Dear Chair, dear Committee Members,

ADM Capital Foundation wholeheartedly supports regulation of single-use tableware in Hong Kong. We would have preferred a more narrowly defined ban, for EPS tableware and single-use peripherals such as straws, complemented with other regulatory tools such as a Producer Responsibility Scheme, and with complementary policies to move away from this waste and resource scourge. But, since a broad ban is what is on the table, let us comment on that today.

In 2021, our Foundation conducted a one-year research project on reducing waste from takeout foodservice in Hong Kong. Its findings have previously been shared with the Government.

Four types of solutions were investigated to address food containers and cups: Recycling instead of disposing single-use packaging; Compostable single-use packaging; Bring Your Own, "BYO", where consumers carry their own reusable cups, bowls, and utensils; and finally, centralized reuse systems where either the Food&Beverage operator or a third party provides the tableware for reuse.

These solutions were evaluated for a suite of environmental, economic, and social metrics: water usage, greenhouse gas emissions, financial costs, the technical performance of the container, and implementation efforts for involved stakeholders. This was investigated under different scenarios of what we called "Mobilization", that is, how serious we take this as a society and a government.

Under each implementation scenario, BYO and Recycling are projected to deliver the strongest outcomes in terms of landfill diversion. The Reuse opportunity is smaller but, under the strongest scenario, could nevertheless reduce up to one- third of Hong Kong's projected single-use foodservice packaging use.

Composting cannot keep containers out of landfills unless composting infrastructure is in place or our existing, and planned anaerobic digestion infrastructure is modified, and therefore could not contribute until these investments are made. Under a scenario where collection and processing infrastructure is in place, however, we project that the Composting solution could potentially keep half of Hong Kong's SFP containers out of its landfills.

Our Foundation notes with interest the timeline for the proposed Tableware regulation. We think it appropriate, maybe even somewhat aggressive, for the following reasons:

- Reusables on site are well established in the majority of operations, and even some that use single-use, already use reusables for part if not most of their operations.
    - Government needs to provide advisory to the Food & Beverage (F&B) industry. This needs to go beyond a database on how to source alternatives that are non-plastic but still disposable. Government will need to provide advisory on how to shift from disposables to reusables for on-site dining. This may include operational best practices but also infrastructure modifications.
    - Government may also have to provide financial assistance to help F&B operators through the transition. This could come in the form of grants or loans for the installation of washing facilities, or in the provision of

centralized wash kitchens for the smallest operators. The latter will prove critical in the second phase of the tableware transition, where centralized reuse systems will need to be developed.

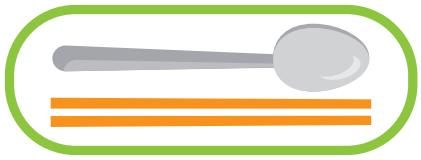
    - Many onsite uses of disposables seem driven by misplaced hygiene concerns (after all, why worry about the cleanliness of a cup but not of a plate?). Government will therefore need to spend the months ahead educating and motivating our citizens to embrace reusables.

- As for the second phase of this tableware transition: 2025 may be disappointing to many of us because we would like to have seen such regulation already yesterday. But if we want to avoid F&B operators simply shifting to other single-use packaging – which will still end up in the landfill, we need to use the time ahead to wholeheartedly move towards Bring Your Own (BYO) and centralized reuse systems.
- This requires on the one hand a big push towards awareness building and habit forming amongst our citizens, and on the other hand the development of new business models and new infrastructure for the widespread use of reusables, and government support and focus will no doubt be required on both fronts.
- In short, we would like to see a firmer commitment to the date of the second phase, a stronger focus on BYO and reusables rather than non-plastic single-use options, and government support for helping F&B operators and their customers through this important transition.

Thank you for your consideration.

Helga Vanthournout

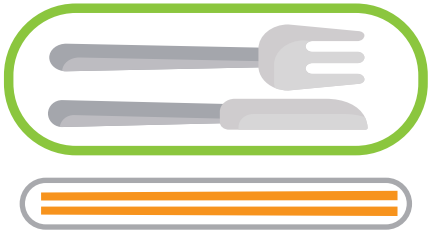
ADM Capital Foundation

免廢外賣

香港管理外賣包裝的挑戰

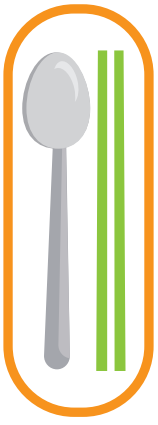
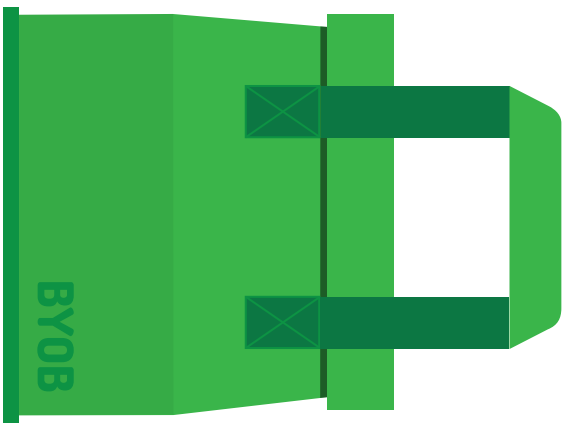
行政摘要









免廢外賣

Eat Without Waste

前言

每逢午飯時段見到同事出外用膳，幾分鐘後便拿着膠袋返回公司，當中有即棄塑膠餐盒、有蓋飲品杯、筷子、攪拌棒和塑膠醬汁盒。轉眼間已過十五分鐘，同事把膠袋包得非常緊，確保剩餘的食物不會漏出。不久，污糟的食物包裝隨之被清潔人員清理，再經垃圾車送去一個永遠不會離開的地方 — 堆填區。食物包裝不但被隨處丟棄，被野生動物踐踏，更會落入大海。發起「免廢暢飲」的原意是要處理飲品包裝。「免廢外賣」則皆在應對已近失控程度的即棄餐具。解決方案非常清晰。最大的挑戰是把方案設計得方便快捷。

司馬文
創建香港
免廢暢飲

「零廢」食飯是我兒時的日常。還記得祖母每當在家打麻雀時都會訂購外賣雲吞麵。外賣送遞員用鐵籃送上熱熱的雲吞麵，食物全都用瓦碗盛載。我當時負責收集用過的碗和筷子，以便當晚或翌日進行的回收重用。

今時今日，大量即棄餐具和容器導致垃圾桶爆滿，污染我們美麗的海灘，更被隨處丟棄在山徑上。

很多人及飲食業好像已經忘記大自然友善的重用措施。可是，當我們重用餐具，便可以避免每日製造過百噸的外賣包裝垃圾和生態污染。

這份報告提醒我們使用即棄餐具的行為已成病態，亦概述如何作出改變。

劉祉鋒
創辦人兼總幹事
綠惜地球

行政摘要

引言

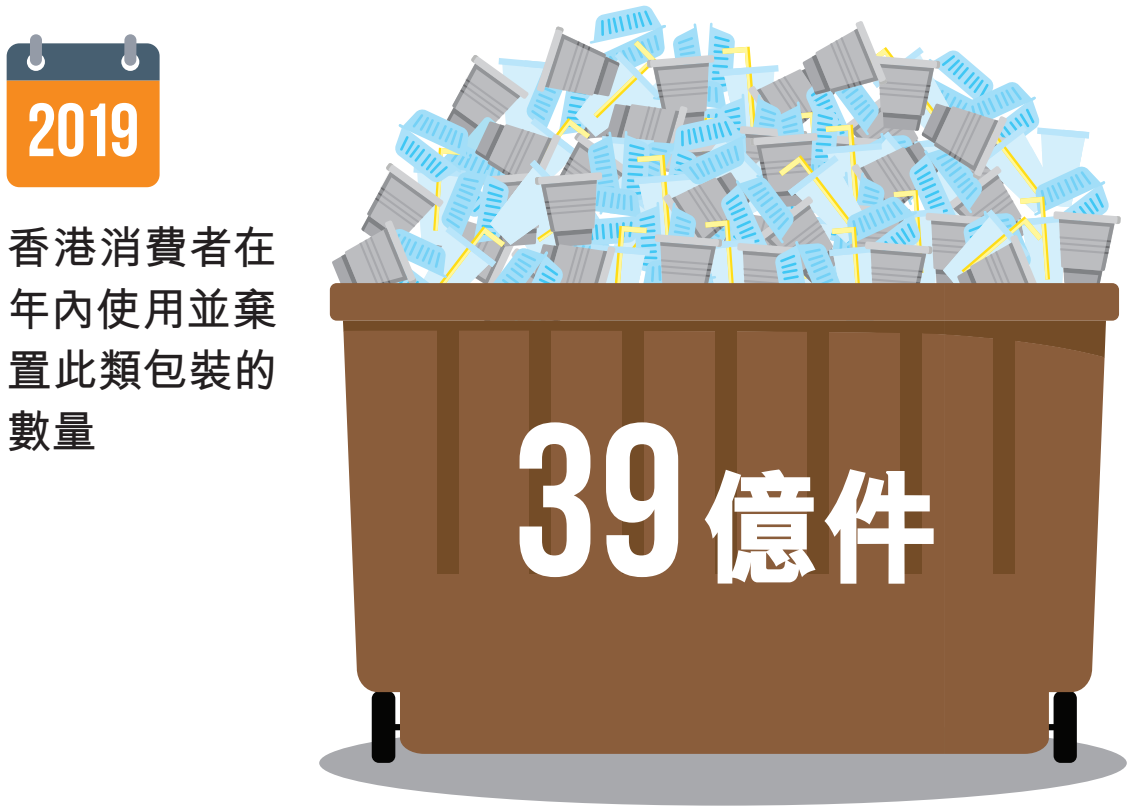
香港人口密度高，崇尚方便快捷，導致即棄食物包裝的使用量龐大。

2019年，即使在新冠疫情爆發前，估計香港消費者在年內使用並棄置此類包裝的數量達39億件。此後，外賣更大行其道，多項市場預測均估計此使用模式會持續，所產生的包裝會導致堆填區不勝負荷、沙灘和街上佈滿垃圾，亦會耗廢資源，對環境構成破壞。

解決這不必要的災害需要以下因素：

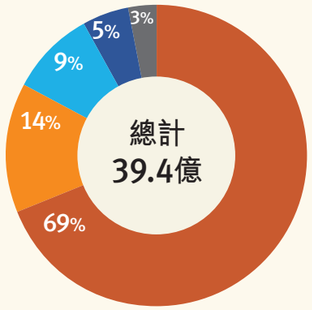
1. **基線：**詳細了解現時情況及原因
2. **解決方案：**分析香港和全球現正採用或未見成熟的各種方案
3. **盡展潛能：**制定能符合香港特定需要且可行的方案，以盡可能減少堆填量

為開展有效的政策介入，並鼓勵更多持份者積極參與，ADM Capital Foundation（ADMCF）按此三主軸進行廣泛研究，聚焦探討即棄有蓋食物盒及飲品杯（下稱即棄包裝）。同時，研究提出的許多建議亦適用於其他與食物有關的即棄用品，例如飲管、攪拌棒、餐具、筷子，以及用以盛載外賣食物的膠袋或紙袋。



分析過程及結果

分析目標	基線	解決方案 - 可行性 - 成本 - 影響	盡展潛能
分析方法	• 以新冠疫情開始前的本地使用模式數據，得出香港使用即棄食物包裝的基線。 • 研究亦推算至2030年，以估計未來的即棄包裝使用模式。	• 沿環形經濟範疇得出四個方案原型：回收、自備容器、堆肥及循環再用系統。 • 每個原型會按一組環境、經濟及社會數據標準評估：用水量、溫室氣體排放、經濟成本、容器的技術表現，以及有關持份者切實執行的程度。	• 按每個方案可用的容器種類／使用(例如凍飲杯)，以及該容器種類／使用的市場大小，擴大方案的使用程度，並決定每個方案的總避免堆填潛力。 • 2030年效能按三個不同的落實情景計算，視乎香港鼓勵有關持份者參與的能力。
研究結果	**香港使用的一次性食品和飲料容器數量** （2019年估計，新冠疫情前水平）	**2030年先進動員情景下解決方案可行性及環境影響總結**	**三種模擬情景下的整體解決方案對香港的影響***



容器種類：
- 熱食
- 熱飲
- 凍飲
- 生冷食物
- 其他 (未能分類)

解決方案	可行程度	
	技術限制	實施工作
回收	100%	76%
自備容器	90%	80%
堆肥	90%	55%
重用	80%	39%

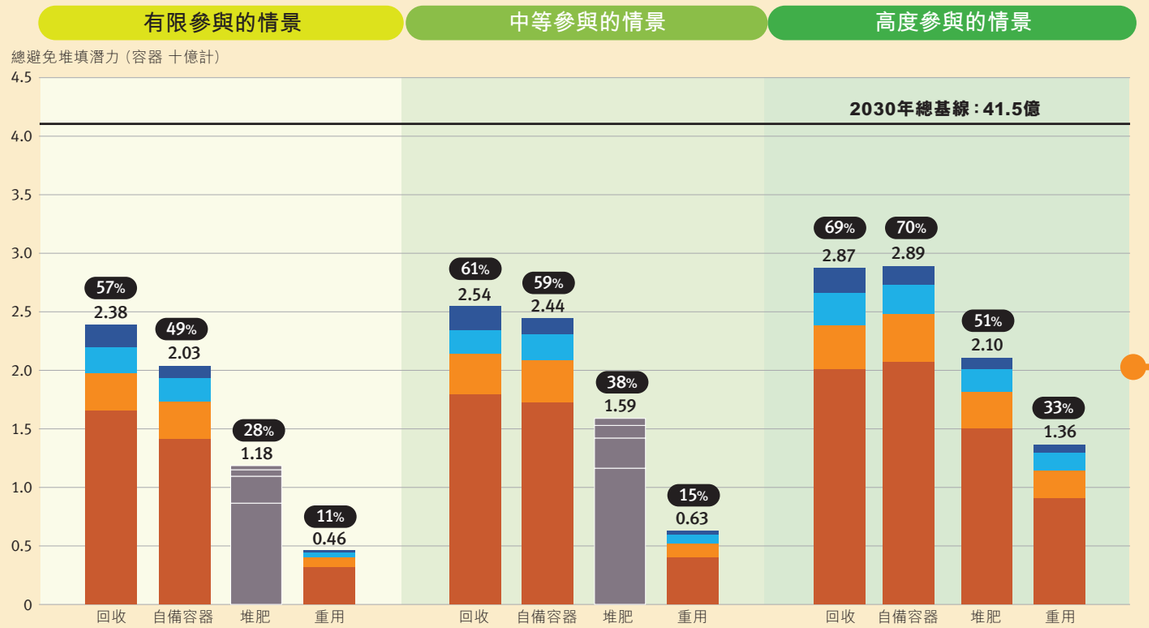
不太可行 (0%) — 非常可行 (100%)

解決方案	成本及環境影響		
	成本	溫室氣體排放量	用水量
回收			
自備容器			
堆肥			
重用			

最低成本/影響 — 最高成本/影響

每行分項載列每個解決方案在高度參與的情景中，就其相對可行程度、成本及環境影響所作預先分析的結果

在每個推行情景中，**自備容器**及**回收**方案預計可發揮最大成效，**重用**的機會較小，但在高度參與的情景中，該方案可減少香港推算即棄包裝使用量的三分之一。除非設置堆肥基建，或改良現有及計劃興建的厭氧消化基建，否則**堆肥**方案不能避免把容器送往堆填，因此在有限或中等參與的情景中，在進行該等投資前，方案未能改善問題。在高度參與的情景中，如能設置收集和處理基建，我們預計堆肥方案可有效避免把一半香港即棄包裝容器送往堆填。



* 在有限及中等參與情景中，我們假設本港不會調整或建造處理有機物的工業設施，因此圖表只顯示堆肥方案在理論上能減少堆填的效果，並以灰色標示。

有限參與的情景

代表各方對環境問題及可能的回應有更好的理解，從而促成一定程度的社會和行為轉變。此情景假設在政策或系統層面投資上欠缺進展。

中等參與的情景

代表不同的解決方案獲得中等參與和投資額。這包括加強教育市民如何減少因外賣和送餐而產生的即棄食物包裝、鼓勵消費者使用重用容器的小型計劃，以及優化另類廢物收集流(例如塑膠回收)。

高度參與的情景

代表政府和私人機構均致力投資於相關的政策、教育和基建項目，以減少把即棄食物包裝送到堆填區。這包括禁止使用某些即棄食物包裝(例如發泡膠)或建造及營運工業堆肥設施。

時機成熟

2021年夏季，香港特區政府進行公眾諮詢，研究規管使用即棄包裝(管制即棄膠餐具計劃)。根據政府在2019年委託進行的顧問報告，諮詢文件建議：

(a) 2025年之前全面禁止售賣發泡膠製的即棄包裝；
(b) 2025年之前禁止在堂食時使用任何即棄塑膠包裝；
(c) 2025年之前禁止為外賣提供飲管、攪拌棒、叉、刀、匙羹及碟；以及
(d) 在評估期後，把任何即棄塑膠包裝的禁令擴展至外賣。

即使管制措施快將推行，我們不認為問題就此解決。ADMCF將研究結果與政府建議中的成份進行比對。分析為政策建議提供三個必要補充。首先，政策應針對各種外賣包裝，而不單止塑膠。第二，環境保護署提議的廣泛禁令並非最佳的解決辦法，亦非大幅減少外賣包裝被送往堆填的數量的唯一方法。第三，時間表應比現時建議更為細緻。下文將加以闡釋此三項元素。

建議

根據分析，以及參考現時的政策建議，可綜合我們的建議如下：

針對所有即棄食物包裝，而不只是塑膠；
採取一系列措施；立即行動。

針對所有即棄食物包裝

政府就管制即棄膠餐具計劃的建議，基本上只聚焦於迫令餐飲業放棄使用塑膠產品，這會引起多種問題。

試圖消弭單一種的即棄包裝難免令其他即棄包裝使用量上升，結果對於達到政府在最新資源循環藍圖中訂定的堆填目標的效果有限。舉例而言，在缺乏收集及處理基建的情況下，採用草本物料可減少依賴石油資源，但這方案仍不能避免把容器送往堆填。

棄置垃圾的問題亦未能根治，因為與其他物料相關的垃圾棄置行為不會減少。相反，被視為「天然」及可生物降解的物料可能會誤導消費者，以為可隨便在公園或海灘棄置這類垃圾，而不會招致後果。

這又導致另一問題，所有即棄食物包裝也會影響環境。在供應鍊的各個環節中均會使用到資源，而商人可能會以不理想的方法提升物料效能以滿足需求，例如使用薄膠層或總全氟和多氟烷基物質等化學物質以阻隔濕氣或油脂。再者，餐飲業營運商及其供應商可能會改用更不可持續的方案，例如使用鍍鋁紙袋。製作該種紙袋需要大量資源，而且現時仍缺乏能回收該類紙袋的科技。

政府政策、餐飲業營運商及非政府組織應研究限制使用所有即棄包裝，而非只是塑膠製的包裝。

採取一系列措施

我們研究了回收、自備和堆肥即棄容器，以及建立相對集中管理的重用系統。分析顯示，由於無一方案能獨力處理整個研究範圍涵蓋的飲品杯和其他容器，本港整體及餐飲業營運商需要採取多於一項解決方案，才能達到最佳的減廢效果。

在所有情景中，回收和自備容器的原型最為有效，因為兩者均可應用於大部分香港市場，可有效避免使用即棄包裝，從而減少堆填，同時限制對環境的影響。更重要的是，兩者相對容易調節力度，亦可應用在今天市場上使用的容器，而不會阻礙將來推出更複雜方案，例如堆肥或重用。從環境影響角度而言，重用系統的潛力最高，但成本和物流要求相對較高，令此方案只適用於部分香港市場。由於其在環境方面的表現出色，值得識別重用方案可較容易實行的地點和情景。

由於香港缺乏處理可堆肥廢料的基建，因此現時不適合採用可堆肥容器。即使未來設立這種基建，可堆肥容器仍然較其他方案產生最多溫室氣體(以每次使用計算)。但若使用合適的收集和處理基建，並提升推行方案的力度，堆肥可處理大量即棄包裝。

由於熱食容器佔香港即棄食物包裝市場的大部分，針對該類容器制定解決方案帶來的影響較熱/凍飲品容器或生冷食物容器為大。因此，為了盡量減少送往堆填區的容器數量，本分析顯示回收及自備容器是解決熱食容器問題的最佳方案。

我們建議的多元化方案應反映在政府政策上。政策支持至關重要，因為無一有利於環境的方案原型比現時廣泛使用即棄包裝的做法，更合符成本效益和便利。政府建議的禁令雖然具行政效率，但不能獨力應對香港即棄包裝的挑戰。

教育和鼓勵消費者及酒店業持份者參與、提供誘因鼓勵重用容器、管制有害的包裝物料，以及投資興建廢物管理基建皆應包括在政策綱領之中。此外，未來如要讓堆肥和重用的方案發揮重大作用，政府亦應盡快作出明確堅定的決定，計劃基建發展。

立即行動

制定強硬法例需時凝聚共識，香港不應等待，必須今天便開展工作，避免把即棄包裝送往堆填區 — 這是必須而可行的。

確有此需要

香港快被外賣餐和飲品廢料淹沒，香港人在預製食物及外出用膳花費甚多，位列地區之冠，同時港人偏好購買外賣。新冠疫情爆發亦令外賣習慣加劇。2020年，即封城和限聚令生效的首年，部分香港酒店業及送餐平台的外賣訂單飆升超過50%。外賣和餐飲速遞比堂食需要更多包裝，但許多餐廳亦同樣以即棄包裝盛載堂食食物。

誠然，就重量而言，塑膠和其他即棄食物包裝在香港龐大的人均廢物之中相對只佔少數，但這是因為其密度較低，而廚餘的密度較高，佔香港都市固體廢物的大多數。

再者，即棄包裝會長期殘留在垃圾堆之中，佈滿香港的街道、海灘和郊野公園。即棄包裝除了會危害海洋和陸地動物、生態和環境，亦會對社會造成直接和間接的損害。

最近的研究已顯示，若要達到零廢物洩漏的目標，社會絕對不能把介入行動推遲五年。香港需要盡其責任，重點解決處理即棄食物包裝的挑戰。

目標可達

政府建議管制即棄膠餐具計劃的時間表訂明，2025年前全面禁止使用發泡膠及塑膠餐具，這適用於針對建議範圍內的特定成份，例如發泡膠容器或大部分堂食容器，但全面禁令的所定時間不足以發展可持續、實惠而功能上可行的另類物料及系統，以代替市場上的塑膠容器。由於缺乏代替品，餐飲業營運商或會被迫改用不理想的方案，以不同形式令香港的廢物問題加劇。

另外，如能即時展開廣泛宣傳和提倡回收，即棄食物包裝便可在2025年前明顯減少。同樣地，亦可向個別餐飲業營運商或其物業管理人介紹自備容器和重用的優點和可行方法，以補足現行使用即棄產品的做法。全面而突然執行的管制工具如建議的管制即棄膠餐具計劃，其時間表必須更深入考慮可以或不能推行的事項，以取得較理想的成果。

展望

本研究旨在提供基礎，推動更多改變，以其在實際行動和高層政策上超越小型而循序漸進的措施。要達到系統性的改變，實現真正可持續發展的外賣包裝方案，免「廢」外賣計劃會繼續透過具結構性和臨時的介入，促進有關持份者之間的溝通，並鼓勵他們參與。期望你加入我們，一起實現免「廢」外賣。


BYOB
BYOB
BYOB

EAT WITHOUT WASTE

HONG KONG'S TAKEOUT PACKAGING CHALLENGE

免廢外賣
Eat Without Waste

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About Eat Without Waste

The Eat Without Waste initiative was founded in 2020 by ADM Capital Foundation to address the growing issue of takeout packaging waste in Hong Kong. By establishing a granular view of Hong Kong's takeout waste landscape, this report sets the foundation to inform and implement a suite of solutions along the circular economy spectrum. In parallel, the initiative fosters change by facilitating communication and mobilisation across various stakeholder groups, from Government agencies to consumers, and from food & beverage operators to service providers.

ADM CAPITAL FOUNDATION

Suggested citation

Vanthournout H & Bang AHY (2021) *Eat Without Waste: Hong Kong's Takeout Packaging Challenge*. ADM Capital Foundation, Hong Kong.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

FOREWORD

Witness the daily waves of people streaming out of their offices for lunch, to return minutes later with a plastic bag containing a polystyrene lunch box, covered drink cup, chopsticks, stirrer, and plastic sauce pot. Fifteen minutes later, bags are neatly tied to ensure leftovers do not spill out. Whisked away by cleaners, compactor trucks collect and deposit the contaminated packaging into landfills where they will stay forever. Poorly disposed along the road and raided by wildlife, food packaging also finds its way into our seas. 'Drink Without Waste' was initiated to address beverage containers. 'Eat Without Waste' is to address the madness of one-off tableware. The solutions are clear. Making it convenient is the challenge.

Paul Zimmerman
Designing Hong Kong
Drink Without Waste

每逢午飯時段見到同事出外用膳，幾分鐘後便拿着膠袋返回公司，當中有即棄塑膠餐盒、有蓋飲品杯、筷子、攪拌棒和塑膠醬汁盒。轉眼間已過十五分鐘，同事把膠袋包得非常緊，確保剩餘的食物不會漏出。不久，污糟的食物包裝隨之被清潔人員清理，再經垃圾車送去一個永遠不會離開的地方 — 堆填區。食物包裝不但被隨處丟棄，被野生動物踐踏，更會落入大海。發起「免廢暢飲」的原意是要處理飲品包裝。「免廢外賣」則皆在應對已近失控程度的即棄餐具。解決方案非常清晰。最大的挑戰是把方案設計得方便快捷。

司馬文
創建香港
免廢暢飲

Eating without waste was the norm during my childhood. I recall my grandma liking to order takeaway wonton noodles whenever she played mah-jong at home. Several bowls of hot noodles kept in ceramics would be delivered by a man using a metal carrier. I was tasked with gathering the empty bowls and used chopsticks, ready for collection later that night or the following day.

Today, huge amounts of single-use tableware and cutlery cause public rubbish bins to overflow. They litter our beaches and are carelessly tossed along hiking trails.

Eco-friendly reuse practices seem to be forgotten by most people as well as the catering industry. However, by adopting the reuse approach, we can rid the city of hundreds of tonnes of takeaway debris every day, and prevent them from harming the ecosystem.

This report will tell you more about the harm brought about by our deep addiction to single-use tableware, and outlines how we can change course.

Edwin Lau, MH
Founder and Executive Director
The Green Earth

「零廢」食飯是我兒時的日常。還記得祖母每當在家打麻雀時都會訂購外賣雲吞麵。外賣送遞員用鐵籃送上熱熱的雲吞麵，食物全都用瓦碗盛載。我當時負責收集用過的碗和筷子，以便當晚或翌日進行的回收重用。

今時今日，大量即棄餐具和容器導致垃圾桶爆滿，污染我們美麗的海灘，更被隨處丟棄在山徑上。

很多人及飲食業好像已經忘記大自然友善的重用措施。可是，當我們重用餐具，便可以避免每日製造過百噸的外賣包裝垃圾和生態污染。

這份報告提醒我們使用即棄餐具的行為已成病態，亦概述如何作出改變。

劉祉鋒
創辦人兼總幹事
綠惜地球

IN SUPPORT OF EAT WITHOUT WASTE

FAIRWOOD HOLDINGS LTD.
Peggy Lee, Chief Marketing Officer

Across our operations, Fairwood is committed to adopting more sustainable solutions wherever possible. This includes eliminating all single-use plastic tableware from on-site dining. The Eat Without Waste report provides valuable research and tangible pathways to facilitate the F&B industry's transition to a less wasteful future.

大快活
Peggy Lee（市務首席主管）

在運營過程中，大快活致力採用更環保的方案。「免廢外賣」報告提供了寶貴的觀點和具體途徑，促進餐飲業邁向減少浪費的未來。

GREENERS ACTION
Angus Ho, Executive Director

Early on in the pandemic, Greeners Action found a 55% increase of single-use plastic cutlery. This report provides important insights to help our society find a way to shift from single-use items to reusable and sustainable habits.

綠領行動
何漢威（總幹事）

綠領行動喺疫症初期發現即棄餐具使用量升幅了55%，我期望呢份報告能給予社會新思維去幫助社會由即棄變成重用文化。

THE HONGKONG AND SHANGHAI HOTELS, LTD.
Joshua Wong, Manager, Corporate Responsibility and Sustainability

Aside from technical and logistical considerations when implementing waste management solutions, there is also the challenge of building a culture around these practices. To achieve the level of circularity we're hoping for, we need to leverage community-level engagement with regards to recycling, composting, or using reusable containers — and this may well be our biggest challenge, even with a comprehensive group-wide waste management strategy, dedicated colleagues, and informed guests. The Eat Without Waste initiative provides the opportunity to bring together stakeholders and collectively address our city's waste issue.

香港上海大酒店有限公司
Joshua Wong（企業責任及可持續發展經理）

要實行廢物管理方案，除了技術及物流上的考慮外，還需要建立減廢文化。要達到我們期望的循環性，我們需要大大提升社區在不同範疇上的參與，包括循環再用、廚餘回收及使用可重用器皿等。即使我們有全面的廢物管理方案、盡心盡力的員工及了解計劃的客戶，社區參與仍可能是我們最大的挑戰。『免廢外賣』提供了機會，將各持分者聚集在一起，並共同處理本港的廢物問題。

IN SUPPORT OF EAT WITHOUT WASTE

KIN FOOD HALLS
Matt Reid, Co-founder & CEO

Developing an innovative new F&B concept with sustainability at the forefront definitely has its challenges. From costs and procurement to adoption, the decisions we make now have an impact on not just the environment, but also the ecosystem in which we operate. The Eat Without Waste initiative is a critical research piece that bridges a knowledge gap by providing important insights supported by data and research, and explores potential solutions to the waste problem here in Hong Kong.

