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Circularity Assessment of Hong Kong

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About BEC

Business Environment Council Limited (“BEC”) is an independent, charitable membership organisation, established by the business sector in Hong Kong. Since its establishment in 1992, BEC has been at the forefront of promoting environmental excellence by advocating the uptake of clean technologies and practices which reduce waste, conserve resources, prevent pollution and improve corporate environmental and social responsibility. BEC offers sustainable solutions and professional services covering advisory, research, assessment, training and award programs for government, business and the community, thus enabling environmental protection and contributing to the transition to a low carbon economy.

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EXECUTIVE SUMMARY

Cities are critical to the circular economy, as rising levels of urbanisation and economic growth has led to greater carbon emissions and resource use in these areas. In Hong Kong, the waste disposal rate has continued to grow in the past 5 years, while resource recovery rate has remained consistently low. Recent events like the global pandemic has further burdened the city's waste management system with an unprecedented disposal of single-use items. Globally, circular economy is becoming more recognised as a solution to facilitate better resource utilisation and waste reduction. It is also championed to be able to address cross-cutting issues, including climate change, energy and transport. As such, it is time for Hong Kong to better integrate and embed circular economy principles into the city, in order to stimulate long-term sustainable growth and regenerate the environment.

City-level circular economy policies around the world



Studies, white papers and roadmaps

Municipal governments may commission or partner up with consultants, non-profit organisations, universities or think tanks for research support to produce studies that assesses, conceptualises and plans circularity within the city

Some cities work with the wider public to co-create knowledge on the topic of circularity

Many governments release a roadmap or strategy that details the city's vision of circularity, targets and policy responses



Legislation and guidelines on waste management, tenders, city planning and contracts

Current resource management requirements in many cities are gradually being tightened (e.g. introduction of mandatory sorting; ban on single-use items etc.)

Circular guidelines for tenders, city planning and contracts are released, which specifies for leaner construction, building with recycled materials etc.



Financial incentives

Funding and land or office leases below market rate are offered to businesses working on circular economy



Non-financial incentives

Local, regional and international networks or platforms are established to facilitate knowledge transfer, co-creation of solutions and sharing of products among stakeholders with different areas of expertise

Some programmes offered by local governments provide advisory services and partnership opportunities for local businesses working on circular economy

Incubators, living labs and pilot parks are created to build clusters of like-minded entrepreneurs working on circular economy



Circular economy-related technologies and facilities

New technologies such as smart recycling bins and related facilities are introduced in some cities

Policy recommendations for Hong Kong

Recommendations

Details



Government leadership

1. Introduce a city-wide action plan or roadmap on circular economy

Formulate a roadmap with a clear vision, measurable targets, critical milestones and supporting policies or initiatives to achieve circular economy

2. Take a holistic approach to achieving circular economy
Move away from current piecemeal approach, and integrate clear circular principles across government functions and policies, as well as embed them across government departments



Financial incentives

1. Urge for the implementation of the municipal solid waste charging scheme

2. Provide more funding to the circular economy and resource recovery industry to increase employment opportunities
3. Provide financial support to companies working on circular economy projects to encourage trials and innovation



Non-financial support

-
1. Introduce regulations, standards and guidelines related to recycling to complement government leadership and financial incentives
Such as extending the producer responsibility scheme into other waste streams
 2. Introduce regulations, standards and guidelines specifically related to design, repair, reuse, refurbishment and remanufacturing
Such as introducing requirements on the use of recycled materials in products and buildings; developing eco-packaging regulations; integrating circular principles into construction and demolition and city planning; providing health and safety standards for the use of recycled or alternative materials etc.
 3. Educate the wider public on circular economy and proper sorting and recycling
Teach the general public and relevant stakeholders along the resource value chain on the importance of circular economy. Inform the wider public on the proper method to wash and sort waste to minimise contamination among recyclables
 4. Re-examine existing regulations and consider how new circular businesses can operate legally and in parallel with other businesses in the city



Collaboration with other regions

-
1. Explore avenues of collaboration with the Guangdong-Hong Kong-Macao Greater Bay Area
Examine the possibility for greater policy coordination, such as the removal of regulatory barriers; consensus on the types of materials or recyclables to be collected and traded; and the streamlining of cross-border waste delivery processes. Though sensible from a resource-based

perspective, it may be controversial given Hong Kong's current social-political climate



Information
collection and
analysis

1. Collect data relevant to circular economy

Gather data with the list of indicators compiled in this report (see Section 3) to measure, track and assess the city's progress towards circular economy. Analyse the information and publish them into useful studies to inform the city's next steps to circularity



Green finance

1. Financial regulators and institutions can incorporate circular economy concepts into risk assessment and modelling

2. Regulators can standardise definitions and metrics on circular activities and heighten the need for proper and greater disclosure among the private sector

3. Incorporate more circularity concepts and metrics into existing frameworks, such as the Task Force on Climate-related Financial Disclosure

Why should businesses care about circular economy?

Businesses play a key role in accelerating the transition to a circular economy. Accenture estimates that applying circular economy principles could represent a USD\$4.5 trillion global growth opportunity by 2030.¹ Adopting a circular business model can bring multiple potential benefits to businesses (see Figure 1).

¹ McGuinness, M. (2015). *The Circular Economy Could Unlock \$4.5 trillion of Economic Growth, Finds New Book by Accenture*. Accenture. Retrieved from <https://newsroom.accenture.com/news/the-circular-economy-could-unlock-4-5-trillion-of-economic-growth-finds-new-book-by-accenture.htm>

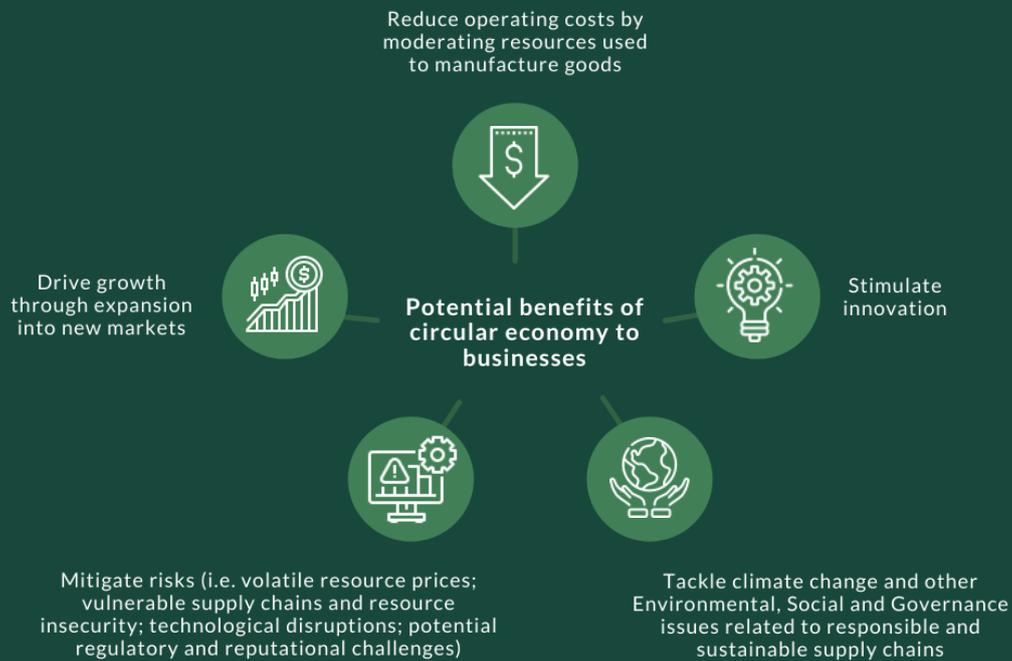


Figure 1: Potential benefits of circular economy to businesses

To begin their transition to circularity, businesses should identify and assess material flows within company boundaries, their resource efficiency, as well as their risks from operating with a linear economy model. They also need to examine the potential opportunities within the context of their businesses and operations to better understand how they can optimise and enhance their structures and systems. This can better enable businesses to maximise and reap the benefits that come with operating in a circular manner.

1. Background

Cities are critical to the circular economy. Increasing urbanisation and economic growth gives rise to growing levels of carbon emissions and resource use. It is estimated that by 2030, around 60% of the world's population will live in cities, which accounts for 70% of global carbon emissions and over 60% of resource use.²

In Hong Kong, waste continues to be a pressing issue that causes significant environmental impact, economic challenges and social issues. Hong Kong's waste disposal rate has continued to grow over the last 5 years, while resource recovery rate has remained consistently low. Recent events like the global pandemic has caused an upsurge in the disposal of single-use items, further burdening the city's waste management systems. While enhanced waste management strategies remain instrumental to tackle the city's waste issue, there has been a recent growing support for Hong Kong to transition from a linear to a circular economy, in order to better utilise resources and reduce waste. circular economy is also championed to be able to address cross-cutting issues, including climate change, energy and transport (which will be discussed throughout the report); stimulate sustainable growth; and regenerate the environment.

