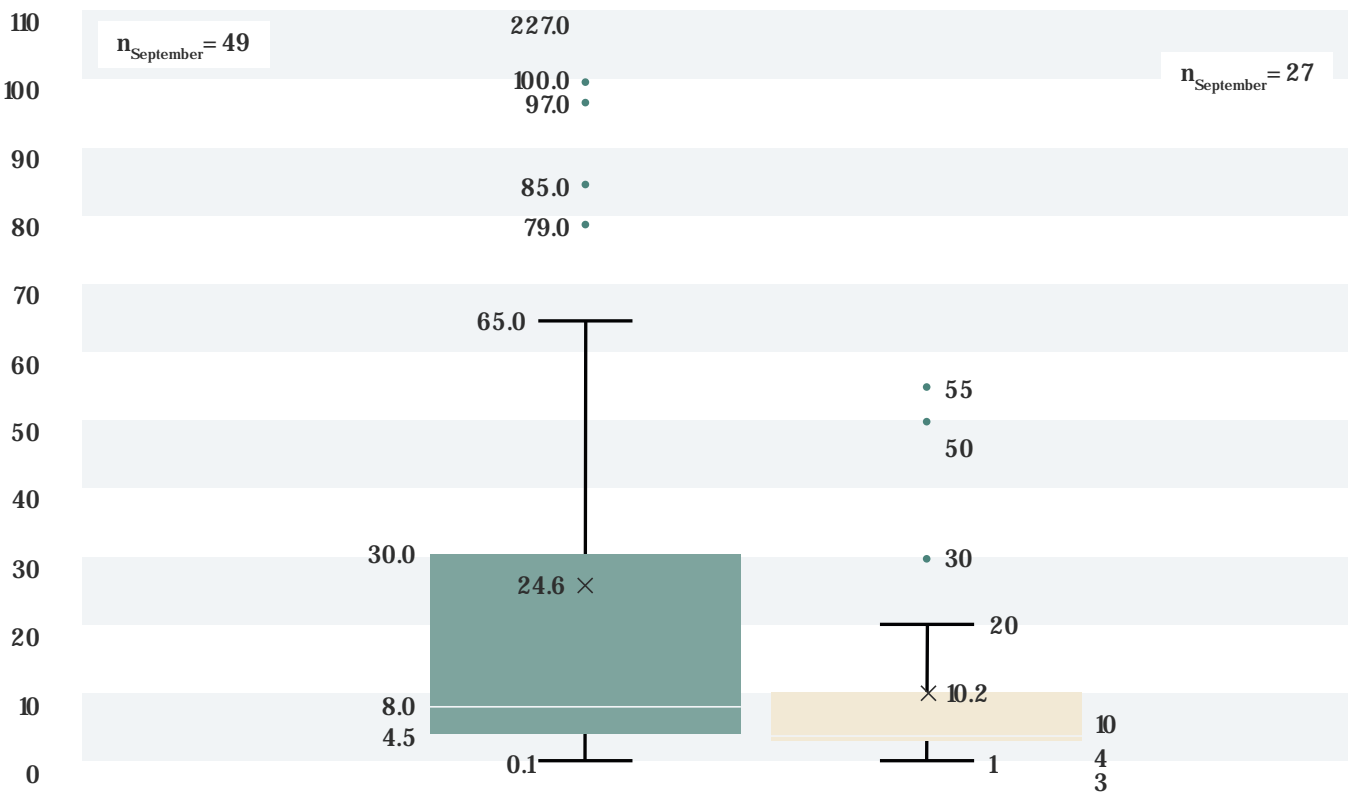
For median delivery values, the decrease for each group appears more nuanced, i.e., 47% for retired residents and 40% for informal waste collectors. Interestingly, the median value for returned volumes by cleaners did not drop.

These figures would imply that cleaners, who according to interviews routinely reclaim recyclables with relatively little effort from residential bins they serve, continue to deliver waste plastic beverage bottles to recyclers. Frontline collectors whose livelihoods depend more directly on the collection of recyclables—retired residents and informal waste collectors—saw their motivation to collect bottles stifled as the scheme discontinued and the opportunity cost became too significant or the revenue opportunity ceased to exist altogether.

Table 17. Plastic beverage bottle transaction size (kg/capita)

	Largest transaction size		Smallest transaction size		Median transaction size	
	Sept	Oct	Sept	Oct	Sept	Oct
Cleaners	100.0	50.0	0.25	2.0	10.2	10.5
Household assistants (helpers')	-	-	-	-	-	-
Retired residents	30.0	10.0	8.0	10	5.0	2.7
Working residents	6.0	13.8	6.0	4.0	6.0	8.9
Residents younger than 19 years	-	-	-	-	-	-
Informal waste collectors	227.0	8.7	0.1	16	9.0	3.6
Others	10.0	-	5.0	-	7.5	-

Figure 29. Box plot with interquartile ranges of Individual bottle transactions (kg/cap) to recycling stations in September 2021 (green) and October 2021 (kaki). Mean values in the box plot are the “x”-value, the median line divides the box plot.



This assessment is accompanied by a finding from the transaction observations. From Table 18, it can be discerned that the presence⁴² of cleaners delivering plastic beverage bottles to recyclers hardly changed over the two months. The presence of retired residents has increased, whereas that of informal collectors has decreased.

The change in presence of different frontline collector groups coincides with a change in the contribution of each frontline collector group to the overall number of plastic beverage bottle transactions. While plastic beverage bottle transactions at the recycler in September (during the pilot scheme) originated mostly from cleaners (39%) and informal collectors (52%), this distribution changed in October. During the second month, surveys revealed that cleaners accounted for 71% of all conducted plastic beverage bottle transactions, whereas the contribution of informal waste collectors steeply fell, to 16%. Moreover, informal collectors' transaction size dropped markedly over the same period.

This finding has major implications underscoring the importance of the scheme. The significant decrease in recovered volumes at the surveyed recyclers (Table 9) can be mainly attributed to the frontline collector group of the informal waste collectors. These informal collectors appear to be highly responsive to the monetary incentive provided by the scheme.

The subsidy scheme's discontinuation has led to a significant loss in reclaiming and recovering capacities provided by informal collectors. The scheme, in other words, enhances social inclusion and improves recycling, which are both important dimensions in the context of sustainable development.

Table 18. Collectors: Presence at recyclers and contribution of overall delivered plastic beverage bottles

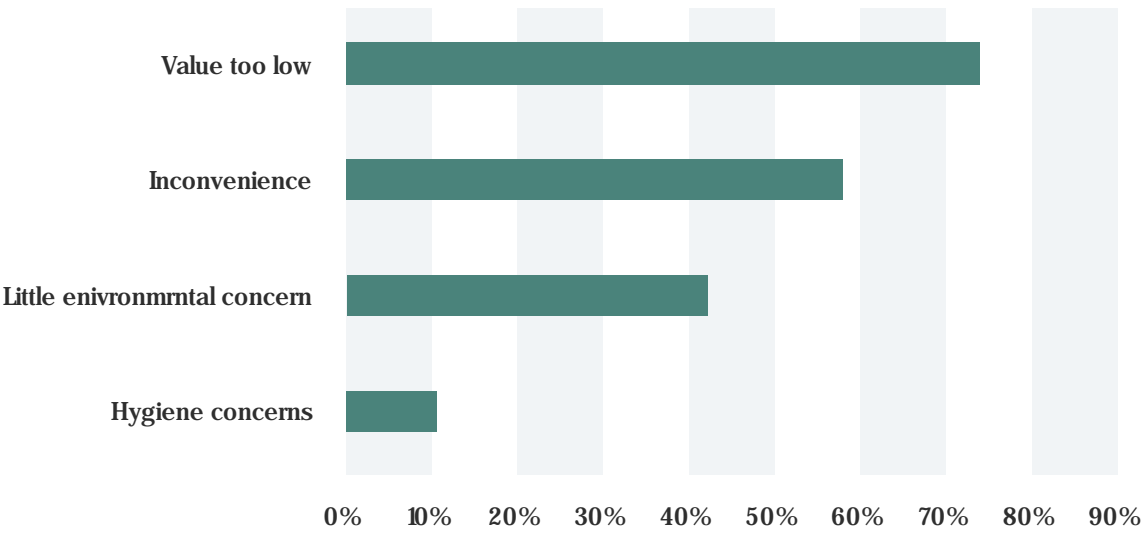
	September 2021		October 2021	
	Presence	Recorded plastic beverage bottle deliveries	Presence	Recorded plastic beverage bottle deliveries
Cleaners	18.9%	39.0%	18%	71.2%
Household assistants ('helpers')	0%	0.0%	1%	< 0.01%
Retired residents	16.6%	7.0%	30%	5.9%
Working residents	7.4%	10%	11%	6.5%
Residents younger than 19 years	0%	0.0%	0%	0%
Informal waste collectors	46.9%	52.0%	36%	16.4%
Others	10.3%	10%	4%	0%

Perceived barriers

Collecting plastics is for most frontline collectors a relatively recent pattern: 73% of interviewees surveyed in September and October had only been collecting plastic beverage bottles for months, not years.

Findings from in-depth interviews provide insights into what, if anything, may have held collectors back from returning plastic beverage bottles to recyclers (Figure 30).⁴³

Figure 30. Factors affecting collectors’ participation, across both instances of the field study



Overall, it can be assumed that the pilot scheme has played a positive, incentivising role. By offering a monetary reward for returned plastic beverage bottles, however small frontline collectors perceived it to be, the scheme may still have initiated a change in collection routines: despite any concerns expressed, collectors engaged in the collection and delivery of plastic beverage bottles.

The October 2021 interviews yielded overall less concerns. During these observations, less individuals engaged in the delivery of plastic beverage bottles. This could mean that those individuals still delivering plastic beverage bottles constitute a core of frontline collectors that are relatively indifferent to various sources of grievance, including limited remunerations. To cultivate a routine among a larger group of potential frontline collectors to include waste plastic beverage bottles in their deliveries, a financial incentive like the one offered in the pilot scheme may, however, be indispensable.

In addition, routines governing recyclable waste transfers from residents and recyclers have proven crucial for recovering household waste in the comparable context of China: Steuer (2020) and Steuer and Li (2022) have shown that routine and habit formation constitute critical elements for realising a sustainable and effective household waste recovery scheme. Herein, key routines of exchange developed as a result of communication and information transparency on market prices of waste fractions by the recycling station managers. This in turn cultivated a sentiment of trust and economic interest in recyclable waste transactions on the side of delivering residents, which frequently embedded waste transactions in their daily activities.^{44,45}

For Hong Kong, the fundament for developing into a similar direction is in place and embodied in the network of recyclers. Support for this system has been underscored by the frontline collectors, who strongly prefer the recycler system over other plastic beverage bottle return options (86% in September and 94% in October 2021). Familiarity with the recycler as well as immediate and cash-based compensation were seen as major benefits.

Interviewees rejected other options, such as Hong Kong’s GREEN@COMMUNITY’s Recycling Stations and reverse vending machines, which many did not know or perceived as incompatible with their interests: the former do not offer a cash-for-material option, while the latter is perceived difficult to handle.

The aspect of hygiene in the context of plastic beverage bottle reclaiming by frontline collectors should be mentioned. Across 16 in-depth interviews conducted among frontline collectors in October, 75% of respondents stated that they did not open up and go through sealed bags to find qualifying bottles. 63% of the same group further claimed that they would not go through waste bins on the street.