KIN FOOD HALLS
Matt Reid（聯合創辦人兼行政總裁）

發展一套以可持續發展為首要目標的創新餐飲概念必定有其挑戰—從成本、採購到正式採用，我們做的每個決定都不只對環境有影響，更會影響我們管理的生態系統。「免廢外賣」是一個關鍵的研究項目。此研究提出以數據支持的觀點及意見、彌補我們的知識上的不足，並探究不同解決香港固體廢物問題的潛在方案。

SWIRE PROPERTIES
Dr. Amie Lai, Senior Sustainable Development Manager

As we work to implement waste reduction solutions across Swire Properties' portfolios, the Eat Without Waste initiative and its research will help unpack complexities and identify potentially impactful actions for consumers, property developers, F&B operators, and policymakers. The report findings will provide insights to inform our circularity strategies and help enhance our reduce, reuse and recycle initiatives.

太古地產
黎戈 博士（太古地產高級可持續發展經理）

太古地產投資項目正向實踐減廢方案前進。在此過程中，「免廢外賣」及其研究可以為顧客、地產發展商、餐飲營運商及政策制定者拆解減廢議題上錯綜複雜的問題，並辨認出潛在的有效行動。此報告的結果可有助改善我們循環策略，以及提升我們「減少使用」、「廢物重用』及「循環再用」的措施。

THE GREEN EARTH
Edwin Lau, MH, Founder & Director

For too long, the extent of the environmental impacts of disposable takeout packaging waste have been unclear. The Eat Without Waste initiative unveils the complexity of this issue and sheds light on workable solutions.

綠惜地球
劉祉鋒（創辦人兼總幹事）

外賣使用的即棄包裝帶來頗多且未知的環保問題。「免廢外賣」拆解複集的問題亦建議可行方案給公眾參考。

EXECUTIVE SUMMARY

Introduction

Hong Kong's prolific use of disposable foodservice packaging is tied to its character as a densely populated city with a culture of convenience.

An estimated 3.9 billion such items were used and discarded by Hong Kong consumers in 2019, even before the onset of the COVID-19 pandemic. Since then, takeout habits have only proliferated, with many market estimates suggesting that consumption patterns will continue. The associated packaging has a detrimental effect on our environment: overflowing landfills, litter on our streets and beaches, and resource wastage.

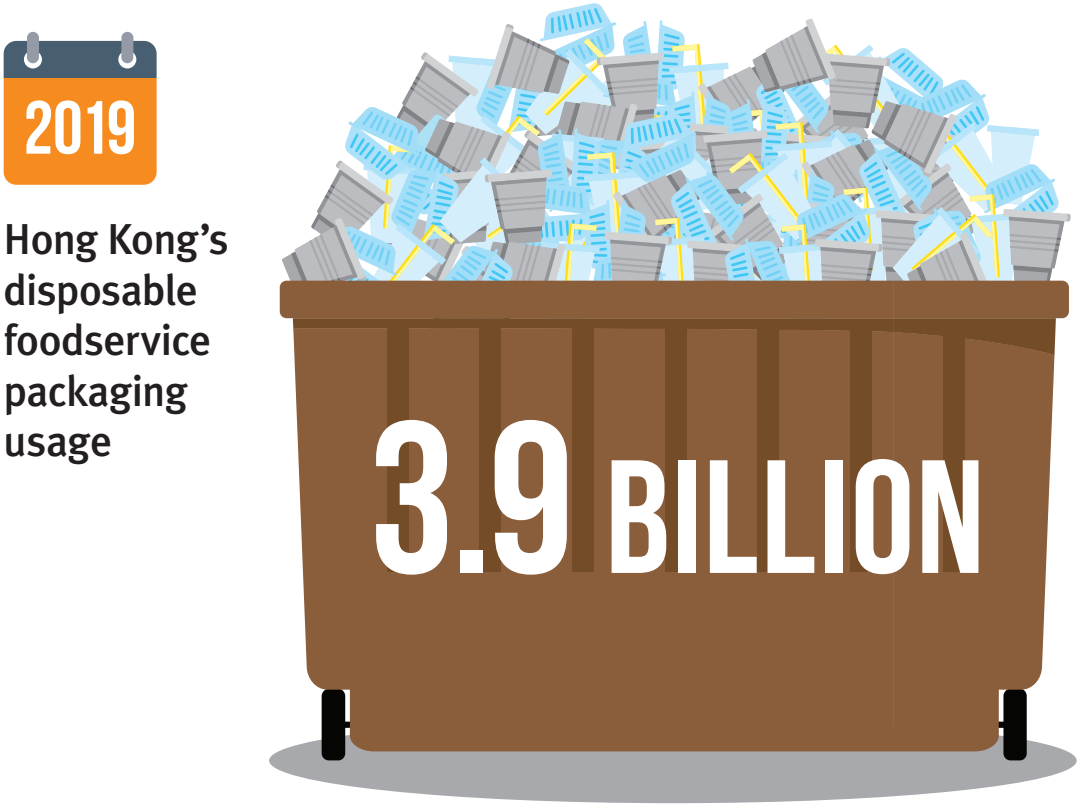
Addressing this unnecessary scourge calls for a deep understanding along three dimensions:

Baseline. A detailed understanding of the current situation and its causes.

Solutions. A critical analysis of the various solutions in operation or under development in Hong Kong and around the world.

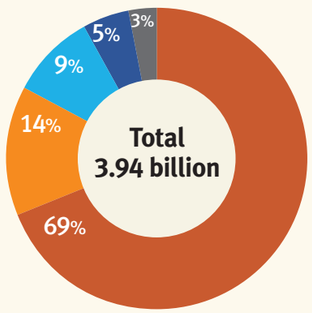
Full potential. The formulation of viable pathways that cater to Hong Kong's specific needs to maximise landfill diversion.

To kickstart effective policy interventions and broad stakeholder engagement, ADM Capital Foundation (ADMCF) undertook extensive research along these three axes. The analysis focused on lidded disposable food containers and to-go drink cups — hereon referred to as single-use foodservice packaging (SFP). Many of the resulting recommendations, however, are also valid for other single-use items related to foodservice, such as straws, stirrers, cutlery, chopsticks, and the plastic or paper bags used to carry takeout meals.



Analytical process and findings

	BASELINE	SOLUTIONS - feasibility - cost - impact	FULL POTENTIAL
What we established			
How we did it	• A baseline of single-use foodservice packaging (SFP) usage in Hong Kong was derived from data on local consumption patterns prior to the COVID-19 pandemic. • It also includes a projection to 2030 to form an estimate of future SFP consumption patterns.	• Four main solution archetypes along the circular economy spectrum were identified: Recycling, Bringing your own container (BYO), Composting, and Reuse systems. • Each archetype was evaluated for a suite of environmental, economic, and social metrics: water usage, greenhouse gas emissions, financial costs, the technical performance of the container, and implementation efforts for involved stakeholders.	• The set of container types/applications for which each solution can be deployed (e.g., cold drink cups) and the relative market size of that container type/application were then used to scale up solutions and determine each solution's full landfill diversion potential. • This 2030 potential was determined under three different implementation scenarios, driven by Hong Kong's ability to mobilise the relevant stakeholders.
What we found	**Number of single-use food and drink containers used in Hong Kong** (2019 estimate, pre-COVID-19 pandemic)	**Summary of solution feasibility and environmental impact under 2030 advanced mobilisation scenario**	**Total solution impact in Hong Kong under three modelled scenarios***



Container type:
- Hot food
- Hot drinks
- Cold food
- Cold drinks
- Others (uncategorised)

Solution pathway	Feasibility	
	Technical limitations	Effort to implement
Recycle	100%	76%
BYO	90%	80%
Compost	90%	55%
Reuse	80%	39%

less feasible (0%) — more feasible (100%)

Solution pathway	Cost and Environmental Impacts		
	Affordable	Greenhouse gas emissions	Water usage
Recycle			
BYO			
Compost			
Reuse			

lowest cost/ impact — highest cost/ impact

Each column breaks down the results of prior analyses on the relative feasibility, cost, and environmental impacts of each solution under an advanced mobilisation scenario

* The composting solution is shown in grey under the limited and moderate scenario, where no adjustment or construction of industrial organics processing facilities in Hong Kong is assumed, and hence its diversion impact is only theoretical.

Hot food · Hot drinks · Cold food · Cold drinks · % Percentage of total

Limited Mobilisation (LM)	Moderate Mobilisation (MM)	Advanced Mobilisation (AM)
Represents a degree of social and behavioural change due to a higher awareness of environmental challenges and possible responses. This scenario assumes no evolution in policy or system-level investment.	Refers to a medium level of effort and investment through the different solution types. This may take shape in the form of increased public education on SFP waste generation from takeout and delivery meals, small-scale incentivisation to encourage the use of reusable containers, or the optimisation of alternative waste collection streams (e.g., plastics recycling).	Represents a major commitment by both Government and private institutions to invest in relevant policy, education, and infrastructure to shift away from sending SFP to landfills. This could involve steps such as banning certain SFP packaging materials (e.g., EPS) or constructing and operating an industrial composting facility.

Under each implementation scenario, **BYO** and **Recycling** are projected to deliver the strongest outcomes. The **Reuse** opportunity is smaller but, under the conditions of an Advanced Mobilisation (AM) scenario, could nevertheless reduce up to one-third of Hong Kong's projected SFP use. **Composting** cannot keep containers out of landfills unless composting infrastructure is in place or existing, and planned anaerobic digestion infrastructure is modified, and therefore would not contribute under a Limited (LM) or Moderate Mobilisation (MM) scenario until these investments are made. Under an AM scenario, however, where collection and processing infrastructure is in place, we project that the Composting solution could potentially keep half of Hong Kong's SFP containers out of its landfills.

The time is right

Over the summer of 2021, the Hong Kong SAR Government conducted a public consultation on regulating SFP use (Regulation of Disposable Plastic Tableware, RDPT). Based on a 2019 commissioned consultancy report, the consultation document proposes:

(a) a full ban on the sale of SFPs made of expanded polystyrene (EPS) by 2025;
(b) a ban on all plastic SFP use for dining in by 2025;
(c) a ban on the provision of straws, stirrers, forks, knives, spoons, and plates for takeout by 2025; and
(d) expanding the all-plastic-SFP ban to cover takeout as well, after an evaluation period.

Rather than considering the problem solved now that regulatory action is underway, ADMCF instead compared its research findings findings to the key elements of the government proposal. Our analysis offers three essential complements to the policy proposal:

- Firstly, any policy should address all forms of takeout packaging, not only plastic.

- Secondly, a ban as broad as the one proposed by the Environmental Protection Department (EPD) may not be the best or the only tool to drastically bring down the quantity of takeout packaging sent to landfills.

- Thirdly, the timeline needs to be more nuanced than what is currently proposed.

These three elements are further elaborated in the next section.

Recommendations

Based on our analysis and taking reference to the current policy proposal, we can summarise our recommendations as follows:

Tackle all single-use foodservice packaging, not just plastics. Use a portfolio of tools. Start now.

Tackle all single-use foodservice packaging

The Government's RDPT proposals primarily aim to shift the food and beverage (F&B) sector away from plastics. This raises multiple concerns.

Trying to eliminate just one type of SFP will inevitably cause a shift to other SFPs. As a result, the contribution made to the landfill diversion goals set out in the Government's latest Waste Blueprint may be limited. For example, without collection and processing infrastructure in place, the use of plant-based materials, could reduce our reliance on fossil resources, but this solution would not contribute to keeping containers out of landfills.

Littering will also not be addressed, since that behaviour will not lessen for other materials. On the contrary, materials deemed 'natural' and biodegradable may mislead consumers to think they can be left behind in parks and on beaches without further consequences.

This is linked to another concern. No SFP type is without environmental impacts. Throughout the supply chain, resources are always required and strong demands on performance may be met through undesirable solutions, such as thin plastic layers or PFAS chemicals. Moreover, F&B operators and their suppliers might shift to even less sustainable solutions, such as paper foil bags. These bags are resource-intensive to manufacture, and there is no technology currently available to recycle them.

Government policy, as well as initiatives of F&B operators and NGOs, should focus on all single-use foodservice packaging rather than just those made of plastics.

Use a portfolio of tools

We investigated recycling single-use containers (Recycling), bringing one's own containers (BYO), composting single-use containers (Composting), and creating a — more or less — centralised reuse system (Reuse). Our analysis shows that Hong Kong and its F&B operators will have to tap into more than one solution to reach the best waste reduction outcome, as no one solution can single-handedly cover all of the cups and containers in scope.

In all scenarios, the Recycling and BYO archetypes show the most promise. Since these solutions are applicable and accessible to a large segment of the Hong Kong market, they have the potential to keep the largest amount of SFP out of landfills with limited environmental impacts. Importantly, both solutions can be dialled up and down relatively easily. This means that they can be encouraged and stimulated for the containers on today's market, without creating a barrier to a future implementation of more complex solutions like Composting or Reuse.

While Reuse systems show the highest potential from an environmental impact perspective, the solution is hindered by its comparatively high cost and logistical demands that make it feasible for only certain segments of the Hong Kong market. Because of its very strong environmental performance, there is value in identifying the locations and configurations where the Reuse solution could be more readily implemented.

Compostable containers are, at present, an unsuitable solution given the lack of infrastructure that can break down this type of waste in Hong Kong. Even if such infrastructure were to be established in the future, compostable containers still produce the most greenhouse gas emissions (per use) compared to other solution types. But with the right collection and processing infrastructure in place and if scaled up, Composting could displace a large share of SFP volumes.

Since hot food containers make up the large majority of single-use foodservice packaging on the Hong Kong market, applying solutions to address this segment offers a stronger potential impact than addressing hot/cold beverage containers or cold food containers. Therefore, to maximise the number of containers that can be kept from landfills, our analysis shows that applying Recycling and BYO containers to address hot food containers offers the most optimal solution/segment combination.

This diversified approach needs to be reflected in Government policies. Policy support is critical because no environmentally beneficial solution archetype can fully compete with SFP usage in terms of cost and convenience. The Government's proposed ban — while administratively efficient — cannot be the sole tool for dealing with Hong Kong's SFP challenges.

Education and engagement with consumers and hospitality stakeholders, incentives for reusable container usage, regulation of harmful packaging materials, and investments in waste management infrastructure need to be part of the policy agenda. Moreover, firm decisions on the infrastructure trajectory must be made soon if Composting and Reuse are to play a meaningful role in the future.

Start now

Hong Kong should not wait for a hard-hitting piece of legislation that will take time to build consensus around. The work to keep SFP waste out of landfills must start today — this is both necessary and possible.

It is necessary

Hong Kong is drowning in waste from takeout meals and drinks. Hongkongers are some of the region's highest spenders on prepared food and eating out, and also have a strong propensity towards takeout meals. Takeout habits only intensified with the onset of COVID-19, with some Hong Kong hospitality groups and delivery platforms experiencing up to 50% more takeout orders in 2020, the first year of lockdowns and restrictions. Takeout and delivered meals are more packaging-intense than dine-in meals, but many meals consumed on-site are also served in disposable packaging.

It could be argued that, in terms of weight, plastic and other single-use foodservice items make only a relatively small contribution to Hong Kong's massive per capita waste. This is, however, due to their density, which is very low in comparison to the much denser food waste that dominates Hong Kong's municipal solid waste.

Moreover, these items are persistent in the litter that plagues Hong Kong's streets, beaches, and country parks. In addition to the potential damage to land and sea animals, ecosystems and landscapes, SFP littering results in direct and indirect costs to society.

Recent research has shown that delaying intervention by even five years is not an option if we are to reach a global goal of near-zero leakage of waste into the environment. Hong Kong needs to do its part and make addressing its single-use foodservice packaging challenge a priority.

It is possible

The Government's proposed RDPT timeline is for a full EPS and plastic ban to be implemented by 2025. This timeline is suitable for addressing certain elements of the proposed scope, such as EPS containers or most dine-in uses. However, the afforded time for a full-scale ban may not be sufficient to develop sustainable, affordable, and functional alternatives — materials and systems — to the plastic containers currently on the market. Without such alternatives, F&B operators may feel compelled to switch to suboptimal solutions that inadvertently enhance the city's waste issue in different ways.

On the other hand, the volume of single-use foodservice items going to landfills could already be meaningfully reduced before 2025 if, for example, broad outreach and support for Recycling were to be initiated right away. Similarly, individual F&B operators or their property managers could be educated on the benefits and feasibility of BYO and Reuse to complement their current single-use practices. The timeline for an all-inclusive, abrupt regulatory tool like the proposed RDPT ban must include more considerations surrounding what can and cannot be implemented with desirable outcomes.

Outlook

This research sets the stage to drive further change and move beyond small-scale and incremental initiatives — both through action on the ground and in the form of high-level policies. To achieve a systemic shift towards truly sustainable takeout packaging solutions, the Eat Without Waste initiative will continue to foster communication and mobilisation across these stakeholders through both structured and ad-hoc interventions. We hope you will join us on our path to Eating Without Waste.

GLOSSARY

Anaerobic digestion (AD)	The process by which organic material, such as food waste, is broken down by microorganisms under non-oxygenated conditions. The output is biogas and digestate that can be further processed for agricultural fertiliser use.
Bagasse	A fibrous material that remains after the sugars and juices have been extracted from sugarcane or sorghum stalks. Considered an agricultural waste by-product with low nutritional value, bagasse can be transformed into pulps or board materials to form packaging products. Bagasse has a variety of others uses, such as for structural particleboards, bio-ethanol production, and cement-based products.
Bring-your-own (BYO)	The practice by which a consumer brings their own container (e.g., reusable lunch box or coffee tumbler) for takeout food/drink orders.
Business-as-usual (BAU)	A state describing an unchanged continuation of current practices.
Carbon dioxide equivalent (CO_2e)	A standard unit that collectively represents greenhouse gas emissions, commonly used to measure carbon footprints.
Composting	The process by which organic matter, such as food waste, is broken down by microorganisms under oxygenated conditions. The output is water, CO2, and compost.
End-of-life (EOL)	The last phase of a product's life cycle that involves the retirement, disposal, or recycling of its materials.
Environmental Protection Department (EPD)	The Hong Kong Government department responsible for waste management, air and water quality management, and nature conservation.
Expanded polystyrene (EPS)	A thermoplastic foam material formed from solid beads of polystyrene, commonly used for takeout food containers.
Food and beverage (F&B) operators	Stakeholders involved with the operation and management of F&B outlets.
Greenhouse gases (GHG)	Gases in the Earth's atmosphere that trap heat (e.g., carbon dioxide, methane, nitrous oxide, water vapour, ozone). An excessive emission of these gases from human sources accelerates the effects of global warming.
Life cycle assessment (LCA)	An analytical methodology used for determining the environmental impacts of a product, process, or service. It considers all stages of a life cycle and quantifies a wide range of environmental impacts, e.g., global warming potential, primary energy demand, human toxicity potential, etc.
Municipal solid waste (MSW)	Solid waste produced from domestic, commercial, and industrial sources.
Plastic-paper composite cups	Disposable beverage cups that are made of plastic-lined paper, made for on-the-go consumption.
Polyethylene terephthalate (PET)	A clear thermoplastic polymer commonly used for food and beverage containers.
Polypropylene (PP)	A clear thermoplastic polymer, lower in density than PET plastic, that is commonly used for food and beverage containers.
Recycling	The action or process of converting waste into reusable material.
Recycling stream	The flow of recyclable material from its source through to processing.
Reuse systems	A system that allows a product, in this case a food or beverage container, to be repetitively used for multiple cycles.
Radio-frequency identification (RFID)	A digital tagging system that uses radio waves to identify and track the labelled product.
Single-use foodservice packaging (SFP)	Single-use packaging and peripherals used for food and beverages to be consumed in a ready-to-eat fashion. These items are packaged onsite and are destined for consumption on-the-go or onsite. For the purposes of this report, we specifically refer to food and beverage containers, with and without lids, and do not focus on peripherals such as cutlery, napkins, or bags.
Solution archetype	A system that serves as a solution model to address a defined problem. In this report, the solution archetypes describe systems that prevent single-use takeout packaging waste from reaching landfills.
Standard operating procedure (SOP)	An established set of instructions compiled by an organisation to help workers or employees carry out routine operations.
Takeout	Ready-to-eat food and beverages that are purchased for off-site consumption. Takeout can either be delivered, or picked up at the point of sale by the customer.

1 INTRODUCTION

A lot has been written about sustainable alternatives to takeout packaging and a growing number of approaches are being piloted around the world. The speed and volume of new product development and other forms of experimentation are accelerating in the wake of new policies and proposed laws aiming to regulate single-use packaging.

Hong Kong-based ADM Capital Foundation decided to address the many misconceptions, misunderstandings, and uncertainty around applicability, landfill diversion potential, environmental benefits, as well as ease of implementation of different approaches. A nine-month research effort was mounted to inform a future programme of work around the most promising solutions, giving rise to Eat Without Waste (EWW).

The EWW team set out to develop a view on the size of the problem and a fact-based perspective on the potential of various solutions. We systematically inventoried initiatives, trials, and programmes; assessed their merit within the context of Hong Kong's complex consumption landscape; and determined what their individual and combined potential is to keep takeout packaging out of the landfill.

This analysis was largely carried out before the Environmental Protection Department (EPD) initiated its public consultation on the Regulation of Disposable Plastic Tableware in July 2021 (Box 1). Therefore, our research did not work around the assumption that such plastic containers would no longer be on the Hong Kong market. We chose not to adjust the analysis in light of this policy development for two reasons.

- First, any policy should address all forms of takeout packaging, not only the plastic ones.
- Second, a ban as broad as the one proposed by EPD may not be the best nor the only tool to drastically bring down the number of takeout packaging items sent to landfills on a daily basis.

The resulting report seeks to guide and instigate action amongst Hong Kong's citizens, its food and beverage (F&B) sector, and its policy-makers. To that end, we structured the report as follows:

Chapter 2: Choking on Takeout Waste lays out the case for action, analysing Hong Kong's underlying consumption patterns as well as their devasting effects on the city's open spaces and landscapes.

BOX 1: A BAN ON DISPOSABLE PLASTIC TABLEWARE?

Over the summer of 2021, the Hong Kong SAR Government conducted a public consultation around the possibility to regulate SFP use, known as the Regulation of Disposable Plastic Tableware (RDPT). Based on a 2019 commissioned consultancy report, the consultation document proposes:

(a) a full ban on the sale of SFPs made of expanded polystyrene

(b) a ban on all plastic SFP use for dining in

(c) a ban on the provision of straws, stirrers, forks, knives, spoons, and plates for takeout.

These three regulations are to take effect by 2025. The Government also proposes to expand the plastic-SFP ban to cover takeout dining, after an evaluation period of the first implementation phase.

FIGURE 1

The EPD's consultation on regulation of disposable plastic tableware

Chapter 3: A Viable Pathway starts out by synthesising the universe of solutions into four 'archetypes': recycling the containers that we currently use, bringing one's own reusable container, switching to compostable containers, and creating a reuse system to provide, recover, and recirculate containers. The chapter continues with a description of the analytical methods and key assumptions. It closes with the report's most important set of insights: each solution's projected potential to keep takeout containers out of the landfill by 2030.

Chapters 4: Recycling, 5: Bring Your Own, 6: Composting, and 7: Reuse Systems offer a deep dive into each solution type. Each chapter starts with a general and then Hong Kong-specific description of the solution mechanism. This is followed by a detailed description of what the solution could deliver in its optimised state. This section looks into the financial and environmental costs of the solution, and the technical performance of the relevant containers. It critically analyses the demands placed on every stakeholder group and system element, and concludes with the projected landfill diversion potential — the objective function of our analysis.

Chapter 8: Scaling up Solutions revisits critical drivers for each solution and offers additional insights as to how to create those conditions for success, based on international best practice.

Chapter 9: A New Approach for Hong Kong translates our findings and insights into recommendations for each relevant stakeholder group — F&B operators, Government and policymakers, and citizens and households. These recommendations are organised along three time-horizons because, while immediate action is necessary and feasible, some interventions and new habits will take more time to develop.

The appendices close off this report with ample details on the methodology (Appendix A) and a comprehensive set of analytical assumptions (Appendix B).

2 CHOKING ON TAKEAWAY WASTE

Single-use foodservice packaging (SFP) is defined as disposable packaging for food and beverage to be consumed in a ready-to-eat fashion. The SFPs included within our scope are those that are filled at the point of sale, excluding pre-packaged food.

Our evaluation of packaging use in Hong Kong focuses on food and beverage containers, with or without lids. Peripheral packaging material such as cutlery, napkins, condiment packaging, bags, or other were not included in the scope of our analysis. This choice was made to draw specific boundaries for the analysis and is not meant to discount the significance of single-use peripherals in their contribution to packaging waste.

Our study includes both the pick-up and delivery channels of SFP usage, hereon collectively referred to as 'takeout'. Prior to the onset of the COVID-19 pandemic in 2019, a survey showed that 75% of the Hong Kong market consumed takeout meals by picking up from the F&B outlet, with the remaining 25% opting for door-to-door delivery services.[1]

2.1 No end to our appetite

The underlying driver for the city's growing pile of SFP waste is the large number of meals prepared outside of the home. Hong Kong is renowned for its diverse cuisine and food scene, with annual restaurants sales amounting to HKD 141 billion in 2019.[2] In the Asia Pacific region, Hong Kong consumers are consistently ranked as the highest spenders on food prepared at a restaurant, with nearly double the regional average monthly spending.[3] This food consumption pattern leads to Hong Kong's disproportionately high SFP use in two ways: a strong propensity towards takeout and the use of disposables even when dining in.

Compared to 10 other East and Southeast Asian economies, Hong Kong has the highest proportion of consumers that express a high preference for takeout meals.[4] In 2019, a local NGO estimated, based on its survey, that the Hong Kong population consumes approximately 27.1 million takeout meals weekly.[5] This amounts to about three to four weekly takeout meals per person.[6] In a densely populated city where space is limited, not all households have access to kitchens. Tenants of public housing commonly share kitchen, laundry, and bathroom facilities, with some subdivided flat units having no kitchen facilities at all.[7] With more than 200,000 Hong Kong residents living in subdivided flats (as of 2016) and 2.2 million people living in public housing (as of 2020), dining out and ordering takeout is therefore a common practice.[8]

The SFP problem in Hong Kong extends beyond its takeout culture. It is not uncommon for canteens, small-scale restaurants, casual eateries and coffeeshops to utilise SFPs for on-site dining. Interviews with F&B staff and operators indicate that this happens for a variety of reasons: convenience, lack of washing facilities, perceived hygiene improvement, or lack of licensing to fully operate catered, on-site dining. Moreover, where both single-use and reusable options are offered for on-site consumption, the reusable option is not systematically prioritised (Box 2).

BOX 2: DISPOSABLE COFFEE CUPS AT CAFES

In July 2021, the Eat Without Waste team surveyed 19 coffee shops in Hong Kong that offer reusable cups for on-site consumption. On average, more than one-third of customers were seen using single-use cups while enjoying their beverage on-site.[9] Furthermore, a survey of 223 coffee shops across six chains, prior to the COVID-19 pandemic, showed that 67% of customers consumed from disposable coffee cups on-site.

Reasons vary:

- Porcelain or ceramic cups were not always visibly located, so customers may not have been aware they were available.
- At some coffeeshops, baristas offered single-use cups as the default. Only when customers specifically requested a reusable cup, one was given. In contrast, baristas at other coffeeshops proactively asked each customer whether they were sitting in or taking away their beverage, therefore only allowing single-use cups to be provided when necessary.
- Several customers thought they would run out of time to finish their drink on-site. When probed, many agreed that they usually are fine on time and could have asked for a single-use cup the moment they had to leave the coffee shop.
- Over 75% of coffee shops allowed customers to bring their own cups for takeout beverages. Many of those that did not allow BYO cited that it was a temporary measure in response to COVID-19, and that they would allow BYO containers again "after the pandemic".

2.2 A container for every taste

An estimate for the number of SFP items placed on the Hong Kong market was derived from a combination of data collection and extrapolation from existing sources. The baseline estimate considered all channels through which meals are served in SFPs: quick- and full-service restaurants, coffee and snack shops, cafeterias, construction sites, etc. Data were obtained for 2018 and 2019, which encompasses the most recent annualised data prior to the onset of the COVID-19 pandemic.

In Hong Kong, an estimated 3.94 billion single-use food and drink containers were used in 2019. The majority of those containers would have been used for hot food (Figure 2). The large variety of containers currently on the market is illustrated in Table 1.

An interview with the chair of a Hong Kong restaurant association confirmed that most local fast food and lower-end F&B outlets use expanded polystyrene (EPS) containers for takeout meals. The key drivers behind that choice are their heat-retaining qualities and low cost, although the price difference between EPS and polypropylene (PP) plastic containers from Hong Kong packaging suppliers is actually negligible.[10] The majority (60%) of customers at these establishments place takeout orders rather than dining in.

Hong Kong's mid- to high-end establishments, particularly those serving Chinese cuisine, typically use PP plastic containers for takeout meals.[11] A 2021 survey of 25 high-end establishments that identify as 'environmentally friendly' showed that all utilised at least some packaging that comes with a compostability claim, with many also opting for paper-based packaging.[12]

FIGURE 2

Number of single-use food and drink containers used in Hong Kong

(2019 estimate, pre-COVID-19 pandemic)

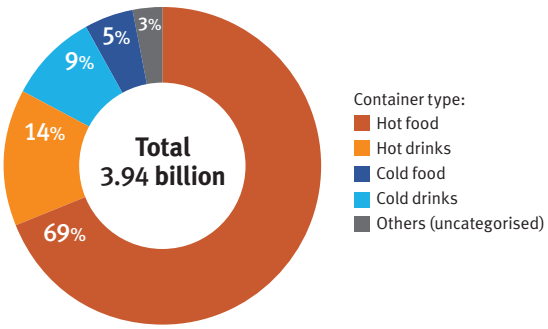


TABLE 1

Types and estimated prices of food and drink containers on the Hong Kong market

Material and size		Price (per unit, HKD)*
Food containers		
	Polypropylene (PP) 500mL	0.31
	Expanded polystyrene (EPS) 500mL	0.38
	Bagasse clamshell ~700mL	2.86
	Reusable glass 500mL	33.00
	Silicon 600mL	40.00
	Polypropylene (PP) 500mL	19.90
Cups with lid		
	Paper-plastic composite 265mL	0.25
	Polyethylene terephthalate (PET) 355mL	0.37
	Polypropylene 400mL	1.05
	Stainless steel ~500mL	157.80

* Price averaged from Hong Kong suppliers and online retailers, supplemented with surveys of local restaurants when possible. Single-use items are based on wholesale prices and reusable items on retail prices (i.e., assumes that reusables are purchased individually by consumers).