To transform Hong Kong's economy and move away from a linear, take-make-waste system, it is first important to understand the city's state of circularity through city-wide data collected from indicators. Cities, including Hong Kong, have conventionally relied on resource-based indicators based on the linear economy system to assess material flows, focusing primarily on reductions in landfill and incineration rates; increase in recycling rates; trade in recyclable materials and so on. However, in order to assess a city's circularity, more holistic indicators are needed to consider different aspects of circularity in an economy, such as examining a city's use of recyclable materials, budget allocated to developing circular innovation etc., in addition to conventional resource-based indicators.

This report will qualitatively evaluate Hong Kong's circularity against a set of city-level circular economy-related indicators taken from institutional, academic and municipal documents, which are further screened and identified as important and relevant to Hong Kong by local industry practitioners in a questionnaire conducted by BEC. Suggestions for a city-level circularity assessment framework and recommendations to accelerate Hong Kong's transition to a circular economy will also be highlighted in the report. This report aims to provide policymakers and industry practitioners an overview of the current state of Hong Kong's resource management system, as well as a summary of the gaps and opportunities identified to achieve circularity.

² United Nations. (n.d.) *Goal 11: Make cities inclusive, safe, resilient and sustainable*. Retrieved from <https://www.un.org/sustainabledevelopment/cities/>

1.1 What is 'circular economy'?

The concept of circular economy aims to redefine growth from a linear, take-make-waste system to one that decouples growth from the consumption of finite resources. A circular economy minimises the amount of raw materials as inputs and waste produced in order to close unsustainable resource flows, and to ultimately achieve an efficient, sustainable and resilient economy.

The Ellen MacArthur Foundation distinguishes between technical and biological cycles within a circular economy. The former cycle refers to the recovery and restoration of products, components and materials via reuse, repair, remanufacture or recycling. The biological cycle describes food and biologically-based materials that are consumed and returned back to the system through composting, anaerobic digestion or other similar processes.³ These cycles are underpinned by three principles key to the concept of circular economy, including designing out waste; keeping products and materials in use; and regenerating natural systems where nutrients can be returned to the ecosystem.⁴ Figure 2 and 3 illustrates the linear and circular economy respectively.



Figure 2: Linear economy

³ Ellen MacArthur Foundation. (n.d.). *Concept: What is a circular economy? A framework for an economy that is restorative and regenerative by design*. Retrieved from <https://www.ellenmacarthurfoundation.org/circular-economy/concept>

⁴ Ellen MacArthur Foundation. (n.d.). *Concept: What is the circular economy?* Retrieved from <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>

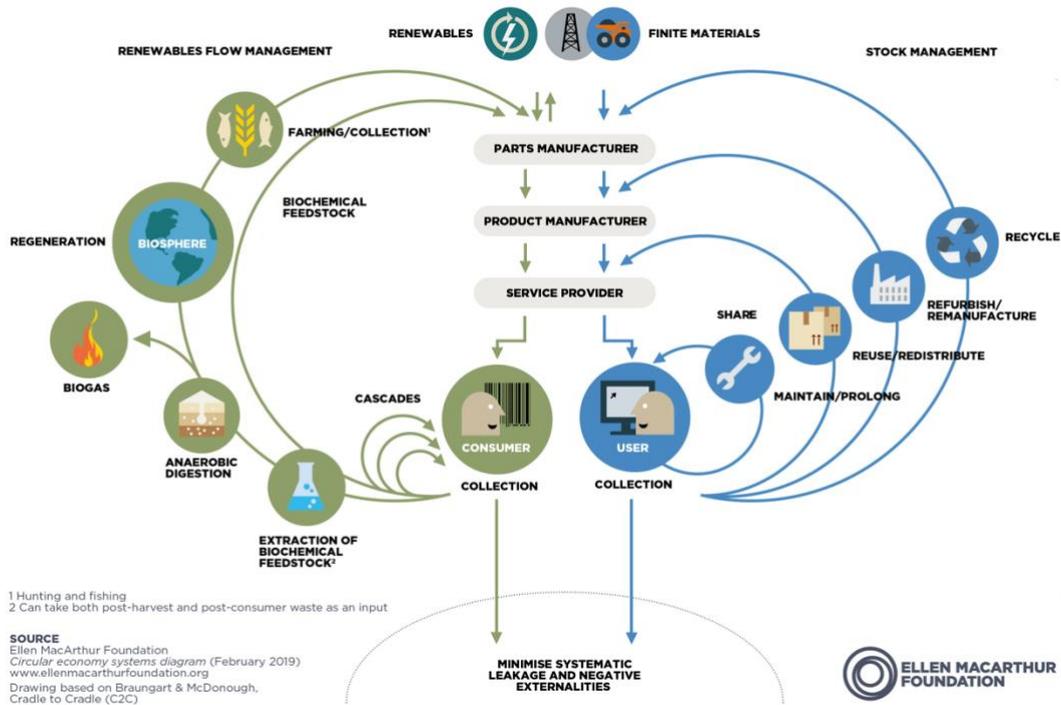


Figure 3: Circular economy
 Source: Ellen MacArthur Foundation⁵

Circular economy interlinks closely with climate change and the Sustainable Development Goals (SDGs). It can present solutions and holds promise to achieve SDG 6 on clean water and sanitation; 7 on affordable and clean energy; 8 on decent work and economic growth; 11 on sustainable cities and communities; 12 on sustainable consumption and production; 13 on climate action; 14 on life below water; 15 on life on land; and 17 on partnerships for the goals (see Figure 4).



Figure 4: Sustainable Development Goals that are closely linked with circular economy
 Source: United Nations⁶

⁵ Ellen MacArthur Foundation. (2019). *Circular economy systems diagram*. [Online image]. Ellen MacArthur Foundation. <https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic>

⁶ United Nations Sustainable Development Goals. (n.d.) Retrieved from <https://www.un.org/sustainabledevelopment/>

The concept of circular economy can operate at multiple levels in society (see Figure 5). At the micro-level, circular economy principles apply to products, companies and consumers. Behaviour of individuals are to be influenced through product design and firms can be more circular by modifying production strategies, operations and reporting practices accordingly. On a meso-level, the concept applies to eco-industrial parks, which is a community of businesses located in a common area, where they try to achieve improved environmental, economic and social performances by managing environmental and resource issues together.⁷ circular economy encourages the development of such parks and industry networks. Lastly, circular economy on a macro-level refers to the application of the concept to a city, region, nation and beyond by improving the exchange of materials between the economy and environment. For the purpose of this report, analysis of Hong Kong's circularity will mainly be focused on the meso- and macro-level.



Figure 5: Micro-, meso- and macro-level applications of circular economy

1.2 What is a circular city?

A circular city embeds the principles of circular economy in its urban system and across its functions. It can be defined by several key characteristics detailed in Figure 6, which is a compilation of different definitions of a 'circular city' by different organisations. The

⁷United Nations Industrial Development Organization. (2020). *Eco-industrial parks*. <https://www.unido.org/our-focus-safeguarding-environment-resource-efficient-and-low-carbon-industrial-production/eco-industrial-parks>

definition comprises of 8 general characteristics of a circular city, covering a range of sectors within a city, including energy, transport and mobility, infrastructure, built environment, resource management, production systems etc. From a BEC survey conducted with key practitioners in Hong Kong, it was generally agreed with the characteristics of a circular city for Hong Kong mentioned below in Figure 6. For a detailed breakdown of each organisation’s definitions, please refer to Appendix A.

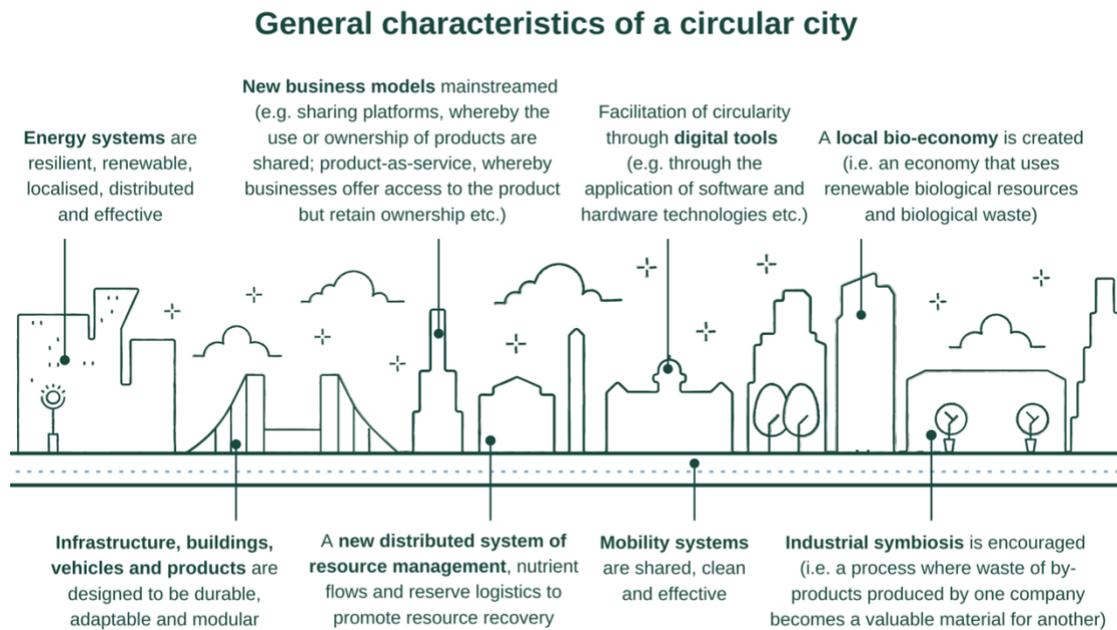


Figure 6: General characteristics of a circular city

Box 1: Other terms relevant to circular economy to know

There are other terms that are important under the topic of circular economy, as they are often used interchangeably or in conjunction with the concept of circular economy or circular city.