While the sample is admittedly small, it could give an indication that such marginalised, grey scaled activities like recyclables reclaiming by informal collectors usually do not violate hygiene standards. This aspect is nevertheless to be investigated further, since in separate, small field samples⁴⁶ residential cleaners did indicate that they retrieved the majority of their materials from mixed waste bags rather than from residential recycling bins.

Catchment area

When inquiring about frontline collectors' sources of plastic beverage bottles in the in-depth interviews, on average waste bins in residential or housing areas (51%) slightly surpassed public waste bins (43%) as main source (Figure 31). The large majority of interviewed collectors have only one source of discarded plastic beverage bottles (Figure 32), from which they by and large source materials only once a day (74%) (Figure 33).

Figure 31. Sources of plastic beverage bottles

Venues:



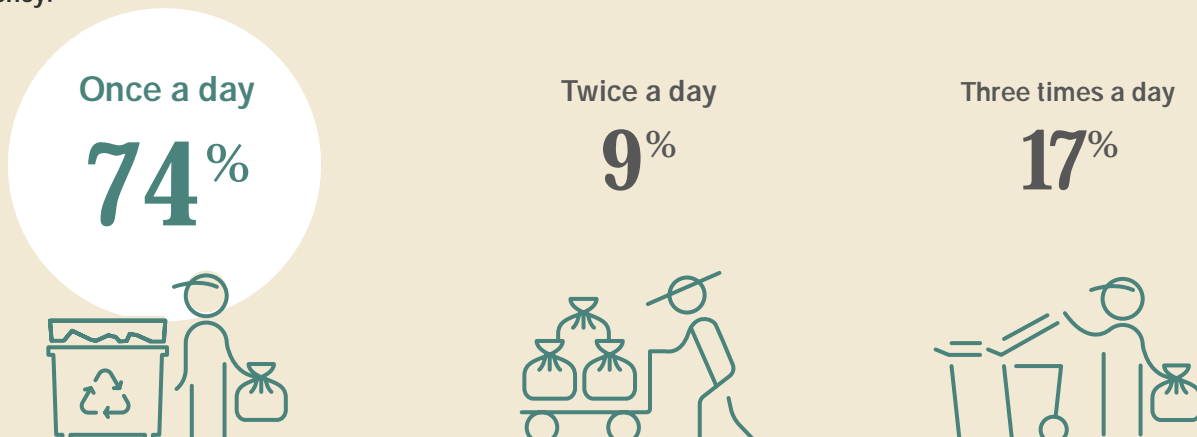
Figure 32. Number of sources per collector

No. of Sources:



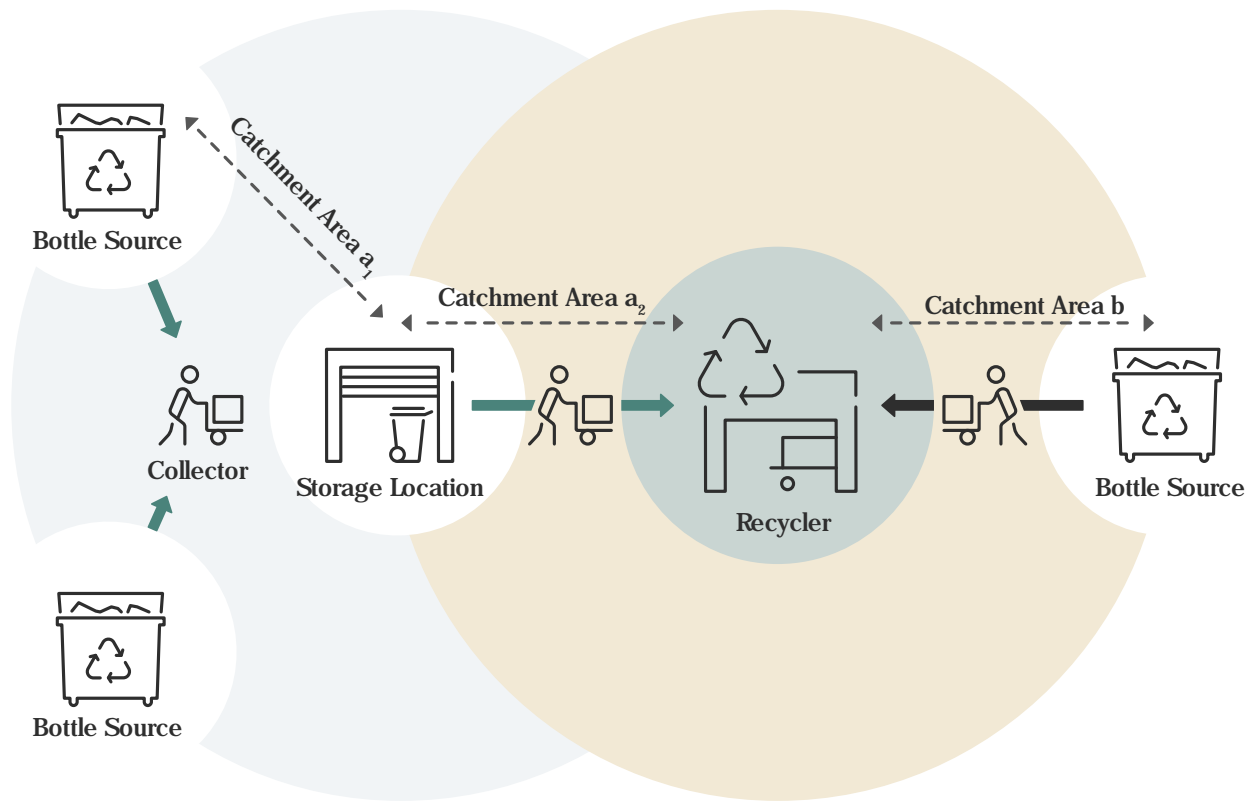
Figure 33. Frequency with which a source is visited

Frequency:



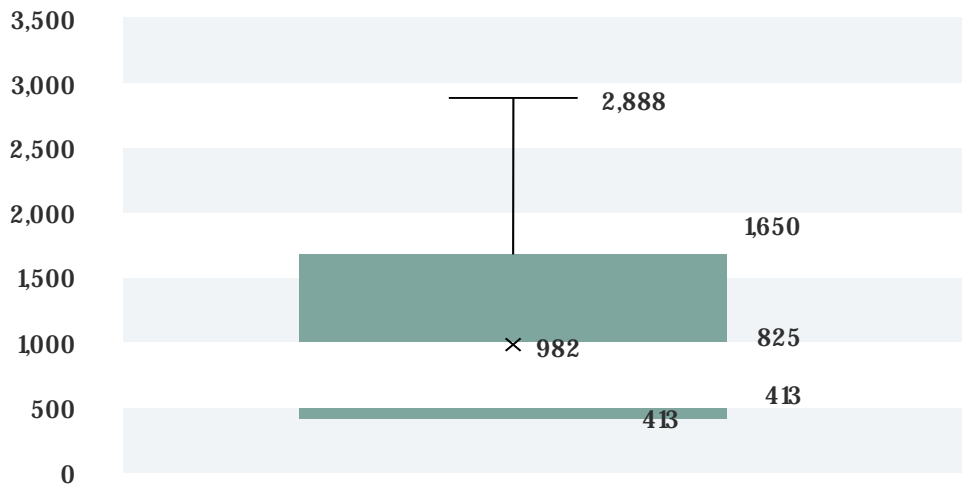
The field surveys revealed two different collection patterns (Figure 34). Some frontline collectors deliver plastic beverage bottles after they have reached their individual carrying capacity over the course of their collection route (catchment area b). Others first gather materials (catchment area a_1), then accumulate these at a storage location, and in a separate instance deliver stored materials to the recycler (catchment area a_2). The overall catchment area of a recycler could therefore be highly dependent on whether the frontline collectors in its network have access to material storage options or not.

Figure 34. Catchment areas of frontline collectors using in-between storage (a) vis-à-vis delivering directly (b)



Based on frontline collectors' own distance estimations,⁴⁷ the median collection distance between source and storage or depot, i.e., catchment area a_1 , is around 0.8 km, with 75% of distances between storage depot and discarded bottle source between 0.4 and 1.6 km—a rather large range of situations (Figure 35).

Figure 35. Collection distance for catchment area a_1 (meter)



The in-depth interviews indicated that these storage spaces are in many instances areas close to frontline collectors' homes (Figure 36).⁴⁸ Most interviewed frontline collectors did not store bottles for more than two days (Figure 37).⁴⁹

Figure 36. Reported storage location

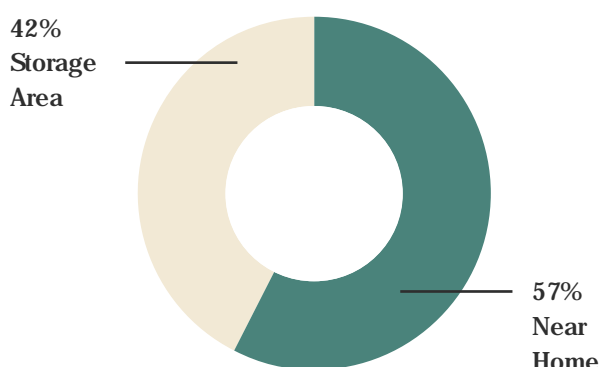


Figure 37. Reported storage duration

Duration	September 2021	October 2021
1 day	52%	9%
2 days	5%	45%
a week	29%	36%
> week	14%	9%

Catchment area b constitutes the transfer from frontline collectors to recyclers, directly after the completion of their collection route. It is assumed to be similar to catchment area a_2 , the transfer from storage depots. Around half the distances for catchment area a_2 and b are between 0.5 and 1 km (Figure 38). Median distances reported to the field survey team were found to be slightly shorter for informal collectors than for cleaners (Figure 39).