2.3 Projecting to 2030

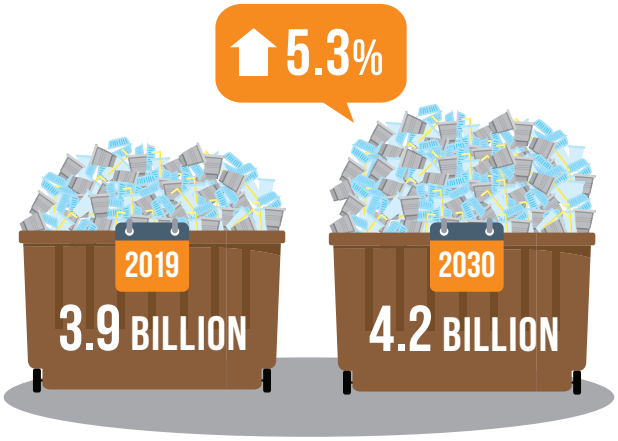
If we scale the 2019 baseline with Hong Kong population growth projections for 2030, that results in a total consumption of 4.15 billion containers per year (Figure 3 and Appendix A).

The year 2030 was selected as a timeline benchmark because it aligns with local as well as global milestone targets for other environmental action plans involving waste management and decarbonisation. For instance, Hong Kong's 2017 *Climate Action Plan*, the most recent report at the time of our analysis, outlines emission reduction targets for 2030. Hong Kong is also part of the global effort by United Nations Member States to reach 17 target Sustainable Development Goals (SDGs) by 2030.[14]

Due to the COVID-19 pandemic, consumer takeout habits have grown (Box 3). The associated use of SFP is thus anticipated to be even higher than our current estimates for 2030. To maintain the consistency, quality, and transparency of the analysis in this report, however, impacts of the pandemic have not been

FIGURE 3

Projected growth in Hong Kong's usage of single-use takeout containers



BOX 3: IMPACT OF COVID-19 ON TAKEAWAY HABITS

Shift in consumption patterns

Around the world, takeout meal habits have proliferated during the COVID-19 pandemic. One survey shows that the number of consumers who ate takeout meals at least once a week in Poland, Austria, and the UK increased from an average of 17.8% prior to the pandemic to 24.7% by late 2020, mid-pandemic.[15] From April to September 2020, when many parts of the United States were placed under 'shelter-in-place' restrictions, the four largest U.S. food delivery apps (Doordash, Uber Eats, Grubhub, and Postmates) had a combined revenue of HKD 42.9 billion — more than twice that of the same period in 2019.[16] Similarly, South Korea's food delivery industry sales, by value, increased by 180% from 2019 to 2020, when the country underwent multiple degrees of pandemic-induced lockdown.[17]

Several surveys, although different in scope and timing, point towards similar trends for Hong Kong. A survey of over 2,000 consumers by Greeners Action, a Hong Kong NGO, identified a 5% increase in the number of takeout meals between April 2019 and April 2020 (the initial stages of pandemic lockdown).[18] This initial increase subsisted and intensified throughout various levels of COVD-19-related restrictions on F&B operations. A survey of 21 F&B outlets across nine hospitality groups estimated a 30-50% increase in delivery orders from the onset of the COVID-19 pandemic in March 2020 to April 2021.[19] Similarly, foodpanda, a leading delivery platform in the Hong Kong market, observed a 50% increase in demand for delivery meals.[20]

Implications for SFP use

The shift in takeout habits during the pandemic takes its toll on SFP consumption. Greeners Action noted a tripling in the number of customers that frequently use such containers (defined as more than five single-use plastic containers each week).[21] Other COVID-19-related developments drove up SFP usage, too. For much of the pandemic, the Government has imposed hotel-based quarantine requirements for nearly all incoming travellers. Hospitality groups that offered quarantine services at their hotels recorded a significant increase in SFP usage.

One hospitality group that operates several restaurants within their hotel noted that they hardly ever used SFPs prior to the pandemic. In September 2020, their monthly order of SFPs consisted solely of cake boxes (n=6,500) for their pastry store. After starting to offer quarantine services, their monthly order of SFPs grew tenfold to 66,300 (January 2021), most of which were plastic containers to cater to meals for quarantined guests.[22]

The shift in consumer and F&B attitudes towards hygiene also influences SFP usage. Due to initial concerns around viral transmission through surfaces, a heavy focus was placed on not only frequently sterilising common surfaces, but also on reducing shared contact points altogether. As a result, several F&B operators halted their 'BYO' programmes, where they previously allowed or even encouraged customers to bring their own cups or containers for takeout. Moreover, out of hygiene concerns, Hong Kong consumers personally clean and disinfect table surfaces and opt for single-use products, which often come individually wrapped and are perceived as 'more sterile'.

Enduring changes?

Studies of consumer behaviour in the F&B industry suggest that the increase in takeout habits will be lasting, even after the COVID-19 pandemic has settled. Nielsen Hong Kong, the market study firm, for example, forecasts that old habits such as eating out will permanently be replaced by new habits, such as ordering takeout — even after the pandemic.[23] SwissRe, a reinsurance company, deems the use of food delivery apps as one of the most permanent pandemic-induced behaviours amongst digital adoption habits.[24]

Even after the pandemic has subsided, Hongkongers' heightened concern for hygiene may continue to pervade daily personal and commercial routines. For example, well after the 2003 SARS epidemic, anti-bacterial soaps are still promoted and used widely. Consumers and F&B outlets alike may show greater hesitancy in adopting or re-introducing shared or BYO container programmes or even in returning to reusable tableware for on-site dining.

included; with the pandemic still ongoing, reliable projections of the long-term effects on societal habits, public health, and consumption trends are yet to be established.

2.4 Wasteful habits with a bitter aftertaste

2.4.1 Waste generation on the rise

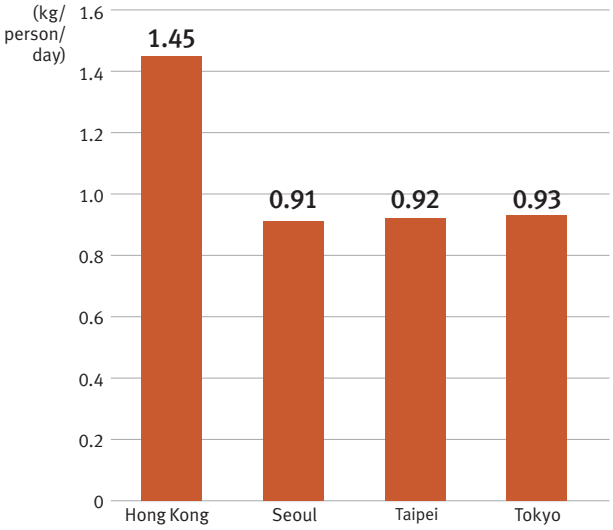
Total solid waste disposal in Hong Kong has risen from 4–5 million tonnes per year in the 1990s to 5.7 million tonnes per year in 2019, of which 4 million tonnes were municipal solid waste (MSW). [25] On a per-capita basis, waste disposal has also increased in recent years, diverging from the Government's waste goals. The Environment Bureau's *Blueprint for Sustainable Use of Resources 2013-2022* outlined the goal of reducing per-capita waste disposal from 1.27 kg per day in 2011 to 0.8 kg by 2022.[26]

Others in the region, such as Taiwan and South Korea, have seen year-on-year reductions in per-capita waste disposal, changes that have been aided by municipal waste charging schemes.[27] Hong Kong's per-capita daily MSW disposal, however, increased from 1.27 kg to 1.47 kg between 2011 and 2019. This daily volume far exceeds what citizens generate in Seoul, Taipei, and Tokyo (Figure 4).

Hong Kong's latest *Waste Blueprint*, released in 2021, outlined three goals: waste reduction, resources circulation, and 'zero landfill'.[29] The waste reduction goal is to be addressed through

FIGURE 4

MSW generated per capita in Hong Kong, Seoul, Taipei, and Tokyo (2017)[28]

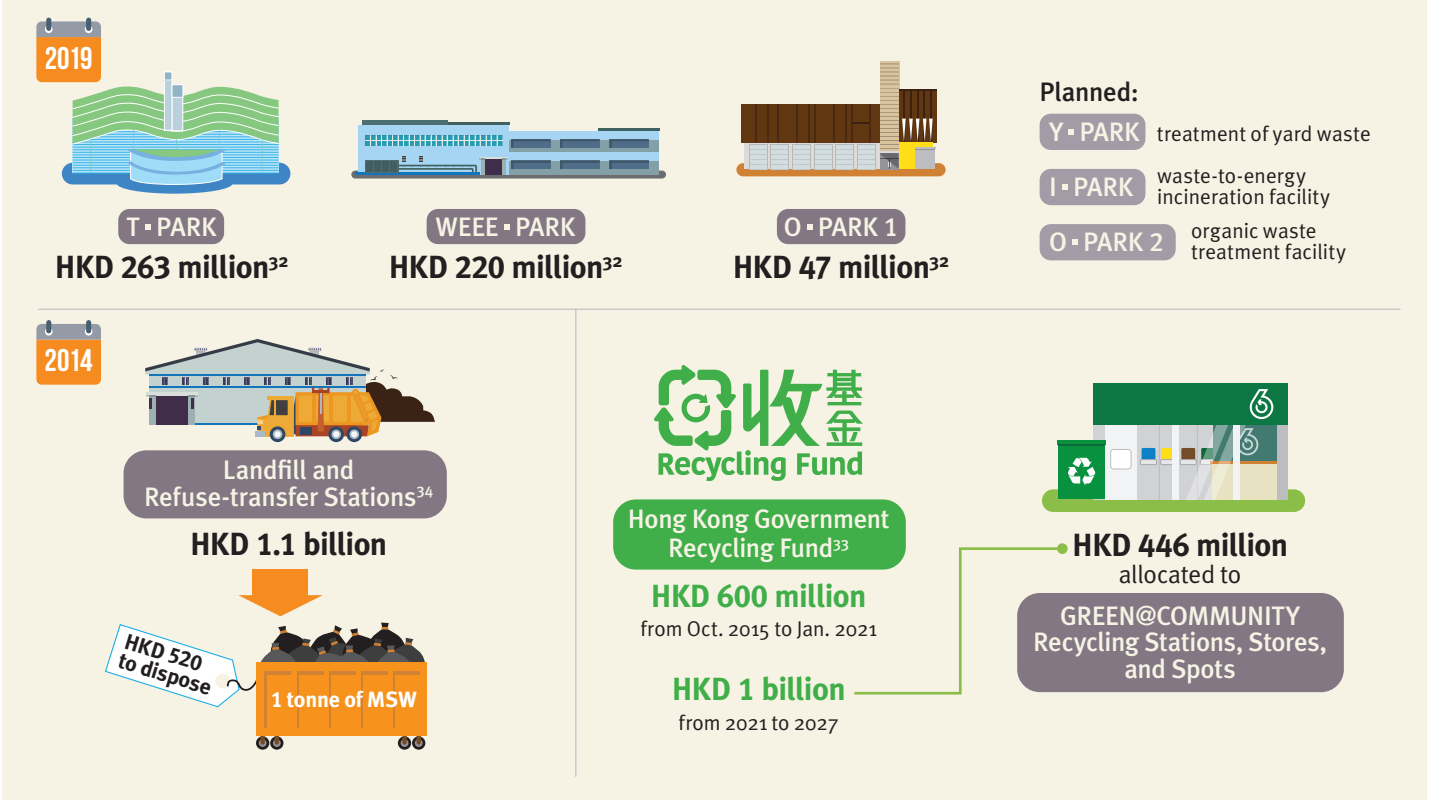


the implementation of Producer Responsibility Schemes (PRS), an increase in funding and support to the recycling industry, and the organisation of public education campaigns for waste separation.

The blueprint outlines the waste management infrastructure that is currently operating or in development to increase 'resources circulation' and decrease reliance on landfills. These facilities and associated budgets are outlined in Figure 5.

FIGURE 5

Cost of operating Hong Kong's waste infrastructure



2.4.2 Recycling on a downward trajectory

The increase in MSW disposal has been accompanied by a decrease in recycling rates, especially in the last decade.[35] Whereas in 2015 one quarter of Hong Kong consumers seldom or never recycled plastics, nearly one third is now disengaged. A similar trend is true for paper, with the number of disengaged consumers evolving from one fifth to one quarter over the 2015–2020 period.[36] Survey respondents cited the **insufficiency and inconvenience of current recycling facilities** as the primary challenge for successful waste separation at the household level.

The decrease in recycling habits has also been driven, in part, by a **distrust in the recycling system**. In a survey commissioned by Drink Without Waste, the Hong Kong Public Opinion Research Institute found that one-fifth of respondents who do not recycle beverage packaging do not believe that the bottles are actually recycled.[37] A 2020 investigation of the plastic bottles collected in the three-coloured waste separation bins at housing estates found indeed that bottles from two-thirds of the estates were sent to landfills instead of being recycled.[38]

A **lack of education, peer pressure, and enforcement** can combine into sub-standard practices amongst those that do participate in recycling. A different study of the three-coloured waste bins showed that more than 60% of the contents were not recyclable, aligning with another 2020 survey revealing that only 40% of people separate out non-recyclables when recycling.[39] Such high degrees of contamination further erode the already low profit margins of collecting and processing recyclables and may result in underfunding and ultimately the retreat of recycling service suppliers from the Hong Kong market.

2.4.3 Littering and pollution persists

Hong Kong's open spaces and landscapes are vulnerable to degradation from takeout food containers (Figure 6). They are strewn around its city **parks, streets, and gutters**. They are abundant in its **country parks** too, especially in frequently visited rest and recreation spots, but also in the farthest reaches of the wilderness. In 2019, more than 2,500 tonnes of litter was collected across the country parks. This number does not even account for litter that had blown off trails or out of reach of collectors.[40] Takeout containers and peripherals are also a scourge on Hong Kong's **beaches and in coastal waters**. A 2020 study of microplastic pollution on Hong Kong beaches found that amongst the most common types of plastic were polypropylene, and polystyrene — which are also some of the most common plastics used for SFPs.[41]

FIGURE 6
SFP littering in Hong Kong

Such littering is not without consequences. Discarded SFP items that end up outside of the recycling or waste bin can do significant damage to ecosystems and have direct and indirect costs associated with them.

Globally, takeout food containers and cutlery have been found to be the most prevalent type of plastic pollution in rivers, negatively impacting ecosystems and human food security.[42] In marine ecosystems, it is estimated that millions of animals are killed by plastics each year through entanglement in plastic items or starvation due to digestive track blockages.[43] Coastal clean-up efforts in Hong Kong showed that one-fifth of all items found were single-use tableware, the large majority made of plastic.[44] This number does not include bags for takeout beverages and meals, which are a significant contributor to these direct impacts on marine and coastal wildlife.

Over time, plastics such as takeout packaging degrade to particles smaller than 50mm and spread throughout marine food webs as microplastics. Microplastics have been found in more than 100 marine species, many of which are commercially important for human consumption.[45]

A study by the World Wide Fund for Nature (WWF) estimates that globally, the plastic produced in 2019 will collectively incur a cost of HKD 24.2 trillion throughout its lifetime through pollution to marine ecosystems.[46] ***"The rise of food takeout during the pandemic has led to a staggering amount of disposable tableware waste being generated in the city. The more plastic waste we produce, the more we pollute our oceans,"*** says June Wong, Manager of WWF-Hong Kong's Marine Pollution programme. ***"Plastic doesn't belong in nature. We have to keep it out of our ecosystems and within a circular economy."***

In addition to the risk of ecosystem damage, SFP littering results in direct and indirect costs. Litter removal is more time-consuming and hence costly than collecting waste or recyclables from bins. Recyclables that are littered also result in foregone materials revenue. Moreover, the collected litter must be disposed of as general waste, which means that it will incur an MSW disposal fee. Finally, storm drain impairment by litter and the resulting risk of flood damage carry an indirect but measurable cost.[47]

2.4.4 Hidden carbon emissions

Hong Kong's per-capita greenhouse gas (GHG) emissions dropped by 28.6% between 2009 and 2018, but fall short of the reduction targets outlined for 2020 and 2030 in the Government's climate action plans.[48] Emissions in 2018 were still 18% higher than 2020 emission targets (5.4 vs. 4.5 tonnes CO_2e per capita).[49] These reported numbers do not include so-called embedded or embodied emissions, the emissions associated with the production of everything we use and consume in Hong Kong — much of which is produced abroad. Single-use food packaging, from its production to its disposal, contributes to this true carbon footprint in multiple ways, most importantly through its production and disposal.

Plastics are made of natural gas or oil, both of which are associated with GHG leakages during exploitation and processing. The agricultural materials and tree fibres for paperboard and other packaging alternatives are associated with GHG emissions from fuels, fertiliser, and soil disruption.

The amount of end-of-life carbon emissions from SFP depends on the material and the pathway. Hongkongers have a habit of disposing of their meal-related packaging waste in its entirety, without attempting to recover the reusable or recyclable parts. As a result, the majority of fibre-based materials end up in the landfill, where their anaerobic degradation results in the production of landfill gas, which contains methane, a powerful greenhouse gas. Even with best-in-class infrastructure to capture and utilise landfill gas, no landfill is completely leak-free.

In the landfill, plastics are inert and will not release greenhouse gases. But when the plans to develop waste incinerator capacity — as outlined in the latest *Waste Blueprint* and *Climate Action Plan* — go ahead, the plastics ending up in the incinerator will produce a far worse carbon outcome than if they had been recycled.[50]

The next chapter outlines the analyses undertaken to evaluate solutions for Hong Kong's takeout packaging challenge and how these solutions shape future pathways.

3 A VIABLE PATHWAY

There is no silver-bullet solution to reduce single-use takeout packaging waste in Hong Kong. Amongst the variety of solutions that can be collectively implemented, we identified four main solution archetypes: Recycling, Bring-your-own, Composting, and Loaned Reusables (hereon 'Reuse systems'). Each was critically analysed for system costs, impacts, and feasibility. This assessment allowed us to quantify the full, scaled-up impact that each solution archetype could have under various scenarios of societal mobilisation and investment. The outcomes of this evaluation pave the way for a realistic and effective prioritisation of different solutions according to their applicability and their potential to create meaningful impacts.

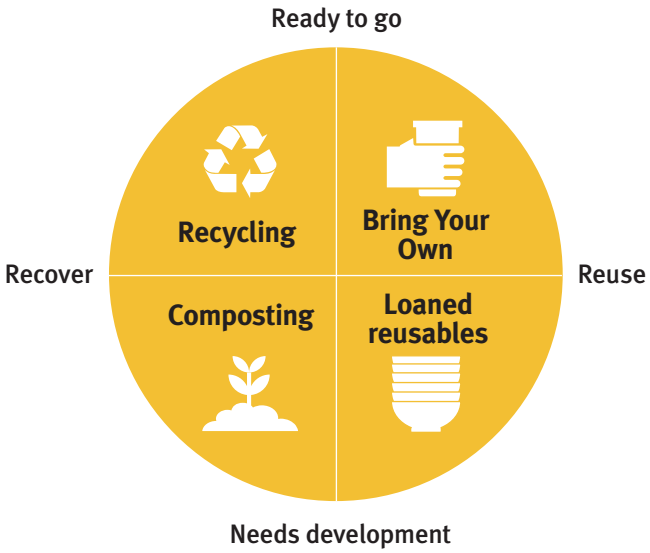
3.1 The solution space

While all four solution archetypes are distinctly different, they do have common traits (Figure 7). They share certain aspects in functionality and system operations. Some solutions, such as loaned reusable container systems, require additional development or investment, whereas others, such as recycling, can immediately start creating impact — although this does not imply that they do not need further optimisation (See Chapters 4 and 5).

The archetypes also differ in the nature of their solution mechanisms. Some keep containers out of landfills through the recovery of raw materials, such as in composting. Others avoid waste altogether through a shift towards reusables that are used for multiple cycles — as in the 'Bring Your Own' (BYO) solution archetype.

In addition to these four archetypes, other creative solutions exist that are potentially impactful on a per-container basis. For example, the Seeds of Art Charity Foundation reuses cleaned PP containers to distribute free meals to the elderly, while social enterprise FoodCycle+ repurposes used, cleaned containers into non-food-grade product packaging, like the Lunchbox Garden Kit. Such solutions, however, are often hard to scale because of implementation barriers like labour cost or food safety regulations, or because the scale of supply and demand do not match.

FIGURE 7
SFP solution framework



3.2 Analytical approach: diverting containers from landfills

We set out to evaluate the overall potential that each solution archetype has for reducing SFP landfill waste under the environmental, social, and infrastructure components of each system. The analytical process is schematically represented in Figure 8.

The landfill divergence potential was determined in three steps.

- **Use-case.** For each solution, a specific container type was chosen to represent the most common use-case on the market (for example, 'bagasse containers for hot foods' in the Composting solution). This was complemented with a set of assumptions around usage and EOL parameters.

- **Feasibility.** Each solution was scored for (a) how well the proposed container meets the various demands placed on it (its 'technical performance'); and (b) the effort required from stakeholders ('implementation effort'). Each solution was assessed for its ability to address five SFP types commonly used today: polypropylene and EPS hot food containers, polypropylene cold food containers, PET cold beverage cups, and paper-plastic composite hot beverage cups. Appendix A.3 offers more details of that analysis and Table 2 summarises its results).

- **Scaling up to full potential.** Finally, the feasibility score of each solution was applied to the baseline values for each container type — the projected volume of containers put on the market in 2030 — to calculate its full impact.

To compare solutions, we analysed them under the assumption that they are all operating at scale. This ensured that the solutions that are currently limited by infrastructure or other factors could be compared with those operating at scale today. For example, although there is no sizable composting infrastructure in Hong Kong, the theoretical removal of this barrier allows for fair comparison with the other solutions.

To achieve as much granularity as possible, the use-cases were also applied to the cost and environmental impact analysis. The four solution systems were also compared to the status quo, which is landfilling. Further details of each solution configuration are further described in the methodology section in Appendix A.

Three implementation scenarios were considered to evaluate the full impact of different solution archetypes: limited, moderate, and advanced mobilisation. These scenarios describe sets of conditions in the target year 2030 and represent different levels of commitment towards solving the SFP challenge for Hong Kong (see Figure 8 and Appendix A for more detail).

FIGURE 8

Defining 2030 potential: Methodology

SCENARIOS

Limited Mobilisation (LM)	Moderate Mobilisation (MM)	Advanced Mobilisation (AM)
Represents a degree of social and behavioural change due to a higher awareness of environmental challenges and possible responses. This scenario assumes no evolution in policy or system-level investment.	Refers to a medium level of effort and investment through the different solution types. This may take shape in the form of increased public education on SFP waste generation from takeout and delivery meals, small-scale incentivisation to encourage the use of reusable containers, or the optimisation of alternative waste collection streams (e.g., plastics recycling).	Represents a major commitment by both Government and private institutions to invest in relevant policy, education, and infrastructure to shift away from sending SFP to landfills. This could involve steps such as banning certain SFP packaging materials (e.g., EPS) or constructing and operating an industrial composting facility.

RECYCLE

Using a **single-use PP container that is manually washed with hot water by the consumer,** disposed of in the plastics recycling stream, and recycled in an industrial facility.

BYO

Using a **BYO container that is manually washed with hot water and reused by the consumer.** End of life is assumed based on recycling a reusable PP container in an industrial facility.

COMPOST

Using a **single-use, commercially compostable container that is disposed of** in a dedicated food waste bin and composted in an industrial facility.

REUSE

Using a **loaned reusable PP container. Consumer rinses it at home with cold water and returns** it to a dedicated bin, after which a third party sends it for commercial washing (with hot water) and redistributes the containers to restaurants.

LANDFILL

Using a **single-use PP container that is sent to the landfill** via current MSW disposal channels.

FEASIBILITY

Technical performance: the container was evaluated for any technical limitations that may reduce its performance in comparison to status-quo single-use containers.

Implementation effort: the degree of effort required for various stakeholder groups to adopt the solution compared to current practices. The four stakeholder groups considered were: consumers, F&B operators, collection systems, and end-of-life (EOL) processing systems.

COSTS AND IMPACTS*

System cost: the cost to operate each system for each container use, estimated based on current market data

Environmental impacts: the emissions (kg CO_2e) and water usage (L) associated with each container use

* Advanced mobilisation scenario only

FULL POTENTIAL

Full landfill diversion potential: the scores derived from stage 2 were applied to the baseline values to calculate the total number of containers that each solution can keep out of the landfill.

3.3 Comparative advantage

The cost and environmental impacts associated with every container use cycle were calculated for each solution archetype. In the comparative charts on this page, each solution is assumed to be operating at scale and with the relevant infrastructure in place (i.e., under an advanced mobilisation scenario). The landfilling pathway was included for reference.

Which solution archetypes have the most merit? Recycling and BYO are the cheapest of the investigated solution archetypes and cost less than HKD 0.50 per use (Figure 9). Reuse solutions cost over HKD 6.00 per use but have the least amount of GHG emissions and lowest water consumption associated with each use. (Figure 10 and Figure 11). In comparison, the BYO and Recycling solutions come with the highest water usage, assuming they are hand-washed. The GHG emissions are the highest for the Composting solution, with costs and water usage being mid-range in comparison to the other solution archetypes.

TABLE 2

Summary of solution feasibility under 2030 advanced mobilisation scenario

Solution pathway	Feasibility	
	Technical limitations	Effort to implement
Recycle	100%	76%
BYO	90%	80%
Compost	90%	55%
Reuse	80%	39%

less feasible (0%) — more feasible (100%)

Each column breaks down the results of prior analyses on the relative feasibility, cost, and environmental impacts of each solution under an advanced mobilisation scenario

FIGURE 9

Costs associated with each solution archetype (for hot food containers)

Full 2030 landfill diversion potential for BYO, advanced mobilisation scenario

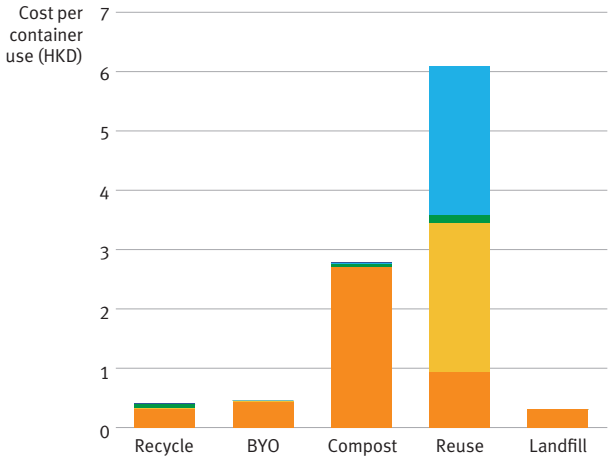


FIGURE 10

Greenhouse gas emissions associated with each solution archetype (for hot food containers)

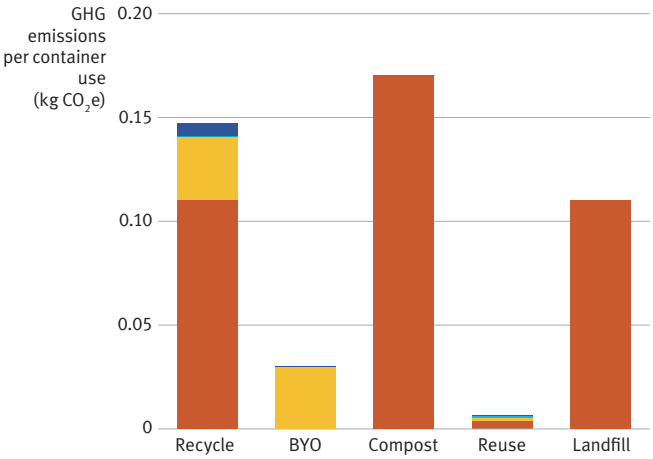
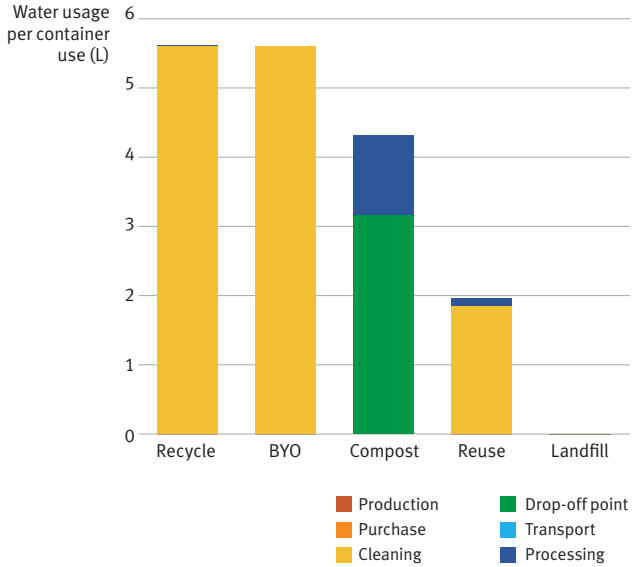


FIGURE 11

Water consumption associated with each solution archetype (for hot food containers)



3.4 Eating without waste, starting now

3.4.1 Drivers

Two factors drive the full landfill diversion potential of each solution. The first is a solution's potential to drive change for a given container usage (e.g., 'hot food' or 'cold drink'). The second is the size of the market for each container usage to which the solution type is applicable.

Given that hot food containers constitute 69% of all containers on the Hong Kong market, focusing efforts on this segment is a high priority to maximise impact. In the LM scenario, the Recycling solution offers the highest impact out of the four solutions, feasibly addressing 58% of all hot food containers (40% of all SFPs).