Zero waste

Zero waste refers to the prevention of waste generated, by conserving resources through responsible production, consumption, reuse and recovery of products and materials. This approach discourages waste to be landfilled or incinerated and avoids any discharge of waste that might harm physical and human health.

Urban metabolism

Urban metabolism uses a system's perspective to analyse the sustainability of a city, which focuses on looking at the interaction between different components within an area, instead of solely examining a single element. Under this approach, social, economic and environmental forces shape material, waste, water and energy flows together.

Industrial symbiosis

Industrial symbiosis is a process where waste or by-products produced by one company becomes a valuable material for another, therefore providing mutual benefit. This process generates an interconnected network and encourages the use of materials in a more sustainable manner, by lengthening the economic value of materials, reducing the need for virgin resources and minimising the amount of waste or by-products generated in industrial processes. Industrial symbiosis promotes the creation of a circular economy.

1.3 Overview of existing city-level circular economy strategies and indicators

Several cities around the world have adopted the concept of circular economy and incorporated it into their city-level development plans or resource management strategies. Among those cities, each has created their own vision of what a circular city looks like and how to achieve it. This section consulted circular economy strategies from Amsterdam, Netherlands; Brussels, Belgium; Glasgow, United Kingdom (UK); London, UK; New York City, United States (US); Paris, France; Peterborough, UK; Phoenix, US; Seoul, South Korea; Shanghai, China; Shenzhen, China; Singapore; and Toronto, Canada. Key drivers of circular economy among these locations are presented, as well as their common policy and initiatives. Their drivers and approaches can be a point of reference for other cities interested in transitioning to a circular economy.

1.3.1 Drivers of circular economy

Before exploring the types of policies and initiatives put in place by municipal governments, it is important to identify the reasons why these locations want to foster and achieve circularity. Table 1 summarises the main drivers of the circular economy agenda identified across the 13 cities and city-state examined.

Table 1: Key reasons to drive circular economy

Reasons	Examples
To feed into city-wide sustainability goals or strategies	<ul style="list-style-type: none"> - Phoenix established a set of city-wide sustainability goals to be met by 2050, including targets on zero waste⁸ - New York City confirmed its goal of zero waste to landfills by 2030⁹ and a city-wide 2050 strategy¹⁰ to build a strong and fair city, including visions on building a circular economy - Circular economy is part of Toronto's waste management strategy
To build an environmentally sustainable image	<ul style="list-style-type: none"> - Phoenix aims to repair the city's environmental-sustainability image in response to criticisms about the city being unsustainable
To be a pioneering city	<ul style="list-style-type: none"> - Glasgow aims to be the first circular city in Scotland, after the region announced its circular economy-related targets - London aspires to become a forerunner in tackling climate change and other environmental issues
To abide by relevant national or regional plans or laws	<ul style="list-style-type: none"> - Shenzhen and Shanghai need to abide by the principles set out in China circular economy Promotion Law¹¹ to promote ecological civilisation - European Union (EU) Member States encouraged to follow the aspirations, goals and obligations set out in the EU circular economy Action Plan¹² and the associated Directives
To alleviate stress off current resource management systems	<ul style="list-style-type: none"> - Singapore's only landfill, Semakau Landfill, will be full by 2035 with current waste disposal rates
To create new jobs and opportunities for businesses and	<ul style="list-style-type: none"> - Brussels hopes to strengthen its economy and enhance people's participation in the job market - The Mayor of London aims to increase the

⁸ City of Phoenix. (n.d.). *Environmental Sustainability Goals*. <https://www.phoenix.gov/sustainability/goal>

⁹ The City of New York. (2015). *One New York*. The City of New York. Retrieved from <http://www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf>

¹⁰ The City of New York. (2019). *New York City's Green New Deal*. Retrieved from <https://onenyc.cityofnewyork.us/>

¹¹ 全國人民代表大會. (2018). *中華人民共和國循環經濟促進法*. The National People's Congress of the People's Republic of China. Retrieved from http://www.npc.gov.cn/zgrdw/npc/xinwen/2018-11/05/content_2065669.htm

¹² Publications Office of the European Union. (2020). *A new Circular Economy Action Plan*. EUR-Lex. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

Reasons	Examples
innovation, as well as strengthen economic resilience	<p>competitiveness of the city's businesses and workers within the growing circular economy market</p> <ul style="list-style-type: none"> - Glasgow believes the circular economy approach can improve the city's ability to respond to economic challenges - Peterborough wants to enhance the use of local resources and develop a strong local economy
To improve public and environmental health, as well as increase the quality of life of citizens	<ul style="list-style-type: none"> - Peterborough looks to creating a sustainable environment where people can live longer, healthier and more prosperously - Amsterdam aims to minimise and halt further damages to the city's social and physical living environments - Seoul hopes to restore relationships and establish people's sense of community through a sharing economy - Paris envisions a better living environment for its citizens through the application of circular economy measures in the city
To future-proof the city	<ul style="list-style-type: none"> - Singapore hopes to build its climate, resource and economic resilience by promoting circular economy - New York City aims to release a holistic strategy, which includes circular economy, to secure the city's future against challenges of today and tomorrow

1.3.2 Common policies and initiatives

This section lists the common policies and initiatives taken by municipal governments to promote and achieve circular economy in a city. The key approaches taken by governments include releasing studies, white papers and roadmaps; introducing legislations and guidelines for tenders, city planning and contracts; providing financial incentives; establishing non-financial incentives; and introducing circular economy-related technologies and facilities.

(i) Releasing studies, white papers and roadmaps

One key initiative undertaken by municipal governments includes the release of official

documents that assess, conceptualise and plan circularity within a city. For example, several municipal governments among the 13 locations mentioned above commissioned or partnered up with consultants, non-profit organisations, universities or think tanks for research support to evaluate the performance and effectiveness of a city's resource management system. An assessment of the city's material flows and potential for circularity can help inform how and where best to introduce circular economy-related policies and initiatives. For instance, Amsterdam¹³, Glasgow¹⁴ and Toronto¹⁵ commissioned a non-profit organisation, Circle Economy, to conduct a city scan to analyse each city's material flows and identify the industries or areas within an economy to introduce relevant circular economy measures. In another example, Brussels partnered up with local universities to carry out studies on the city's urban metabolism.

Meanwhile, some other cities worked with the wider public to co-create knowledge on the topic of circular economy to establish an official document that conceptualises circularity within their local context. Paris formed a group to allow the general public to gather and converse about key circular economy issues in the city. The discussions from the group shaped the scope and content of the government's white paper on circular economy.

Among the types of official documents published, the release of a roadmap to achieve circular economy is the most common and popular approach among governments. Amsterdam,¹⁶ Brussels,¹⁷ Glasgow,¹⁸ London,¹⁹ New York City,²⁰ Paris,²¹

¹³ Circle Economy, TNO, FABRIC. (2015). *Amsterdam Circular*. Circle Economy. Retrieved from https://assets.website-files.com/5d26d80e8836af2d12ed1269/5ede5a03e4cd056426b86d8b_20152115%20-%20Amsterdam%20scan%20-%20report%20EN%20web%20single%20page%20-%20297x210mm.pdf

¹⁴ Glasgow Chamber of Commerce, Circle Economy. (2016). *Circular Glasgow*. Retrieved from <https://circularglasgow.com/wp-content/uploads/2019/01/Glasgow-City-Scan.pdf>

¹⁵ Circle Economy (2020). *Baselining for a Circular Toronto Landscape Analysis Technical Memorandum #1*. Retrieved from <https://www.toronto.ca/wp-content/uploads/2020/10/8da9-Technical-Memorandum-1-2020.19.10-FINAL-V2.pdf>

¹⁶ City of Amsterdam. (2020). *Amsterdam Circular 2020-2025 Strategy*. City of Amsterdam. Retrieved from https://ec.europa.eu/jrc/communities/sites/jrccties/files/amsterdam-circular-2020-2025_strategy.pdf