For catchment area a_1 , the average distance between source and storage depot comes relatively close to the average distance between storage depot and recyclers. This means that **individual frontline collectors' choice or ability to operate a storage depot could double a recycler's catchment area.**

Figure 38. Collection distance for catchment area a_2 and b (meter)

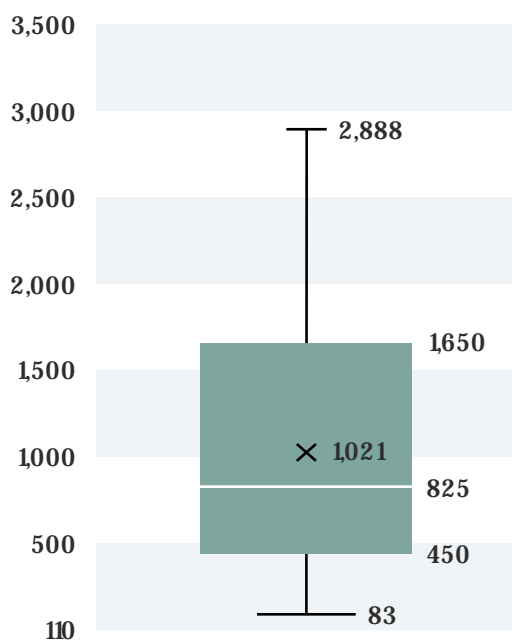
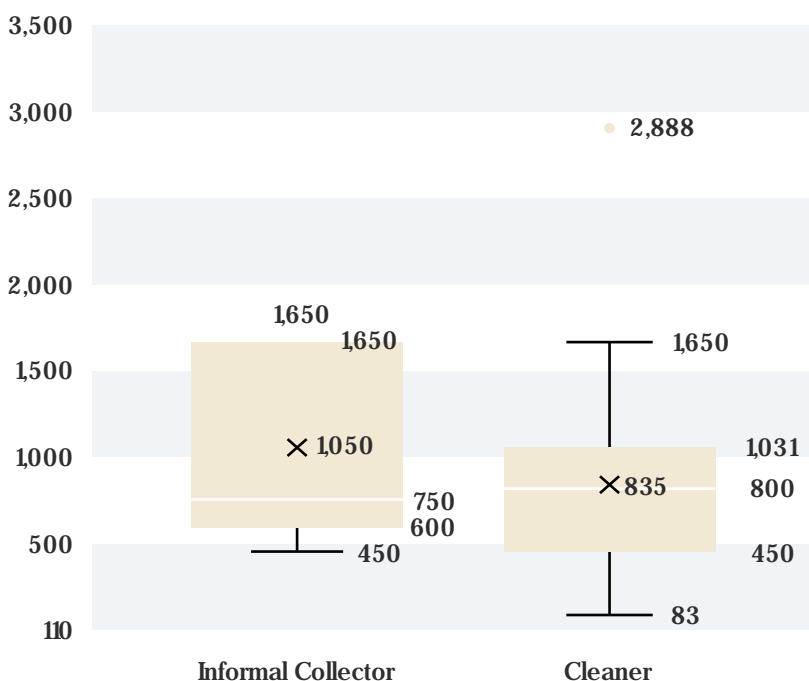


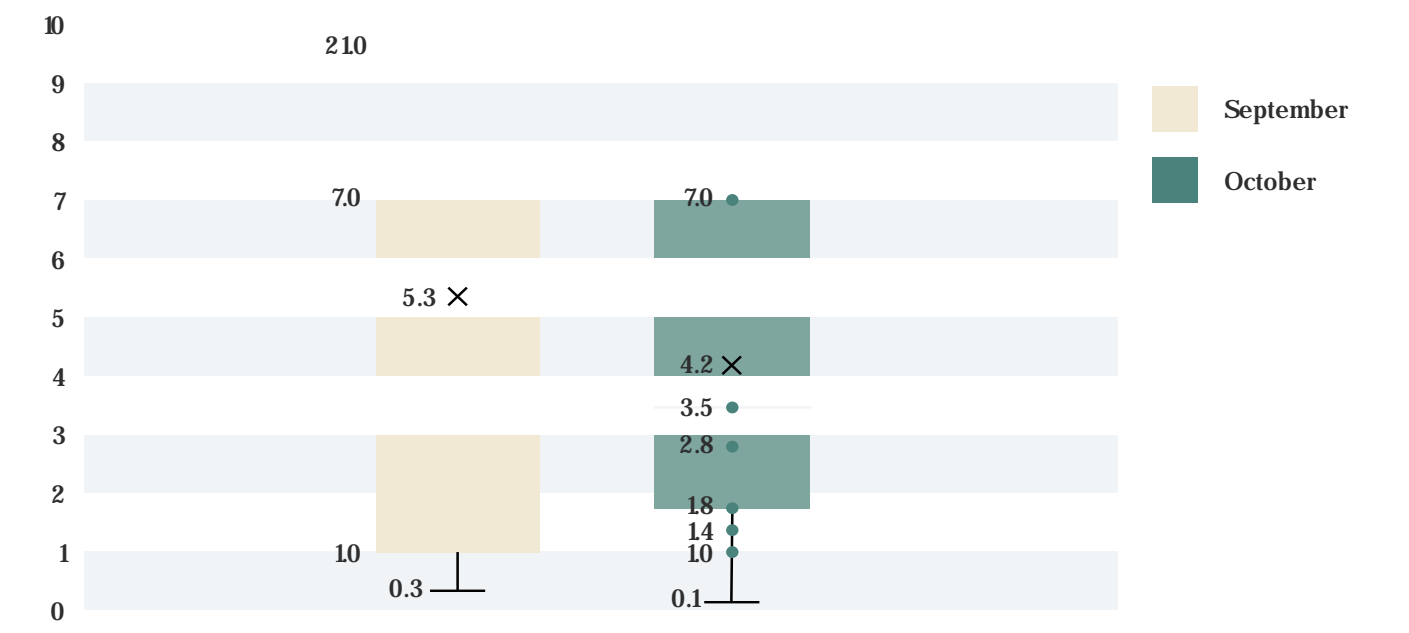
Figure 39. Collection distance for catchment area a_2 and b (meter) for different collector groups



Closely related to the question of catchment areas is the issue of delivery frequency. The median frequency dropped from seven instances per week in September to 3.5 in October (Figure 40).

As outlined earlier (see Table 18), overall informal waste collectors’ presence decreased in October. Over that same period, overall plastic beverage bottle delivery frequency as well as overall recovered plastic beverage bottle quantities have significantly decreased. Along with the drop in transaction size, it appears that the scheme achieved a triple effect: a broader collector pool, more frequent transactions, and larger average transaction sizes—with all three levers working towards better recycling outcomes.

Figure 40. Delivery frequency to recyclers (in instances per week)



Access to recyclers

In-depth interviews with frontline collectors have shown that this group considers recyclers highly accessible, with approval ratings at 4.8/5 and 4.1/5 in September and October 2021, respectively. The major reason for this positive perception is the physical proximity of recyclers to frontline collectors’ catchment area. Collectors have already developed individual collection and delivery routes around the locations of recyclers for other recyclables, and maintain that network rather than shifting or expanding it for the purpose of bottle collection.

Frontline collectors that were interviewed at the recyclers prefer this recovery network over other options such as the EPD’s @Green Community’s Recycling Stores—of which there is only one per district—or Reverse Vending Machines. The key reason for this preference is the option to directly obtain cash without significant hurdles but frontline collectors also seemed to lack awareness of such alternatives. When asked whether alternative locations for recyclers—MTR stations, shopping centres etc.—would be favoured over the current setting, interviewees mostly declined.

Since these interviews suffer from a location-bias, i.e., the interviews were conducted at or near the recycler locations that frontline collectors have grown accustomed to, frontline collectors that use those locations may not have perceived the need for an alternative. Given that there seems to be an upper limit to the distance that frontline collectors are able or willing to walk, it would seem logical that some potential frontline collectors did not participate in the scheme because they had no participating recycler within reasonable distance.

Some cleaners that were observed and interviewed during a field visit in November 2021 were selling large volumes of bottles directly to processors that picked up recyclables directly from the cleaners' place of work. These cleaners would not have been in a position to bring their recyclables to a conventional recycling shop, due to the sheer volume of each transaction. This was especially the case for those cleaners that had access to equipment (large wheelie bins) and storage space (in the refuse room of the estate), as they could afford to have longer intervals between pickups. Smaller volumes and more frequent transactions would be viable through access to a readily available mobile or stationary pop-up recycler at the estate.

Incentives

The field survey shows that remuneration plays a key role in triggering frontline collectors to collect and deliver waste plastic beverage bottles to recyclers.

Interviewees considered the cash amount as too low. Frontline collectors surveyed in September 2021 considered the reward level to be significantly too low (4.3 out of 5).⁵⁰ Indeed, when asked about incentives to increase quantities, 75% of those interviewed in September did indicate they would collect more plastic beverage bottles if reimbursements were higher.

Those surveyed in October saw this aspect slightly less sharp, although they still thought of it as not sufficient (3.8 out of 5). This difference could be related to the sample composition, which in October featured a substantially lower share of informal collectors, who may be more concerned with compensation, it constitutes their primary or at least important source of income. Instead, more October interviewees indicated they found it difficult to gather more because of insufficient availability of bottles at the accessed sources (44%) or due to personal, non-financial motivations (38%) (Table 19).

Table 19. Incentives & disincentives for collecting more plastic beverage bottles

Question: Would you collect more if the reimbursement per bottle were higher?	September	October
Yes – higher reimbursement	75	19%
No – insufficient generation at the source	15%	44%
No – too tired/ collection as health exercise/ collection for environmental benefit	10%	38%

In addition to financial incentives, frontline collectors sometimes receive non-financial incentives. During the November field visit, the mobile recycler that is not related to the pilot scheme explained how he and his colleagues somehow offer the cleaners food or drinks in addition to the HKD payment for the collected volumes. Government's GREEN@Community locations as well as its predecessor Community Recycling Centres provide only in-kind remuneration.

Interviews during a collection marketing campaign in the first half of 2020 (so before the pilot scheme), that gave out in-kind compensation, a cleaner explained to the team how she appreciated in-kind remuneration more because she experienced it as more valuable. But the surveys conducted for the pilot showed that cash in hand was an attractive characteristic of the pilot model to many of the semi-professional collectors, and a 2019 PORI survey indicated that Hongkongers prefer (electronic) cash over in-kind.⁵¹

Recycler relationships

As for matters of trust and working relationship perspectives expressed by frontline collectors, responses collected over the field survey showed implicit preferences for certain recyclers. **Convenience and proximity** are the most-stated factors for delivering to a particular recycler (57% in September, 68% in October). Nevertheless, some frontline collectors explicitly value the **familiarity with and the kindness** of managers at surveyed recyclers (14% in September, 19% in October). When seen through the lens of continuity in material exchanges, even preferences for convenience and proximity may lead to a certain familiarity in exchange relationships (Figure 41).

In this pilot, correct payout of frontline collector remuneration was verified through spot checks rather than control mechanisms that can verify every single transaction. The role of trust in the relation between frontline collectors and recyclers is therefore an essential element in the collectors' revenue optimisation.

Figure 41. Active group of frontline collectors have a close relationship with the recycling shop owner



Formalisation

Organising informal collectors could be an important task to strengthen social inclusion as well as further improve the performance of any future scheme extension or replication. As shown in this report, these collectors are significant suppliers of plastic beverage bottles to recyclers. However, with the end of the scheme and subsequent profit reductions, many informal collectors have lost interest (see page 73).

Helping this group to organise as a step towards self-governance would benefit their work and reduce their individual burden. Examples of such self-induced, bottom-up organisation or formalisation have been documented for mainland China's city of Changchun. There, an informal waste collector cooperative formed, in collaboration with the local recycling association, Ant Recovery (蚂蚁回收), which helped providing a safer and more profitable work environment for these collectors.^{52,53} In Hong Kong, Waste Picker Platform⁵⁴ already engages with informal collectors, and local sustainable business initiatives such as V Cycle have strived to include and cooperate with this relatively vulnerable group.⁵⁵

Future schemes could seek to enlist WPP's help in advocating for frontline collectors' rights and interests during the operation of the scheme (e.g., to monitor correct payouts). Schemes could also aim to learn from and cooperate with such existing structures during the design phase—to align, streamline and upgrade collection activities in ways that are societally and financially sustainable.

Processors

Transport

Since all aspects of the relationship between recyclers and vetted processors were subject to private contracts, the Scheme did not design in a separate transport step. This led in some cases to stress for one or both parties, since they had to engage in negotiations around transport cost and modalities, such as pickup frequency. This is typical for sub-scale systems like the one designed for the Scheme.

One processor, who absorbed the additional cost of more frequent pickups, became a more attractive business partner to most recyclers, who saw the pressures on their limited storage space reduced.