The BYO solution is also an impactful solution. It could address 49% of all hot food containers, which equates to 34% of all containers on the market. The impact of these solutions grows under the AM scenario, in which Recycling and BYO can address 69% and 70% of all single-use containers respectively.

The Reuse solution is estimated to be about one-fifth as impactful as the Recycling or BYO solutions in the LM scenario. Under the MM and AM scenarios, Reuse solutions operate at a greater scale and can ultimately address up to 33% of the market. The Recycling and BYO solutions nevertheless continue to outperform the Reuse solution.

Similarly, even if the city were to invest in composting infrastructure to potentially address 51% of containers, the Composting solution would not meet or exceed the level of impact of Recycling or BYO solutions.

The impact of each solution may also depend on the application for which it is used (Figure 12). In line with technical limitations and implementation efforts, solutions may play a lesser or stronger role in different usage situations. For example, while a compostable container may have certain technical limitations

FIGURE 12

Hot food containers have the greatest opportunity for impact

Full 2030 landfill diversion potential for BYO, advanced mobilisation scenario

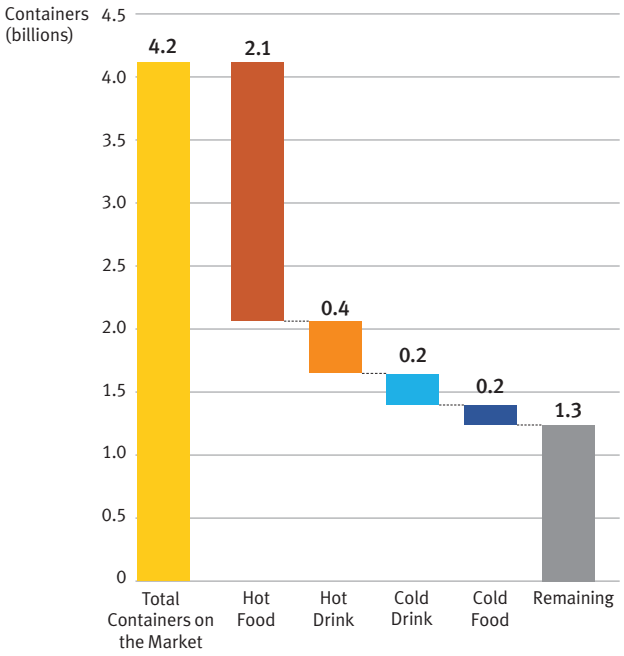
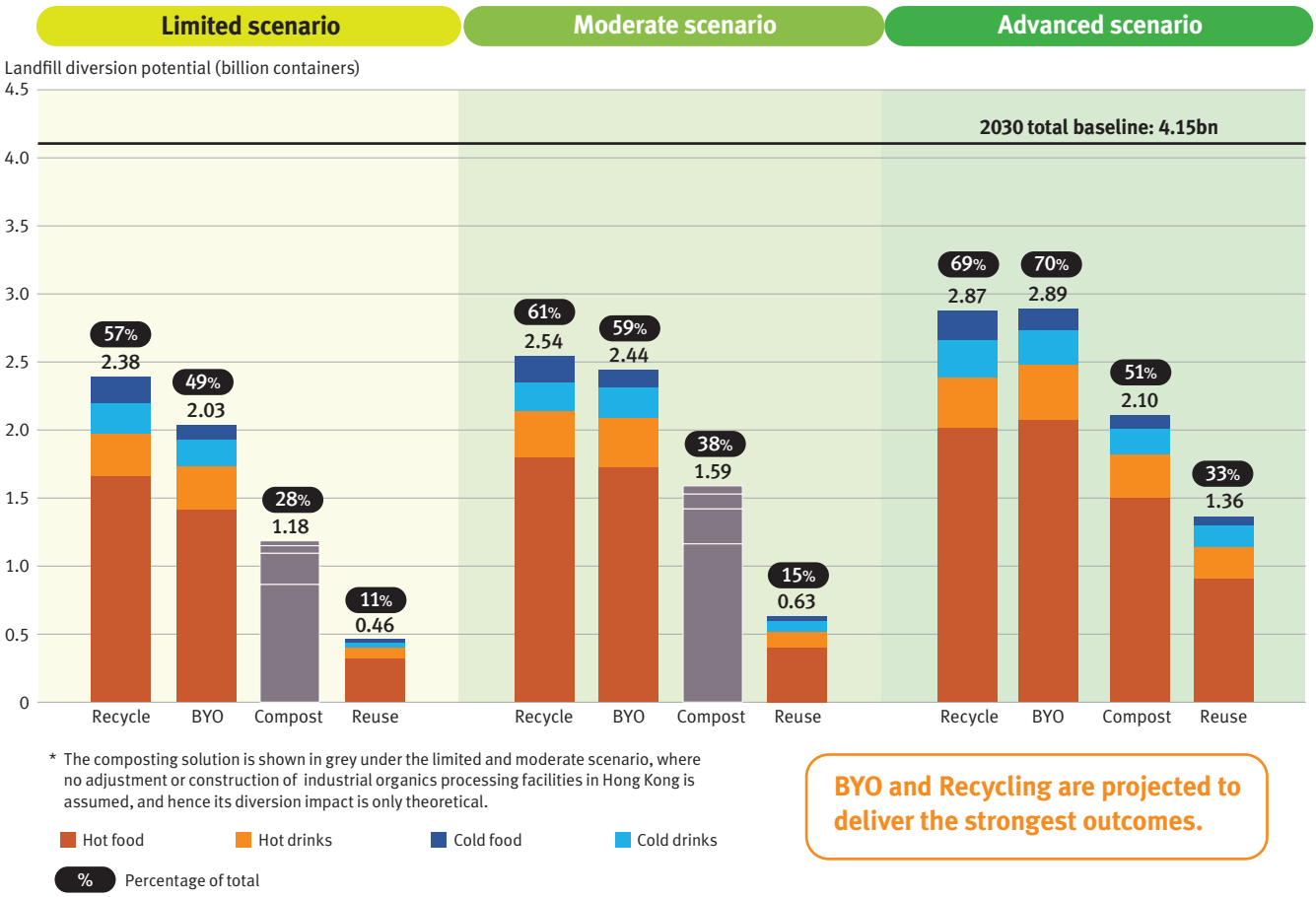


FIGURE 13

Total solution impact in Hong Kong under three modelled scenarios*



* The composting solution is shown in grey under the limited and moderate scenario, where no adjustment or construction of industrial organics processing facilities in Hong Kong is assumed, and hence its diversion impact is only theoretical.

Hot food Hot drinks Cold food Cold drinks

% Percentage of total

BYO and Recycling are projected to deliver the strongest outcomes.

for hot foods, different challenges would arise for cold foods or beverages. As such, the most optimal solution varies by application. Under the AM scenario, the Recycling solution can keep the most cold food and cold drink containers out of landfills, but the BYO solution is the most optimal for hot drink containers.

3.4.2 Landfill diversion potential

Under each implementation scenario, BYO and Recycling are projected to deliver the strongest outcomes (Figure 13; a detailed discussion of each solution is provided in Chapters 4 through 7). The Reuse opportunity is smaller but, under the conditions of an AM scenario, could nevertheless reduce up to one-third of Hong Kong's projected SFP use. Composting cannot keep containers out of landfills unless composting infrastructure is in place or existing and planned anaerobic digestion infrastructure is modified, and therefore would not contribute under an LM or MM scenario. Under an AM scenario, however, where collection and processing infrastructure is in place, we project that the Composting solution could potentially keep half of Hong Kong's SFP containers out of its landfills.

3.5.3 Identifying priorities

These results form an 'order of operations' by which different solution archetypes can be combined to maximise impact. For example, approximately half of the containers in scope could be kept out of landfills by focusing solely on Recycling or BYO systems for hot food containers. Recycling beverage containers, however, tends to be less burdensome for the consumer and the recycling system due to easier cleaning. In addition, BYO for beverages, while still in its infancy, is currently more popular than for food containers. Public policies education support or regulation could therefore concentrate on Recycling and BYO for hot food containers, leaving it to industry to capture an additional 5–10% of SFP containers through programmes around hot beverage containers.

The Government's proposed timeline for its Regulation of Disposable Plastic Tableware (RDPT) is for a full ban to be implemented by 2025. This timeline is suitable for addressing certain elements of its proposed scope, such as EPS containers or most on-site uses. However, the afforded time for a full-scale ban may not be sufficient to develop sustainable, affordable, and functional alternatives to the plastic containers currently on the market. As a result, F&B operators may feel compelled to switch to suboptimal solutions that inadvertently worsens the city's waste issue in different ways.

On the other hand, the volume of single-use foodservice items going to landfills could already be meaningfully reduced before 2025 if, for example, broad outreach and support for Recycling were to be initiated right away. Similarly, individual F&B operators or their property managers could be educated on the benefits and feasibility of BYO and Reuse to complement their current single-use practices.

The timeline for a blunt regulatory tool like a ban, and with a scope as broad as the proposed RDPT, must include more considerations surrounding what can and cannot be implemented with desirable outcomes. Chapters 8 and 9 include further discussion on immediate solution implementation and recommended action items for stakeholders.

Our analysis also highlights solutions whose full landfill diversion potential across different scenarios and container types is lower but have greater environmental benefits on a per-meal basis. Reuse may require greater investment and societal mobilisation to run at scale, but there are specific situations that offer conditions conducive to the takeup of a Reuse operation (see Chapters 7 and 8). At the same time, higher-impact solutions such as Recycling or BYO can run more broadly across Hong Kong to maximise impact. Importantly, for on-site consumption reusable tableware should be prioritised, whether through a Reuse system or with containers and peripherals individually owned and cleaned by the F&B operator.

The next four chapters describe each solution type along with a quantitative analysis of their potential, and an assessment of what it would take to implement each one.

4 RECYCLING

ENSURING PROPER COLLECTION AND RECYCLING PRACTICES

4.1 How it works

Recycling is the recovery of useful material from the MSW and other waste streams to make new products.[51] Such materials include paper, plastic, glass, and metal. The most common forms of SFP materials in Hong Kong are the plastic resins polypropylene (PP), polyethylene terephthalate (PET), and expanded polystyrene (EPS), all of which are technically recyclable.

4.1.1 System description

The food or beverage is prepared at the point of sale and packaged in a recyclable SFP. For most recycling streams, users must clean the container after consuming their takeout product. Depending on the material, the container can be dropped into a mixed recyclables (e.g., mixed plastics) collection bin, which requires sorting the materials before processing them at a recycling plant. Alternatively, the container is returned to a designated recycling bin for materials of that specific type, to be sent to the processing facility without further sorting. After processing, the secondary materials are then sold locally or exported.

4.1.2 Recycling in Hong Kong

To recycle plastic food containers in Hong Kong, consumers must first wash the container. This is necessary for removing food residue that would otherwise contaminate the recycled material, especially in the case of oily and to avoid pests and odours in the collection stage.

After washing, **PP containers** can be dropped in designated 'mixed plastics' collection bins throughout the Environmental Protection Department's (EPD) GREEN@COMMUNITY recycling network (Figure 15).[52] This is also where **PET containers**, such as bubble tea and other cold drink cups, must be dropped off, since they, too, are not accepted in the plastic bottle collection bins ('three coloured bins') found on many street corners.

The plastics collected through the designated mixed plastic collection bins are sorted, aggregated, and delivered to processors, who turn the PP and PET into flakes or pellets for export.

FIGURE 14

Schematic diagram of a typical SFP Recycling system

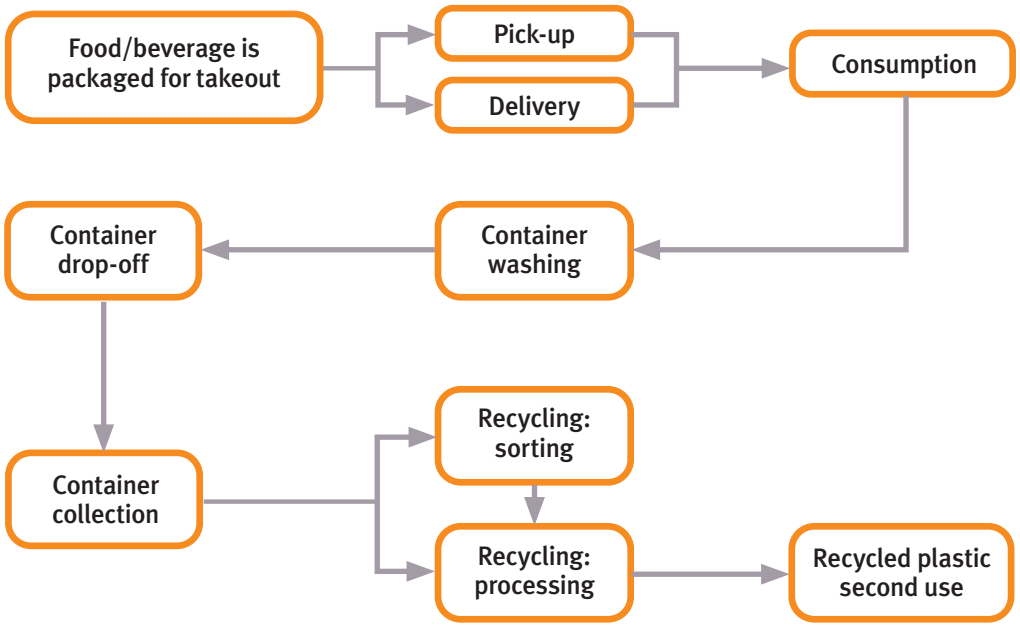


FIGURE 15
GREEN@COMMUNITY recycling store (top) and recycling point (bottom)

To recycle PP food containers in Hong Kong, consumers must first wash the container.

EPS containers are mainly recycled at one facility in Hong Kong, but are accepted through the mixed-plastics collection bins at the GREEN@COMMUNITY recycling network. Hong Kong recyclers have noted, however, that PP plastic is much easier to recycle than EPS plastic.[53]

To-go hot beverage cups, which are mostly made of paper-plastic composites, can be disposed of through dedicated collection bins in the GREEN@COMMUNITY network.[54] Alternatively, they can be dropped at one of the 124 public liquid carton collection bins or 116 privately-funded liquid carton collection bins,[55] such as the programme funded by local beverage manufacturer Vitasoy at some school campuses, offices, and other city locations.[56]

Currently one, privately-operated pulp mill in Hong Kong, Mil Mill, is able to handle these cups.[57] At this facility, the inner plastic lining is separated from the fibre portion of the cup or container. The resulting high-quality (long-fibre) pulp is sold to paper mills abroad. At the moment, the plastic component of the plastic-paper composite, usually consisting of polyethylene, is still discarded and ultimately landfilled. As the Hong Kong Government will start charging households and businesses for disposing municipal solid waste by weight in the next 18 months ('MSW charging'), disposal of this unrecovered residue in landfills may become a financial burden for the recycling operation.

While beverage cups usually require less cleaning than food containers, because their contents are less sticky and oily, it is recommended they are rinsed and dried to maintain hygiene and preserve fibre quality — particularly if they are being stored for long periods of time before being processed.

4.2 2030 potential

The following recycling solution analysis was conducted for a single-use PP food container. Our baseline analysis shows that PP is the most common type of plastic used for containers in Hong Kong, the majority of which are used to serve hot foods.

4.2.1 Financial costs

The system cost of using and recycling one PP container is an estimated HKD 0.43 (Figure 16). This is the lowest amongst all four solution archetypes.

- Per container, approximately three-quarters of the system cost is driven by the container purchase.
- Treatment and transportation costs are comparatively small for each container because the costs of operating the recycling system are shared by many other recyclable items.
- Another small portion (5%) of the overall cost is incurred by the hot water required to clean the container prior to recycling — and hence shouldered by the consumer.
- About 15% of the cost goes to rental space for collection bins, procuring and maintaining collection bins, and retrieving containers from drop-off points.

FIGURE 16
Recycling system costs
(Advanced mobilisation scenario, 2030)

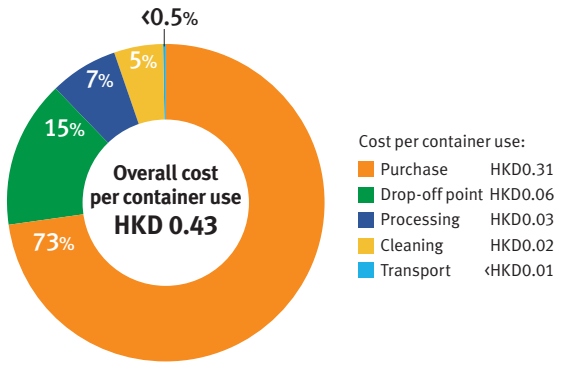
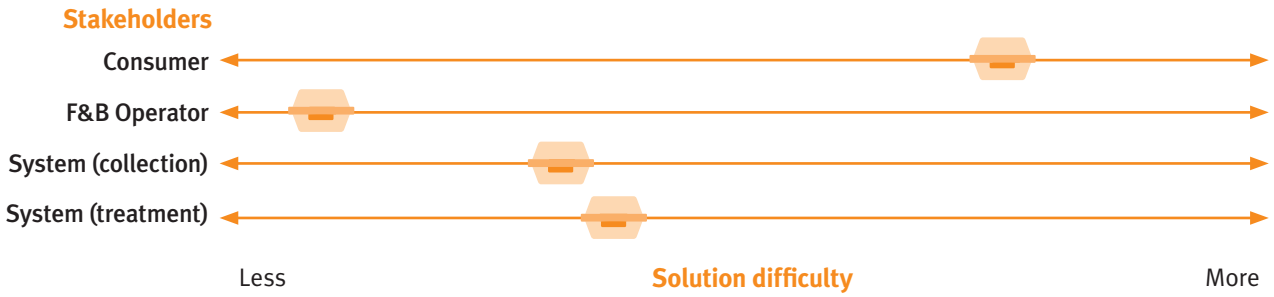


FIGURE 17
Demands on stakeholders in the recycling solution



4.2.2 Water usage and carbon emissions

Recycling, along with BYO, requires the highest per-container usage of water, due to the amount of water used to manually wash a container (Figure 11 and Appendix B). Dishwashing machines are a lot more water-efficient than manual washing,[58] but few households in Hong Kong have sufficient space to install this appliance.[59] The amount of water used for manual washing varies based on individual habits but could be improved as households develop stronger recycling practices (e.g., using the rinse water from other dishes to cleanse the recyclables). The recycling process itself contributes only marginally to per-container water consumption (approximately 20mL water per container).[60]

When recycled, each PP container use produces an estimated 147g CO_2e across the lifecycle components analysed (see Figure 10 for a breakdown and Appendix A for the methodology). For reference, the average Hong Kong taxi emits about 290g of CO_2e for each kilometre driven.[61] The container production phase contributes 75% of emissions, with the remainder largely comprised of the energy required to heat the water for manual dishwashing. The recycling process itself contributes less than 5% to the total system emissions.[62]

4.2.3 Container technical performance

Considering that recyclable containers are currently the most common option in the Hong Kong takeout market, there are no technical performance limitations associated with this solution that would bar users from adopting it, nor is further packaging innovation required to make this solution work. This contrasts with other solution archetypes, which have yet to materialise or operate at scale.

4.2.4 Demands on stakeholders

For recycling schemes to run successfully in Hong Kong, the largest incremental demands are placed on the consumer (Figure 17). Food containers must be cleaned, kept separate, and returned to the appropriate recycling stream — a habit that is not yet well developed despite years of 'Clean Recycling' education efforts.[63] Moreover, this may present challenges for those who do not have immediate access to sinks or the space to accumulate recyclables within their work or living areas. Consumers are not always up-to-date with the best practices for recycling in Hong Kong, with guidelines on the use of recycling infrastructure evolving considerably over the last decade.

Furthermore, many people do not recycle their waste due to distrust in the system.[64] A 2020 survey on the plastic bottle recycling habits of Hong Kong citizens revealed that of the respondents who do not recycle, 20% did not believe that returned bottles are actually recycled.[65]

Plastic Free Seas, a Hong Kong NGO, ran a successful monthly recycling collection in the neighbourhood of Discovery Bay from August 2018 to May 2021. ***"Many residents told us that they wouldn't recycle in public bins in Hong Kong as they didn't trust the system,"*** notes Dana Winograd, co-founder and director of Plastic Free Seas. ***"At the same time, people were willing to save their recyclables for a month to bring them to us, since we took the items directly to the recyclers. The programme, though small in scale, helped improve Discovery Bay residents' trust in recycling."*** The weekly GREEN@ COMMUNITY pop-up collection point that was established in Discovery Bay in 2019 has seen higher volumes of recyclables compared to the earlier Plastic Free Seas programme, indicating that residents' willingness to participate in recycling schemes is growing.

Since plastic single-use containers are already more or less the standard in the Hong Kong takeout market, there is little effort required from F&B operators to adopt this solution. However, F&B operators must play a role in educating their consumer base on best practices for recycling the plastic containers offered. They can also facilitate recycling, for example by offering dedicated bins where customers can return their take-out containers, as a complement to the existing network of collection points.

In comparison to other solutions, Recycling puts relatively few incremental demands on collection and treatment systems because the relevant infrastructure is already in place in Hong Kong. Further expansion and optimisation of the processing infrastructure would, however, be beneficial to Hong Kong's SFP recycling outcomes. Similarly, while collection networks for SFP materials such as PP, PET, and plastic-paper composites exist in Hong Kong, they are not yet dense and expansive enough to readily take up a large share of the volumes on the market.

4.2.5 Impact on landfilling

By 2030, the Recycling solution archetype may have the potential to address 69% of the containers on the market (see Figure 13). This, however, is contingent on a commitment to increasing consumer education on recycling habits and further optimising the collection, sorting, and recycling systems (AM scenario).

Without a major shift in behaviour or significant technological advances, the recycling system is still projected to addresses 57% of the containers on the market (LM scenario; see Appendix A for more details on scenario projection). This is the highest total potential impact that can be delivered by a single solution with the current-day level of technology and infrastructure, largely due to the recycling system already in place.

4.3 Driving the Recycling solution

Although most SFP materials can technically be recycled today in Hong Kong, doing so is not always straightforward or convenient. System improvements to increase the scale and effectiveness of this solution archetype include: educating consumers and businesses to improve recycling habits; widening collection networks to increase accessibility; and expanding recycling infrastructure to handle higher recyclable volumes and diverse material types. Collaborations and demand stimuli can further drive investments in these improvements.

Education. The success of SFP recycling is contingent on consumers' willingness to develop strong recycling habits. While this undoubtedly involves behaviour change and willingness to invest time and effort into recycling, it also necessitates clearer and more consistent education on best practices, such as the need to clean containers. Consumers must be taught exactly how and where they can recycle different container types, rather than being expected to seek out the information. To rebuild consumer trust in the recycling system, facilities must be more transparent about their processing protocols and the destination of the materials that enter their facility.

Widening collection networks. Hong Kong's recycling collection system is not optimised for convenience, further posing a barrier to consumers. While plastic bottles (e.g., from pre-packaged beverages, body care products, detergents) can be dropped in recycling bins available on the street, there are far fewer locations in the city where a consumer can recycle other types of plastics and pack formats.

- Most types of clean plastic food and beverage containers can be returned through privately run services, set up by NGOs and commercial entities. For example, social enterprise V Cycle operates plastic recycling programmes in offices. In addition to facilitating collection logistics, V Cycle provides education for office staff on source separation and clean recycling. However, many programmes are highly localised and may be difficult to sustain or scale up. Effective systems such as V Cycle's could theoretically be expanded to F&B tenants, but would require food containers to be cleaned either by tenants prior to collection, or after collection at the sorting facility.

- Some building managers offer mixed plastics recycling bins to residents, although not all have contracted trustworthy recyclers who ensure that collected waste actually ends up as secondary material. In some cases, the recyclables collection contract is too narrowly scoped to allow for non-bottle plastics to be picked up.

- In 2020 and 2021, the Government introduced a number of pilots and programmes to try to address these gaps in the collection network (See Box 4).

BOX 4: GOVERNMENT COLLECTION PROGRAMMES FOR PLASTIC FOOD AND BEVERAGE CONTAINERS

EPD's GREEN@COMMUNITY recycling network was established in 2015 and expanded in 2020. It now includes nine large Recycling Stations, 22 local Recycling Stores, and over 100 pop-up Recycling Spots.[66] However, the network is still not dense enough to give all consumers easy access to mixed plastic recycling, or large enough to collect all of Hong Kong's recyclables. A new Government tender therefore aims to expand the network with additional locations.

Several Government pilots allow for the mixed collection of all plastic types. Currently, the EPD is piloting a two-year 'all-plastics' collection scheme in three districts (Shatin, Kwun Tong, and Eastern) in an effort to make plastic recycling more accessible to the public.[67] Under the scheme, which began in January 2020, the Government funds the collection of all plastic types from schools, housing estates, and public institutions through 453 collection points across the three districts. As of June 2021, the programme had collected a total of 1,379 tonnes of plastics,[68] equivalent to the amount of plastic waste produced in these districts in just three days (approximately 594 tonnes/day).[69] The scheme will be expanded to six more districts to continue promoting plastics recycling habits.

With funding from the EPD's Recycling Fund, an incentive programme targeting waste plastics will liaise with commercial recycling collection points, their network of frontline recyclers, and informal collection channels to process the waste by qualified local plastic recyclers.[70]

Expanding recycling infrastructure. As recycling habits strengthen and collection rates increase, recycling facilities, too, must be able to handle the growth. This is particularly important for recyclable materials that are currently only processed by small-scale independent recycling facilities — such as hot beverage cups made from plastic-paper composites. Further investment may be needed to develop relevant infrastructure for sorting or aggregating recyclable materials, and to scale up the capacity of facilities to process more and a greater diversity of materials.

Our 2019 baseline analysis (see section 1.2), for instance, indicates that approximately 22 tonnes of takeout hot cups are used daily in Hong Kong. Mil Mill, a privately-run paper recycling facility, has the daily capacity to process up to 50 tonnes of composite paper-plastic materials such as beverage cartons and to-go coffee cups.[71] This means that hot cups alone would already make up half of Mil Mill's total daily capacity, with no other processing facilities in Hong Kong to share this load. Considering that hot cups make up only 14% of all SFP items used today, a much larger facility would be needed to recycle fibre-based SFP alternatives in larger volumes.

Collaboration. Packaging innovation, potentially beneficial to improve the economics and environmental outcomes of SFP recycling, can be driven by collaborations along the value chain. In Australia, packaging manufacturer Detpak partnered with paper recyclers to develop takeout cups in which the plastic lining can be separated from the paper outer layer in standard paper recycling plants, without the need for additional infrastructure. Such innovation-oriented partnerships can stretch beyond the product itself. Detpak's RecycleMe System partners with a waste collector to transport used cups to the recycling facilities in a dedicated waste stream. Until it has transitioned to full-scale public collection systems, Hong Kong can also benefit from such privately orchestrated end-to-end integrations of takeout packaging providers with product users, collection networks, and recycling facilities.

Demand. A more widespread use of recycled materials can drive the demand for recycling services and drive investment in collection and processing infrastructure. Some packaging manufacturers have begun producing food containers made from food-grade recycled plastic. When scaled up, such SFPs can help truly 'close the loop' for the recycling system, allowing recycled food containers to feed back into the product from which they originated.

5 BRING YOUR OWN

ENCOURAGING CONSUMERS TO SUPPLY THEIR OWN CONTAINERS

5.1 How it works

'Bring your own' (BYO), in the context of this report, is the practice of consumers bringing their own food or beverage containers when purchasing takeout meals. This practice has been encouraged globally to eliminate the need for SFPs altogether, building upon the larger packaging-free movement in supermarkets and other retail outlets.[73]

5.1.1 System description

Customers bring their own containers to F&B outlets, where prepared food or beverage is directly placed into the customers' containers. Since the containers belong to the consumers, it is their responsibility to clean them for continued use. F&B employees commonly conduct a quick visual inspection to ensure hygiene is maintained, and may refuse containers if they are not deemed clean or if the size or quality is deemed inappropriate for the food or beverage served.

5.1.2 BYO in Hong Kong

A few F&B establishments in Hong Kong actively promote and even incentivise BYO habits to their customers (see Box 5). A much larger proportion of eateries, particularly small independent operators permit customers to bring their own containers, without public signage or advertisement.[74]

BOX 5: ENCOURAGING BYO IN HONG KONG

SaladStop!, a Singapore-based salad chain with three outlets in Hong Kong, runs various BYO programmes. Its first BYO campaign in 2019 incentivised customers to bring their own containers or borrow a reusable container from the eatery.[75] Today still, customers are given discounts on beverages and free salad toppings when they bring their own lunch bowls.

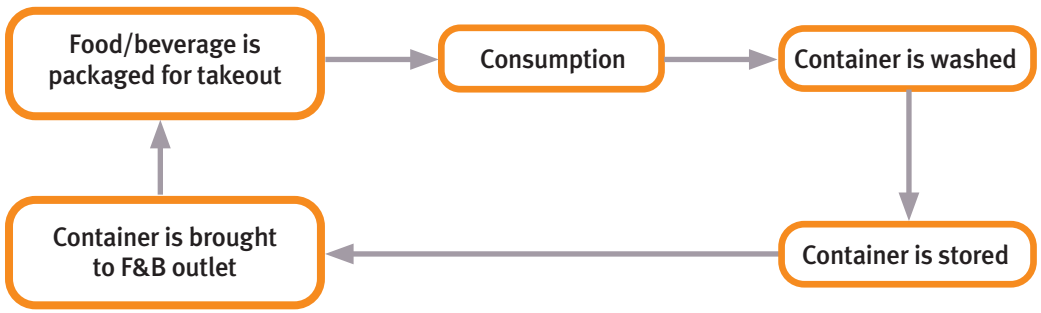
Chickpea, a to-go chain based in Hong Kong, debuted its 'eco-merch' programme in June 2021.[76] Customers can bring their own containers for takeout meals or purchase a collapsible reusable silicone bowl. The repeated use of reusable containers is encouraged through a loyalty programme with rewards such as free meals and side dishes.