¹⁷ be circular be.brussels. (2016). *PROGRAMME RÉGIONAL EN ECONOMIE CIRCULAIRE 2016-2020*. https://document.environnement.brussels/opac_css/elecfile/PROG_160308_PREC_DEF_FR

¹⁸ Glasgow City Council. (2020). *Circular Economy Route Map For Glasgow 2020 – 2030*. <https://www.glasgow.gov.uk/councillorsandcommittees/viewSelectedDocument.asp?c=P62AFQDNDX2UT1NTNT>

¹⁹ London Waste and Recycling Board. (2017). *London's Circular Economy Route Map*. London Waste and Recycling Board. Retrieved from https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-circular-economy-route-map_exec-summary_16.6.17a.pdf

²⁰ New York Circular City Initiative. (2020). *Complex challenges. Circular solutions*. Retrieved from https://assets.website-files.com/5e3d73eeaf2dec70808520e3/5f7304c98b3d53613d6cb15c_08380_BS_MBD_NY_CircularCityReport%20Update_PDF_AW%203.pdf

²¹ Mairie de Paris. (2017). *Paris Circular Economy Plan*. Mairie de Paris. Retrieved from <https://cdn.paris.fr/paris/2019/07/24/38de2f4891329bbaf04585ced5fbd0f.pdf>

Peterborough,²² Phoenix,²³ Shanghai,²⁴ Shenzhen²⁵ and Toronto²⁶ all released a roadmap or plan for the city to transition to a circular economy across different sectors. Singapore²⁷ also released a plan that work towards the aspirational goal of zero waste, but not circular economy in particular. Each roadmap includes the local government's vision of circularity, targets or goals, areas within the city that encounters circular economy-related issues and possible solutions or policy responses. This enables businesses and other organisations to understand the government's targets and plans and to prepare and strategise accordingly. Paris and Amsterdam further produced a roadmap for certain sectors or departments, including the food and agriculture sector and the land issuance department respectively.

(ii) Introducing legislation and guidelines on waste management, tenders, city planning and contracts

Some municipal governments may also choose to rely on more mandatory or recommendatory approaches to achieve circular economy. Existing legislations typically promulgated by governments are resource management regulations that aim to embed circular economy principles within the waste management industry. New York City, Paris, Phoenix, Singapore, Shenzhen, Shanghai and Toronto have all introduced measures to make current resource management requirements more stringent. For example, New York City extended organic waste treatment requirements for commercial food and beverage operators. Singapore passed the Resource Sustainability Act, which partially came into force in January 2020. It will establish mandatory requirements on the collection and treatment of waste electrical and electronic equipment (WEEE), food waste and packaging waste.²⁸ Similarly, Toronto introduced the Policy for the Addition of New Materials to the city's waste diversion programmes, which proposes a formal procedure for new recyclables or organic

²² Opportunity Peterborough. (2018). *Circular City Roadmap - an ambitious plan & performance monitoring framework towards 2021*. Opportunity Peterborough. Retrieved from http://www.futurepeterborough.com/wp-content/uploads/2018/05/PREVIEW_Peterboroughs-Circular-City-Roadmap.pdf

²³ City of Phoenix. (n.d.). *Reimagine Phoenix*. <https://www.phoenix.gov/publicworks/reimagine>

²⁴ 全國人民代表大會. (2016). *上海市國民經濟和社會發展第十三個五年規劃綱要*. 全國人民代表大會. Retrieved from <http://czj.sh.gov.cn/cmsres/a2/a24ebd2dbaf34a64b69ed20ac12fbf10/943aea2f87a6ef865e7373dfbed3004a.pdf>

²⁵ 深圳市發展和改革委員會. (2016). *深圳市循環經濟“十三五”規劃*. 深圳市發展和改革委員會. Retrieved from <http://fgw.sz.gov.cn/attachment/0/296/296843/4561194.pdf>

²⁶ City of Toronto. (n.d.). *Working Towards a Circular Economy*. City of Toronto. <https://www.toronto.ca/services-payments/recycling-organics-garbage/long-term-waste-strategy/working-toward-a-circular-economy/>

²⁷ Ministry of the Environment and Water Resources Singapore. (2019). *Zero Waste Masterplan*. Ministry of the Environment and Water Resources Singapore. Retrieved from <https://www.towardszerowaste.gov.sg/images/zero-waste-masterplan.pdf>

²⁸ Government of Singapore. (2019). *Resource Sustainability Act 2019*. Singapore Statutes Online. <https://sso.agc.gov.sg/Acts-Supp/29-2019/Published/20191004?DocDate=20191004>

materials to be included in the city's recycling programmes.²⁹ Shenzhen has been requiring all new residential areas to plan and reserve space for a recovery centre for renewable resources industry since 2009.³⁰ In another example, the Shanghai Household Waste Management Regulation was passed in 2019 to restrict disposable items in restaurants and hotels. Rules were also set regarding the sorting of household waste into 4 categories, including household food waste, hazardous waste, recyclable waste and residual waste, in order to facilitate recycling in the city.³¹

Other cities also introduced obligations relating to other sectors of the city, albeit less common. For example, Seoul introduced the Seoul Metropolitan Government Ordinance on the Promotion of Sharing in 2012, where sharing-related initiatives in the city emanate.³² More specifically, sharing-related initiatives by Seoul include bike, car or data sharing programmes. Meanwhile, Shenzhen established standards related to green buildings, which set rules on the types of materials for construction and so on. Similarly, New York City modified zoning regulations to encourage the construction and retrofitting of more green buildings.

For cities in EU Member States, they are governed and influenced by the EU Circular Economy Action Plan (2015 and 2020) and the related Directives. The old Action Plan in 2015 mapped out 54 actions on production and consumption; waste management; and market for secondary raw materials, as well as four legislative proposals on waste³³.

²⁹ City of Toronto. (2017). *Policy for Addition of New Materials to the City's Waste Diversion Programs (Adapt Policy)*. City of Toronto. Retrieved from <https://www.toronto.ca/legdocs/mmis/2018/pw/bgrd/backgroundfile-115693.pdf>

³⁰ Shenzhen Government Online. (2019). *Measures of Shenzhen Municipality on Administration of Renewable Resources Recovery*. Retrieved from http://english.sz.gov.cn/laws/201912/t20191231_18960121.htm

³¹ Zhang, L. (2019, 27 June). *China: New Waste-Sorting Rules to Take Effect in Shanghai*. The Library of Congress. Retrieved from <https://www.loc.gov/law/foreign-news/article/china-new-waste-sorting-rules-to-take-effect-in-shanghai/#:~:text=In%20order%20to%20reduce%20the,quest%20rooms%20without%20specific%20requests.>

³² Seoul Metropolitan Government. (2019). *SEOUL METROPOLITAN GOVERNMENT ORDINANCE ON THE PROMOTION OF SHARING*. Seoul Legal Administration Services. Retrieved from [https://legal.seoul.go.kr/legal/english/front/page/law.html?pAct=lawView&pPromNo=1191#:~:text=SEOUL%20METROPOLITAN%20GOVERNMENT%20ORDINANCE%20ON%20THE%20PROMOTION%20OF%20SHARING&text=Article%201%20\(Purposes\)%20The%20purpose,through%20the%20promotion%20of%20sharing.](https://legal.seoul.go.kr/legal/english/front/page/law.html?pAct=lawView&pPromNo=1191#:~:text=SEOUL%20METROPOLITAN%20GOVERNMENT%20ORDINANCE%20ON%20THE%20PROMOTION%20OF%20SHARING&text=Article%201%20(Purposes)%20The%20purpose,through%20the%20promotion%20of%20sharing.)

³³ The key elements in the revised legislative framework on waste includes:

- A common EU target for recycling 65% of municipal waste by 2035;
- A common EU target for recycling 70% of packaging waste by 2030;
- There are also recycling targets for specific packaging materials:
 - Paper and cardboard: 85 %
 - Ferrous metals: 80 %
 - Aluminium: 60 %
 - Glass: 75 %
 - Plastic: 55 %
 - Wood: 30 %
- A binding landfill target to reduce landfill to maximum of 10% of municipal waste by 2035;
- Separate collection obligations are strengthened and extended to hazardous household waste (by end 2022), bio-waste (by end 2023), textiles (by end 2025).

The new Action Plan released in 2020 proposed 35 actions on designing and making sustainable products; empowering consumers and public buyers; increasing circularity in resource-heavy sectors; reducing waste; and leading global efforts on circular economy. Regulations on this front will include sustainable product policy initiative, new “right to repair” measures, Mandatory Green Public Procurement Criteria and targets; ban on the destruction of unsold durable goods and so forth, which will be introduced according to their implementation timetable.³⁴

Aside from introducing legislations, some governments released guidelines for tenders, city planning and contracts, which summarises the requirements and best practices to achieve circularity. Based on the circular guidelines for tenders published in Amsterdam, the government applied circular criteria, such as building with fewer materials; building with reused and/or biobased materials; and adaptive and modular construction, to 4 development tenders when leasing public land for 3 housing development projects and a retail project.³⁵

(iii) Providing financial incentives

In some cities, financial incentives are provided to local businesses working on circular economy. Brussels, Phoenix and Glasgow all offer funding to small and medium-sized enterprises (SMEs) working on circular economy-related research or innovations. It is envisioned that the funding will help businesses to better understand the market for circular economy, commercialise circular economy business models or develop new technologies that promote the principles of circular economy.