In future scaled-up or concentrated schemes, the sweet spot for frequencies that are high enough to match recyclers' space constraints and low enough to remain affordable, will shift. Transporters will be able to achieve full truckloads multiple times a week within single or just a few neighbourhoods, dramatically reducing transportation cost.

If a Scheme Operator or other party were to centrally manage the relationships with recyclers or third-party transporters, such coordination could further optimise truckloads and hence reduce transportation costs.

Processing cost

Since processing happened at market value and outside of the scheme, the project did not conduct any analysis on current or future processor economics. However, import restrictions issued in mainland China—the traditional main destination for recyclable waste streams from Hong Kong—were reported to have increased local pre-processing costs. Due to requirements on low contamination levels for waste imports, local labour increases have raised operational costs. For example, one recycler explained that sorting and separating costs for one metric ton of plastic beverage bottles in Mainland China ranged at around HKD 48 in mid-2017. Given that this task must now be conducted before the shipping from Hong Kong, these fees, driven by higher Hong Kong labour costs, have risen to HKD 332 per metric ton.⁵⁶

Processor quality

As described in Page 29, the project team had developed a strong processor vetting programme. Desk research had indicated that 38 firms in Hong Kong were, in one way or another, handling waste plastics in Hong Kong. Contact with those firms showed that 19 of them were dealing with plastic bottles. The criteria described earlier yielded four processors that were accepted into the pilot programme.

A few recyclers voiced concerns about the limited pool of processors to choose from. Some recyclers suggested to add more paper aggregators to the pool, since they already work with them and already have a regular logistics setup. One paper aggregator had, in fact, applied but had not understood how the scheme works and retracted their application.

While paper aggregators would not fulfil the processor criteria as formulated for the pilot scheme (or those currently adopted by Drink Without Waste / the Working Group, see Box), future programmes could consider adding a trading category in their processor pool. It would be known that these companies do not process themselves, and explicit transparency requirements around the destination would need to be added. Whether or not to also add requirements on the quality of the destination depends on the ambitions of any future programmes.



Drink Without Waste standards for processing



Process

- The site operation should not be merely sorting (e.g., manually or by flotation) and bagging or baling material for onward transport. Material separation is, of course, acceptable, provided that it is a preliminary step in the preparation of material for processing on the same site.
- At minimum, the operation must include the treatment of PET to produce granules or flakes to a specification that would render the product fit for export. Operations that also treat HDPE and/ or PP are welcome additions. The operator must be able to demonstrate that the product complies with all regulatory requirements in connection with its export. The operator must declare sufficient customer information to enable the approval body to conduct a downstream audit.
- If the operation includes the utilisation of the flakes or granules in the manufacture of a consumer or industrial product, that would be a welcome addition. Nevertheless, the operator must still be prepared to supply relevant customer information.



Feedstock to be generated in Hong Kong

- The operation must process incoming material that has been generated in Hong Kong. The sources of the material and the carriers must be recorded and declared.
- Aggregating domestic and properly imported feedstock in the operation would be acceptable. The justification is that, applying the relevant provisions of the Basel Convention, the Environmental Protection Department will permit the import of uncontaminated plastics provided that (i) this is in accordance with an export licence from the country of origin; (ii) the processor subjects the material to “re-processing, recycling or recovery”. The quoted example of these activities is “Thermal treatment for the production of recycled plastic pellets.” (See EPD Guidelines on Import and Control of Waste Plastics, 28 September 2020).
- However, the domestic portion of the processor’s mix of feedstock must be no less than 10 per cent by weight, the burden of proof being upon the operating company.



Central activity and commitment

- The onsite plastics processing operation must be a core activity of the company. It should not be a fringe business, a side-line to (say) paper or metal recovery. If the processing of plastics were only a marginal activity, the company could discontinue that segment for any one of many reasons, leaving the collectors of plastics in the lurch.
- That the processing of plastics is indeed the principal activity can be judged by observation of the site. Suitable plant and equipment must be in continuous action, supported by permanent operating and maintenance staff. The operating company should be obliged to supply monthly reports of the types of material and throughput quantities. Unscheduled shutdowns (that is, other than for planned maintenance) will require explanation.
- The decision on whether this criterion has been met, and continues to be met, should be at the discretion of the approval body. Approval can be suspended. If necessary, the operating company may be required to re-apply for inspection and approval.



Long-term site security

- The processing company cannot be relied upon if it is at the risk of having to find new premises at intervals. The operating company must therefore supply proof that it either (1) is a Landowner with unencumbered title to the site under a block lease from Government and is paying Government rent, or (2) is a Tenant of the Landowner with a formal tenancy agreement which sets out the intended use of the site as a plastics processing facility and which has a term of 7 years until the next expiry or renewal date, or (3) holds a Short Term Tenancy from Government for an initial duration of 7 years on appropriately specified terms and conditions.
- Furthermore, under Option 1 or Option 2, the operating company must supply proof that, in compliance with the zoning of the site, it has successfully applied for (either as the Landowner or as the Tenant with supporting documentation from the Landowner) and has obtained a Short-Term Waiver so that suitable infrastructure can be erected on the site.



Environmentally sound and safe

- With the benefit of the security and approvals for site infrastructure described above, the operating company should have invested in appropriate environmental protection infrastructure. This should include paving, perimeter drainage, housing of all equipment and offices, and (if contaminated water is generated) a wastewater treatment plant. Site activities should comply with all pollution control ordinances.
- Staff facilities should be provided. The working conditions and employment terms of all personnel should be in keeping with best available Health & Safety regulations and practices.

4.4

The scheme demonstrated a cost-effective, robust, and scalable collection model

Cost per unit

The cost per unit recovered through this scheme was HKD 0.11, a low cost by any standard.⁵⁷ The drivers of this cost are visualised in Figure 42.

Frontline collector subsidies were the most important cost driver, at nearly half of the total cost per bottle. Frontline collector incentives were kept low as they aimed primarily to compensate for the lack of market value, which was seen as the biggest barrier towards the engagement of existing collection networks (see page 13, Theory of Change).

While adjustments may be necessary due to fluctuations in market prices as well as inflation, the scheme's results show that even small incentives may be effective in obtaining higher volumes through this channel, especially since the strongest-performing frontline collector group—cleaners—is less sensitive to the size of the remuneration.

The compensation for handling costs is a further important cost component. Whereas some deposit schemes in other jurisdictions do not cover this cost and leave that to the market, this opens up schemes to the risk of inadequate network density and service levels (e.g., opening hours too limited) in an effort to suppress costs.

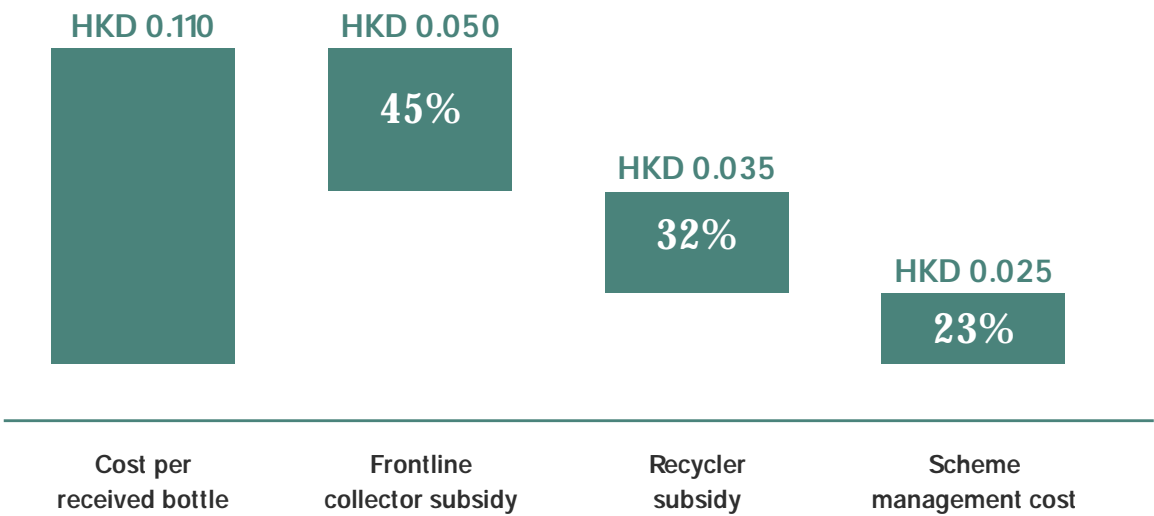
While recyclers would no doubt welcome a higher remuneration and while this could help address network stability issues related to opportunity costs, it was clear that assistance with other aspects like use of public space and downstream logistics were also of paramount importance. Not having the additional cost of frequent pickups invoiced separately, for example, was an important concession. Also, while no balers were distributed during this scheme, it is likely that with scheme replication and expansion, such capital investments would have to be made—driving up system costs and hence potentially scheme costs.

Scheme management costs, covering staff time and other overhead costs, were kept at less than a quarter of total cost, which is not particularly high but could probably be managed down with much larger scale. The programme’s biggest staff time expenditure was on these three tasks:

- Spot checks. These are time-consuming because of travel distances. In a scaled-up system, the field force could be more localised and hence travel time could be reduced.
- Recycler recruiting. Especially in the first recruiting wave, when little viability evidence was available to help convince recyclers, the effort was intense. While circumstances would likely not be exactly the same, a new and scaled-up effort would be able to reduce the marginal recruiting effort for the bulk of required recruiters, although convincing the last stragglers would be relatively more expensive.
- Transaction verification. As discussed elsewhere in this report, the scale of the pilot project did not allow to automate these tasks. Although a scaled-up effort with a larger number of participants could invite more fraud and hence requires more vigilance, the scale in itself would justify more automation and hence bring down the marginal cost of transaction verification and other administrative tasks.

The programme was efficient in terms of communication spending, where word of mouth advertising had a very positive effect on the collector participation rate. One would expect to see a different picture for consumer-oriented programmes, or if bulk locations would be deployed to service consumers directly.

Figure 42. Average cost of recovering a bottle under the pilot subsidy scheme



Channel comparison

A full comparison of the performance and efficiency of this pilot scheme with that of other efforts on the Hong Kong market to collect plastic beverage bottles is hindered by the lack of detailed published data. Nevertheless, a set of observations can be made. EPD, which has access to detailed data across all programmes, will need to further corroborate these initial observations as part of its planning process.