5.2 2030 potential

To assess the potential of the BYO solution, we based our analysis on a reusable PP food container, one of the many options available. We chose food containers because they make up the majority of containers on the market, and specifically focused on *PP containers* as a popular choice for consumers. Light-weight yet durable, these containers also seal well, can store hot foods, and are what many people already have in their homes for at-home food preparation and storage.

FIGURE 18

Schematic diagram of the BYO system



5.2.1 Financial costs

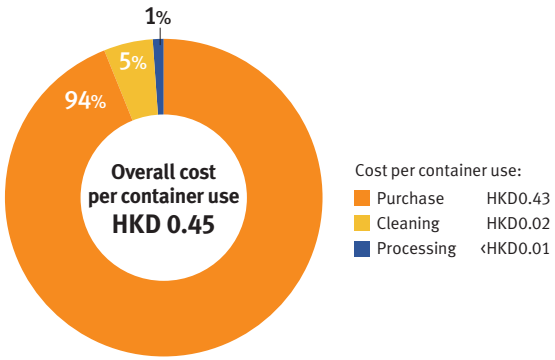
The BYO system cost per container use is an estimated HKD 0.45 across an assumed 50 use cycles (Figure 19). This is only slightly (HKD 0.02) more than the Recycling solution.

- This cost is almost completely driven by the purchasing cost of the container. Consequently, each further use cycle helps drive down the overall solution cost.
- As is the case for the recycling solution, the consumer pays a small amount for the hot water required to clean the container.
- The end-of-life costs, assuming that the container is recycled, only contribute marginally to the per-container costs because they are spread across many uses of the same container.

FIGURE 19

BYO system costs

(Advanced mobilisation scenario, 2030)



5.2.2 Water usage and carbon emissions

BYO containers utilise the most water during washing (see Figure 11). The water consumption of this system could be lowered if households employed more efficient techniques for manual washing, or if they used dishwashing machines. The water used for recycling the BYO container at the end of its lifespan is nearly negligible, especially when accounting for the many reuse cycles of the container.

The emissions associated with each BYO container use is an estimated 35g of CO_2e. This value is much lower than the footprint of single-use recyclable or compostable containers because the higher emissions associated with container production are divided over the multiple uses of the container.[77] The majority of greenhouse gas emissions associated with the BYO system comes from the energy used to wash the container with hot water (see Figure 10).

5.2.3 Container technical performance

The BYO solution is advantageous in that the container has a high utility in the consumer's household — it can be used to store home-cooked leftovers or produce, in between uses for takeout. Plus, most households already have reusable containers.

The main technical performance issue is the lack of standardised sizes and shapes, which may not be compatible with the beverage or food being served at different outlets. For example, some meals in Hong Kong require separation or partitions — such as soups where the broth is kept separate from noodles or dumplings, or *bento-style* meals that require several partitions for different meal components (Figure 20). If the customers' containers do not fit the dimensions or characteristics of what is being served, they may have to opt for a single-use option. This limitation may be mitigated over time, as consumers start planning ahead and bring the appropriate container. As such, they may consider purchasing additional containers that specifically suit the requirements of different meals or beverages.

FIGURE 20

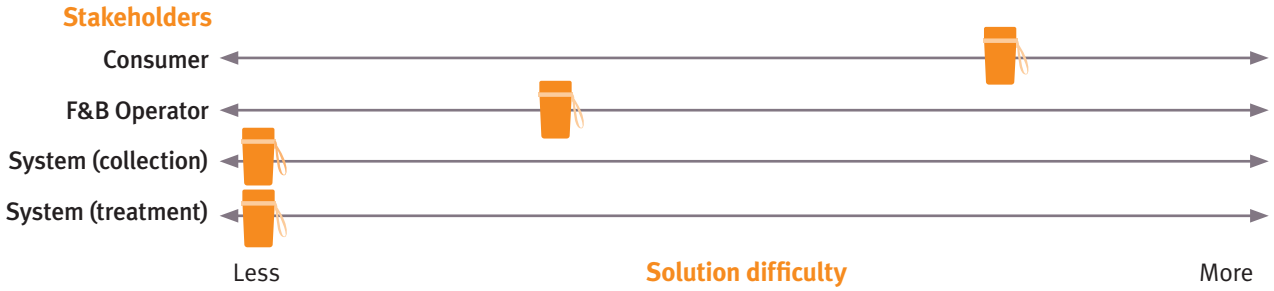
Takeaway meal in a single-use bento container

5.2.4 Demands on stakeholders

The BYO solution archetype is consumer-driven. Consumers need to bring containers from home, and even plan in advance what type of containers they need when setting out for the day. Over time, however, this habit may become as natural as leaving home with one's keys, wallet, and phone. Consumers are also responsible for carrying or storing their containers until they can clean them for the next use.

Though most of the BYO system is handled by the consumer, F&B operators must also adapt in various ways. While some geographies place legal restrictions on handling customers' containers, this decision is left up to individual F&B operators in Hong Kong.[78] As such, Hong Kong's F&B operators may need to adjust standard operating procedures (SOPs) to accept outside containers.

FIGURE 21
Demands on stakeholders in the BYO solution



Smaller eateries and establishments may be more flexible in making this switch, whereas large or international chains may have strict SOPs (e.g., hygiene protocols) that require more coordination to adapt. ***"We have been able to dedicate a small area in the outlet behind the salad bar to place the BYO bowls, so that we avoid cross contamination with the food on the bar as well as the rest of the orders,"*** explains Katherine Desbaillets Braha, a founder of SaladStop! ***"This area is then sanitised after each order, allowing us to maintain a high standard of hygiene while encouraging BYO bowl habits."***

There are no system-level requirements from an infrastructural level, except for the retirement of the container when it is no longer suitable for use in the system, through recycling or disposal. Repurposing of retired containers (e.g., for storage) is usually a private initiative and does not tend to put additional demands on the system.

5.2.5 Impact on landfilling

The BYO solution archetype has the potential to address 70% of the containers on the market by 2030 (see Figure 13). Of the four archetypes, this solution holds the highest landfill reduction potential due to its applicability to many different food and beverage types. It also is not contingent on additional infrastructure investment.

5.3 Driving the BYO solution

The BYO solution requires additional effort to change current single-use habits — primarily those of consumers, but also of F&B operators. Even though the BYO solution is consumer-driven, it will take more than just individual commitment to make it work at a greater scale. Broader uptake is contingent on systematic encouragement at all levels, from the provision of customer incentives by the Government or private operators, to the adaptation of current F&B SOPs.

Incentives, such as discounts and other perks, can help prompt consumers to overcome these barriers. Some Hong Kong establishments charge consumers for SFPs, making BYO containers the default. 走杯 (Cupfy, Figure 22), a bubble tea store, recently began charging customers HKD 2 for SFPs and anticipates a 20% increase in the number of customers who bring their own cups.[79]

Even without incentives, F&B outlets that actively advertise being BYO-friendly can also prime customers to adopt this practice. A study of the effects of incentivisation schemes in over 220 Hong Kong coffee shops shows that effective communication and consumer nudging (e.g., educational posters or signs, verbal signalling from baristas) were more effective than financial incentives at switching consumers to use reusable cups instead of disposable cups.[80]

"I believe that convenience is the easiest way to change customers' behaviour," says Ms. Desbaillets Braha of Saladstop! ***"Giving the customers the convenience to borrow containers in store or online and then incentivising them by giving them a discount or free item is the most effective way to shift consumer habits away from single-use."***

F&B operators can positively influence their customers through effective verbal and visual communication strategies. They should also ensure that they are well-equipped to handle BYO containers in their operations. This will likely involve updating SOPs and training staff.

FIGURE 22
Cupfy single-use cup charge

Image credit: Openrice

6 COMPOSTING

CLOSING THE LOOP WITH COMPOSTING INFRASTRUCTURE

6.1 How it works

Composting is the process by which organic matter, such as food waste, is naturally broken down by microorganisms under oxygenated conditions.[81] The output of this biological process is water, CO_2, and compost, which serves as a natural fertiliser to enrich soil.

While composting can be done at home, industrial composting centres optimise and expedite the process by providing ideal temperature and oxygen levels.[82] All composting systems require aerobic (oxygenated) conditions to allow for the natural breakdown of the organic waste. Alternatively, certain microorganisms can carry out this process in anaerobic (non-oxygenated) conditions in an anaerobic digester. In a landfill, however, the conditions are unsuitable to facilitate this breakdown process. Compostable packaging therefore cannot be truly 'closed loop' unless this end-of-life phase is correctly executed.

The term 'composting' will hereon refer to both the aerobic and anaerobic processes by which organic waste can be metabolised (i.e., aerobic composting, anaerobic digestion), unless explicitly stated otherwise.

6.1.1 System description

The food or beverage prepared on-site is served in a compostable SFP. After consumption, the consumer disposes of the compostable packaging into a compostable waste stream. This may take the form of a) a generic organic waste compost bin, which combines all organic types; b) a dedicated packaging compost bin.

The organic waste is processed at a composting facility, which can be either small-scale (e.g., on-site at a school) or at an industrial level. Depending on the quality of the waste materials and the level of process control, the resulting compost can be used as agricultural fertiliser.

6.1.2 Composting in Hong Kong

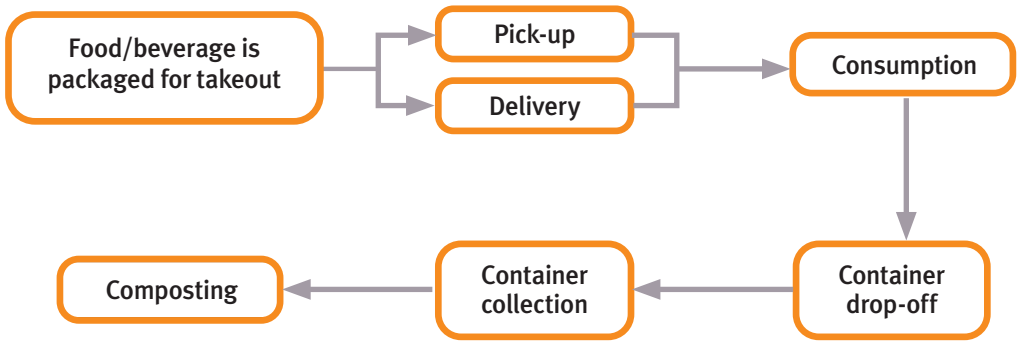
Hong Kong does not have scaled-up processing facilities equipped to handle compostable packaging. It has an organic waste treatment facility (O-PARK) that is, at the moment, focusing on commercial organic waste from F&B operators, wet markets and food processors. This facility uses anaerobic digestion technology rather than composting under aerobic conditions.[87]

The current process configuration is not able to treat compostable packaging as a raw input. While anaerobic digestion could in theory convert compostable packaging waste into energy and compost, this waste must be pre-treated through a shredding or maceration process before being sent into the anaerobic digestor.[88]

Without the addition of this pre-treatment infrastructure to O-PARK or the construction of an industrial composting facility, compostable packaging cannot be treated at scale in Hong Kong.

FIGURE 23

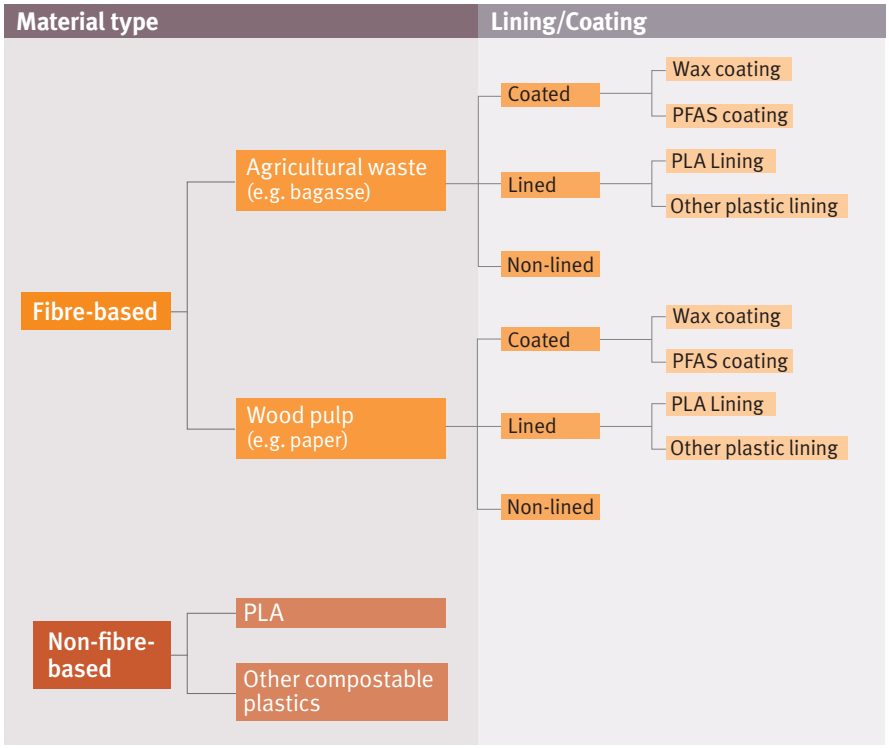
Schematic diagram of the composting system



BOX 6: COMPOSTABLE ≠ BIODEGRADABLE ≠ BIO-BASED

FIGURE 24

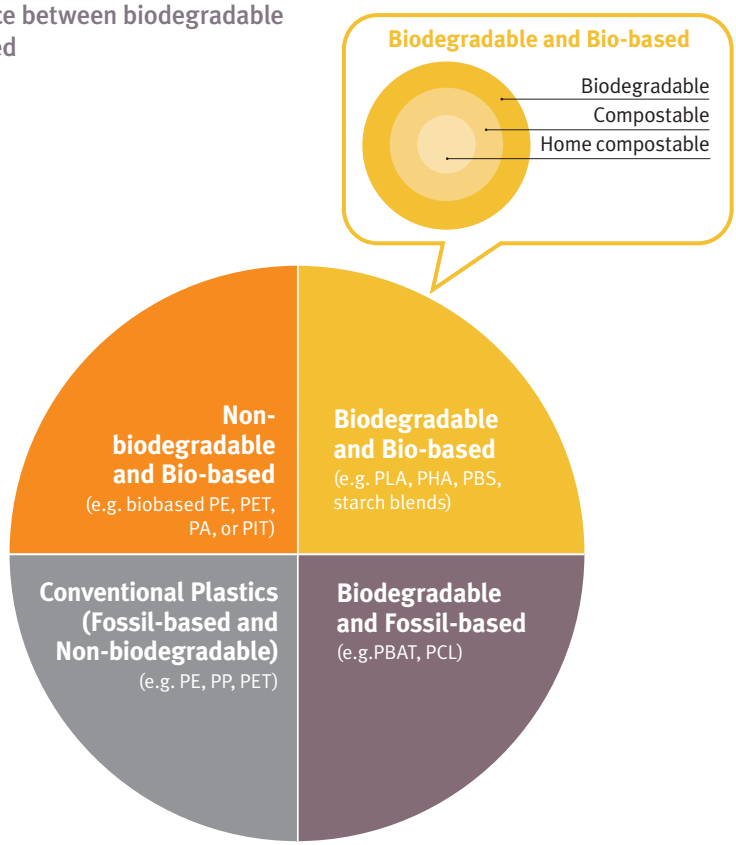
Types of compostable packaging on the market



PFAS: Per-and polyfluoroalkyl substances PLA: Polylactic acid

FIGURE 25

The difference between biodegradable and bio-based



Biodegradation is the process by which a material is broken down with enzymes or chemical reactions in living organisms such as bacteria, microbes, and fungi. When materials biodegrade, the polymers are first fragmented into smaller molecules, then assimilated and decomposed by the organism. Packaging can be considered 'biodegradable' if it conforms to a specific national or global standard (e.g. the International Organization for Standardization, European Norm, American Society for Testing and Materials).[84] Each standard defines the parameters of biodegradability differently based on the temperature, timeframe, and other environmental conditions in which the material breaks down.

Composting is a specific type of enhanced biodegradation under managed conditions, which yields compost as the output product for use as an agricultural fertiliser.[85] Composting could be considered a type of recycling because it repurposes organic waste. In our report, however, we refer to recycling strictly as the process of recovering the raw material through a mechanical or chemical process, rather than *transforming* organic waste through decomposition.

In sum: not all biodegradable materials are compostable, but all compostable materials are biodegradable when processed under the specifically-defined conditions. There is a variety of compostable packaging on the market, designed to break down under set conditions and timescales. These parameters separate compostable packaging from other biodegradable packaging. Whether the conditions to process, digest, or decompose these materials and products are actually available in Hong Kong is discussed further in this chapter.

While the labels 'compostable' and 'biodegradable' refer to the breakdown conditions of the material, the term 'bio-based' refers to its origins, specifically materials that originate from biological resources and have been processed and manufactured into a material suitable for packaging.[86] The end-of-life options for bio-based packaging materials depend on the products' tested specifications for breakdown or recycling. In some cases, such as with 'drop-in' bio-based materials, the bio-based material has the same molecular composition and characteristics as its fossil-based counterpart, allowing both to be processed in the same recycling stream.

Since May 2019, the EPD has been piloting a scheme to co-digest food waste and sewage sludge. Under the scheme, 50 tonnes of food waste are pre-treated daily before being sent to the Tai Po Sewage Treatment Works facility for anaerobic digestion along with the sewage sludge.[89] The food pre-treatment stage involves uniformly reducing the size of the waste and separating out impurities to prime the food waste for co-digestion.[90] Preliminary trials have concluded that any fibre-based compostable food containers need to be shredded before being combined with the sludge as part of the food waste.[91] This may require keeping food container and food waste streams separate in the collection process, to keep shredding costs to a minimum.

In October 2021, the EPD announced plans to implement the food waste/sewage sludge co-digestion plant at full scale as part of its waste-to-energy conversion programme.[92] As similar infrastructure continues to be scaled up across Hong Kong, it is important that the Government ensure that the appropriate technology and collection infrastructure is in place to accommodate not just food waste, but other types of compostable material — such as compostable SFPs.

Few Hong Kong households and restaurants have the space to compost. There are several private facilities, community outlets and networks through which households and F&B operators can collect organic waste for recovery (see Box 7). Each type and brand of compostable packaging, however, requires specific conditions for breakdown, which may or may not be compatible with the private composting facilities in Hong Kong. The now defunct Hong Kong Community Composting network, for example, utilised anaerobic digestion and is not compatible with compostable packaging.[93] Therefore, while private and municipal organic waste treatment exists in Hong Kong, the options for treating compostable packaging are very limited today.

BOX 7: ORGANIC WASTE COLLECTION AND PROCESSING IN HONG KONG

There are a variety of organic waste collection and processing initiatives in Hong Kong that serve different purposes within the composting system. While compostable packaging may not yet be accepted in these programmes, there is potential for these networks to eventually include packaging waste along with other types of organic food waste.

One company, Green Environmental Kitchen Residue Recycle Ltd. (GEKRRL), is moving towards integrating compostable packaging into their existing food waste composter. Their facility processes a specific compostable food container model that was pre-approved for the system. These food containers are made from a mix of PLA (plant-based polylactic acid) and PBAT (polybutylene adipate terephthalate, another biodegradable plastic), leading GEKRRL's operations manager to be optimistic that pure PLA containers could also be accepted in the system in the future.[94]

Other small-scale composting facilities are currently only accepting food waste. Mong Tseng Farm in Tin Shui Wai composts agricultural waste and organic waste collected from nearby restaurants and Chinese Medicine clinics to produce fertiliser. FoodCycle+ offers composting collection services to the F&B sector, linking these organic waste producers with farms that can use the compost.[95] The farms ultimately sell their produce back to the restaurants, therefore closing the nutrient cycle in a circular economy fashion. Similarly, Eco-Greenergy seeks to connect a broader set of compost users (typically local farms) with compost producers by offering matchmaking and transport logistic services.[96]

Some school campuses, both public and private, have begun composting on-campus, using a variety of methods from anaerobic digestors to worm composting bins. Since 2018, the EPD's Environment and Conservation Fund (ECF) has been supporting a programme that provides small (5kg) food waste composters to around 90 participating primary and secondary schools.[97] Each school is also provided with education materials to facilitate on-site food separation by teachers and students. Going forward in 2021, the ECF is supporting a further expansion of the programme to 56 other schools.

These composting systems are in place to break down food waste, but also have the potential to handle compostable packaging waste if they operate under high-temperature conditions. This is the case for the more sophisticated composting equipment at the Independent Schools Foundation Academy,[98] but integrating compostable packaging into these existing systems still requires a pre-treatment phase to macerate (shred and soften) the packaging before composting. Such small-scale additional equipment, however, is not widely accessible in Hong Kong and the high-temperature composter itself requires a level of operational supervision that most schools might not be able provide.

Even some existing larger-scale shredding infrastructure, such as the shredder at the pre-treatment plant for the Tai Po's food waste/sewage sludge co-digestor, has shown to be ineffective in processing food containers to serve as an input for producing stable compost — and hence would have to be complemented with more appropriately specified shredding equipment.[99]

FIGURE 26

EPD food waste composter provided to Hong Kong schools

6.2 2030 potential

For the various assessments leading up to evaluating the potential impact of compostable solutions, we chose bagasse containers, which are made from the fibres of agricultural by-products from sugarcane or sorghum stalks. Of the single-use containers in Hong Kong that are industrially compostable, bagasse containers have been observed to be the most common. Moreover, some bagasse containers are certified as home-compostable. Although opportunities are limited in Hong Kong, this does open a few more options for closing the loop. A third, minor reason for selecting bagasse containers is that much of the existing literature on the lifecycle impacts of compostable packaging is specifically focused on this material.

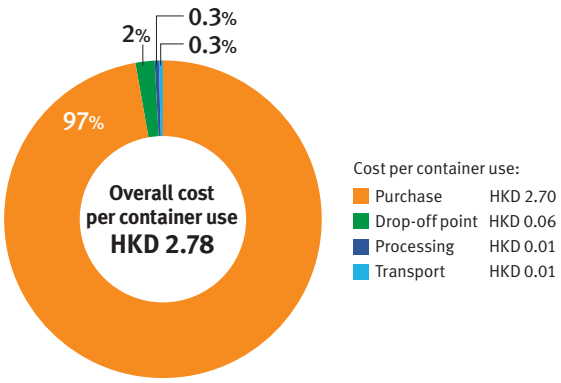
6.2.1 Financial costs

Use of a compostable container costs an estimated HKD 2.78. This cost is based on the theoretical assumption that the appropriate processing capacity would be in place in the form of composting or anaerobic digestion. Most of the cost comes from the purchase price, which is about HKD 2.70 when sourced in bulk on the Hong Kong market (Figure 27). The processing costs were derived from large-scale composting facilities in other jurisdictions. These costs will depend on the technology and capacity of the composting infrastructure that may eventually be used in Hong Kong. Given their limited contribution to the overall system cost, even higher processing costs are unlikely to change the picture considerably. Appendix B lists details and assumptions for this calculation process.

FIGURE 27

Composting system costs

(Advanced mobilisation scenario, 2030)



6.2.2 Water usage and carbon emissions

Composting is the only solution archetype in this study that does not include a washing stage. The most water-intensive component of the system is container production (73%), mainly driven by the conversion of sugarcane fibres into bagasse. The composting process contributes a further 25% of the system's water usage. In this stage, the water is used to homogenise the input organic waste.

Since bagasse is produced from what is considered an agricultural waste product, the water associated with growing the sugarcane was not included in the water usage impacts (See Appendix A for clarifications). If agricultural water usage were included, as some life cycle assessment (LCA) studies do, or if the feedstock were not a waste product, the analysis would show composting as the most water-intensive solution. This highlights the sensitivity of the composting model's environmental sustainability to the origins of its feedstock. Using sustainably sourced feedstock that is derived from agricultural residues or waste — second generation feedstock — is critical.

Each bagasse container emits an estimated 174g CO_2e, the highest per-container greenhouse gas footprint of the four solution archetypes. Over 99% of these emissions are associated with the bagasse fibre production and product moulding (see Figure 10). Not included in this number are any methane emissions from compostable containers that may end up in the landfill rather than in a composting or anaerobic digestion facility.

6.2.3 Container technical performance

Both fibre-based and PLA compostable containers are comparable in weight to single-use plastic containers (around 200 to 250g for a 500mL container) and are also easily stacked. Even if the desired end-of-life treatment is not available, these containers may therefore be attractive to outlets that are transitioning away from (conventional) plastic packaging as part of their sustainability strategy.

Conventional (i.e., amorphous) PLA does not hold up under high temperatures and, as such, is not suitable for hot meals or beverages.[100] Newer types of heat-resistant PLA are trying to address this. Interviews with F&B operators and compostable packaging providers highlight the limitations of fibre-based compostable packaging in handling liquids. Customer anecdotes reveal the challenges with leakage or a loss of container rigidity when using fibre-based packaging. This is a particularly notable issue in Hong Kong, where hot meals with soups and oily sauces are far more common than in Western markets.[101]

Fibre-based packaging providers trying to overcome this limitation typically either add a PLA lining, or a coating with per- and polyfluoroalkyl substances (PFAS).[102] Neither is a satisfying solution. Not all industrial composting facilities — in Hong Kong and elsewhere — operate under the rigorous temperature requirements and processing times required to fully compost PLA.[103] PLA does not biodegrade in home composting conditions, as it requires temperatures of at least 50°C, which are hard to maintain in home composting systems.[104]

The use of PFAS introduces its own set of challenges as this group of chemicals has been associated with liver damage, harm to the immune system, developmental toxicity, and cancer. Fidra, a UK charity focused on plastic waste and chemical pollution, recommends phasing out PFAS from food packaging. It also recommends lowering the accepted PFAS content in compostability standards, so that the level is no more than what could be considered background contamination.

Innovators in the compostable packaging sector are specifically addressing functionality challenges. They aim to improve the containers' ability to handle liquid and oily foods and beverages without resorting to potentially harmful chemicals. ***"Typically, packaging that is made entirely from plant fibres will leak or lose functionality when serving hot or oily foods,"*** describes George Chen of Ecoinno, a Hong Kong-based packaging company that focuses on the use of biotechnology to develop cellulose-based food containers. ***"It is important that fibre-based containers do not sacrifice these qualities in the consumer's experience. However, it is still crucial that the container is made entirely from plant cellulose and does not contain any types of PFAS, or PLA, which may disrupt the composting process."***

F&B outlets and consumers may have to adapt to other characteristics when migrating from single-use plastic containers to compostable fibre-based packaging.

- The use of an opaque compostable cup for cold beverages, which are typically served in a clear cup, may affect the aesthetic quality of the drink. This is particularly relevant to dessert-drinks (e.g., bubble tea). Some bubble tea stores, however, already serve beverages in paper-plastic composite cups, successfully turning the opaque optics into an iconic element of their brand.

- From an F&B operator standpoint, switching to opaque containers may also increase the likelihood of mixing up orders, particularly during peak hours. Many high-volume F&B operators have overcome this challenge through pre-printed check lists on cups, or customised labels that are linked to their point-of-sale (POS) software.

- Fibre-based lids on compostable cups and bowls may also not be leakproof. This may present challenges for customers who do not consume the beverage or soup straight away or opt for delivery. This issue is traditionally addressed by using PLA lids, but the two materials require different processing conditions.

6.2.4 Demands on stakeholders

Industrial composting facilities are pivotal to implementing this solution. Without them, the composting solution does not keep any containers from being sent to landfills.

If a suitable composting facility were available in Hong Kong, it would not demand an unreasonable effort from the consumer to implement the solution. Consumers do, however, need to separate their compostable packaging from general waste.

Depending on the network of composting bins, this habit can be easily integrated into daily patterns by consumers after the initial effort of seeking out a convenient bin location. If F&B operators serve as publicly or customer-accessible collection points for compostable packaging waste, staff, too, must be educated on waste sorting practices.

FIGURE 28
Demands on stakeholders in the composting solution

From the F&B operators' perspective, for those who already separate food waste from general waste, compostable packaging could be a sensible solution, provided that collection and processing systems that can accept containers along with food waste are developed.

Customers and F&B operators may have to adapt to the aforementioned differences in packaging characteristics, such as containers that do not seal as tightly or soften when carrying hot foods.

6.2.5 Impact on landfilling

If, by 2030, sufficient capacity for industrial composting or packaging-capable anaerobic digestion can be developed, the composting solution could replace 51% of the SFPs placed on the market (see Figure 13). Without this infrastructure in place, the use of plant-based materials could reduce our reliance on fossil resources, but this solution would not contribute to keeping containers out of landfills.

6.3 Driving the Composting solution

6.3.1 Infrastructure

While the use of plant-based materials could reduce our reliance on fossil resources, this solution cannot yet contribute to keeping containers out of landfills in absence of composting or modified anaerobic digestion technology.

"For the development of infrastructure for any material, that material has to be in circulation in sufficient volumes to make collection and processing viable. We anticipate that the further growth of compostables in the market in Hong Kong will build a business case for infrastructure development," asserts Eilidh Brunton, Senior Waste Management Consultant at Vegware United Kingdom. ***"If the Government's proposal to ban plastic tableware is passed and introduced by the proposed timeline,[107] we would expect to see a significant rise in the marketing, use, and hence disposal of compostables in Hong Kong. In that case, the Government would have to plan for and develop the infrastructure to collect and process it."***

Specifically for bagasse material, however, Hong Kong may be in a position to offer recycling until the appropriate composting facilities are brought online. Early-stage testing at Mil Mill shows that lightly-stained bagasse and (plastic-lined) paperboard food and drink containers can be processed in their recycling stream, which targets hard-to-recycle paper and cardboard. ***"We have over 450 collection points around Hong Kong for our beverage carton recycling system. We are now also partnering with some suppliers of composite paper products — like those used in F&B — to integrate them into our recycling scheme,"*** explains Harold Yip, one of Mil Mill's founders. ***"In this way, they are able to leverage our existing collection network and offer a recycling avenue to their customers."***

6.3.2 Collection

The collection challenge is two-fold: ensuring sufficient and conveniently-located collection points, and determining whether containers can be collected together with other organic waste.