Aside from the provision of funding, arranging land or office leases below market rate to businesses working on circular economy is a popular option in some cities as well. This provision lowers the fixed cost of businesses, therefore freeing up more resources for companies to contribute to circular economy-related projects. For example, Phoenix formed a hub within the city, which allows for cheaper land leases to businesses working on circular economy-relevant projects. Meanwhile, Seoul’s business incubation programme provides financial support for businesses working on

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- Minimum requirements are established for extended producer responsibility schemes to improve their governance and cost efficiency.
 - Prevention objectives are significantly reinforced, in particular, requiring Member States to take specific measures to tackle food waste and marine litter as a contribution to achieve EU commitments to the UN SDGs

European Commission. (n.d.). *First Circular Economy Action Plan*. European Commission. Retrieved from <https://ec.europa.eu/environment/circular-economy/first-circular-economy-action-plan.html#:~:text=EU%20action%20plan%20for%20the,growth%20and%20generate%20new%20jobs>.

³⁴ European Commission. (2020). *Quick Reference on circular economy AP Implementation*. Retrieved from https://ec.europa.eu/environment/circular-economy/pdf/implementation_tracking_table.pdf

³⁵ City of Amsterdam. (2020). *Amsterdam Circular 2020-2025 Strategy*. City of Amsterdam. Retrieved from https://ec.europa.eu/jrc/communities/sites/jrccties/files/amsterdam-circular-2020-2025_strategy.pdf

circular economy to rent office spaces in the city and may even cover other project costs.

(iv) Establishing non-financial incentives

In comparison to financial incentives and investments, more municipal governments have decided to introduce non-financial incentives for businesses and the wider public to drive the circular economy agenda within a city. The most common non-financial incentives provided by governments include the formation of networks or platforms to facilitate discussions on circular economy; establishment of programmes that provides advisory services to businesses and facilitate partnerships; and provision of research and development (R&D) and innovation support.

Networks or platforms

The establishment of networks or platforms remains the most common non-financial incentive to further the circular economy agenda among the locations studied. The networks or platforms created by these areas enable diverse stakeholders with different areas of expertise to come together – either in person or virtually – to transfer knowledge, co-create solutions and share products.

The scale of these networks and platforms can range from local, regional to international. Local networks or platforms usually aim to drive circularity within a city by encouraging different citizens, businesses or government departments to share knowledge or resources and allow for collaborations to better transform into a circular economy from a linear economy. For example, Amsterdam established a 'Concrete Value Chain Network' that promotes partnerships and training on supply chains. Seoul and Peterborough created an online platform for enterprises to share equipment, skills, events or even news on circular economy. In another example, Brussels established an 'Employment Environment Alliance Programme', which formed a formal collaboration platform between different government departments, specifically between the Minister for the Environment, for the Economy and the Minister-President to discuss city-wide circular economy issues in a more holistic manner and to lay the foundation for future work on circular economy. In the case of New York City, a DonateNYC website was created to provide a platform for businesses, schools, universities and non-profit organisations to donate and collect donated items.³⁶

Regional and international networks or platforms typically connect different cities together to share knowledge and insights. Currently, there are several

³⁶ Department of Sanitation. (n.d.). *DonateNYC*. DonateNYC. <https://www1.nyc.gov/assets/donate/site/>

established global networks that strives to achieve circular economy, such as the Ellen MacArthur Foundation's Circular Cities Network, which provides an online knowledge exchange platform among different city leaders to engage each other and where appropriate, support each other's initiatives to facilitate the transition to a circular economy. Other networks such as C40 Cities Network, Circular Economy Task Force of Eurocities etc., also facilitate similar interactions.

Programmes that provide advisory services and facilitate partnerships

Some programmes offered by local governments also provide advisory services and opportunities for partnerships in addition to financial incentives (which are mentioned above). For example, Brussels, Glasgow, London and Seoul provide advisory services, investment guidance or consulting services to local businesses and SMEs. Meanwhile, Singapore has a programme which encourages partnerships between research institutes and companies to create innovative solutions that increases the efficiency in material use.

Among these programmes, some may even give businesses public recognition for their efforts and work in circular economy. Brussels and Peterborough publicly celebrate successful entrepreneurial circular economy projects or organisations respectively, for their efforts in nudging the city towards circularity.

Support for R&D and innovation

Incubators, living labs and pilot parks are also major tools used by governments to encourage innovation and foster innovation. Clusters of like-minded entrepreneurs driven by the common goal to achieve circular economy facilitates the exchange of knowledge, connections and expertise. Phoenix created a 'Resource Innovation Campus' – a hub that provides infrastructure support and business incubation services for innovators working on circular economy-related issues. Amsterdam established living labs to exhibit and share local circular methods and buildings. Meanwhile, Shenzhen designated Pingshan Park as a national circular transformation demonstration pilot area to test circular economy-related technology.

(v) Introducing circular economy-related technologies or facilities

Relatively more mature but new technologies have since been introduced in several cities to diverge from a linear economy. For example, Shanghai introduced smart recycling bins, which reads each resident's smart card and allows them to sort their waste correctly to earn points. The points can then be exchanged for rewards such as cash or daily necessities. Meanwhile, Shenzhen decided to make its transport systems

cleaner and more efficient, by replacing all previous public bus fleets and 23,000 taxies to electric buses and taxies, to reduce the consumption of fossil fuel, a non-circular resource.

2. How Circular is Hong Kong?

This section aims to evaluate Hong Kong's circularity according to 8 categories and 48 indicators that were identified as important and relevant to the context of Hong Kong by local industry practitioners: raw materials; waste management process and infrastructure; government legislations and initiatives; sharing economy; industrial symbiosis; water; energy; and circular economy market, private investments and jobs. The indicators will be further elaborated in Section 3.

2.1 Raw materials

Raw materials can be divided into primary or secondary and it is one of the aims of a circular economy to ensure that such materials are used and sourced sustainably. The significance of each type of raw material to circular economy and Hong Kong is further explained below.

2.1.1 Primary raw materials

In a circular economy, it is vital for primary raw materials to be extracted sustainably and in a way that would lessen the adverse impacts to the environment. Any resources extracted from nature without further processing is considered a virgin material or primary raw material

Hong Kong is a service economy made up mostly by the trading and financial service sector. In 2018, 93.1% of GDP was contributed by the service sector in the city³⁷, while primary and secondary industries are not prominent, and the extraction of virgin materials is not commonly practised. Extractive activities including fishing, mining and quarrying only accounted for 0.1% of gross domestic product (GDP) in 2018.³⁸

Although there is a low demand for raw materials in the domestic market, Hong Kong is a major port for imports, exports and re-exports of primary raw materials. In 2018, the value of the city's total exports of goods was HKD\$4,158.1 billion, while imports of goods were HKD\$4,721.1 billion.³⁹ The city is a key player in global supply chains due to its strategic geographic location. Raw materials such as iron and steel are imported, which are mostly re-exported overseas.

³⁷ Census and Statistics Department. (2020). *Gross Domestic Product (Yearly)*. Census and Statistics Department. Retrieved from <https://www.statistics.gov.hk/pub/B10300022019AN19E0100.pdf>.

³⁸ Census and Statistics Department. (2020). *Gross Domestic Product (Yearly)*. Census and Statistics Department. Retrieved from <https://www.statistics.gov.hk/pub/B10300022019AN19E0100.pdf>.

³⁹ Census and Statistics Department. (2019) *Hong Kong Monthly Digest of Statistics: Analysis of Hong Kong's Imports of Goods*. Census and Statistics Department. Retrieved from: <https://www.statistics.gov.hk/pub/B71909FA2019XXXXB0100.pdf>

2.1.2 Secondary raw materials

Secondary raw materials refer to recycled materials used for manufacturing, such as recycled paper, recycled plastic, scrap metal etc. It can be used alongside virgin materials or in place of it during manufacturing processes. Secondary raw materials are considered to be crucial within the context of circular economy, as economies that can maximise the use and potential of each material is considered to be more circular. Fuller and more efficient utilisation of raw materials enable certain wastes to be recovered (depending on technological development) and injected back into the economy. This may lead to a reduction in energy use and may minimise environmental degradation, through decreasing the need for mining and other extractive practices.

The production of secondary raw materials is closely linked to the recycling industry. In Hong Kong, various types of recyclables are collected by local recyclers, which are then transformed into useful secondary materials where possible. Different recycling facilities are responsible for handling particular types of recyclables like waste wood, waste glass, waste paper etc. After the collection of recyclables, processes such as sorting, dismantling and shredding are carried out in the recycling facilities. Harmful substances and impurities are removed, while useful materials are retained after processing. Despite some facilities in place, the value and volume of total local production of secondary raw materials are unclear, as there is an absence of data specifically on secondary raw materials.