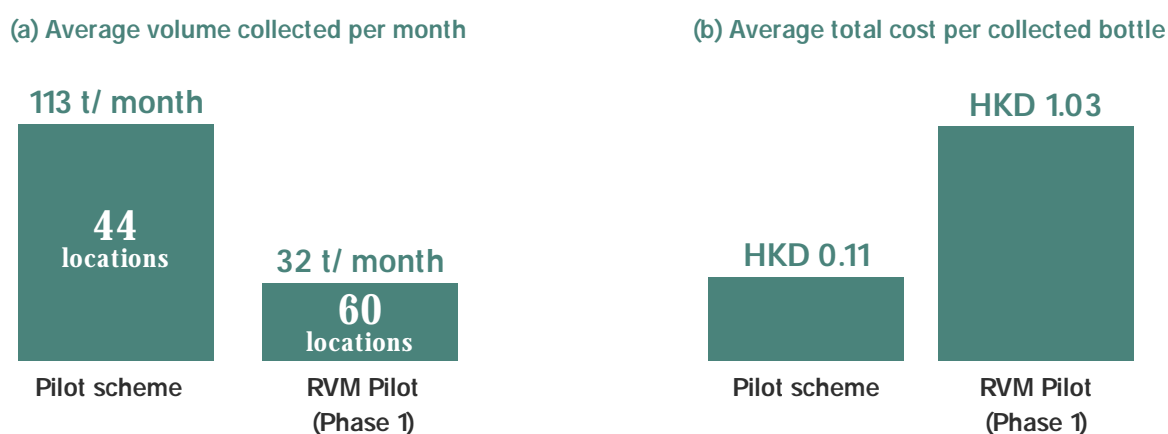
- **Programmes and schemes with a strong education focus**, such as GREEN@Stores and GREEN@Stations, tend to be well-appointed, well-staffed, and sited shops in prime locations. Any expansion under those parameters should focus on supporting Government's education and communication mission, which in turn can positively affect recycling outcomes for Hong Kong.
- **Pilot schemes with a focus on bulk collection**, such as the two projects supported by the Recycling Fund, tend to operate at very low cost. Not only do these schemes rely on existing recycler and frontline collector networks, participating shops and pop-ups sit in non-prime locations and run a no-frills operation. While the use of public space needs to be regulated, this model offers lots of opportunity for expansion.

A rollout to all districts and an extended recruitment drive (and follow-up) to increase recycler and possibly collector participation rate can further augment volumes without driving up the marginal cost of bottle recovery. It would be wise to explore this further, even before society considers higher or different incentives to drive up recycling rates.

Recycling outcomes should also be further investigated: whereas the all-plastics RF ISP project has comparable costs per collected volume, lower-quality materials end up in the collected mix. Not only do these in themselves carry less market value, they may also bring down the value and recycling outcomes for high-quality materials like PET bottles.⁵⁸ Whether in the Hong Kong context the increased volumes offset such a potential reduction in value will be an interesting pilot outcome that needs to be taken into account in further planning efforts.

- **Automated return points** like the ones in the current RVM pilot are relatively more expensive (Figure 43) but can provide operational efficiencies if well-integrated in the operations (cleaning, maintenance, and logistics) of the site that hosts them. The fact that RVMs compact bottles on-site helps overcome one of the key issues in plastic bottle collection: low density leading to high transportation costs. For the expansion of this type of network
 - it will be critical to understand the driver(s) of differences between the highest and lowest performers, and replicate as much as possible the conditions of the former;
 - potential challenges around sufficient uptime and availability need to be anticipated and addressed through adequate service contracts (emptying, maintenance, and repair);
 - while challenges around missing labels cannot be resolved, the likelihood of bottle rejections can be reduced through more comprehensive databases of bar codes and form factors, and best-in-class barcode reading technology;
 - expansion of the use of RVMs beyond small volumes should be investigated: there are currently no bulk RVMs in the network and RVMs have an imposed limit of 30 bottles/collector/day. The average number of bottles recovered per RVM usage is indeed under 10.⁵⁹

Figure 43. Comparison of (a) scheme performance and (b) scheme efficiency⁶⁰



No fraud detected

Across the full collection period, no fraud was detected. In addition to the fraud detection and control mechanisms described in Page 35, the project team looked for unusual numbers or outliers to make sure everything happened within the rules governing the scheme. For example, the team visited the shops of the two largest-volume recyclers, looked into the number of collectors working with these shops, and counted on-site bottle volumes. It also observed additional trucks working with these locations. The totality of these observations convinced the team that the reported volumes were real and legitimate.

Throughout the collection period, project staff would routinely single out unusually high collection volumes and changes in collection patterns for further investigation. This is best practice in compliance schemes worldwide, with some larger scheme operators hiring one or more full-time statisticians to help with fraud detection. While not considered fraud (i.e., a deliberate attempt to obtain unwarranted subsidies), sampling during recycler spot checks indicate that quality monitoring is required, both when the recycler receives materials from frontline collectors, and when materials are picked up from the recyclers.

Could the system scope be expanded?

Future volume growth through network expansion and through growing performance within network was discussed in the previous sections. The question must be asked whether the model and the network that services the model could serve a broader materials and product scope. After all, through its public consultations, public engagements, pilots and pilot schemes, EPD is giving clear signals that it would like to pursue a broader plastics recycling future for Hong Kong, one that extends well beyond beverage packaging.

Frontline collectors' perspective. The motivation to collect other beverage packaging than plastic beverage bottles was assessed in the frontline collector interviews.⁶¹ Responses were explicitly negative, with 76% of surveyed collectors rejecting this idea in September 2021 and another 100% refusing to theoretically do so in October 2021.

Frontline collectors would, however, like the opportunity to include other plastic bottles, i.e., those not used for beverages. This would not only have the benefit of increasing their potential revenue by tapping into a larger (and heavier) pool of materials. It could also improve their efficiency, by not having to be quite as particular about what materials to retrieve from their feedstock sources. While this was not explicitly tested with the frontline collectors in the scheme, expanding the scheme even further, beyond plastic bottles, would likely be conceivable from a collector's perspective, but could invite a host of new challenges around quality control, recyclability, value, and weight/volume conversion. A different ISP project is currently testing that model.

Recyclers' perspective. The pilot scheme reintroduced the idea of plastics collection to a pool of recyclers where many had previous experiences with plastics collection. Interviews that were conducted by the Drink Without Waste secretariat prior to the scheme commencement had shown that many recyclers in Hong Kong did not consider plastics collection to be viable. A Hong Kong Productivity Council report from 2014, that showed the market value for mixed plastics to be highly unattractive, reinforces that perspective.⁶²

By focusing on the highest value plastics fraction, the pilot scheme has successfully re-engaged recyclers on the plastics question. And by removing operational and perception barriers, the scheme has also paved the way for a greater openness to potential all-plastics collection schemes.

System coordination perspective. For all incentive-based producer responsibility schemes applies the same scoping rule: the broader a scheme is scoped in terms of materials or products covered, the more complex the scheme becomes to manage. From product and producer registration, to determining subsidy levels, to transaction management and fraud prevention, these operational challenges grow significantly with scope.

This does not mean that a broader scope should not be considered; the positive impact on collection volumes may well be worth the additional complexities. It does mean, however, that these trade-offs should be carefully considered along with the potential impact on recycling outcomes in terms of volume and quality of what re-enters the market. If necessary, this analysis needs to be carried out for each type of collection channel individually.



5.0

Recommendations for future beverage packaging collection effortsA



5.1

Financial incentives are effective

A producer responsibility scheme for beverage producers and importers (PPRS) could be more effective if an incentive for the frontline collector—whether in the form of a deposit or Value-on-Return—were to be added.

Such a PPRS would also benefit from explicit payment for the services of the recyclers, rather than relying solely on the market value of the collected plastics, which tends to be volatile and may lead to recyclers dropping out more readily or not fully investing themselves in maximising volumes.

The incentive must be sufficiently high to overcome the opportunity cost. For that reason, even a small incentive can be effective in enticing individuals and organisations to engage in these collection activities. This is especially true for those already formally or informally active in a waste-related activity.

5.2

The network needs to combine effectiveness and pragmatism

Bulk collection points are required

A future collection network to support a PPRS should include bulk collection points. Cleaners remain a critical node in the collection network. They tend to drop off large volumes (with a median of 400 bottles per transaction) and cannot spend the time to feed individual bottles into a reverse vending machine (RVM) or have them counted one by one manually. Moreover, retailers, malls, and other potential RVM hosts are not keen on having large-volume collectors taking up too much time or space on their premises.

Existing networks of collectors and recyclers are effective and efficient

Through existing networks, meaningful volumes of used plastic bottles are collected. This despite their already high to very high utilisation rates.

Relationships between the recycler and the frontline collectors that supply materials, the processors that buy the materials (and the transporters with whom they interface), and with the neighbourhood are already established. While or maybe because frictions do occur, these relationships are tried and tested, and ready to try out new opportunities. Future programmes should explicitly aim to adopt such nodes into the network, in addition to newly developed ones.

Moreover, these networks operate efficiently because they require very little overhead and utilise existing infrastructure. On a per bottle or per tonne collected basis, these networks are estimated to be significantly cheaper to operate than RVM-based collection operations. Since the cost of a PPRS will ultimately be passed back to society, it is important to indeed look for such efficiencies in the collection infrastructure.

Location matters

A balance must be struck between proximity and logistics. Since beverages are a consumer product, collection points must be relatively close to where consumption happens. But while proximity drives up collection rates, it can also be a key driver in high logistics costs, both because of difficulty of access and number of stops on collection rounds. There are also considerable issues with storage space in densely populated or commercially valuable areas. 'Pop-up' recyclers that set up shop in residential areas but remove all materials by end of day prove highly effective in balancing these various needs.

Support matters

Across all different nodes of the collection network, support in the form of access to physical space is needed. Property Management Offices, District Councillors, FEHD and other official inspectors could not just tolerate but actively enable these services that are so essential for the city.



Storage areas

- Cleaning companies and their customers—such as property management companies—to allow and even incentivise cleaning staff to collect recyclables
- Property management companies and building owners to provide space for cleaners to separate and stockpile recyclables
- Make use of existing facilities, such as Refuse Rooms
- Cultivate the separation of recyclables by the consumer, e.g., by providing designated recyclables collection points on each floor, however small



Recycling shops

- Give the extensive network of existing recycling shops systematically access to any new collection opportunities
- Government to support recycling shops by ensuring that a future PPRS includes an explicit payment for the services of stationary and mobile recyclers
- Establish licensing system for registering Shop Front Extensions (SFE) under specific circumstances



Pop-ups

- Different Government departments to cooperate to accommodate efficient recycling pop-ups in every neighbourhood
- Small Material Recovery Facilities (MRFs) in housing estates to consolidate the scattered recovery of recyclables, improving logistics for cleaners and transporters
- Make use of existing public facilities, such as Refuse Collection Points (RCPs) and parking lots
- Provide temporary space allocations for temporary collection, consolidation, sorting and pick up under a licensed system rather than by simply turning a blind eye to such activities and occupation of space

5.3

A chain of custody benefits all actors^A

The key aims for setting up a chain of custody for Hong Kong's single-use beverage packaging recycling include:

- producing strong recycling outcomes (high rates of recovery; recycle that is as high quality as is viable);
- ensuring recyclables originating in Hong Kong end up in recycling facilities—locally or after export—that are safe, environmentally sound, and socially correct;
- creating a transparent and verifiable flow of recyclables to reassure the Hong Kong public of what is happening to this material and increase their desire to return beverage packaging to the correct return location.

To that end, and based on the insights from the pilot, the following measures should be addressed in any future scheme:

- user-friendly interfaces for record entry to encourage participants along the value chain to use the digital systems correctly and consistently;
- a data room and digital record keeping to greatly facilitate the reconciliation of records and verification of transactions, allowing for significantly scaled-up transaction volumes and participant numbers;
- a rhythm of field visits to both recyclers and processors, with additional bandwidth to carry out field visits triggered by irregularities or unexplained observations in the record;
- a portfolio of data-driven fraud detection techniques and mechanisms;
- strong and nuanced consequence management—both as a deterrent and to maintain a high level of accountability—with a regular review and updating of consequence management rules, to make sure that they stay both financially and technically relevant.

Regarding processing capacity, it is in addition recommended to:

- pre-qualify processing operators to guarantee minimum recycling outcomes and reduce fraud;
- possibly increase options for recyclers and improve logistics by adding traders to the pool, under the condition that their destinations are known and documented;
- investigate the viability of creating a trip ticket system to facilitate record keeping and system monitoring.