Currently, Hong Kong's O-PARK food waste treatment system does not collect from individual households. The system consists of two anaerobic digestion facilities: O-PARK 1, which has a 200 tonne/day capacity, and O-PARK 2, which is set to begin operations in 2022 with a 300 tonne/day capacity.[108] Composting takeout containers at scale would ideally utilise household-oriented collection services rather than, or in addition to, drop-off points at F&B operators.

If future organic waste treatment facilities can handle compostable packaging, the collection system must be adapted accordingly. If, for example, a composting facility is eventually constructed to operate in parallel with traditional waste systems, there may need to be separate collection streams depending on what can be accepted in each system. Furthermore, the practical placement of bins in public or private spaces must also be planned if composting systems are to be operated at scale.

Outside of Hong Kong, compostable packaging companies have successfully integrated their products with composting streams in municipalities where there is existing composting infrastructure. In Australia, compostable packaging company Biopak offers F&B operators that use their products the option to join a compost collection service that feeds into a network of municipal composting operators.[109]

6.3.3 Communication

In the UK, compostable packaging brand Vegware partnered with waste collectors and composting facilities to form collection programmes for F&B operators. The success of these programmes was largely dependent on the education and engagement with consumers to ensure that the packaging was properly separated from recyclable and general waste.[110]

"Composting is particularly sensitive to contamination. Consumer engagement is vital in ensuring the correct materials make it into the right bin and onwards to be accepted at the composting facility," confirms Vegware's Ms Brunton. ***"Delivering value-added services such as bespoke bin signage and tailored communications materials ensures our products can be truly composted after use."***

Education and communication requirements are not limited to instructions for consumers and F&B operators on how to dispose of compostable containers correctly. It is paramount that communication and education for F&B operators, especially those in procurement roles, include facts on actual compostability in Hong Kong — in terms of both available processing infrastructure and packaging characteristics.

Until public or private investors develop adequate collection and processing capacity, F&B operators and consumers need to be aware of the true fate of what may be perceived as more sustainable packaging: compostable packaging in a market without the necessary infrastructure will still end up in landfills.

Clarity on packaging characteristics is critical. Any facility operator will need to determine and communicate what product types can be accepted in their facility, and what compostable certifications will be required, to steer both container procurement practices and disposal behaviours. For consumers that opt for private composting networks, it is crucial for them to confirm that the composter offers the conditions required to break down their specific type of packaging.

Simultaneously, false claims about a packaging's compostability characteristics must be penalised. Under Hong Kong's Trade Descriptions Ordinance (Cap. 362), the practice of advertising false trade descriptions is prohibited.[111] The implementation challenge is two-fold, however: both labelling standards and technical standards are not available for the Hong Kong market. Inconsistent labelling causes confusion for F&B operators, consumers, and waste management operators.[112] Furthermore, there is no control over whether any compostability claims are truthful in Hong Kong, since there are no official standards that uniformly define the conditions required for packaging that is labelled 'compostable' or 'biodegradable' to actually break down in either commercial or at at-home composting facilities.[113]

7 REUSE SYSTEMS

FACILITATING REUSE AT THE COMMUNITY-LEVEL

7.1 How it works

Reuse systems broadly refer to the practice of eliminating single-use packaging and instead utilising containers that can be used for many lifecycles. While the BYO container practice is a type of reuse, we refer to a Reuse system as one where reusable containers are loaned to consumers and typically managed by a third party on a system level — as with shared bikes or library books. Durable, reusable substitutes for SFPs keep an SFP container out of the landfill with each use. Globally, converting 20% of all plastic packaging into reusable packaging is estimated to create a HKD 46.8 billion opportunity through savings in material, transport, and reprocessing costs alone.[114]

7.1.1 System description

The reuse system is logistically one of the more complex solution archetypes, because the SFP needs to move between various parties in the system. It allows customers to borrow containers for their takeout food or beverage and requires them to return the container after use. The return process can take shape in two primary forms: the customer returns it to a dedicated collection bin or point, or the container is picked up from the consumer at a pre-arranged time.

Used containers are cleaned (a) by the F&B operator, (b) at a centralised wash facility, or (c) at the site of one participating F&B operator on behalf of other participants. In the latter two models, the containers must be redistributed to participating points of sale for the next use cycle.

Reuse systems can vary on other dimensions, like the use of technology and financial incentives. Technology such as QR codes or Radio Frequency Identification (RFID), can facilitate the tracking and accountability of containers within the system.[115] Monetary incentives can be used to motivate customers to return containers within an allotted period, or to maximise use. Customers may also be charged subscription or use fees, which help finance the reuse system.

Reuse systems deploy a wide variety of material types such as stainless steel, silicone, glass, bamboo, and a range of plastic resins. Each material type has its own advantages and disadvantages with respect to the container's technical performance, marketability, affordability, and environmental impact (see non-exhaustive list provided by the Institute of Food Technologists[116] in Table 3). Ultimately, however, the choice of container material and design primarily depends on the requirements of the food or beverage that it caters to.

FIGURE 29

Schematic diagram of the reuse system

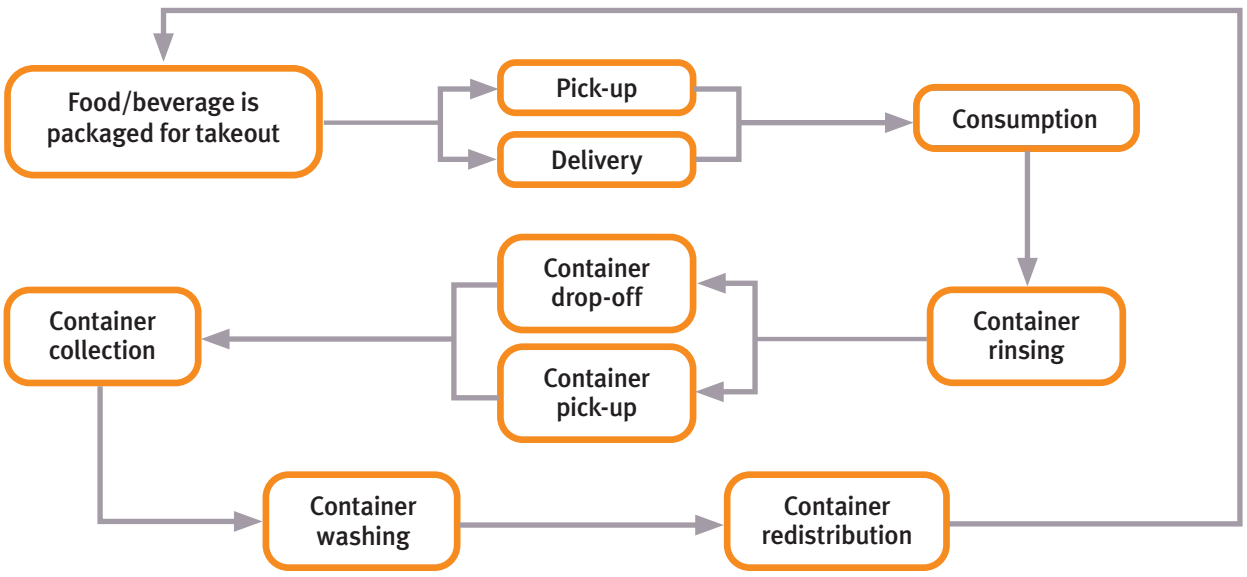


TABLE 3

Advantages and disadvantages of food packaging material types

Material	Product characteristics/food compatibility		Consumer/marketing issues		Environmental issues		Cost
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages	
Glass	• Impermeable to moisture and gases • Nonreactive (inert) • Withstands heat processing	• Brittle and breakable • Needs a separate closure	• Transparent: allows consumer to see product • Can be colored for light-sensitive products	• Poor portability: heavy and breakable • Relatively difficult to decorate	• Reusable • Recyclable • Often contains recyclable content	Heavy and bulky to transport	Low-cost material, but somewhat costly to transport
Aluminum	• Impermeable to moisture and gases • Resistant to corrosion • Withstands heat processing	• Cannot be welded • Limited structural strength	• Easy to decorate • Lightweight • Good portability • Not breakable	Limited shapes	• Recyclable • Lightweight • Economic incentive to recycle	• No disadvantages in rigid form • Separation difficulties in laminated form	Relatively high cost, but value encourages recycling
Tinplate	• Impermeable • Strong and formable • Resistant to corrosion • Withstands heat processing	Can react with foods; coating required	Easy to decorate	Typically requires a can opener to access product	• Recyclable • Magnetic, thus easily separated	Heavier than aluminum	Cheaper than tinplate
Tin-free steel	• Strong • Good resistance to corrosion • Withstands heat processing	• Difficult to weld, requires removal of coating • Less resistant to corrosion	Easy to decorate	Typically requires a can opener to access product	• Recyclable • Magnetic, thus easily separated	Heavier than aluminum	Cheaper than tinplate
Polyolefins	• Good moisture barrier • Strong • Resistant to chemicals	Poor gas barrier	Lightweight	Slight haze or translucency	Recyclable[a]	Easily recycled in semi-rigid	Low cost
Polyester	• Strong • Withstands hot filling • Good barrier properties		• High clarity • Shatter resistant		Recyclable[a]	Easily recycled in rigid form, but identification and separation more difficult for films	Low cost, but higher cost among plastics
Polyvinyl chloride	• Moldable • Resistant to chemicals		High clarity		Recyclable[a]	• Contains chlorine • Requires separating from other waste	Low cost
Polyvinylidene chloride	• High barrier to moisture and gases • Heat sealable • Withstands hot filling		Maintains product quality		Recyclable[a]	• Contains chlorine • Requires separating from other waste	Low cost, but higher cost among plastics
Polystyrene	Available in rigid, film, and foamed form	Poor barrier properties	Good clarity		Recyclable[a]	Requires separating from other waste	Low cost
Polyamide	• Strong • Good barrier properties				Recyclable[a]	Requires separating from other waste	Low cost, but higher cost among plastics
Ethylene vinyl alcohol	High barrier to gases and oils/fat	Low moisture barrier, moisture sensitive	Maintains product quality for oxygen-sensitive products		Recyclable[a]	Requires separating from other waste	Low cost when used as a thin film
Polylactic acid	• Biodegradable • Hydrolyzable				Recyclable[a,c]	Requires separating from other waste	Relatively high cost
Paper & paperboard	Very good strength-to-weight characteristics	• Poor barrier to light • Recycled content makes it unsuitable for food contact material	• Low-density materials • Easily decorated • Efficient, low-cost production	• Moisture sensitive, loses strength with increasing humidity • Tears easily	• Made from renewable resources • Recyclable[b]		Low cost
Laminates/ coextrusions	Properties can be tailored for product needs		Flexibility in design and characteristics		Often allows for source reduction	Layer separation is required	Relatively high cost, but cost-effective for purpose

a All thermoplastics are technically recyclable and are recycled at the production environment, which contributes to lower cost. As inexpenstive materials, post-consumer recycling competes with ease of separating and cleaning the materials.

b Recycled extensively for non-food product uses.

c Can be broken down to monomer level and reprocessed.

7.1.2 Reuse in Hong Kong

Globally, reusable container systems are still an emerging solution. In Hong Kong, a handful of small-scale pilots have trialled reuse systems for both food and beverage items (Box 8).

Insights from organisers of reuse system pilots highlight the various Hong Kong-specific considerations that narrow choices for specific system parameters. For many F&B outlets, space is highly limited and necessitates containers that can be compactly stacked, hence the continued use of EPS containers in many eateries.

Space is also an important consideration in the return process. The pick-up collection method requires several containers to fit in the delivery rider's motorbike storage at a time. On-foot delivery staff would be even more constrained in terms of how many containers they can return on one journey. If containers are dropped off by consumers at a collection bin, the bin must be able to store many containers at a time without taking up too much space in the restaurant or public space.

Unlike in most other cities, not all Hong Kong F&B outlets have their own dishwashing facilities.[121] Many eateries outsource to commercial wash kitchens because of space restrictions and the high labour costs of hiring dishwashers, which are high in demand and short in supply in Hong Kong.[122] The lack of dishwashing facilities both in restaurants and as dedicated commercial services poses another challenge to reuse systems in Hong Kong.

BOX 8: REUSE SYSTEMS IN HONG KONG

Cups. Muuse, a Singapore- and Hong Kong-based reusable coffee cup company, has been piloting a reusable coffee cup system in Hong Kong since November 2020. Across five coffee shops within the Taikoo Place commercial complex, the pilot currently has an average monthly uptake of about 850 uses. Since the summer of 2021, Circular City has been trialling a reusable cup system for hot and cold drinks in both Discovery Bay ferry terminals. In its 17th week, the trial saw an average of 200 uses per week.

Food containers. Several private and public sector trials are planned or under way. The Black Sheep Restaurant Group, which operates over 25 mid- to high-end restaurants of diverse cuisines, began piloting a reusable container programme in July 2021 to complement its in-house delivery food service. The delivery platform foodpanda aims to incentivise customers to bring their own cups and container for pick-up orders, and will trial a reusable packaging model for delivery orders for launch in 2022.[117]

The Hong Kong Government's Environmental Campaign Committee piloted a reusable lunch box service, *ben don go!*, over a 50-day period in summer of 2021.[118] The pilots ran in two locations: a Government office building in Wan Chai and the D-PARK shopping mall in Tsuen Wan. Users paid a HKD 20 deposit with their Octopus card and received a loaned food container for ordering takeout (Figure 30). Customers were refunded the deposit upon returning the container, without having to wash or rinse the container first. The container was then washed by an externally contracted washing company.

Events. In 2019, the EPD also launched a 'Reusable Tableware Lending Programme for Large-scale Events', offering free reusable tableware delivery, collection, and cleaning services for large-scale event organisers. Other reusable tableware initiatives are being trialled in different event settings, such as sporting events, music festivals, and banquets. We Use is one such tableware rental company that has been operating since 2015. It coordinates the delivery, on-site facilitation, collection, and washing of tableware in return for a rental and logistics fee.[119] Similarly, the Hong Kong Rugby Sevens purchased 250,000 reusable cups for Hong Kong Stadium in 2019 and hired the reusable tableware company BottLess to facilitate the off-site cleaning in commercial washing facilities.[120]

FIGURE 30

ben don go! Reusable food container pilot

Source: ben don go! Facebook page

7.2 2030 potential

We selected a reusable PP food container to evaluate the potential for the Reuse solution archetype. It is widely used in food container reuse systems around the world, such as InfinityBox (India), ReCircle (Switzerland), VYTAL (Germany, Austria, France) and GO Box (United States). Early-stage pilots of reusable systems in Hong Kong are also utilising PP containers.

7.2.1 Financial costs

Even a reuse system that runs with a scale and infrastructure that is highly optimised around each dimension of its design remains the most expensive solution archetype. Each container use costs approximately HKD 6.08 (Figure 31), which is more than double the cost of the next most expensive solution, the use and composting of compostable containers.

- The various transport costs (e.g., from the collection point to the commercial washing facility, or redistributing the clean containers to F&B outlets) are a large component (41%). These costs tend to be higher than for transportation in the Recycling or Composting solutions because the loading density is lower and the transport system requires customisation for purposes of hygiene, breakage prevention, and other quality control issues.

- Cleaning the container accounts for a further 41% of the cost when a third-party commercial washing facility is used. This includes the associated costs for labour, electricity, and water usage (see Appendix A for more detail).

- The container itself is more expensive to purchase than BYO containers. Costs are driven up by demands around optics and seamless functionality, which are higher than for consumer-owned containers. Moreover, containers in a reuse system are usually custom-ordered with a unique design and/or custom branding.

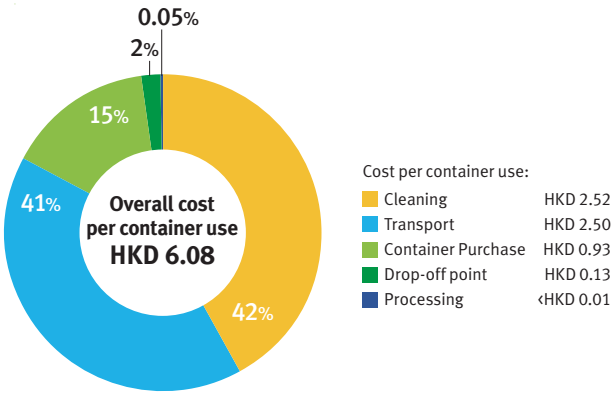
- The drop-off point cost only makes up 2% of the overall cost. It includes the initial set-up costs of purchasing the collection bin, as well as the cost to rent the bin space.

- The per-container cost for end-of-life collection and processing is comparatively small because both are shared amongst many containers.

FIGURE 31

Reuse system costs

(Advanced mobilisation scenario, 2030)



7.2.2 Water usage and carbon emissions

The reuse system is the best performer out of the four solution archetypes for both environmental impact variables analysed.

It uses the least amount of water per container use (see Figure 11). Unlike in the BYO and Recycling solution archetypes, containers in a reuse system are washed in a commercial dishwasher. Per container, a commercial dishwasher uses three times less water than handwashing does. Compared to domestic dishwashers, commercial dishwashers have larger capacity batches that are sanitised in shorter cycles at higher water temperatures.[123]

The reuse system also has a significantly lower GHG emission footprint compared to the other solutions — producing an estimated 6.6g of CO_2e per container use (see Figure 10). With many containers being grouped into each collection bin, transport load, and washing cycle, the impact produced by a single container is low. The emissions associated with the container production is also reduced due to the multiple uses of each container throughout its lifespan.

7.2.3 Container technical performance

Unlike single-use containers, reusable containers are built robustly for repeated use. This typically offers a higher heat-retention capacity compared to thinner-walled single-use containers. As with other containers, the reuse system's container may need to be leak-proof, particularly if the food is being delivered. This is achievable with reusable containers since there is a greater degree of customisation over the container design.

In the other solution archetypes, customers (BYO) and/or F&B operators (Recycling and Composting) may choose from a variety of container designs and select the one most suitable to a particular meal type or delivery model. Containers in a reuse pool, however, require more standardisation across all uses, for reasons of scale and logistics. Consequently, a single or limited set of designs must be able to handle a wide variety of foods. Due to its repeated use, the reusable container must be resistant to retaining odours, oils, and colour staining — no small task in Hong Kong with its range of local and international cuisines. This combined need for versatility and durability puts extraordinary demands on the technical characteristics of the container.

Other challenges may be easier to overcome. For example, if the container is opaque, operators may need to compensate for any perceived loss of aesthetics — as discussed with the compostable container. Another potential barrier identified by F&B operators is the loss of fill level indicators, but there are ample precedents for durable food service items that have such markers, e.g., beer glasses.

7.2.4 Demands on stakeholders

The Reuse system requires a sizeable shift from current practices on the part of consumers, F&B operators, collection systems, and treatment infrastructure alike.

Consumers are responsible for rinsing the loaned container and returning it in a timely manner, by arranging a pick-up time or seeking out a designated drop-off bin. While not all consumers have immediate access to washing facilities, a small survey of office workers in various commercial buildings shows that the vast majority (88%) have access to pantries with sinks in their workplace.[124] If consumers are allowed to rent multiple containers at a time, they must also have the adequate space to store the containers until they return them.

As with BYO containers, **F&B operators** may require a new set of standard operating procedures as well as staff training. Reusable cups and food containers are typically considerably less stackable than their single-use counterparts. Given that space is such a limiting factor in the Hong Kong market, F&B operators will likely require frequent deliveries of clean containers — more so than in geographies where operators have better access to on-site storage.

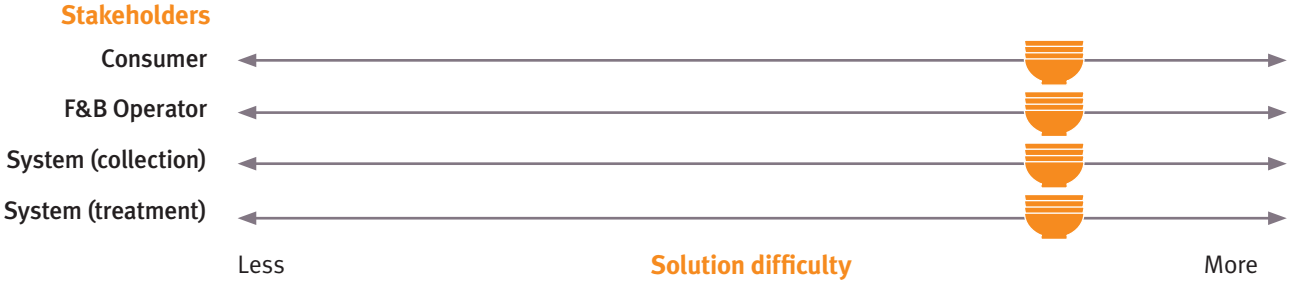
F&B outlets may also be container collection points or serve as cleaning stations if they possess washing facilities. This, too, will necessitate updates to standard operating procedures. Moreover, staff must be equipped to encourage and educate customers, and troubleshoot when needed.

The collection infrastructure is dependent on how consumers return the containers. Unless containers are picked up directly from the consumer, bins must be placed in locations that are convenient enough to encourage repeated use. The 'five-minute walk' range, equal to about 400 meters, has been suggested as the range in which a reuse system should design its collection point network.[125]

Collection bins may also attract pests or develop odours, especially in Hong Kong's subtropical climate. This necessitates a systematic and expedient collection system that operates with a daily frequency at a minimum. Some systems have used participating F&B outlets as return collection points, whereas others have worked with Government agencies or property developers to place bins in commonly-accessed public and commercial spaces.

FIGURE 32
Demands on stakeholders in the Reuse solution

The reuse system requires a sizeable shift from current practices on the part of consumers, F&B operators, collection systems, and treatment infrastructure alike.



In both cases, containers must be aggregated and brought to the washing facility on a regular basis to prevent the remaining food residue from attracting pests or developing excessive odours. Pick-up services facilitated by the collection operator also require an aggregation centre to store the used containers before they are sent to the washing facility.

The washing infrastructure poses a unique set of challenges to be addressed in the Reuse solution: facilities are lacking; those that exist struggle to survive; equipment is not suited for the variety of containers; and demands on washing performance are high.

As mentioned prior, one of the primary barriers to implementing reuse systems in Hong Kong is the lack of commercial washing infrastructure. For example, there are hardly any such facilities on Hong Kong Island, despite the high density of key business districts that may serve as ideal communities for reuse systems. The daily transportation to and from wash facilities off Hong Kong Island incurs a sizable cost barrier, particularly for reuse systems that are in their early stages of operation.

Furthermore, several centralised washing facilities have scaled down or closed altogether from 2020 onwards due to the economic impacts of the COVID-19 pandemic. Phoebe Leung, who manages circularity and waste diversion strategies at Swire Properties, explains that it is a chicken-and-egg situation. ***"Commercial wash kitchens find it uneconomical to offer their services if product volumes are too low, but it's not possible to achieve greater scales without these washing logistics,"*** she said.

Even with commercial washing facilities available, containers from the reuse system are not as easy to clean compared to regular dishware. ***"Commercial dishwashing machines are not always equipped to handle containers or tumblers of materials or shapes that vary from typical restaurant dishware such as plastic or melamine and porcelain plates, bowls, and cups,"*** describes Hannah Chung, who helped test and develop the ongoing Muuse reusable cup pilot.

Since containers may sit for several hours or days in collection bins before being washed, food or beverage residue becomes harder to remove. Depending on the level of soiling, containers may require a soaking stage prior to being run through the dishwasher. With consumers placing high demands on real and perceived hygiene, optics matter a lot. ***"It is a given that the cup needs to be clean, but it also must appear clean for customers to trust in the loaned cup system. This means that we had to pay extra to manually remove any water stains on our tumblers after they were run through the industrial dishwasher — even though these cups were technically already sanitised,"*** Ms Chung explains. Some F&B operators also choose not to outsource to commercial wash kitchens because the sanitisation procedure has yet to be regulated by the Government and may not meet the standards of the F&B operator.[126]

Coordination is critical. The reuse system requires a high level of system-wide coordination across various stakeholders. Operators of the reuse system must monitor the whereabouts of each container and its condition upon each use cycle. Some systems rely on customers to keep track of their containers by charging refundable deposits, which holds the consumer accountable. Other systems utilise technology by pairing QR-coded or RFID-tagged products with a smartphone app. While this approach alleviates the burden for accountability placed on consumers, it requires a higher input investment for initial development.

7.2.5 Impact on landfilling

If the reuse system can reach an optimised scale of operation by 2030, the solution is projected to eliminate 33% of the SFP containers on the market (see Figure 13). While this is the lowest projected full impact of the four solution archetypes, there are specific use-cases and segments within the market in which a reuse system would be highly effective (see Box 9).

7.3 Driving the Reuse solution

Reuse systems offer considerable potential to offset SFP waste, and produce the least environmental impacts out of the four solution systems. Of all solution archetypes, however, Reuse is the most nascent — globally, not just in Hong Kong. Moreover, there is no one-size-fits-all reuse model. Every successful application requires a significant amount of trial and error to tailor the components to its specific use-case. There is no existing, proven model that can be replicated for the Hong Kong market. These models need to be designed, more or less from scratch, for Hong Kong communities. This process necessitates multiple iterations on the system design to produce and apply insights on best practices. Hong Kong's early adopters, such as the Black Sheep Restaurant Group, are testing various phases of this iterative design process.

The reuse system's many layers of complexity make it considerably more costly to operate than the other solution archetypes. The implementation considerations listed below aim to drive down cost and improve stakeholders' overall acceptance and adoption.

Infrastructure. Cleaning costs can be optimised by improving commercial wash kitchens. More capacity is needed, and their ability to handle diverse dishware must be improved. At the moment, containers have to travel far to reach a wash kitchen and a lot of manual labour is required, driving up the cost.

System scale. Per-container transport costs can also be reduced if the system operated at a greater scale — thus establishing more efficient transport routes. Generally, the system costs will diminish as more users in an area participate in the programme. Support from district councils to scale up reuse pilots and accommodate washing facilities closer to F&B outlets could be instrumental in improving the cost competitiveness of reuse systems (further discussion on scaling provided in Chapter 8).

Product scale and customisation. There are various scale aspects that must be addressed and balanced. The development of containers that can last for more use cycles is crucial in driving down per-usage cost and reaping larger environmental benefits. It is also important to develop low-cost options for container customisation that do not negatively affect container longevity. This customisation should not negatively affect scaling up across a catchment area, nor the actual retention and reuse of containers in the system. Catchment-specific branding may be more flexible and scalable than branding referring to the specific F&B-operator (Figure 33). Event-specific branding may, however, increase the risk of consumers keeping containers as souvenirs — resulting in accelerated shrinkage of the container pool. Similarly, branding that includes a date may prevent event operators from carrying over the pool to the next season or year.[127]

Location. While reuse systems may be more complex to implement than other solutions, there are specific environments that lend well to facilitating reuse habits. Semi-closed systems, such as buildings, construction sites, or campuses, offer a catchment area and controlled environment where tenants, workers, or regular visitors can incorporate reusable systems into their regular routines more easily. For example, a cup of coffee from a kiosk in an office tower lobby can be returned to the same place at lunchtime or the end of the day. Distribution logistics for the containers, too, can be simplified when the system area is contained within specific boundaries. This is the case for the Muuse pilot in Taikoo Place, with five closely-located cafes.

Coordination. Reuse systems require coordination to connect participating stakeholders and facilitate trial iterations. Many of the parameters described in this chapter cannot be fully determined or fixed ahead of a new reuse scheme. The availability of dishware, pickup frequency, signage, and other forms of communication all should be fine-tuned and even overhauled to maximise F&B operator and consumer participation. Feedback from various users must be collected to drive further optimisation after the initial setup. As MIT Sloan professor Pierre Azoulay noted in a 2017 article on platform strategies, ***"[This] is, in some sense, one of the most ambitious ways of entering a market you could have, because it requires coordinating the behaviours of multiple parties that might not know each other, that might not even want to know each other. You're sort of this orchestra conductor, and as a result of being very ambitious, it also fails very often."*** [128] For this reason, too, semi-closed systems can be beneficial for reuse. As Dr. Lai, who oversees the Taikoo Place reusable cup programme for Swire Properties, points out, ***"Property developers and management companies can help reuse systems run smoothly by connecting F&B tenants, consumers, and logistics partners."***

FIGURE 33

Catchment-specific branding of reusables at a food court located in a Hong Kong mall

Even when all optimisation levers are pulled, the per-meal cost of a reuse system may never drop to the exceedingly low cost of disposables. While the Government's planned introduction of Municipal Solid Waste charging will bridge some of the gap, the reuse system will likely remain premium-priced. Unless the Government facilitates and even co-funds such systems at scale, this solution will likely remain limited to select catchment areas and applications where the property manager, F&B operators, or consumers are willing to pick up the bill for reasons of placemaking, quality of the consumption experience, or enhanced sustainability.

Following the analysis of each solution system's merits and challenges in Chapters 4–7, the next chapter discusses critical implementation dimensions.

8 SCALING UP SOLUTIONS

In a 2018 report on the opportunity for Reuse and BYO systems in Sydney's Central Business District, the authors caution that food outlets would likely try to manage BYO containers on an exception basis, if uptake was limited and growing slowly.[129] Anything that is managed as a concession rather than as the rule, however, does not offer a good basis for long-term sustainability and growth.

The key, then, is to scale any solution quickly. Growth in demand drives interest and investment on the supply side, while growth in supply drives convenience and normalisation.

This is the case for all aspects of solutions systems, from recycling bins to F&B operators' BYO container acceptance. In addition to the solution chapters' more comprehensive discussion of all that is needed for a solution to thrive, this chapter highlights some of the key aspects of facilitating this accelerated maturation for the four solutions analysed in this report.

8.1 Behavioural sciences offer food for thought

The behavioural sciences can offer clues for how to scale up the behaviours that are required to make each of the studied solutions work. It is worthwhile to review the most recent insights from a theoretical perspective before offering some examples of how to apply these insights and principles practically in the next sections.

Most studies, and hence many public and private interventions emphasise the role of values, norms, attitudes, intentions, and motivation in driving behaviours.[130] This is evident in the growing emphasis on environmental education in Hong Kong and across the world. The hope is that a better understanding of, for instance, the ecological and resource-driven imperative to recycle (*'our beaches are full of plastics, what a waste'*), will result in shifting intentions (*'I will recycle my drink bottles'*) as well as an actual behavioural shift (*individual recycles their drink bottles*).