Overall, the level of demand for different types of local secondary raw materials in Hong Kong and abroad is also unclear. In general, it is estimated that the level of demand for local secondary raw materials remain low due to the lack of industries in Hong Kong. However, there are examples to exemplify some demand for certain recycled materials locally. For instance, recycled aggregates are used for local land reclamation and road building in the construction industry, which is encouraged through the Environmental Protection Department's (EPD) Construction Waste Disposal Charging Scheme. For example, the construction of the Hong Kong Wetland Park required around 150,000 cubic metres recycled aggregate concrete.⁴⁰ In another example, biodiesel produced locally from waste cooking oil can be supplied to vessels, vehicles, equipment from the construction sector or even various Government departments. In 2012, the EPD launched a central procurement scheme for biodiesel, which raised the total consumption of biodiesel by Government departments from 2.6 million litres to 14.5 million litres in 2018.⁴¹

⁴⁰ Poon, C. S., & Chan, D. (2007). *The use of recycled aggregate in concrete in Hong Kong. Resources, Conservation and Recycling*, 50(3), 293-305.

⁴¹ The Government of the Hong Kong Special Administrative Region. (2019, 5 June). *LCQ12: Promoting use of biodiesel* [Press release]. Retrieved from <https://www.info.gov.hk/gia/general/201906/05/P2019060500435.htm?fontSize=1>

2.2 Waste management process and infrastructure

In order to maximise the use, circulation and inherent value of products and materials in the economy, a well-managed and efficient waste management system with supporting infrastructure is crucial. When resources are recycled, reused or repurposed, the lifespan of products can be extended, and materials can remain in the economy for a longer period of time. It can also play an important role in producing secondary raw materials or products for the economy.

In Hong Kong, total solid waste includes municipal solid waste (MSW), construction waste and special waste. According to the EPD, total disposal of solid waste in landfills increased from 14,859 tonnes per day (tpd) in 2014 to 16,096 tpd in 2018.⁴² Among the classifications above, MSW comprises of domestic, commercial and industrial waste, and makes up the highest percentage of total waste in Hong Kong, at around 70%.⁴³ It is followed by construction waste. Since 2014, the generation of MSW in Hong Kong increased from 5.62 million tonnes to 5.95 million tonnes in 2018.⁴⁴ Furthermore, MSW disposal rate per capita has also been increasing since 2013 and in 2018, 1.53 kilogramme of MSW were disposed per person per day.⁴⁵

This section will examine the state of Hong Kong's waste management process and infrastructure according to following areas: recycling and waste disposal. To begin, Figure 7 gives an overview of how MSW and recyclables are handled in Hong Kong, which will be further discussed later in this section. Waste management-related policies and regulations will be covered under Section 2.3.

⁴² Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁴³ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁴⁴ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁴⁵ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

Handling Process of Municipal Solid Waste and Recyclables in Hong Kong



Figure 7: Handling process of municipal solid wastes (brown) and recyclables (green)

2.2.1 Recycling

Recycling is important in guiding Hong Kong towards a circular economy, as it can reduce the amount of waste disposed in the landfills and recover components and materials that may be useful to the economy. It will lower the demand for primary raw materials in certain economies, as valuable materials can re-enter manufacturing supply chains after processing.

This section will examine in greater depth the collection, processing and export of recyclables in Hong Kong.

(i) Collection

Unlike other cities that mainly focuses on a centralised collection system, Hong Kong relies on the city's informal collectors, where scavengers play an important role in collecting recyclables. These scavengers are mostly made up of citizens in the aged group. They mainly collect cardboards and sometimes aluminium cans on the streets or from the rubbish bins and sell them to the recyclers directly. According to a survey carried out by Waste Picker Platform, a social organisation in Hong Kong, it is estimated that 193 tonnes of cardboards are collected by scavengers each day.⁴⁶

⁴⁶ 拾平台. 全港拾荒者調查研究報告.(2018).新福事工協會 – 關懷貧窮學校.Retrieved from

However, the market value of cardboards has been fluctuating throughout the past few years and even dropped significantly after the import control of solid waste by Mainland China in 2017. The volatile and decreasing market prices of relevant recyclables significantly affect collection rate and therefore recycling rate, as over 80% of the scavengers cite economic returns as the main reason for collecting recyclables.⁴⁷ This would also greatly affect the income and livelihoods of scavengers, who are mostly part of the vulnerable population.

On the other hand, waste separation bins (also known as three-coloured waste separation bins) are placed on the streets or in most residential buildings under the centralised collection system to collect specific types of paper, plastic and cans. It is estimated that over 80% of residents in Hong Kong currently have access to recycling bins close to their homes.⁴⁸ With regards to waste plastics, only beverage plastic bottles and personal care product plastic bottles are collected in these bins, while other recyclable plastics, such as plastic bags have to be delivered to Community Green Stations (CGS) or recycling centres, though the latter are often disposed of in recycling bins close to residential areas instead as it is more convenient to do so. The Government plans to build CGS in all districts to collect most types of recyclables. Until June 2020, 9 out of 18 stations were built and operated by non-profit organisations. A total of 7,000 tonnes of recyclables were collected by the end of 2019 in CGS alone.⁴⁹

A key reason for the lack of prominence of sorting bins in Hong Kong's waste collection system is public distrust towards the handling of recyclables collected in these bins. On previous occasions, several organisations found that some street cleaners would combine recyclables and general waste together, which meant that recyclables would also end up in landfills. In 2013, it was found that these sorting bins were managed by different Government departments including the EPD; the Food and Environmental Hygiene Department (FEHD); the Leisure and Cultural Services Department (LCSD); and the Agriculture, Fisheries and Conservation Department (AFCD), and only plastics recovered in sorting bins managed by the EPD would be sent to EcoPark for further processing.⁵⁰ These events have lowered public confidence towards the centralised collection system and partly explains why the local waste recovery rate has remained low throughout the years. In light of this, the Office of the Ombudsman launched a direct investigation of the management of waste separation bins by EPD in November 2020.⁵¹

http://newarrivals.org.hk/News/2783/New_Report_Ragpicker_Research_20180528.pdf

⁴⁷ 拾平台. 全港拾荒者調查研究報告.(2018).新福事工協會 – 關懷貧窮學校.Retrieved from

http://newarrivals.org.hk/News/2783/New_Report_Ragpicker_Research_20180528.pdf

⁴⁸ Environmental Bureau. (2013). *Hong Kong Blueprint for Sustainable Use of Resources 2013-2022*.

Environmental Bureau. Retrieved from <https://www.enb.gov.hk/en/files/WastePlan-E.pdf>

⁴⁹ Environment Protection Bureau. (n.d.). *Community Green Stations*. Retrieved August 12, 2020, from

https://www.wastereduction.gov.hk/tc/community/cgs_intro.htm

⁵⁰ Fabian, N., & Lou, L. I. T. (2019). *The Struggle for Sustainable Waste Management in Hong Kong: 1950s–2010s*. *Worldwide Waste: Journal of Interdisciplinary Studies*, 2(1), 10. Retrieved from

<https://www.worldwidewastejournal.com/articles/10.5334/wwwj.40/>.

⁵¹ Office of The Ombudsman, Hong Kong. (2020). *Press Release - Ombudsman probes into management*

(ii) Processing

In Hong Kong, the waste recycling industry is small. Based on the Hong Kong Collector and Recycler Directory by the EPD, in August 2020, there are around 500 recyclers who are responsible for processing and turning recyclables into useful secondary materials.⁵² Among these recyclers, most are waste collectors and traders, and consequently, a high proportion of waste is exported overseas for further processing rather than being processed locally (further discussed later).

There are several key waste streams collected and processed in Hong Kong, including ferrous metals, such as alloy steel scrap; non-ferrous metals, such as aluminium; plastic; glass; and food etc. According to the EPD, waste plastics accounted for around 40% of the total waste recovered locally, which made up the largest share of waste recovered in 2018.⁵³ It was found that over 90% of plastic waste were recovered locally in 2018 after the introduction of the National Sword policy by Mainland China in 2017, which banned the import of certain types of solid waste.⁵⁴ WEEE and food wastes made up the second and third largest share of locally recovered recyclables, both accounting for around 19% in 2018.⁵⁵ It is important to note that EPD's definition of resource recovery refers to activities that divert wastes from local landfills, and includes reuse and composting of local recyclables in addition to recycling. Therefore, the data presented above may not solely be on the recycling of the material.

There is limited progress in improving recycling in Hong Kong so far, and recyclers encounter a number of issues that may adversely affect their operations, profitability and therefore, the city's overall recycling rates (see Figure 8). First, volatile or declining market prices of recyclables affect the ability of businesses to plan their operations and may dampen their profitability, which would have a knock-on effect on the overall recycling rate.