A strong chain of custody for a bulk collection system can also benefit other collection channels that have a stronger consumer focus. Although RVMs do facilitate record keeping and fraud prevention, RVM networks, too will have to guarantee that recyclables end up with bona fide processors.

Moreover, the more that every part of Hong Kong's collection and processing infrastructure can be trusted, the more consumers will be willing to participate in recycling opportunities. Today that lack of trust in the recycling system is holding back a significant number of citizens.⁶³



6.0

Appendices



Budget: Original

Expenses

Section A	Overall Total
1. Project Officer	450,000
2. Project Assistant	306,000
3. MPF	37,800

Section B

1. Mobile Phone	5,396
2. Laptop	14,000
3. Baler	1,422,000

Section C

1. Subsidies paid to collector & street corner shop recycler (handling& transportation)	2,800,000
2. Financial Audit	30,000
3. Volume Audit	204,000
4. Project Consultant	140,000
5. Stationery, printing and postage	26,400
6. Report	71,000
7. Transportation cost for volunteers	32,400
8. Promotion	58,828
9. Sim Card	4,968
10. Hiring Ad for two	2,064
Project Budget:	5,604,856

Budget: Modified A

Expenses

Section A	Overall Total
1. Project Officer	423,000
2. Project Assistant	333,000
3. MPF	37,800
4. Part time staff including transportation allowance and MPF	73,920

Section B

1. Mobile Phone and associated accessories	896
2. Laptop and associated accessories	8,328
3. Baler	0

Section C

1. Subsidies paid to collector & street corner shop recycler (handling & transportation)	4,213,920
2. Financial Audit	30,000
3. Volume Audit	58,800
4. Project Consultant	140,000
5. Stationery, printing and postage	32,960
6. Report	71,000
7. Scheme Monitoring	47,400
8. Promotion	84,000
9. Sim Card	4,968
10. Hiring Ad for two	2,064
11. Fishnet bag including delivery	42,800
Project Budget:	5,604,856

List of recyclers

Participant ID	Company name (Chinese)	Company name (English)
DWW01	恒星廢紙五金公司	Hang Sing Recycle Company
DWW02	新建記五金廢紙	Sun Kin Kee Metal & Paper
DWW03	成昌廢紙有限公司	Shing Cheong Waste Paper Co
DWW04	金記	Kam Kee Garage
DWW05	新泰和五金	Sun Tai Wo Metal
DWW06	龍記五金貿易	Lung Kee Metal Trading
DWW07	鴻禧五金廢紙公司	Hung Hei Metal and Waste Paper Co
DWW08	石麟廢紙	Shek Lun Waste Paper
DWW09	再世高環保回收處理公司	Choice Recycle Services Company
DWW10	長旺回收有限公司	Ever Profit Recycle Company Limited
DWW11	天合環保回收公司	Tin Hop Environmental Recycle Company
DWW12	新利公司	Sun Lee Co
DWW13	平記廢紙廠	Ping Kee Waste-Paper FTY
DWW14	富榮公司	Fu Wing Co
DWW15	鑫發	Xin Fa
DWW16	新新廢紙公司	Sun Sang Waste Paper
DWW17	達朗環保回收有限公司	Tat Long Environmental Company Limited
DWW18	黃仔廢料回收中心	Wong Chai Waste Paper Metal Centre
DWW19	鴻記廢紙	Hung Kee Waste Papers
DWW20	朱創新 (合興五金廢紙)	Chu Chong Sun
DWW21	何氏五金貿易有限公司	Ho's Metal Trading Company Limited
DWW22	潤昌電子五金環保有限公司	Yun Cheong Electronic Recycle Company
DWW23	金輝環保有限公司	Golden Fair Environment Limited
DWW24	文興實業公司	Man Hing Industrial Co
DWW25	新豐環保顧問有限公司	Sun Fung Environmental Consultants Limited
DWW26	力軒環保回收公司	Lik Hsin
DWW27	權記塑膠原料廠	Kuen Kee Plastic Material FTY

Category	Type	District	Sub-district
Recycling shops	Shop	Kowloon	Yau Tsim Mong
Recycling shops	Shop	New Territories	Kwai Tsing
Recycling shops	Shop	Kowloon	Yau Tsim Mong
Recycling pop-ups	Station	Kowloon	Yau Tsim Mong
Recycling shops	Shop	Kowloon	Yau Tsim Mong
Recycling shops	Shop	New Territories	Tuen Mun
Recycling shops	Shop	New Territories	Tuen Mun
Recycling shops	Shop	New Territories	Kwai Tsing
Recycling areas	Station	Hong Kong Island	Central & Western
Recycling shops	Shop	New Territories	North
Recycling shops	Shop	New Territories	Yuen Long
Recycling shops	Shop	New Territories	Kwai Tsing
Recycling shops	Shop	Hong Kong Island	Central & Western
Recycling shops	Shop	Kowloon	Sham Shui Po
Recycling shops	Shop	New Territories	Tsuen Wan
Recycling shops	Shop	New Territories	Kwai Tsing
Recycling shops	Shop	New Territories	Yeun Long
Recycling shops	Shop	New Territories	Yeun Long
Recycling shops	Shop	Hong Kong Island	Central & Western
Recycling shops	Shop	New Territories	North
Recycling shops	Shop	New Territories	Tuen Mun
Recycling shops	Shop	New Territories	Kwai Tsing
Recycling shops	Shop	Kowloon	Wong Tai Sin
Recycling shops	Shop	New Territories	Yuen Long
Recycling pop-ups	Truck	New Territories	North
Recycling pop-ups	Station	New Territories	Yuen Long
Recycling pop-ups	Truck	New Territories	North

List of recyclers

Participant ID	Company name (Chinese)	Company name (English)
DWW28	俠記五金回收公司	Hop Kee Metal Recycling Company
DWW29	光明環保回收有限公司	Kwong Ming Recycling Limited
DWW30	星回收公司	Ekonkar Recycling Limited
DWW31	何松記	Ho Chung Kee
DWW32	樹記廢紙五金	Shu Kee Paper Metal Recycling
DWW33	江雄廢紙五金公司	Kwong Hung Material Co
DWW34	容記環保回收	Yung Kee Recycle
DWW35	基群環保回收有限公司	Kay Kwan Environmental Recycling Ltd
DWW36	榮記	Wing Kee
DWW37	廣發五金廢紙公司	Kwong Fat Metal Waste-Paper Co
DWW38	環保站(香港)有限公司	Recycle Cycle (HK) Company Limited
DWW39	光頭仔環保回收	Kwong Tau Chai Environmental Recycle
DWW40	合俐隆環保貿易有限公司	Hop Lee Lung Environmental Trading Ltd
DWW41	龍興廢紙有限公司	Lung Hing Waste Paper Co. Ltd.
DWW42	永興五金廢紙回收	Wing Hing Gather Metal Waste Paper
DWW43	榮明環保回收	Sun Ming Environmental Recycling Limited
DWW44	文記環保	Man Kee Environment
DWW45	好運環保服務公司	Good Luck Environmental Protection Service Company
DWW46	金水廢紙的士有限公司	K&S Enterprise Company Limited
DWW47	世華回收 Sewa Limited	SEWA Limited
DWW48	進昇廢紙五金回收	Chun Sing Waste Paper Metal Recycling
DWW49	專業回收服務有限公司	Professional Recycle Service Ltd
DWW50	永豐五金廢紙回收	Wing Fung Gather Metal Waste Paper
DWW51	梁輝記紙業公司	Leung Fai Kee Waste Paper Co
DWW52	榮興五金環保回收公司	Wing Hing Metal Environmental Recycle Company
DWW53	陽光環保回收	Sunny Recycle

Category	Type	District	Sub-district
Recycling shops	Shop	Hong Kong Island	Central & Western
Recycling pop-ups	Station	New Territories	Yuen Long
Recycling shops	Shop	Hong Kong Island	Central & Western
Recycling shops	Shop	Hong Kong Island	Wan Chai
Recycling pop-ups	Station	New Territories	Tai Po
Recycling shops	Shop	New Territories	Tai Po
Recycling pop-ups	Truck	New Territories	Sha Tin
Recycling pop-ups	Truck	New Territories	Yuen Long
Recycling pop-ups	Station	New Territories	Sha Tin
Recycling shops	Shop	Kowloon	Kowloon City
Recycling pop-ups	Truck	New Territories	Tsuen Wan
Recycling pop-ups	Station	New Territories	Sai Kung
Recycling pop-ups	Station	New Territories	Sha Tin
Recycling shops	Shop	Hong Kong Island	Eastern
Recycling pop-ups	Truck	Hong Kong Island	Eastern
Recycling pop-ups	Truck	New Territories	Sha Tin
Recycling pop-ups	Station	New Territories	Sai Kung
Recycling shops	Shop	New Territories	Tai Po
Recycling shops	Shop	Hong Kong Island	Eastern
Recycling shops	Shop	New Territories	Tuen Mun
Recycling shops	Shop	Hong Kong Island	Eastern
Recycling pop-ups	Truck	New Territories	Yuen Long
Recycling shops	Shop	Hong Kong Island	Eastern
Recycling shops	Shop	Hong Kong Island	Wan Chai
Recycling shops	Shop	New Territories	Tuen Mun
Recycling pop-ups	Truck	New Territories	Tai Po

Monthly volumes by recyclers

	Phase I	Phase II	Phase III	Phase IV	Phase V	Phase VI
	12 Nov - 22 Nov 20	23 Nov - 22 Dec 20	23 Dec 20 - 22 Jan 21	23 Jan - 22 Feb 21	23 Feb - 22 Mar 21	23 Mar - 22 Apr 21
Participant ID	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21
DWW01	0	23	27	27	0	66
DWW02	1,300	4,690	3,000	4,430	5,680	7,670
DWW03	97	Suspended	Suspended	Suspended	Suspended	Suspended
DWW04	0	0	0	0	0	0
DWW05	0	77	Suspended	Suspended	Suspended	Suspended
DWW06	40	460	532	398	570	1025
DWW07	0	0	0	0	0	0
DWW08	0	90	35	227	100	160
DWW09	0	238	330	252	277	390
DWW10	30	190	120	130	180	280
DWW11	405	2,430	690	890	180	190
DWW12	49	273	220	323	286	434
DWW13	806	3,021	4,828	4,346	6,515	8,056
DWW14	62	174	124	110	241	296
DWW15	242	1,174	987	1,098	1,202	1,869
DWW16	0	0	0	0	0	0
DWW17	141	701	682	599	1,098	1,180
DWW18	0	29	36	0	0	0
DWW19	Suspended	Suspended	Suspended	Suspended	Suspended	Suspended
DWW20	390	710	700	510	1,070	1,610
DWW21	0	0	19	0	0	0
DWW22	Suspended	Suspended	Suspended	Suspended	Suspended	Suspended
DWW23	23	241	124	108	229	315
DWW24	Not yet joined	Suspended	Suspended	Suspended	Suspended	Suspended
DWW25	Not yet joined	9,005	13,710	10,180	9,170	11,460
DWW26	Not yet joined	16,140	15,240	14,070	17,210	15,390
DWW27	Not yet joined	13,710	14,190	13,580	14,670	14,750
DWW28	Not yet joined	0	39	75	104	77