However, while interventions based on so-called a*ttitude–behaviour models*[131] can be pragmatic and effective, people often fail to align their knowledge and internal motivations with sustainable actions. Even though individuals possess intrinsic motivation, they will not necessarily translate this into pro-environmental behaviours. Consumers may understand why recycling is necessary and become determined to recycle, but they may not actually change their behaviour.

Scientists believe these limitations can be overcome if we look at sustainable behaviours through a habit lens.[132] Habit theory lays out how habits matter in improving environmental outcomes: [133]

Behaviour is heavily reliant on automatic processes. If individuals can develop true recycling habits that rely on their 'impulsive system', rather than having to muster conviction and reasoned motivation every time a behaviour is called for, recycling behaviours should expand in terms of participation, frequency, and scope.

Social and physical contexts set boundary conditions for environmental behaviour. Contexts shape habits and cue action responses. For a habit to develop, the surrounding context must provide a possibility for that habit. Importantly, if such an environment is designed to make a sustainable behaviour (like bringing a reusable cup) the easiest option, that behaviour is likely to take shape regardless of the underlying attitudes or intentions of the individual.

Conversely, contexts that have shaped non-environmental habits for a long time can also overpower people's ability to act according to their new or existing environmental values and convictions. If everyone in the team or office throws their coffee cups in the rubbish bin, it is hard for an individual to change that habit, even after learning that cups collected in the dedicated recyclables bin will, in fact, get recycled in Hong Kong.

Our habits and past behaviour shape our values and self-identity. *Self-perception theory* argues that some of our attitudes and preferences may be determined through the interpretation of our past actions. In other words, an individual's repeated recycling behaviour might lead to adopting a more sustainability-oriented identity. Based on attitude–behaviour models, this in turn may stimulate further recycling behaviours: 'Because I see myself as 'green' based on my recycling of plastic drink bottles, I will start bringing my own coffee cup, as this is aligned with my values.' It can also act as a buffer against relapsing into former disposal habits when new, more sustainable practices are not yet fully anchored.

8.2 Scaling up Recycling

In Hong Kong, as in many other jurisdictions, there is an ongoing discussion around the causes of poor recycling outcomes. It could be argued that there is little point in expanding, refining, or upgrading recycling infrastructure if citizens display poor recycling behaviours and underutilise or abuse existing infrastructure. Others may argue that citizens will not increase recycling participation if the available infrastructure is not convenient, accessible, and trustworthy.

Behavioural science offers insights to address this chicken-and-egg argument through the right type of interventions. Based on Section 8.1, we conclude that both education and infrastructure are necessary to facilitate the behavioural changes that are required to obtain better recycling outcomes. The former helps in conveying values and developing attitudes, with the aim of prompting intent. The latter facilitates the transition from reflective (i.e., goal-oriented) to impulsive (i.e., cue-driven) behaviours — an absolute necessity when anchoring and scaling recycling practices.

The principles discussed in Section 8.1 also carry practical implications for improving Hong Kong's recycling of single-use foodservice containers (Table 4).

TABLE 4
Applying habit theory to SFP Recycling

Principle	Implications for the Recycling solution
Habitat architecture	Design the waste and recycling infrastructure to transform waste-related habits, making recycling an easier option than disposing to landfills. • Achieve this by developing a sufficiently dense network of all-plastic collection points. • Make sure these points are clean and accessible (suitably positioned both in- and outdoors, adequate signage, sufficient opening hours, and available capacity). Reinforce the physical environment with cues from the social environment. V Cycle's Eric Swinton offers this example: ***"An office environment is one setting where consumers are more readily educated, especially since colleagues end up encouraging one another."***
Consistency	Reinforce the formation of recycling habits by creating consistency in the look and feel of the collection points, as well as in the rules for usage (e.g., the scope of what is collected). ***"Communication surrounding clean recycling needs to be both memorable and consistent over time,"*** Mr Swinton suggests. Such consistency allows for Recycling habits to be carried across into all areas of life: home, work, school, leisure, and transport.
Undoing poor habits	Avoid appeals for behavioural change without context change. For example: simply relabelling a bin from 'any plastics' to 'plastic bottles' without changing location or form factor will not disrupt the context sufficiently to effectively change the habit.

8.3 Fostering BYO behaviours

The same principles can be applied to stimulate adoption of the BYO model. Here, too, the key imperative is habit formation. As long as behaviours need to be triggered by environmental values and convictions, we cannot anchor the behaviour as a habit. If we only rely on environmental values to trigger alternative waste disposal habits, BYO and other solutions will only be applied selectively. Just as with Recycling, the new practice must be the path of least resistance in order to reach scale amongst all consumers.

Table 5 shows how both consumers and F&B operators can leverage these insights to accelerate the adoption of BYO.

TABLE 5

Six strategies to build BYO habits[134]

Strategies	How F&B operators can apply this	How consumers can apply this
Create stable, supportive environments	Develop standard operating procedures to ensure the customer encounters a uniform staff response to BYO at every visit. If operating more than one location, offer consistency in terms of visual and oral communication across locations.	Start by taking one's own cup or container to regularly visited coffee shops or lunch places, and on days when it is known ahead of time what F&B site will be visited.
Leverage contexts: capitalise on disruptions of the status quo or piggyback onto an existing habit	Run a BYO reward campaign for those who are developing new F&B routines anyway, such as new university students or new arrivals to a neighbourhood. Give BYO a special focus when opening a new location.	Start BYO routines when moving house, jobs or making other changes to daily patterns. Attach BYO to an existing habit, such as a Friday afternoon bubble tea with the team.
Make it easy: reduce the number of decisions, number of steps, and perceived effort	Make the alternative less accessible or visible, such as by removing SFPs from prominent counter spaces. Provide clear and visible instructions around size, cleanliness, pricing etc., needed to facilitate BYO. Declare a regular day or time 'SFP-free' (e.g., one afternoon per week).	Pick one day a week as an initial BYO commitment. Make washing containers and placing them in an obvious, convenient location (e.g., next to house keys), part of daily routines.
Develop cues and rewards (reinforcement theory)	Give oral cues such as 'Did you bring a reusable cup/container today?' Offer discounts for BYO use.[135] Charge for SFP use.	Self-impose consequences, e.g., when forgetting to bring one's cup, drink office coffee, take extra time and use a ceramic cup on-site at the coffeeshop, or skip daily coffee entirely. Self-reward, e.g., saving money by collecting BYO discounts, or spending those savings on treats or on a nicer BYO cup.
Practice and repeat	Offer a BYO cup or container to use for free during a specified amount of time. Rely heavily on BYO (e.g., by deploying drinks fountains) in captive, high-use environments such as concerts, conferences or sports events.	Take BYO cups or containers to contained settings or periods where they will be used multiple times, such as schools, offices, camps, or conferences
Build meaning and motivation	While the business impact of loyalty cards is sometimes questioned,[136] use them to help consumers understand the impact of their new habits when rewarding BYO rather than consumption ('You've kept 12 cups out of landfills, well done! Your reward is a free coffee!'). This helps shape values and identities.	Remind oneself of the reasons for picking up this habit. Investigate whether behaviours can/should be replicated or extended to other areas. For example: 'Since using a BYO coffee cup makes me feel good about the impact I'm making, maybe I can start bringing my own food container too.'

8.4 Enabling Composting at scale

The habit-forming conditions set out in the previous sections are also valid for the consumer side of the Composting solution. For it to deliver on its potential, however, four further requirements must be met in other parts of the value chain. Functional yet compostable packaging must exist, and that packaging should be identifiable. Treatment facilities must exist, and it has to be possible to get the discarded packaging there in a cost-effective way.

Driving packaging innovation. The use of compostable packaging at scale necessitates the expansion of available products on the market. Their technical performance must be improved without resorting to solutions that require plastics or chemicals that compromise the health of factory workers, F&B staff, or consumers.

Communicating clearly. Packaging nomenclature and labelling should be consistent and unambiguous. Materials should be detailed correctly. For example, containers with a very thin layer of plastics should not be labelled as 'plastic-free', as can currently be found on the market. End-of-life claims must be specific; compostability claims should explicitly state whether the product is home-compostable or industrially compostable. Certification of such characteristics can help avoid misunderstandings, build confidence, and hence accelerate uptake.

Developing treatment infrastructure. For the highly significant impact potential of Composting to become a reality, new infrastructure must be put in place or existing facilities must be upgraded. The infrastructure roadmap set out in the latest Waste Blueprint must be detailed and, where necessary, modified to ensure that facilities can receive pre-specified compostable packaging types.

Expanding and improving collection infrastructure. As some restaurants turn to compostable packaging, most of these items will be discarded outside F&B facilities: at home, in the office, and on the go. It is therefore paramount to expand the scope of the organic waste collection programmes beyond F&B sites, food processors, and wet markets. Households, building managers, and consumers on-the-go must also gain access to convenient collection facilities.

The Government's proposed ban on plastic single-use foodservice packaging, RDPT, will affect the first dimension described above, *packaging design*. F&B operators that cannot or will not fully switch to reusables may initially rely on the non-plastic single-use solutions already in the market. The demand for packaging products that meet Hong Kong-specific needs in terms of oil- and heat resistance or format functionality (e.g., to keep wontons separate from soup) will drive innovation from local and international manufacturers.

Until a ban or similar regulation is in place, Hong Kong's many small-scale restaurants may not be able to drive such innovation on their own. Aggregating that collective buying power could help expedite the process. For example, ***"foodpanda has been working directly with a compostable packaging supplier to provide plastic-free, bagasse packaging to our partner restaurants,"*** says Woody Chan, foodpanda's CSR & Sustainability Manager. ***"The main challenge is getting the cost to be fully competitive with current plastic or EPS containers."***

Bagasse is a relative newcomer to the SFP materials market. Its growing uptake warrants a further look at the material's sourcing, in terms of both quantity and quality. The sugarcane industry (a source of bagasse feedstock) is the second largest agro-industry in the world, suggesting that bagasse feedstock supplies are ample.[137] Dr. Meike Sauerwein, from the Hong Kong University of Science and Technology's Division of Environment and Sustainability, cautions: ***"The alternative use of bagasse, such as for bio-ethanol production, cement production, or structural particleboards, may increase the price of bagasse food containers or limit the available supply, especially if these alternative uses are higher in value."***

Given that bagasse is derived from an agricultural feedstock, there could be unaddressed health concerns associated with pesticide residues that contribute to the toxicity of the bagasse product — especially those that are used for food and beverage packaging. While the European Union, for example, strictly regulates such residues in food and feed products, food contact materials are currently more of a grey area. ***"The use of pesticides and other chemicals during the production and processing of bioplastics and other plant-based materials is a concern,"*** notes Dr. Shauhrat S. Chopra, whose research has focused on the life cycle assessments (LCAs) for emerging materials and technologies at the City University of Hong Kong. ***"It must be brought to the attention of the public as well as the manufacturers of the alternative plastic materials."***

A ban on certain types of containers might affect *product communication*. F&B operators, keen to remain compliant, will want to assure that the products they use are effectively plastic-free. If frivolous product claims lead to fines or the revoking of licensing due to packaging non-compliance, F&B operators may start requiring more formalised, harmonised, or even certified product content statements. Dominic Dubois, Corporate Responsibility and Sustainability Officer at The Hong Kong and Shanghai Hotels, illustrates this: ***"As we continue to***

search for sustainable packaging alternatives, we come across a myriad of 'eco-friendly' solutions. Yet, even with a dedicated sustainability team, we continue being challenged when comparing environmental benefits, costs, practicality and ease-of-use, and fostering guest behaviour. With so many new materials and alternatives, it is imperative that brands make informed decisions."

The search for transparently-marketed compostable packaging might prove even harder for small- and medium-sized F&B operations, who might lack access to specialised information or additional manpower to devote to this topic. ***"Currently, information on sustainable or alternative packaging is scattered across the market and difficult for F&B operators to access, particularly if they are small-scale,"*** confirms Aditi Deodhar, CEO and Co-Founder of Planeteers. Creating a centralised directory of 'sustainable' packaging suppliers available to F&B operators in Hong Kong, with details on the type of solution or the certifications it possesses (e.g., compostable, FSC-certified), would be a productive first step to address this issue.

It is unlikely that the Government's proposed ban would immediately lead to *better communication around actual compostability*. Because the RDPT ban would focus on the nature of the materials rather than on its end-of-life performance, compostability claims are irrelevant to F&B compliance and may not receive much scrutiny from F&B operators or Government agencies.

Unaccompanied, the proposed ban also cannot address *collection and treatment infrastructure* needs: compliance with the ban does not require the packaging or the packaging user to meet any end-of-life considerations and hence the use of non-plastic packaging in itself may not necessarily drive demand for composting solutions. Separate, additional policy tools are needed, such as a more explicit translation of the Blueprint's zero landfill target into a detailed masterplan for all of Hong Kong's organic waste.

8.5 Accelerating Reuse systems

Reuse systems are, in essence, platforms. Much like online platforms, the success of such systems is largely — but not solely — driven by the number of participants. Depending on the level of centralisation of the Reuse system, those participants include either users (in a decentralised, operator-based system) or both users and suppliers (in a centralised system with multiple operators). Thought needs to be given as to how to increase participation in both of these operation models. Here, too, the behavioural sciences can offer valuable insights.

As MIT Sloan Professor Catherine Tucker expressed in a 2017 article on platform strategies, rather than having a *feature* mindset, one needs to have a *seeding* mindset.[138] Platforms require three key steps to increase both supplier and user rates: exposing many people to a new idea like Reuse, encouraging them to give it serious consideration, and convincing them to try it out. Since Reuse systems involve a material and handling component — as opposed to the simple mouse-clicks required in many online platforms — these platforms require even more thought as to lowering the threshold for participant experimentation.

Garnering the attention of potential new participants is only the beginning. Kate Daly, the Managing Director of the Center for the Circular Economy at Closed Loop Partners, explains: ***"It is important to consider not just the customer's first use of a reusable, which might be driven by curiosity, the search for sustainable alternatives, or a reward programme, but also what incentivises them to continue opting out of single-use."*** Customer retention and frequent usage requires not only convenience, but also trust. There is a lot to learn from digital markets in this regard. The early days of eBay, Uber, and AirBnB, experts point out, were riddled with fraud and abuse that the platform operators did not interfere with, let alone offer protections against.[139] In the meantime, mechanisms such as supplier and user vetting, disagreement resolution, buyer protection plans, and even compensation, have increased trust, and hence, participation of both new and existing suppliers and users.

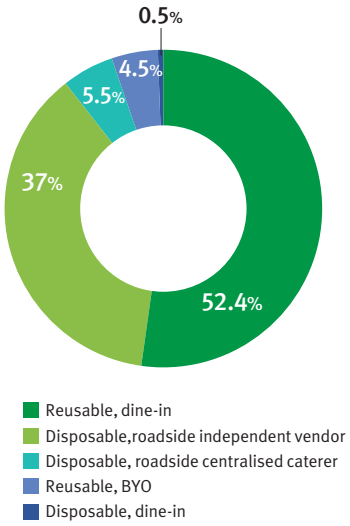
Overcoming this lack of trust comes down to creating a new way for F&B operators and customers to interact and grow comfortable with the addition of a third partner, the platform operator. MIT Sloan's Azoulay elaborates: ***"There are a lot of non-pricing rules involved. Who can join, what kind of information you get to have on what's happening on the other side, how open the data that's generated by your platform is to others, how easy it is for others to play with that data. All of that needs to be decided, and it needs to be decided very early on."*** [140]

BOX 9: TAKEOUT AT CONSTRUCTION SITES

Hong Kong's construction sites are an example of a semi-closed system that would lend itself well to the use of reusable or compostable containers. In a 2019 survey of construction sites that engaged a total of 10,224 construction workers, over half of the surveyed workers (52%) were reported to eat their lunches at on-site or nearby restaurants and canteens, which use reusable tableware (Figure 34).[141] Not all construction sites have such amenities nearby. In these cases, construction workers who do not bring their own lunches buy pre-packed lunchboxes from roadside food vendors that are either centralised caterers or small, independent vendors. These lunches are typically sold in EPS or PP containers and come with disposable cutlery and plastic bags.

FIGURE 34

Use of disposable vs. reusable lunch containers at Hong Kong construction sites



At some large, multi-year construction sites, canteens are set up on-site. These establishments serve with reusable tableware and have washing facilities operated by a licensed commercial canteen vendor. However, the licensing process takes close to one year, and the canteens often need to operate for a timeframe of one or two years before seeing sufficient returns on investment.[142]

To overcome these challenges and make on-site canteens a more accessible option for construction sites, some construction contractors have suggested a modular approach to canteen operations — pre-constructed modules fitted with a kitchen and serving area that would be attached to on-site water and electricity supplies[143]. Though this proposal has yet to be trialled, it serves as a potential reuse system that is well-suited to short-term or small construction sites.

Given that Hong Kong already has a city-wide plastics collection system in operation (see Chapter 4), the containers used for construction site lunches can already be collected and washed on-site at the end of the lunch break and sent for recycling. However, additional personnel would need to be deployed to facilitate this process.

A construction site offers a real opportunity to operate a reusable container programme or an on-site composting machine because only one point of collection is needed. This eliminates the need to arrange for costly and complex collection and redistribution across various locations.

FIGURE 35

Hong Kong construction workers on lunch break[144]

We compared the costs of implementing recyclable, compostable, or loaned reusable container solutions at a construction site. The costs were calculated to cater to 273 construction workers, which is the average workforce size based on a survey of Hong Kong sites.[145] The costs were composed of a) initial investment costs for infrastructure or container procurement; and b) daily running costs to facilitate the solution system (Table 6). Further system assumptions and cost details are in Appendix B.

Table 7 provides a summary of the system costs incurred when implementing reusable, compostable, or recyclable container systems at an average Hong Kong construction site.

- The daily and per-meal cost numbers include both running and the initial investment cost, averaged over the period of a year (excluding Sundays and public holidays).
- No capital expenditure for maintenance was included.
- Charges under the upcoming MSW charging scheme were not included as the Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Bill 2018 had not been passed yet by the Legislative Council at the time of the analysis. MSW charging could, however, work towards levelling the playing field for alternatives to simple disposal in general waste. This requires two conditions: for construction sites to be mandated to keep food and packaging waste separate from the construction waste stream, and for site operators to pass on the benefit of avoided MSW charges to the workers.

TABLE 6

Solution systems for an average-sized Hong Kong construction site

Solution System	Initial investment	Daily operation
Reuse	• Two 200L foamboard collection bins • 273 reusable PP containers, custom-ordered	• Transport of containers to washing facility • Container washing (third-party facility)
Compost	• 240L plastic collection bin • Composter (TidyPlanet A700 model, 100L daily capacity)	• Electricity and labour to run the composter • 273 compostable containers (500mL)
Recycle	• 240L plastic collection bin • Three 24L plastic crates for container rinsing	• Transport of containers to recycling facility • Labour to facilitate rinsing and transport • Water and dishwashing detergent for rinsing • 273 polypropylene containers (500mL)

BOX 9: TAKEOUT IN CONSTRUCTION SITES (continued)

TABLE 7

System costs for SFP alternatives at Hong Kong construction sites (HKD)

Solution System	Initial investment	Running cost, daily	Running cost, per meal	Daily cost, averaged out over 1 year	Per-meal cost averaged out over 1 year
Reuse	18,030.00	1,365.00	5.00	1,425.91	5.22
Compost	157,600.00	897.95	3.29	1,430.38	5.24
Recycle	680.34	657.24	2.41	659.54	2.42

Consistent with the results of the cost analysis conducted for these solutions in prior chapters, the Recycling solution was the cheapest. Both initial investment costs and daily running costs were the lowest for recycling, largely because the containers are sent off-site to be recycled. Any costs associated with the recycling process itself, such as gate fees,[146] were not included. This market is highly fluid, and the scope of this project did not allow for the additional analysis that would be required to arrive at reasonable assumptions on this cost. Even if such costs were included, however, Recycling would likely remain the cheapest solution system for construction sites.

For the Composting solution, the upfront investment costs for the composter are the biggest barrier for implementation. The use of an on-site composter allows for compostable containers to be used without dependency on industrial composting facilities, which has previously been discussed as the main barrier to implementing this solution. Spread over a year, the per-container costs resemble that of the Reuse system (both of which are twice as costly as the Recycle solution).

The construction site must, however, have adequate space and access to water and electricity outlets to operate the composter. Site management procedures must also include measures to keep hygine up and rodents and other pests at bay.

A Reuse system also requires a higher upfront investment cost compared to the Recycle system, but it is significantly lower than the composter costs. However, due to the labour and logistics involved with washing the containers for each daily use cycle, the Reuse system has the highest daily running costs.

Our holistic analysis of the four solution archetypes showed that reusable container systems have the lowest environmental footprints per container use, both from a water use and greenhouse gas emissions perspective. When applied to a semi-closed system like a construction site, the logistical complexities associated with this system are greatly alleviated.

This leaves cost as the only but important barrier to implementing what is otherwise the optimal solution, particularly from an environmental sustainability angle. These additional costs need not be solely shouldered by construction workers: construction companies could choose to make the initial investment and the Government could offer subsidies.

8.6 A note on peripherals

While peripheral single-use takeout packaging items (e.g., cutlery, condiment cups, napkins, bags) have not been included in the scope of this study, they still must be addressed in the broader effort to eliminate SFP waste. Based on the number of takeout meals consumed by Hongkongers in 2019, an estimated 9.8 billion sets of disposable cutlery were used that year.[147] This does not include the usage of single-use peripherals for many on-site dining occasions. The latter include the many fast casual operators (e.g., burger restaurants) that rely entirely on single-use foodservice items, from cutlery to containers. It also counts a considerable number of restaurants that serve with reusable plates, bowls and cups, and nevertheless use single-use peripherals such as chop sticks, spoons, and straws (Figure 36).

The initiatives in Box 10 illustrate some options F&B operators have available to eliminate SFP peripherals.

FIGURE 36
Using both reusable and single-use foodservice items

BOX 10: ELIMINATING SINGLE-USE FOODSERVICE PERIPHERALS IN HONG KONG

On-site. Hong Kong's Fairwood restaurant group has completely removed SFP from their premises in all but two of their restaurants. While many customers see individually wrapped SFP as a convenient way to address hygiene concerns, Fairwood — which cleans all its foodservice items to strict legal and corporate standards — tackles this concern differently. It now makes unlimited hot water available so customers can rinse the provided utensils to satisfy their individual hygiene standards — as is customary in many restaurants around Hong Kong.

Delivery. Efforts have also been made to reduce single-use cutlery waste in Hong Kong's food delivery industry. In 2020, WWF established the Plastic ACTion initiative (PACT) in efforts to reduce single-use plastic cutlery and packaging.[148] At its launch, delivery platforms foodpanda and Deliveroo — which collectively comprise over 90% of Hong Kong's food delivery industry — pledged to engage with network restaurants and consumers to 'remove all unsustainable packaging by 2025'.[149] As a result, both platforms added a disposable cutlery opt-in button to their user interfaces and now only provide cutlery to orders that explicitly specify it. Since the implementation of the 'opt-in' feature, foodpanda has seen 50% of its customers forgo disposable cutlery in their orders, saving up to 32 million sets of cutlery over two years.[150]

Takeaway. SaladStop!'s 'Borrow Tree' initiative lets customers contribute and borrow carrier bags free of charge, via a prominently placed bag hanger in each outlet. Similar to reusable container systems, the 'Borrow Tree' simultaneously reduces single-use consumption and increases the life cycle of each product.[151] F&B staff can be instructed to ask customers whether they need a bag, utensils, a napkin, etc. rather than offering it automatically.

Government. EPD's 2018-19 'Plastic-Free Takeaway, Use Reusable Tableware' campaign in collaboration with about 700 eateries and canteens across Hong Kong encouraged the community to reduce the use of disposable utensils. Earlier in 2018, EPD's 'Plastic-Free Takeaway, Use Reusable Tableware' campaign focused on fast food kiosks and restaurants at and near public beaches to avoid plastic straws, utensils, and bags.

Replacing disposable peripherals with reusable ones can pay off. Rethink Disposable, a California-based organisation focused on helping organisations transition from disposables to reusables, tracked the costs of disposables to the F&B operators it works with. Cups and containers constituted the biggest cost factor. Depending on the cuisine or meal style, however, peripherals accounted for a quarter to a third of the cost of disposables.[152]

The next chapter offers a realistic and effective action plan for each stakeholder group. This can help prioritise the roll-out of different solutions according to their applicability and potential to create meaningful impacts.

9 A NEW APPROACH FOR HONG KONG

9.1 Conclusion

What would need to happen for the solutions' potential to be captured and the steady stream of SFP heading to the landfill to be stemmed?

No solution is completely straightforward to implement, and all require commitment and effort from multiple parties. As with many, if not most, solutions based in the circular economy, system-level thinking and coordination is required — extending and integrating upstream (the supply chain), consumption/usage, and downstream (end-of-life).

We propose an approach that can be summarised as follows:

Tackle all single-use foodservice packaging, not just plastics. Use a portfolio of tools. Start now.

9.1.1 Tackle all single-use foodservice packaging

Importantly, our analysis and recommendations are not restricted to plastic items only. In contrast, the Government's proposals for the Regulation of Disposable Plastic Tableware primarily aim to shift the food and beverage (F&B) sector away from plastics. This raises multiple concerns.

Trying to eliminate just one type of SFP will inevitably cause a shift to other SFPs. As a result, no contribution will be made to the waste reduction goals set out in the Government's latest Waste Blueprint. Moreover, without collection and processing infrastructure in place, the use of plant-based materials could reduce our reliance on fossil resources, but would not contribute to keeping containers out of landfills , in line with the Blueprint's *zero landfill* goal.

Littering concerns will also not be addressed, since littering behaviours do not subside with the use of other materials. On the contrary, materials that are deemed 'natural' and biodegradable may mislead consumers to think they can be left behind in parks and on beaches without further consequences.

This is linked to another concern: no SFP type is completely without environmental impact. Resources are always required, and strong demands on performance may be met through undesirable solutions like thin plastic layers or PFAS chemicals. Moreover, F&B operators and their suppliers might shift to even less sustainable solutions, such as paper foil bags. Not only are such bags resource-intensive to produce, but there is also currently no technology available to recycle them.

For all these reasons, Government policy as well as initiatives by F&B operators and NGOs should focus on all single-use foodservice packaging rather than just those made of plastics.

9.1.2 Use a portfolio of tools

Our analysis shows that Hong Kong will have to tap into more than one solution. None of the four solution types we investigated can cover the entire load of cups and containers in scope, and none can fit the bill for all F&B operators or all customer groups.

In all scenarios, the Recycling and BYO archetypes show the most promise. Since these solutions are applicable and accessible to a large segment of the Hong Kong market, they have the potential to keep the largest amount of SFP out of landfills. Importantly, both solutions can be dialled up and down relatively easily. This means that they can be encouraged and stimulated for the containers on today's market, without creating a barrier to the future implementation of more complex solutions like Composting or Reuse.

While Reuse systems show the highest potential from an environmental impact perspective, the solution is hindered by its comparatively high cost and logistical demands that make it feasible for only certain segments of the Hong Kong market. Because of its very strong environmental performance, there is value in identifying the locations and configurations where the Reuse solution could be more readily implemented.

With the right collection and processing infrastructure in place and scaled up, Composting could displace a large share of SFP volumes. Without it, however, Composting remains an unsuitable solution. And even with such infrastructure in place, compostable containers would still produce the most greenhouse gas emissions (per use) compared to other solution types.

Since hot food containers make up the large majority of single-use foodservice packaging on the Hong Kong market, applying solutions to address this segment offers a stronger potential impact than addressing hot/cold beverage containers or cold food containers. Therefore, to maximise the number of containers that can be kept from landfills, our analysis shows that applying Recycling and BYO containers to address hot food containers is the most optimal single solution application.

This diversified approach needs to be reflected in Government policies. Policy support is necessary because no environmentally-beneficial solution can currently compete with the cost and convenience of SFP use and disposal. However, the proposed ban — while administratively efficient — cannot be the sole tool for dealing with Hong Kong's SFP challenges. Education and engagement with consumers and hospitality stakeholders, incentives for reusable container usage, regulation of harmful packaging materials, and investments in waste management infrastructure need to be part of the policy agenda. Moreover, firm decisions on the infrastructure trajectory must be made soon if Composting and Reuse are to play a meaningful role in the future.

9.1.3 Start now

Hong Kong should not wait for a hard-hitting piece of legislation that will take time to build consensus around. The work to keep SFP waste out of landfills must start today — this is both necessary and possible.

It is necessary

Hong Kong is drowning in waste from takeout meals and beverages. Not only are Hongkongers some of the region's highest spenders on prepared food and eating out, but they also have a strong propensity towards takeout meals. Takeout habits only intensified with the onset of COVID-19, with some Hong Kong hospitality groups and delivery platforms experiencing up to 50% more takeout orders in 2020, the first year of pandemic-related lockdowns and restrictions. Takeout and delivered meals are more packaging-intense than dine-in meals, but many meals consumed on-site are also served in disposable foodservice packaging.

By weight, plastic and other SFP items make a relatively small contribution to Hong Kong's massive per capita problem. This is, however, due to their density, which is very low in comparison to the far denser food waste that dominates Hong Kong's municipal solid waste. Moreover, these packaging items are persistent in the litter that plagues Hong Kong's streets, beaches, and country parks. In addition to the potential damage to animals, ecosystems and landscapes, SFP littering results in direct and indirect costs. Litter removal is more time-consuming and costly than collecting waste or recyclables from bins. Recyclables that are littered also result in foregone materials revenue. Furthermore, the collected litter must be disposed of as general waste, which means that it will incur an MSW disposal fee. Finally, storm drain impairment by litter and the resultant risk of flood damage carry an indirect but measurable cost.[153]

Importantly, regardless of the size of Hong Kong's plastic waste problem, and regardless of the specific contribution of SFP to the overall waste problem, these volumes do add up and so does their risk to our oceans. The PEW Charitable Trusts found in their 2020 analysis that delaying implementation by five years could result in 80 million metric tonnes more plastic stock in the ocean by 2040. They also pointed out that delays in implementing the system interventions could take the world off its critical path towards a long-term goal of near-zero leakage.[154]

It is possible

The Government's proposed RDPT timeline is for a full ban to be implemented by 2025. This timeline is suitable for addressing certain elements of the proposed scope, such as EPS containers or most on-site uses of SFP. However, the afforded time for a full-scale ban may not be sufficient to develop sustainable, affordable, and functional alternatives to the plastic containers currently on the market. As a result, F&B operators may feel compelled to switch to suboptimal solutions that inadvertently enhance the city's waste issue in different ways.