Furthermore, the collection rate of recyclables significantly affects the recycling industry, as a fall in the quantity of recyclables collected makes it hard for recyclers to offset high operating costs. During the outbreak of COVID-19 in Hong Kong, waste paper collected by a local recycler dropped by 50% due to the closure of schools and

and effectiveness of waste separation bins. https://ofomb.ombudsman.hk/abc/en-us/press_releases/detail/242

⁵² Environment Protection Department (n.d.). *Hong Kong Collector / Recycler Directory*. Retrieved August 12, 2020, from https://www.wastereduction.gov.hk/en/quickaccess/vicinity.htm?collection_type=collector&material_type=all&district_id=0

⁵³ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁵⁴ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁵⁵ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

many offices.⁵⁶ In another case, it was reported that one local plastic recycler imported foreign waste plastics from Southeast Asia (SEA) to support 80% of its operation, even though waste plastics were collected from over 500 residential buildings in Hong Kong.⁵⁷ The prices of materials also affect collection rate, as there are greater incentives to collect recyclables of a higher value. Among the different types of recyclables, the EPD found that in 2018, non-ferrous metals had the highest value per unit weight, followed by textile and ferrous metals.⁵⁸ This strongly explains why metal recyclables had the highest recovery rate of 90% in 2018.⁵⁹ In contrast, the recovery rate of recyclables with a lower value per unit weight, such as paper and plastic recyclables, had recovery rates of 41% and 7% respectively.⁶⁰

Another constraint faced by the recyclers in Hong Kong includes high land rental prices and limited land supply. In response, the Government designated an area for recycling companies to rent short-term tenancy sites at a more affordable price in EcoPark.

A fourth constraint faced by recyclers includes the contamination of recyclables, due to inappropriate or insufficient sorting and cleaning at source. This leads to higher labour and treatment costs due to the additional washing process.

Overall, the constraints faced by recyclers significantly increases their operating costs. A study by the Hong Kong Baptist University (HKBU) found that only 14% of recyclers surveyed made a profit in 2017, while 37% broke even and the remainder suffered a loss.⁶¹

⁵⁶ 潘婉玲. (2020, 2 February). 港故事: 疫情拖累 回收減半 環保廁紙陷停產. 蘋果日報. Retrieved from https://hk.appledaily.com/local/20200222/MIJP27QH3FXWJG7OPSKOSJ46KQ/?utm_campaign=hkad_social_hk.nextmedia&utm_medium=social&utm_source=facebook&utm_content=link_post&fbclid=IwAR0Hi9Pr0Id8l-UWCiulVaXocZ_Bpsl9gyx3F5VWrv9Rj7RpijThLjH78VM

⁵⁷ 勞敏儀. (2020, 22 June). 【廢膠去哪兒】回收不足廠商進口外國膠撐營運 中央收膠起步觸礁. 香港 01. Retrieved from

<https://www.hk01.com/%E7%A4%BE%E6%9C%83%E6%96%B0%E8%81%9E/487583/%E5%BB%A2%E8%86%A0%E5%8E%BB%E5%93%AA%E5%85%92-%E5%9B%9E%E6%94%B6%E4%B8%8D%E8%B6%B3%E5%BB%A0%E5%95%86%E9%80%B2%E5%8F%A3%E5%A4%96%E5%9C%8B%E8%86%A0%E6%92%90%E7%87%9F%E9%81%8B-%E4%B8%AD%E5%A4%AE%E6%94%B6%E8%86%A0%E8%B5%B7%E6%AD%A5%E8%A7%B8%E7%A4%81>

⁵⁸ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁵⁹ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁶⁰ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁶¹ Lam, S. (2019). *Information Note: Policy support to the recycling industry in selected places*. Research Office of the Legislative Council Secretariat. IN12/18-19. Retrieved from <https://www.legco.gov.hk/research-publications/english/1819in12-policy-support-to-the-recycling-industry-in-selected-places-20190430-e.pdf>

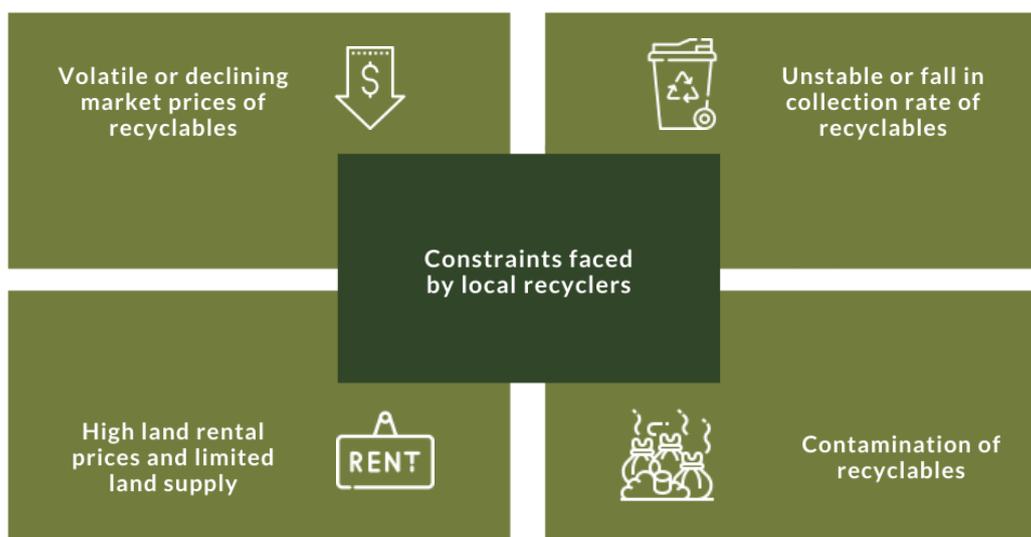


Figure 8: Issues or constraints faced by recyclers in Hong Kong

(iii) Export

Most local recyclables are exported, since Hong Kong has a low demand for raw materials or recycled materials as it is a service economy, as well as a limited capacity to recover MSW locally. In 2018, over 92% of recyclables recovered from MSW in Hong Kong are exported for recycling.⁶²

Hong Kong typically exports its waste to Mainland China (before the introduction of waste trade restrictions in 2017) and more recently to countries in SEA, such as the Philippines, Malaysia, Thailand and Vietnam. A total of 1.77 million tonnes (97%) of recyclables recovered in the city were exported for recycling in 2017. The amount exported decreased in 2018 (partly due to the introduction of China's waste trade restrictions) to 1.63 million tonnes (92%).⁶³ In 2017, before the promulgation of Mainland China's National Sword policy, over 80% of local plastic waste were exported across the border for further processing.⁶⁴ After the implementation of waste trade restrictions by China, Hong Kong exported 177 times more waste plastics to Thailand

⁶² Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁶³ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁶⁴ Environment Protection Department. (2018). *Waste Statistics 2017*. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2017.pdf>

in 2018 compared to 2016.⁶⁵ Similarly, an increase of 75 and 21 times more local waste plastics were exported to Malaysia and Vietnam respectively.⁶⁶

Hong Kong also acts as a re-exporter of overseas waste plastics. As a result of the import control by Mainland China, 280,000 tonnes of waste plastics from developed countries such as the US and Japan were re-exported to SEA counties in 2018.⁶⁷ However, this situation will change when the new Basel Convention controls on international shipments of non-hazardous plastic waste go into effect on January 1, 2021.

Overall, heavy reliance on exporting waste recyclables may not be a sustainable solution for the city. There are fears that countries in SEA would impose similar trade restrictions as Mainland China on the import of recyclables. Although the capacity of the local recycling industry has increased since, it remains small and less cost effective to foreign recycling industries. Reliance on exporting waste recyclables may also indicate insignificant local demand for waste recyclables, which points to possible public and private interventions in order to develop a market for it (refer to Section 4 for further discussion).

2.2.2 Waste disposal

Although materials can be recovered and injected back into the economy, disposal of waste in landfills will continue to play a part in a city's waste management system in the foreseeable future. In Hong Kong, not all resources can be recovered with the current processes and system, due to the insufficient capacity of local recycling and absence of technologies to recover every type of waste produced. This situation goes against the principles of circular economy, as waste should be designed out of the system. Given Hong Kong's circumstance, this section will present the city's disposal of waste in landfills and incinerators, as well as the handling of special waste in the city.