Phase VII	Phase VIII	Phase IX	Phase X	Phase XI	Phase I - XI
23 Apr - 22 May 21	23 May - 22 Jun 21	23 Jun - 22 Jul 21	23 Jul - 22 Aug 21	23 Aug - 22 Sep 21	12 Nov 20 - 22 Sep 21
May-21	Jun-21	Jul-21	Aug-21	Sep-21	Total volume per recycler
72	162	324	300	427	1,428
7,820	9,310	8,740	9,810	10,570	73,020
Suspended	Suspended	Suspended	Suspended	Suspended	97
0	0	0	0	0	0
Suspended	Suspended	Suspended	Suspended	Suspended	77
1,454	2,166	210	Suspended	Suspended	6,853
20	0	0	0	0	20
130	250	160	170	280	1,602
282	228	251	280	396	2,924
370	450	320	360	380	2,810
120	1,638	54	110	172	6,879
643	721	728	675	834	5,186
7,508	7,368	8,677	8,971	9,282	69,378
460	477	470	100	0	2,514
1,779	1,971	2,097	2,044	2,038	16,500
0	0	0	0	0	0
2,720	3,809	4,543	4,516	5,619	25,608
0	0	0	0	0	65
Suspended	Suspended	Suspended	Suspended	Suspended	0
2,560	3,490	3,010	2,430	2,900	19,380
0	0	0	0	0	19
Suspended	Suspended	Suspended	Suspended	Suspended	0
418	405	455	289	243	2,850
Suspended	Suspended	Suspended	Suspended	Suspended	0
13,360	15,000	15,000	15,000	15,000	126,885
15,370	16,220	15,770	15,980	17,700	159,090
14,840	14,690	14,910	15,000	15,000	145,340
126	135	162	138	76	931

Monthly volumes by recyclers

	Phase I	Phase II	Phase III	Phase IV	Phase V	Phase VI
	12 Nov - 22 Nov 20	23 Nov - 22 Dec 20	23 Dec 20 - 22 Jan 21	23 Jan - 22 Feb 21	23 Feb - 22 Mar 21	23 Mar - 22 Apr 21
Participant ID	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21
DWW29						15,000
DWW30	Not yet joined	Not yet joined	38	Suspended	Suspended	Suspended
DWW31						0
DWW32	Not yet joined	Not yet joined	Not yet joined	0	0	2,724
DWW33						509
DWW34	Not yet joined	Not yet joined	Not yet joined	1,430	1,910	3,450
DWW35						970
DWW36	Not yet joined	Not yet joined	Not yet joined	Not yet joined	694	2,967
DWW37						4,861
DWW38	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	4,110
DWW39						0
DWW40	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	733
DWW41						0
DWW42	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	1,050
DWW43						453
DWW44	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined
DWW45						Not yet joined
DWW46	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined
DWW47						Not yet joined
DWW48	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined
DWW49						Not yet joined
DWW50	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined
DWW51						Not yet joined
DWW52	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined	Not yet joined
DWW53						Not yet joined
Monthly Total	3,585	56,545	71,410	71,400	78,108	102,044

Phase VII	Phase VIII	Phase IX	Phase X	Phase XI	Phase I - XI
23 Apr - 22 May 21	23 May - 22 Jun 21	23 Jun - 22 Jul 21	23 Jul - 22 Aug 21	23 Aug - 22 Sep 21	12 Nov 20 - 22 Sep 21
May-21	Jun-21	Jul-21	Aug-21	Sep-21	Total volume per recycler
15,000					141,958
Suspended	Suspended	Suspended	Suspended	Suspended	38
0					0
6,599	12,526	14,462	15,000	13,923	65,234
674					6,106
3,600	7,080	6,410	7,160	8,190	39,230
1,440					10,400
3,104	4,694	5,185	5,730	6,481	28,855
6,921					55,005
5,270	5,530	6,820	7,610	7,990	37,330
0					0
1,921	6,292	7,090	6,134	10,585	32,754
179					2,299
7,830	12,080	10,700	7,530	10,510	49,700
1,158					12,266
783	1,933	1,588	2,954	3,527	10,785
Suspended					0
Not yet joined	0	3,181	2,250	2,470	7,901
Not yet joined					338
Not yet joined	1,710	4,066	6,670	8,290	20,736
Not yet joined					26,540
Not yet joined	810	1,110	860	1,260	4,040
Not yet joined					0
Not yet joined	400	3,084	3,449	3,676	10,609
Not yet joined					13,280
124,529	168,722	174,850	179,754	213,910	1,244,857

Exit survey

Full appendices information is available here:



https://drinkwithoutwaste.org/wp-content/uploads/2022/07/NHS-Report_Exit-Surveys_combined.pdf

Fieldwork survey and transaction observations

Full appendices information is available here:



https://drinkwithoutwaste.org/wp-content/uploads/2022/07/NHS-Report_Fieldwork-survey-and-transaction-observations_combined.pdf

Fieldwork survey: Collectors

Items marked green indicate questions that were added in October 2021

Main questions	Subordinate questions
1. Approximate age	
2. How would you describe your occupation?	
3. What is your approx. income per month?	
4. Have you been collecting/ returning PET bottles for a long time?	
5. Why don't you normally return bottles, what failed to motivate you?	a. inconvenience b. Value too low c. Environment / don't care about the environment d. Hard to say e. unhygienic f. others
6. Where do you get your PET bottles from?	
6.5 Would you open waste bags or go through waste bins to get a PET bottle?	Closed waste bags at resident quarters? (Y/N) Waste bins on the street? (Y/N)
7. Do you store empty bottles at home/ in your office/ elsewhere	(Y/N)? a. How long do you store it (a day/ a week/ longer)?
8. Distance between obtaining the empty bottles and delivering it here ? (multiple options)	a. In mins (approx.) b. In distance (approx.) [indicate the metric] c. Specific starting point/ address (e.g. when coming from home)? d. How many stops to pick up PET bottles inbetween?
9. How many bottles (kg) do you	a. Generally deliver approximately per visit of the recovery point? b. Today?
10. How would you assess the option to return your PET bottles at this point?	a. 1-5, five being the best b. Which are the advantages? c. What are the challenges?
11. Are you aware of the reimbursement scheme for returning PET bottles?	
11.5 Would you prefer to get paid by bottle units or by weight?	Y/N? why?

12. How often do you return PET bottles per week?	a. To this recovery point which offers reimbursement? b. To other, similar recovery point which offer reimbursement (Where are these)? c. To normal street bins?
13. How much more often would you collect, clean and then return bottles to this point, if the reimbursement figure per bottle would be raised to	a. If 10 HKD cents, then how much more often? b. 50 HKD cents, then how much more often? c. 1 HKD, then how much more often?
13.5 If the reimbursement figure per bottle would be raised, would you collected more?	a. If PET-bottle value is raised by 10 HKD cents (Y/N) b. if (a.) is yes, could you collect twice the amount of PETs that you collect now? c. if (a.) is yes, would you go longer distances for collecting the bottles?
14. Is this recovery point more appealing to you then the EPD's @GREEN COMMUNITY's Recycling Stations, Recycling Stores and Recycling Spots?	a. Yes, because... b. No, because... c. Never heard of the others.
15. Could you imagine to return other beverage packaging than PET bottles?	a. Y/N b. If yes, what would it need for you to return these here?
16. What major challenges do you face for returning PET bottles to a recovery point?	a. Distance for delivery (1-5, 5 being the biggest challenge)? b. Accessibility (1-5, 5 being the biggest challenge)? c. Low value return of bottles (1-5, 5 being the biggest challenge)?
17. Ideally, where should recovery points like this one be situated? (multiple answers possible)	a. Here (y/n) b. Housing estates(y/n) c. Close to MTR stations/ bus terminals (y/n) d. Public spaces (y/n) e. Supermarkets (y/n) f. Street markets (y/n) g. Shopping centres (y/n)
18. Where do you get your bottles from (source)?	Public waste bins? Street markets? Residential quarters? Retail?
19. How many sources are there for your collection?	
20. Frequency of each source (times/day)	
21 How far is each source away from your storage location?	in minutes? in meters?

Fieldwork survey: Recyclers

Items marked green indicate questions that were added in October 2021

Main questions	Subordinate questions
1. Business hours at the location?	
2. Type of recovery point operated?	a. Pop-up recycler b. recycling shop c. Mobile recycling truck d. Recycling area within a shopping mall
3. Daily operation hours (hour-exact time)?	
4. How much quantities on average collected per day/ week/month ? (potentially: good vs. bad day)	a. PET (Tons/week) b. Other plastics (tons/week) c. Paper (tons/week) d. Metals (tons/week) e. E-waste (Kg/ tons/ units)
4.5 Best and worst PET recovery achievements per week?	a. Best: (kg/week) b. Worst: (kg/week)
5. How many persons approximately come per day/ hour?	
6. Transfer of the PETs further downstream	a. To where? b. How (personal delivery with truck/ collected from downstream)? c. When on average (after each day/ week/ month)? Reason?
7. How much gross do you make in HKD from PETs per month – approximately (excl. subsidy)?	
8. Major expenditure items?	a. Truck maintenance and gas per month (approx. HKD/ month)? b. Rent of recovery point infrastructure (approx. HKD/ month)? c. Employed labour (approx. HKD/month)? d. Others – please specify (approx. HKD/month)?
9. How motivated are you to continue in this line of work?	a. (1-5, 5 being strongest motivation)? b. why/why not?
10. Could you imagine to take back other beverage packaging materials?	a. Y/N b. if yes: what would you need for your operations to change?

11. Major challenges encountered regarding	<ul style="list-style-type: none"> a. Local regulations (1-5, 5 being the biggest challenge)? b. Taxation and subsidies (1-5, 5 being the biggest challenge)? c. Routines/ habits of collectors (1-5, 5 being the biggest challenge)? d. Local storage (1-5, 5 being the biggest challenge)? e. Usable infrastructure of the recovery point (1-5, 5 being the biggest challenge)? f. Competition from other nearby recovery points similar to yours? (1-5, 5 being the biggest challenge)?
12. What should be done to help your business operations through (Y/N)	<ul style="list-style-type: none"> a. Governmental policy and regulations? b. Taxation and subsidies? c. Consumers/ collectors (e.g., no price negotiation, proper sorting)? d. Local storage capacities? e. Infrastructure & selection of area for your recovery point (e.g., housing estates)? f. Competition from other nearby recovery points similar to yours (e.g., min. distance to each other, contracts for certain housing estates per recovery point)?
13. According to your experience, what infrastructure-specific conditions would safeguard/improve your recovery performance/ operations (street access, space for storing etc.)?	
14. How do you feel about the subsidy scheme for PET bottles?	<ul style="list-style-type: none"> a) In general (1- poor, 5-perfect) b) What should be improved?
15. How do you feel communication and relationship building works with PET-delivering persons?	<ul style="list-style-type: none"> a) In general (1- poor, 5-perfect) b) What should be improved?
16. How much do you make with each collected PET bottle you collect?	
17. What are the reasons for the low price of PET bottles in Hong Kong? (multiple answers)	
18. If that net profit would be raised by 50% would you willing to	<ul style="list-style-type: none"> a. Document & report overall recovered PET quantities on a daily basis beyond the period of the subsidy scheme? (Y/N) b. Document & report downstream channels and for each channel transacted quantities of PET bottles on a monthly basis? (Y/N) c. Engage in education of community one hour every two weeks? (Y/N)

Glossary

ADM Capital Foundation: A foundation that promotes equity and environmental conservation in Asia; with tax exempt status under Section 88 of the Hong Kong Government Inland Revenue Ordinance and 501(c)(3) charitable status in the United States.