On the other hand, the volume of single-use foodservice items going to landfills could already be meaningfully reduced before 2025 if, for example, broad outreach and support for Recycling were to be initiated right away. Similarly, individual F&B operators or their property managers could be educated on the benefits and feasibility of BYO and Reuse to complement their current single-use practices. The timeline for an abrupt regulatory tool like a ban, and with a scope as broad as the proposed RDPT, requires more considerations surrounding what can and cannot be implemented with desirable outcomes.

9.2 Recommendations

To facilitate and accelerate the development and ultimately the realisation of the landfill diversion potential, we need to take action in a number of areas without delay, while also designing future strategy and actions. To this end, we formulated a set of recommendations across three time horizons. We organised them by stakeholder group for ease of use but, again, each solution requires extensive coordination amongst these groups.

The **hospitality industry** needs to lead by example: instead of waiting for policy change. F&B operators can encourage widespread shifts in consumption and takeout habits by improving consumer communication, adjusting SOPs to accommodate reusable containers, and carefully evaluating the full lifecycle of any single-use products offered by their establishments.

Government and policymakers are required to intervene since no environmentally beneficial solution archetype can fully compete with the SFP-laden status quo in terms of cost and convenience. In July 2021, the EPD took the possibility of introducing a ban on single-use plastic tableware to the public. The identified solutions require further policy support, such as education and engagement with consumers and hospitality stakeholders, incentives for reusable container usage, regulation of harmful packaging materials, and investments in waste management infrastructure.

The individual, daily choices that citizens and households make can collectively instigate a societal shift away from disposal and landfills. Consumers should opt for reusable containers whenever possible and recycle single-use products if the infrastructure is in place. It is also important for households to signal their interest in systemic adjustments and infrastructure upgrades to Government and hospitality stakeholders.

HOSPITALITY INDUSTRY: DITCH THE DISPOSABLES!

Short-term	Mid-term	Long-term
For any on-site consumption, encourage guests to choose available reusable options.	Investigate the business case for on-site reusables. Consider shared services like external wash kitchens.	Cut out single-use takeout packaging altogether for on-site use and use it judiciously for takeout applications.
For takeout consumption, • Allow and encourage customers to bring their own containers wherever possible. Train staff and adjust SOPs as needed. • If reusable/BYO options are not (yet) feasible, exclusively use containers that are readily recyclable in the Hong Kong system and educate customers on why, how, and where to recycle the containers.	For takeout consumption, • If existing channels prove to be ineffective for the SFP materials offered, offer support for dedicated recycling channels (e.g., placing a collection bin, organising back-hauling with suppliers, giving communications support) • Consider joining a centralised reuse scheme if available; several ones may need to be tried out to ensure best fit with the operations and the client base. • Consider switching to compostable containers if the customer base has access to a composting pathway (e.g., where home composting is an option).	
Train staff and use customer nudging to maximise the effectiveness of BYO, Reuse, and Recycling programmes.		

POLICYMAKERS AND GOVERNMENT: DRIVE THE CHANGE!

Short-term	Short-/Mid-term	Mid-/Long-term
Provide information to consumers about environmental and health challenges related to the use of plastic and other single-use takeout packaging, and about their alternatives.	Enact legislation to regulate SFPs, e.g., • Narrowly defined ban (e.g., on expanded polystyrene), with mitigating/transition measures for small F&B operators. • Producer Responsibility Scheme for all other single-use takeout packaging, not just plastic. Differentiation between plastic packaging and more sustainable alternatives could be achieved through fee modulation (e.g., higher fees for plastic items). • A prohibition on PFAS in all food contact materials (including fibre-based ones) in shops, restaurants, and their associated supply chains to ensure both their primary use and subsequent reuse, recycling, and/or composting are safe.	Develop and/or support infrastructure for centralised Reuse schemes: • Offer attractive leases for centralised washing facilities • Provide convenient locations for collection bins
Encourage consumers to avoid the unnecessary use of any disposable food packaging and favour reusable containers wherever appropriate, in order to lower their exposure to PFAS and minimise environmental impacts.		
Provide information to F&B operators, caterers, and those procuring their services about alternatives to and options for single-use takeout packaging.		Develop and/or support infrastructure for composting: • Develop a masterplan and roadmap for all organics material in Hong Kong • If compostable packaging is a sustainable alternative that the Government accepts under its proposed disposable plastic tableware ban, consider filling in some of the required treatment capacity with anaerobic digestion equipped for handling compostable containers, or with composting infrastructure • Expand organics collection programme to make it accessible for households. Depending on the organics treatment infrastructure portfolio, create dedicated channels for organic waste, or have them go through the existing 'purple bin' organic waste channel.
Encourage F&B operators to voluntarily reduce and eliminate PFAS in all food contact materials in their shops/ restaurants and supply chain.		
Make sustainable takeout packaging part and parcel of Government procurement procedures — at a minimum for their own catering, but possibly/increasingly as part of qualifying conditions for contracts and funding proposals as well.	Improve collection infrastructure for recyclable single-use foodservice packaging. This must consist of a convenient network of collection points, adequate service contracts, sustainable funding, and substantial citizen education.	
Provide incentives for parties procuring catering services to opt for more sustainable options. An existing example is the subsidies provided to schools for organising on-campus food preparation to avoid single-use takeout packaging.		

CITIZENS AND HOUSEHOLDS: EAT WITHOUT WASTE!

Short-term	Short-/Mid-term (if centralised reuse systems are being developed in Hong Kong)	Mid-/Long-term (if composting collection and treatment infrastructure is developed in Hong Kong)
For any meals enjoyed outside of the home, consume them on-site as much as possible to avoid any need to package the food and/or beverage. This usually also benefits the quality of both the meal and the experience.	Use reusable options when available, instead of accepting single-use takeout packaging. Consumers may wish to adopt such habits first for those uses where they find reusable containers most convenient, e.g., first for their frequent hot drinks, and and then for food at a later stage.	Keep compostable food containers along with food waste separate and dispose of waste food and containers through dedicated channels rather than through general waste streams.
If on-site consumption is not an option, consider bringing your own reusable cup or food container.	Encourage F&B outlets to participate in such reuse schemes.	Offices and residential property management companies can facilitate this by providing appropriate bins and signage and contracting private collectors to increase convenience for employees and tenants.
Employers can further facilitate this by: • Making reusable takeout cups and containers available to employees. • Making washing facilities (sinks ideally with hot water) available so that employees do not have to carry dirty containers home to wash them.		
If bringing a reusable container is not an option, but the single-use containers provided by the F&B outlet are recyclable, rinse the container so it can be disposed of in a suitable recycling channel.		
Signal support for regulation of every type of single-use foodservice packaging. Even after Government's public consultation is closed, feedback channels remain open and useful — the Government does not anticipate this scheme coming into force before 2025.		

APPENDIX A: METHODOLOGY

A.1 Quantifying single-use foodservice packaging consumption in Hong Kong

The annual quantity of SFP put on the market was derived from data on food and beverage packaging usage by Hong Kong consumers. We chose to use pre-pandemic datasets, which are more complete and stable. Where available, 2019 data was used. In a few cases, we used 2018 data — this is clearly indicated.

A.1.1 Single-use food containers

One estimate for SFP associated with takeout foods was produced from survey data collected in 2019 by the NGO Greeners Action, prior to the onset of the COVID-19 pandemic. The survey gathered detailed statistics on the frequency of takeout consumption and amount of single-use food containers used by Hong Kong consumers on a weekly basis. A second estimate for takeout food SFP was calculated from a market report by Nielsen on Hong Kong consumers, which provided data on the average number of weekly takeout orders in 2019.

Whenever possible, the input parameters and assumptions for the initial baseline estimates were validated by cross-referencing with distributors, food and beverage (F&B) operations managers, and first-hand data collection in the Hong Kong market. Examples of such parameters include the number of SFP containers used in each meal, and were derived from anecdotal surveys and interviews of local F&B stakeholders.

A.1.2 Single-use cups

Takeout beverage consumption, namely for coffee, tea, and dessert drinks, was estimated through the use of consumer survey data for both Hong Kong and neighbouring markets (see Appendix B). These values were further segmented by estimating proportions of hot and cold beverages, which are typically served in different types of takeout cups (further details on assumptions and parameters in Appendix B).

A.1.3 Limitations

Consumption patterns in Hong Kong differ from other markets where SFP research has been extensively conducted, such as in the United States or European Union. Expanded polystyrene (EPS), for instance, is far more prevalent in Hong Kong compared to other more economically developed countries (MEDCs). Hong Kong's local cuisine and meal preferences skew much more heavily toward hot food such as noodles, soups, or stir-fried dishes, rather than to cold foods such as pastries, sandwiches, and salads. For these reasons, we acknowledge the limitations to deriving numbers on SFP usage in Hong Kong from internationally sourced data. We have taken steps to utilise locally-specific data whenever possible, or at least verify the suitability of non-local data sources with local market experts.

Though our study portrays SFP consumption patterns between 2018-2019, the considerable impact of the ongoing COVID-19 pandemic on F&B takeout and delivery must be acknowledged. Many early findings, both anecdotal and empirical, have noted the increase in single-use plastics used as a result of city-wide lockdowns that restrict typical dining habits and increase the frequency of ordering takeout and delivery food.[155] Very few of these distribution systems have non-single-use options in place, contributing to a large increase in total SFP use from 2020 onwards. During the majority of the pandemic up to the time of writing, travellers arriving in Hong Kong have been subjected to 7–21-day quarantine procedures, mostly in designated hotel facilities. All the meals provided for hotel quarantine guests come in single-use containers, further amplifying the amount of SFPs used at present.

A.1.4 2030 extrapolation

The baseline number of SFPs put on the market was extrapolated to the 2030 Hong Kong population size.[156] It is established by Engel's Law that households spend a smaller percentage of their total income on food as incomes rise.[157] Above a certain GDP per capita threshold reached by higher-income countries, this proportion remains relatively unchanged with ~7-12% of household income spent on food. With a GDP per capita of HKD 380,000, Hong Kong is classified as high-income economy. The per-capita share of income spent on food in Hong Kong is comparable to countries such as Canada, the UK, and Germany.[158] Having already surpassed the threshold that ties household spending on food to income, Hong Kong's rate of food consumption will likely remain unchanged by future economic development. Therefore, extrapolation for 2030 SFP consumption was based solely from population projections rather than economic factors.

After the COVID-19 pandemic subsides, changes in consumer behaviour and dining habits may become permanent in many cases. However, we chose not to include any potential long-term impacts in the extrapolation because the pandemic is still ongoing and there is insufficient analysis available to

make reasonable assumptions. In the assessment of solution pathways, we also did not take into account potentially lasting impacts on the standards for hygiene that consumers place on the F&B industry.

A.2 Costs and environmental impacts

To compare the financial costs and environmental impacts associated with each of the four solution archetypes, these were calculated for each on a per-container unit and per-tonne basis. Time and team resources did not allow us to conduct a full life cycle assessment (LCA). The calculations did not include every component of the product lifecycle (i.e., they were not cradle-to-cradle). Rather, relevant data from existing LCAs and market analyses were applied to produce evaluations of the financial and environmental impacts for the key components of each system. This allowed for the prioritisation of components that highlighted insightful differences across the systems.

The four solution archetypes were evaluated under a theoretical scenario in which all were operating at scale with the relevant infrastructure in place, regardless of whether they are available today. For solution systems such as composting, in which the end-of-life infrastructure has yet to be established in Hong Kong, the theoretical removal of this barrier allows for fair comparison with the other solution systems. It was also assumed that consumer behaviour is optimised and conducive to the operation of each system (e.g., consumers will clean out a plastic container prior to recycling). However, the assessment was still conducted under the parameters of present-day technology with respect to the availability of processing technology, container materials, and other areas of potential future innovation.

The primary environmental impacts of the four systems were quantified through two metrics: greenhouse gas (GHG) emissions and water usage. The GHG emissions metric represents the emissions associated with each lifecycle stage, measured in kilograms of CO_2 equivalent (kg CO_2e).
The main impact drivers included in this analysis, when applicable, were container production, container purchase, post-use collection, transport to the end-of-life (EOL) facility, and EOL processing (i.e., recycling or composting). The analysis did not include cost or environmental impact drivers that were uniform across all systems, including the status quo, because the assessment's main purpose is the identification of key differences between the four solution systems. Food preparation, for example, was not included in the impact analysis, nor were shipping and transport associated with container production and purchase or the transportation and use(s) of the processed material (e.g., recycled plastic flakes or organic compost). For solution archetypes in which the containers were reusable over multiple cycles, the impacts generated from the non-iterative phases of the lifecycle (e.g., container production, EOL processing) were divided by the number of uses.

The compostable containers were assumed to be made of bagasse, a fibrous material produced as a by-product of sugarcane processing. Many LCAs conducted for waste by-products such as bagasse do not include the emissions or water usage associated with the agricultural phase, attributing a 'burden-free' system boundary.[159] Based on this common practice, the environmental burdens from the agricultural stage of sugarcane were not included in our analysis.

The analysis focused on hot food containers for several reasons. Firstly, hot food containers make up the majority of SFPs placed on the market (69% by our baseline estimate). They also generate greater environmental impacts and unit costs compared to other SFP types. Each food container requires more material and resources for production compared to beverage cups, posing larger costs and environmental impacts throughout the supply chain. However, these differences between container types are largely negligible on a broader scale, making hot food containers a suitable SFP representative for this analytical segment.

Even within a narrowed scope of hot food containers, a large number of configurations are possible when delivering an alternative solution. Within the reuse or BYO scenarios, for example, the container may be made from different materials: silicone, stainless steel, PP, glass, etc. The type of container material in turn affects the environmental impacts and costs associated with its production phase. A specific configuration was therefore chosen for each solution system to represent a realistic model for their application in the Hong Kong market.

The degree to which other configurations might impact the costs or environmental impacts was considered through sensitivity analyses for key system components. To compare the four solution archetypes with the status quo, a base case scenario was chosen: sending a single-use PP container to the landfill. Details of each solution configuration are below in Table 8, with the underlying assumptions and parameters described in Appendix B.

TABLE 8

The system components of recycling, BYO, composting, and reuse systems

System Component	Recycle	BYO	Compost	Reuse	Landfill
Production	CO_2e	CO_2e	CO_2e + water	CO_2e	CO_2e
Purchase	$	$	$	$	$
Container cleaning	$ + CO_2e + water	$ + CO_2e + water		$ + CO_2e + water	
Drop-off point*	$		$	$	
Transport to EOL facility	$ + CO_2e	$ + CO_2e	$ + CO_2e	$ + CO_2e	$ + CO_2e
EOL processing	$ + CO_2e + water	$ + CO_2e + water	$ + CO_2e + water	$ + CO_2e + water	$ + CO_2e

* Costs reflect the initial investment (i.e., the purchase of the collection bin) and do not include long-term capital expenditures for repair and replacement.

$ = cost (HKD), CO_2e = GWP ($kgCO_2e$), water = water usage (L)

A.3 Feasibility assessment

Each solution archetype was assessed for the technical performance of the container and the necessary implementation effort within the context of different SFP categories.

First, data and insights were collected through interviews with various stakeholders: solution providers for each solution archetype (e.g., companies running reusable container models or manufacturing compostable containers), local F&B businesses, and waste facility managers, as well as through a literature review. Next, this information was distilled into empirical scores for each metric.

A total of 20 different SFP replacement solutions were evaluated in this analysis: each of the four solution archetypes (Recycling, Bring-Your-Own, Composting, and Reuse systems) was applied to five different SFP categories: polypropylene (PP) hot food containers, EPS hot food containers, PP cold food containers, PET cold beverage containers, and plastic-lined paper cups for hot beverages.

The technical performance of each packaging type considers the aspects of design or function that may affect the operational performance of the container. For this analysis, a list of technical performance limitations — any features the replacement solution lacks compared to the SFP container it is replacing — was compiled for each replacement solution. For instance, replacing a PP hot food container with a compostable container may not be viable when the container must be leak-proof (e.g., when serving soups). Each limitation was translated in an estimated proportion of the market that would be excluded from implementing the solution. The total technical performance score for each SFP replacement solution thus indicates the portion of the market available to implement the solution — after accounting for technical limitations to the user experience. Some solutions, such as Recycling, entail no restrictions from a technical performance perspective — its score of 100% indicates that this solution could be applied to all meals within the scope of that SFP category.

The implementation effort required to deviate from current practice reflects the various behavioural, infrastructural, and operational challenges imposed on key stakeholders: consumers, F&B businesses, collection/logistics systems, and treatment facilities. For each stakeholder, the 20 SFP replacement solutions received a score that reflects the level of effort required from that particular stakeholder group to implement that solution. A low score indicates a large effort for the stakeholder to implement the solution, while a high score indicates relatively little effort. A score of 0, therefore, would indicate total infeasibility, while a score of 100 indicates a complete lack of friction because there is no change from current practice. For each solution archetype, the resulting score across stakeholder groups indicates its ease in terms of deviating from current practice.

A.4 Scenario projection

Three implementation scenarios were calculated: limited mobilisation (LM), moderate mobilisation (MM) and advanced mobilisation (AM). These scenarios represent different levels of commitment towards solving the SFP challenge for Hong Kong. They describe sets of conditions in the target year 2030. In the MM and AM scenarios, it was assumed that technical performance limitations would lessen with a greater uptake of solutions. This could take shape in the form of more BYO container types made available for consumers or the reduction in compostable container prices with greater market scale. Therefore, LM *technical performance* scores were increased by 10 and 20 percentage points in the MM and AM scenarios, respectively.

Improvements associated with the aggressiveness of the scenario, however, could not be applied in similar, standardised fashion, to the *implementation effort analysis*. The nuances of mobilisation thresholds across different stakeholder groups would not allow for this. Instead, each of the 20 SFP replacement solutions were individually considered and scored, for each of the three mobilisation scenarios.

A.5 Full landfill diversion potential

The impact that each solution archetype could feasibly produce was calculated by multiplying the baseline quantity of each type of SFP, such as 'hot food containers' or 'cold drink containers', with the respective technical performance score and implementation effort score. This produced a value indicating the amount of SFP in that category that could feasibly be replaced by the particular solution archetype. For instance, one solution type involves the replacement of single-use PP hot food containers with a reusable container system, which under a LM scenario has a technical feasibility score of 30% and an implementation effort score of 20%. Given our 2030 estimate of ~2.9 million hot food containers placed on the market, we estimate the full potential of replacing single-use PP hot food containers to be ~174,000 (= 2,900,000 x 0.3 x 0.2) hot food containers kept out of the landfill annually.

APPENDIX B: SYSTEM ASSUMPTIONS AND PARAMETERS

TABLE 9

Baseline SFP consumption: assumptions and parameters

Calculation component	Description	Value	Unit	Notes and sources
Takeout food consumption	Hong Kong population	7,520,800	people	Hong Kong's 2019 population, reported by the HK Census and Statistics Department (2019)
	Hong Kong population (above age 15)	6,654,600	people	Hong Kong's 2019 population, reported by the HK Census and Statistics Department (2019)
	Frequency of takeout in HK, per individual	3.31	times/ week	Reported by Nielson Hong Kong (2019). 'Takeout' hereon refers to both self-pickup and delivery.
	Average number of containers used per takeout meal (hot food only)	2.4	containers	Assumes that 40% of takeout meals consist of 3 containers (e.g. 1 box, 1 soup bowl, 1 drink) and 60% consist of 2 containers (e.g. 2 main meal bowls)
	Proportion of takeout meals that is hot	0.9		Assumption, validated by interviews of industry stakeholders
	Average number of containers used per takeout meal (cold food only)	1	containers	Assumption, validated by interviews of industry stakeholders
	Number of weekly takeout meals in Hong Kong	27,100,000	takeout meals/ week	Reported by Greeners Action (2019)
Takeout beverage consumption	Annual coffee consumption outside the home	731,100,000	cups/yr	Estimate 1 - derived from US and UK consumer behavior, reported by BBC (2013)
	Annual per capita coffee consumption outside the home	150	cups/yr	Estimate 2 - derived from HK consumer data, reported by the South China Morning Post (2013)
	Proportion of coffee that is consumed takeout (not on-site)	0.75		Estimate from anecdotal surveying of HK consumers and coffee shops
	Proportion of coffee that is hot	0.80		Assumption derived from anecdotal survey of HK consumers
	Annual bubble tea consumption	239,565,600	cups/yr	Estimate derived from bubble tea consumption in neighboring markets (Singapore, Vietnam, Malaysia)
	Proportion of bubble tea that is cold	0.90		Assumption derived from anecdotal survey of HK consumers
2030 projection	Hong Kong population (2030)	7,920,100	people	Hong Kong's 2030 population projection, reported by the HK Census and Statistics Department (2020)
Takeaway food consumption (by sales channel)	Number of off-premise meals: miscellaneous	63,411,100	meals/yr	Estimated from HK gov restaurant sales data, reported by the HK Census and Statistics Department (2019)
	Number of off-premise meals: construction sites	16,312,300	meals/yr	Estimated from an ADMCF survey data on HK construction sites, scaled to the active workforce size of approx. 70,000
	Average meal price: Chinese restaurant	60.00	HKD	Estimated from HK cost of living data
	Average meal price: non-Chinese restaurant	90.00	HKD	Estimated from HK cost of living data
	Average meal price: fast food	40.00	HKD	Estimated from HK cost of living data
	Average meal price: miscellaneous	50.00	HKD	Estimated from HK cost of living data

TABLE 10

Cost and environmental impacts: system assumptions and parameters

Lever	Description	Value	Unit	Notes and sources
Recycle	Container size	500	mL	Single-use, clear polypropylene container
Recycle	Container price	0.31	HKD	Averaged from HK wholesale market and Taobao
Recycle	Container weight	0.02	kg	Averaged from HK wholesale market and Taobao
Recycle	Emissions to produce a single-use PP container	0.11	J	Gallego-Schmid 2019
Recycle/BYO	Handwashing: water used (hot)	5.6	L	Stamminger 2011
Recycle/BYO/Reuse	Handwashing: cost of water	0.0042	HKD/L	HK Water Supplies Department
Recycle/BYO	Emission factor to heat water	65,438	$kgCO_2e/TJ$	Gas-heated water, HK (Towngas) – source = HK 2050 is Now
All	Collection cost – labour	2,400.00	HKD	Labour cost per pickup, derived from DWW Appendix 3-1
All	Collection cost – rent	288.00	HKD	Rent cost per pickup, derived from DWW Appendix 3-1
Recycle/BYO	Recycling compactor truck	16	tonnes	Assumed capacity of a recycling compator truck in HK
Recycle/BYO	Volume to weight conversion for mixed plastic containers, #3-#7	25.7	lb/cubic yard	EPA 2016
All	Freight vehicle fuel efficiency	14.29	L/100km	HK 2050 is Now
All	Emission factor for mobile combustion of diesel	2.614	$kgCO_2e/L$	HK EPD Table 2-1
All	Transport distance to EOL processing facility (including collection route)	57	km	DWW Appendix 3-1
All	Fuel cost for transport to EOL facility	132.36	HKD	Derived from HK Shell diesel fuel costs
Recycle/BYO/Reuse	Water usage for recycling PP	1.03	L/kg	APR 2018, pg. 22
Recycle/BYO/Reuse	Energy usage for recycling PP	0.53	kWh/kg	APR 2018, pg. 22
Recycle/BYO/Reuse	Operating cost for recycling plastic solid waste	200	USD/tonne	Genc et al. 2019
Landfill	Operating cost for HK landfill	432,000,000	HKD/yr	HK EPD
Landfill	Landfill transport costs	355,000,000	HKD/yr	HKD EPD
Landfill	Transport emissions per tonne of MSW hauled in HK	1.1	$kgCO_2e$	Woon et al. 2013
BYO	Container size	500	mL	
BYO	Container price	27.57	HKD	Averaged from reusable PP, glass, and silicon containers
BYO	Container weight	0.22	kg	Averaged from reusable PP, glass, and silicon containers
BYO/Reuse	Emissions to produce a reusable PP container	0.223	$kgCO_2e$	Gallego-Schmid 2019. Used China emission factor for electricity, source – ⇢
BYO	Uses per container lifestime	50		Accorsi et al. 2013
Compost	Container size	550	mL	Averaged from product specifications from two main compostable container providers in HK
Compost	Container price	2.70	HKD	Averaged from product specifications from two main compostable container providers in HK
Compost	Container weight	0.023	kg	Averaged from product specifications from two main compostable container providers in HK
Compost	Emissions to produce a compostable container	0.176	$kgCO_2e$	Derived from Harnoto 2013
Compost	Water to produce a compostable container	36	L	Derived from Harnoto 2013
Compost	Volume of HK Gov food waste collection bin	240	L	
Compost	Number of food waste bins collected per truckload			Estimated from standard recycling collection trucks in HK
Compost	Daily disposal of food waste in HK	3,353	tonnes	HKGov (pg1)
Compost	Volume to weight factor for food waste	463	lb/cubic yard	EPA 2016
Compost	Proportion of food waste bin consists of compostable containers	0.059		Estimated from HK food waste generation in relation to takeout box consumption
Compost	Emissions to compost one tonne of food waste	0.062	$kgCO_2e$	Derived from Harnoto 2013
Compost	Water usage to commercially compost one compostable container	1.16	L	Derived from household food waste composting in Lundie 2005
Compost	Operating cost for commercial composting one tonne of food waste	35	USD/short ton	District of Columbia Dpt. of Public Works 2017

Cost and environmental impacts: system assumptions and parameters (continued)

Lever	Description	Value	Unit	Notes and sources
Reuse	Container size	550	mL	Averaged from various PP reusable containers
Reuse	Container price	60.00	HKD	Based on quote from HK-based reusable container logistics company – for a PP reusable container
Reuse	Container weight	0.118	kg	Averaged from various PP reusable containers
Reuse	Handwashing: water used (cold)	1.75	L	Calculated from 15 seconds of rinsing under a 7L/min flow rate (mid-level efficiency)
Reuse	Commercial bin setup and collection system (per container)	63.33	HKD	Averaged from upper and lower limits of quote from HK-based reusable container logistics company
Reuse	Commercial dishwashing water usage	1.7	L/rack	Averaged from a small and large capacity hood-type dishwasher commonly used by commercial wash kitchens in HK
Reuse	Commercial dishwashing energy consumption	0.0725	kW/L	Averaged from a small and large capacity hood-type dishwasher commonly used by commercial wash kitchens in HK
Reuse	Additional handwashing water usage (hot)	2.8	L	Commercial dishwashing is followed by manual dishwashing to ensure cleanliness in HK reuse systems, same emission factor used as recycle/BYO handwashing
Reuse	Commercial dishwashing cost	13.50	HKD	Based on quote from HK-based reusable container logistics company – for a PP reusable container
Reuse	Transport distance to commercial washing facility	22	km	Includes redistribution route and average cross-harbor distance in HK
Reuse	Number of return crates containing used reusables per pickup load	400	crates	Estimated from a 5.5 ton, mid-sized freight truck with a crate size of 40x30x20cm
Reuse	Number of reusable containers per crate	24	containers/ crate	Assumes that the container dimension is 19x13x6cm and that the height of each container is reduced by 50% when they are stacked in crates
Reuse	Uses per container lifestime	64		Averaged from 3 sources:
All	Lifespan of a plastic collection bin	10	years	City of San Diego – 10yrs being the lower limit

TABLE 11
Construction site case study: system assumptions and parameters

Solution Type	Item / system component	Value	Unit	Description
All	Containers used daily	273.00	Container per day	Based on surveys of lunch consumption at eight construction sites in 2019
Recycling	Container cost	0.32	HKD per container	500mL clear PP container, cost averaged from wholesale market (bulk purchase)
	Bin cost	350.00	HKD	70L stainless steel bin that fits approx. 1.07 tonnes mixed plastics (#3-7)
	Rinsing bin cost	26.78	HKD	24L plastic crate, cost averaged from local suppliers
	Labour cost	320.00	HKD per day	Labour for collection and transport to recycling facility, assuming an 8hr workday with a wage of HKD40/hr
	Transport cost	252.00	HKD per day	Transport from site to recycling facility (one trip daily), excluding labour
	Water cost	0.43	HKD per day	Water used to wash containers on-site. Assumes each bin is filled with 20L water with a water cost of 7.11/m^3 at the construction site.
	Detergent cost	0.18	HKD per day	Industrial 50L detergent = CNY25, HKD30.43. Each bin needs 100mL soap.
Composting	Container cost	2.70	HKD per container	550mL container, averaged from two main compostable container providers in Hong Kong
	Bin cost	600.00	HKD	240L plastic cart bin that fits ~66kg of organic waste
	Composter cost	157,000.00	HKD	TidyPlanet A700 food waste composter (100L per day), which has a suitable capacity and conditions for breaking down the compostable containers
	Electricity cost	0.85	HKD per day	Based on the electricity consumption of the composter and assumes a 1.057HKD/kWh electricity cost
	Labour cost	160.00	HKD per day	Labour for container collection and composter operation, assume 4hrs total with a wage of HKD40/hr
Reuse	Collection bin cost	550.00	HKD	200L foamboard bin that fits four crates each (96 containers/ bin)
	Washing cost	2.50	HKD per container	Includes labour, obtained from optimised industry estimate
	Transport cost	2.50	HKD per container	Includes labour, obtained from optimised industry estimate
	Container cost	60.00	HKD per container	550mL container with printed logo (bulk custom purchase)

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