Designing Hong Kong: Designing Hong Kong Limited is a not-for-profit organisation devoted to promoting sustainability, quality of life and good design as core values in planning, development, and governance.

Frontline collector: Cleaner or informal worker that is active in the collection of recyclables, or formal worker that maintains an informal activity in the collection of recyclables.

HDPE: High-density polyethylene.

PP: Polypropylene.

PET: Polyethylene terephthalate, the most common plastic resin for beverage bottles on the Hong Kong market.

PPRS: Producer responsibility scheme on plastic beverage containers.

Processor: Purchases the bottle materials from the recyclers and provides value-added services ranging from sorting and baling to washing and production of flakes or pellets.

PS: polystyrene.

Recycler: Private stationary or mobile collection point for recyclables; some recycling operations are downstream integrated with processing capabilities in Hong Kong or the mainland.

RF: Recycling Fund.

Reverse Vending Machine (RVM): A self-service machine that accepts and temporarily stores empty beverage packaging. Many offer an incentive for every beverage packaging item returned, either in (electronic) cash or as credit for redeeming rewards. Reverse vending machines do not include hand scanners or other similar devices.

Scheme: Pilot Scheme for Beverage Bottles, a pilot scheme on the establishment of a single-use plastic beverage bottle recycling network; this is an Industry Support Programme funded by the Recycling Fund (ISP-1920-16-007).

Working Group: Single-Use Beverage Packaging Working Group, a broad coalition of stakeholders focused on reducing waste from beverage consumption. (www.drinkwithoutwaste.org)



Disclaimer

Any opinions, findings, conclusions, or recommendations expressed in this material do not reflect the views of the Government of the Hong Kong Special Administrative Region, or the Advisory Committee on Recycling Fund or the Recycling Fund Secretariat.”

Footnotes

1. Reloop (2020) Global Deposit Book 2020—an overview of deposit systems for one-way beverage containers
2. Hong Kong Environmental Protection Department (2021) Monitoring of Solid Waste in Hong Kong: Waste Statistics for 2020.
3. Hong Kong Environmental Protection Department (2021) Monitoring of Solid Waste in Hong Kong: Waste Statistics for 2020.
4. Deloitte Risk Advisory and Cistri (2018) Drink Without Waste Research Report
5. Hong Kong Environmental Protection Department (2021) LC Paper No. CB(1)672/20-21(03) Public Consultation on A Producer Responsibility Scheme on Plastic Beverage Containers
6. Hong Kong Environmental Protection Department (2021) Monitoring of Solid Waste in Hong Kong: Waste Statistics for 2020.
7. The Single-use Beverage Packaging Working Group (the ‘Working Group’) is an alliance uniting beverage manufacturers and importers, waste handlers and recyclers, institutions, retailers and NGOs, formed in Hong Kong in 2017. In line with Government’s intent and public aspirations, it seeks to recover 70% to 90% of used beverage containers by as early as 2025. It intends to achieve this by reducing the use of single-use beverage packaging; adopting sustainable beverage packaging standards; recovering used beverage packaging; and recycling the collected materials. As an input to the pilot subsidy scheme, the Working Group members and secretariat shared insights from collection efforts they had conducted in the past or that were still ongoing.
8. https://www.wastereduction.gov.hk/en/waste_paper_collection_and_recycling_services.htm. Accessed 6 June 2022.
9. Green Power (2020) Press release: Drink Cartons Recycling Cash Reward Programme Formally Launched \$0.05 per Carton to Subsidize the Upper, Middle and Lower Ends of Local Recycling Chain.
10. https://www.wastereduction.gov.hk/en/waste_paper_collection_and_recycling_services.htm. Accessed 6 June 2022.
11. Green Power (2020) Press release: Drink Cartons Recycling Cash Reward Programme Formally Launched \$0.05 per Carton to Subsidize the Upper, Middle and Lower Ends of Local Recycling Chain
12. Hong Kong Island, Tai Kok Tsui, Tsim Sha Tsui, Tuen Mun, Yuen Long, Sun Po Kong, Kwai Chung, Tsuen Wan, Sheung Shui.
13. To make sure that the new pilot scheme was sufficiently attractive to recyclers in terms of opportunity cost, without inviting fraud, the maximum monthly volume was set in line with a Recycling Fund pilot project that paid out a subsidy for waste paper collection. Under that scheme, stationary recyclers could receive a maximum of HKD 48,000 per month. More or less matching that value, and based on a subsidy of HKD 3,400 per tonne of plastic bottles, translates in a maximum plastic bottle volume of 15 tonnes per month, or HKD 51,000 per month.
14. ADM Capital Foundation and Designing Hong Kong (2020) “Neighbourhood bottle reward scheme”, A scheme executed by Designing Hong Kong Limited, on behalf of the ADM Capital Foundation, The Industry Support Programme “A pilot scheme on establishment of a single-use plastic beverage bottle recycling network”, funded by the Recycling Fund (ISP-1920-16-007)—Inception Report.
15. Tender Reference No.: WM 21065 (Set up, Operation and Management of the Pilot Scheme on Application of Reverse Vending Machines in Hong Kong - Stage 2), Terms of Tender (Supplement)—Appendix E - Number of Permitted Recyclables collected in April to June 2021
16. This recycler’s business focuses entirely on plastics; this helps explain why there was no drop in relevant transactions at the end of the pilot programme.
17. The Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Bill 2018
18. <https://www.gov.hk/en/residents/environment/waste/management/prsplastic.htm> (last visited 23 November 2021).

19. Hong Kong Environment Bureau (2021) Waste Blueprint for Hong Kong 2035.
20. Hong Kong Environment Bureau (2021) Waste Blueprint for Hong Kong 2035.
21. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours.
22. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours. Question: 'Which of the following locations would you consider most convenient to return your bottles?'
Answers were read out in randomised order and only one answer was allowed. n=1001
23. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours.
24. Q&A on Municipal Solid Waste (MSW) Charging as passed by the Legislative Council and Related Arrangements (Question 11: How can the public reduce the cost incurred by MSW charging?).
25. Hong Kong SAR Environmental Protection Department (2021) Producer Responsibility Scheme on Plastic Beverage Containers—consultation document, point 2.3.
26. Hong Kong SAR Environmental Protection Department (2021) Producer Responsibility Scheme on Plastic Beverage Containers—consultation document.
27. ReLOOP (2020) Global Deposit Book 2020.
28. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours.
29. Note that the map shows the districts where recyclers were allocated for statistical purposes; in reality, two additional districts (Southern and Islands) benefited from the pilot subsidy scheme because some mobile recyclers extended their services there.
30. Distribution of recyclers in the paper subsidy scheme: Hong Kong Island – 52, Kowloon – 83, New Territories – 112.
31. Recycler interviewee #1, October.
32. Question 5. How do you feel about the subsidy scheme for PET bottles? (October 2021)
33. Question: How do you feel about communication and relationship building with the collectors? 1- poor, 5-perfect.
34. Interview question: "Major challenges encountered regarding – c. Routines / habits of collectors? Please use the number 1-5 to indicate your sentiment in between a min. of negative/rejection (1) and full agreement/ support (5)".
35. Interview question: "6. On a scale of 1 to 5, with 1 poor and 5 perfect, how do you feel communication and relationship building works with PET-delivering persons?".
36. <https://www.youtube.com/watch?v=z1zYCuF5KY> (Last visited 29 November 2021).
37. Sum is larger than 100% due to rounding
38. Graedel, T. and Reck, B.K. 2014. Recycling in context. In: Worrell, E. and M. Reuter (eds.), 2014. Handbook of recycling - State-of-the-art for Practitioners, Analysts, and Scientists. Online: <http://www.sciencedirect.com/science/book/9780123964595> (accessed October 2021)
39. Waste Picker Platform (2018).
40. Steuer B and Li H. 2022. An alternative model for effective household waste recycling in China: Ant Recovery's bottom-up scheme in Changchun City. Waste Management, Vol 139, pp.352-361. Doi: <https://doi.org/10.1016/j.wasman.2021.12.039>
41. Sum is larger than 100% due to rounding.

42. Presence: Is measured as proportional value. It indicates the percentage of collectors that were documented over surveys, and only includes individuals that transacted plastic bottles at the recycler.
43. Question: “Why don’t you normally return bottles, what failed to motivate you?”; question asked of all interviewees, i.e., both those that returned plastic bottles and those that did not. “Hygiene concerns” was only added in October as an explicit response option, and did not come up under “Other” in the September interviews.
44. Steuer B. 2020. Identifying effective institutions for China’s circular economy: Bottom-up evidence from waste management. *Waste Management & Research*, Vol 39(7), pp. 937-946. Doi: <https://doi.org/10.1177/0734242X20972796>
45. Steuer B and Li H. 2022. An alternative model for effective household waste recycling in China: Ant Recovery’s bottom-up scheme in Changchun City. *Waste Management*, Vol 139, pp.352-361. Doi: <https://doi.org/10.1016/j.wasman.2021.12.039>
46. Compactor truck ride-alongs in October and November, with each time <10 interviewees (high-volume collectors from which recyclables were picked up by the processor directly, i.e., not through the intermediary of a recycler)
47. Most of the distances were derived from walking times stated as approximate figures in minutes by interviewees. A few collectors provided housing addresses and minutes, which allowed for a conversion from minutes into meters, i.e. 82.5 meters/min.
48. Question: “Do you store empty bottles at home / in your office / elsewhere?”
49. Question: “How long do you store empty bottles (a day / a week / longer)?”
50. Question: “What major challenges do you face in returning PET bottles to a recovery point? C. Low value return of bottles? Rate 1-5, with 5 being the biggest challenge.”
51. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours.
52. Steuer B and Li H. 2022. An alternative model for effective household waste recycling in China: Ant Recovery’s bottom-up scheme in Changchun City. *Waste Management*, Vol 139, pp.352-361. Doi: <https://doi.org/10.1016/j.wasman.2021.12.039>
53. http://www.changchunnews.com/content/2019-07/15/content_4749996.html
54. <https://www.facebook.com/wastepickerplatform/>
55. <https://www.vcycle.com.hk>
56. Numbers provided by recycler interviewee #7
57. ReLOOP (2020) Global Deposit Book 2020.
58. In the ISP projects, this difference is not reflected, since both projects pay out the same subsidy to the collectors, regardless of the value of the material collected.
59. EPD (2021) Annex E Number of Permitted Recyclables collected in April to June 2021 – Recovery figures of Reverse Vending Machines (RVMs)
60. The cost per collected bottle in the RVM pilot was estimated based on the average monthly cost of the programme and the average monthly volume of plastic beverage bottles recovered. The cost is based on the total tender value of HKD 19,989,560 and includes rebate value, administrative and operations cost of the programme funded by the Government. A total collection period of 15 months is assumed (collection start date 25 January 2021—end date 31 March 2022, when the next phase of the pilot starts).
61. Question: Could you imagine returning other beverage packaging than PET bottles?
62. Hong Kong Productivity Council (2014) A study to promote recycling of plastic, paper and used cooking oil in Hong Kong.
63. Hong Kong Public Opinion Research Institute (2020) Survey—Plastic bottle recycling public attitudes and behaviours.