Currently, there are 3 strategic landfills in Hong Kong that are all located in the New Territories. In order to monitor and reduce the environmental impacts of landfills, management systems of leachate, landfill gas, ground water and so on are installed. As mentioned above, the disposal of total solid waste at landfills increased from 14,859 tpd in 2014 to 16,096 tpd in 2018.⁶⁸ In 2018, food waste, paper and plastics were the

⁶⁵ Low, Z. (2019, 11 November). *Since Beijing shunned waste imports, Hong Kong has deluged Southeast Asia with plastic*. South China Morning Post. Retrieved from <https://www.scmp.com/news/hong-kong/health-environment/article/3037261/beijing-shunned-waste-imports-hong-kong-has>

⁶⁶ Low, Z. (2019, 11 November). *Since Beijing shunned waste imports, Hong Kong has deluged Southeast Asia with plastic*. South China Morning Post. Retrieved from <https://www.scmp.com/news/hong-kong/health-environment/article/3037261/beijing-shunned-waste-imports-hong-kong-has>

⁶⁷ Low, Z. (2019, 11 November). *Since Beijing shunned waste imports, Hong Kong has deluged Southeast Asia with plastic*. South China Morning Post. Retrieved from <https://www.scmp.com/news/hong-kong/health-environment/article/3037261/beijing-shunned-waste-imports-hong-kong-has>

⁶⁸ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department, Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

most dominant types of MSW disposed of in landfills, which accounted for 31%, 24% and 21% of MSW respectively.⁶⁹ During the outbreak of COVID-19, more single-use food containers and cutleries were used and disposed of, as more consumers ordered takeaway to avoid eating in restaurants. After the Government imposed the dine-in bans for public health and safety reasons, street cleaners had nearly double the amount of solid waste collected.⁷⁰ The global pandemic also increased the use of single-use personal protective equipment (PPE), some of which has been documented to be disposed incorrectly in the city. Given the current rate of waste disposal, it is estimated that landfills will reach their maximum capacity by the end of 2020.⁷¹

As for the 13 closed landfills, they have undergone landfill restoration. Most of them were turned into recreational or green open spaces, such as the Jordan Valley Park and Sai Tso Wan Recreational Park.

Additionally, the Integrated Waste Management Facilities (IWMF), a waste-to-energy (WtE) facility, is planned to be fully operational by 2024. As an alternative to landfills, IWMF incinerates the disposed waste using high temperature, high turbulent currents and sufficient amount of residence time.⁷² It could reduce the emission of methane gas, while generating electricity from waste at the same time.⁷³ However, there are concerns about over-relying on incinerators to manage the city's waste, as it does not encourage a reduction of waste at source and therefore may not facilitate circularity.

Other than managing the disposal of MSW, handling of special wastes, such as chemical waste and sludge is essential in order to reduce pollutions such as contamination of freshwater. The Chemical Waste Treatment Centre in Tsing Yi has been treating clinical waste and other kinds of chemical waste since 1993. Meanwhile, the Sludge Treatment Facility is responsible for handling sewage sludge from 11 sewage treatment works in Hong Kong.

⁶⁹ Environment Protection Department. (2019). *Waste Statistics 2018*. Environment Protection Department, Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁷⁰ 呂凝敏, 陳蕾蕾, 鄧栢良. (2020, 6 August). *【新冠肺炎】外賣垃圾增 清潔工狂換袋 環團促WFH 市民洗盒回收*. 香港 01. Retrieved from <https://www.hk01.com/18%E5%8D%80%E6%96%B0%E8%81%9E/506845/%E6%96%B0%E5%86%A0%E8%82%BA%E7%82%8E-%E5%A4%96%E8%B3%A3%E5%9E%83%E5%9C%BE%E5%A2%9E-%E6%B8%85%E6%BD%94%E5%B7%A5%E7%8B%82%E6%8F%9B%E8%A2%8B-%E7%92%B0%E5%9C%98%E4%BF%83wf h%E5%B8%82%E6%B0%91%E6%B4%97%E7%9B%92%E5%9B%9E%E6%94%B6>

⁷¹ Research Office of the Legislative Council Secretariat. (2019). *Environmental Affairs: Statistical Highlight*. Research Office of the Legislative Council Secretariat. ISSH20/18-19. Retrieved from <https://www.legco.gov.hk/research-publications/english/1819issh20-municipal-solid-waste-and-food-waste-recovery-20190212-e.pdf>

⁷² Environment Protection Department. (2018). *Tackling Imminent Waste Management Problem: Integrated Waste Management Facilities*. Environment Protection Department. Retrieved from https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/waste/prob_solutions/files/IWMF_PPT_2018-02-14%20v1.pdf

⁷³ Environment Protection Department. (2018). *Tackling Imminent Waste Management Problem: Integrated Waste Management Facilities*. Environment Protection Department. Retrieved from https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/waste/prob_solutions/files/IWMF_PPT_2018-02-14%20v1.pdf

2.3 Government legislations and initiatives

Government policies are crucial in leading the city towards a circular economy, through city-wide strategies, incentives, legislations and systems to nudge society towards more circular thinking, attitudes and actions. Governments can also facilitate dialogues and coordination among various stakeholders in the public and private sectors.

This section will examine the policies and initiatives related to circular economy introduced by the Hong Kong Government. Policies related to water and energy systems in Hong Kong will be presented in Section 2.6 and Section 2.7 respectively.

2.3.1 Roadmap and studies

As suggested by the results from the questionnaire conducted by BEC (see Appendix B for the questionnaire), a roadmap is key to facilitate a city's transition towards circularity. A readily accessible roadmap with clear targets and timeline allows businesses to organise their strategies and operations accordingly and conveys to the wider public the direction and plans of the government. It also ensures that the relevant stakeholders are held accountable by tracking a city's progress towards the goals laid out in the roadmap.

A roadmap on circular economy can include targets related to waste disposal, resource consumption, recycling rate and so on, with a clear timeframe. Other components such as the approaches and directions to foster industry development, improve resource consumption habits and improve waste management technologies can be included in a city's roadmap (see examples of roadmaps from other cities in Section 1.3).

Hong Kong currently does not have a roadmap specifically on circular economy. However, a similar roadmap on resource use and conservation, "Hong Kong Blueprint for Sustainable Use of Resources for 2013-2022" was published by the Environmental Bureau in 2013. The overall target is to reduce MSW disposal rate per capita by 40% by 2022⁷⁴, through enforcing a comprehensive waste management plan and facilitating social mobilisation of resource conservation in society. An overview of the existing problems and gaps in Hong Kong was included in the document, together with the practices in other countries as references. A number of key actions were listed in the blueprint, including the finalisation of the legislation on MSW charging, which will be explained in greater depth in the following section. More recently, the Government has announced that it would formulate a long-term strategy blueprint on waste management in order to support circular economy in its 2020 Policy Address.⁷⁵

⁷⁴ Environmental Bureau. (2013). *Hong Kong Blueprint for Sustainable Use of Resources 2013-2022*. Environmental Bureau. Retrieved from <https://www.enb.gov.hk/en/files/WastePlan-E.pdf>

⁷⁵ The Hong Kong Special Administrative Region of the People's Republic of China. (2020). *Policy Address*. The Chief Executive's 2020 Policy Address.

The Government also releases studies related to the environment in Hong Kong, for example, a study was conducted in 2019 examining the feasibility of controlling or banning disposable plastic tableware; another study was conducted in 2017 analysing the feasibility of introducing a Producer Responsibility Scheme (PRS) on suitable plastic product containers etc. These are usually carried out by external consultants, with the aim to better understand current local trends and emerging issues, as well as provide relevant recommendations. These studies are for particular schemes or projects related to waste, energy and water sectors, which covers topics related to circularity, but does not have clear objectives set to improve the city's circularity.

2.3.2 Legislation and guidelines

Legislation is one of the direct approaches taken by governments to drive more immediate changes in the society. Currently, there are no legislations that are specifically promulgated under a Government circular economy strategy, but there are many on improving local waste management systems and reducing waste, which can help the city transition to a circular economy. In previous years, a number of regulations have been introduced to reduce the amount of MSW and facilitate circularity indirectly. Of the policies, this section will examine the major schemes, including the PRS, Green Procurement and MSW Charging Scheme.

The Product Eco-responsibility Ordinance (Cap. 603) was enacted in 2008 in order to implement the PRS. A PRS follows the Polluter Pays Principle, which posits that the costs incurred from any kinds of pollution should be borne by the producers. A PRS aims to reduce the environmental impacts of products at the post-consumer stage by incentivising manufacturers, wholesalers or consumers to be responsible for the disposal, recycling and other parts of products. An example of Hong Kong's PRS includes the Plastic Shopping Bag Charging, which was implemented in 2009. According to the EPD, total volume of plastic bags disposed decreased slightly from 2010 in response to the scheme and reached the lowest record of 649 tpd in 2015.⁷⁶ However, the charge of HKD\$0.5 has not been adjusted since and recent figures demonstrate that the levy is not incentivising the wider public to further reduce the use of plastic bags. As a result, more plastic bags have been disposed of since 2015 and a total of 851 tpd were disposed of in 2018.⁷⁷ In addition, Hong Kong also implemented PRS for the recycling of WEEE and glass beverage containers since 2019. It is planned for the PRS to be expanded overtime, although plans to include plastic beverage containers by the end of 2020 has be postponed due to COVID-19.

<https://www.policyaddress.gov.hk/2020/eng/p124.html>

⁷⁶ Environment Protection Department. (2016). Waste Statistics 2015. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2015.pdf>

⁷⁷ Environment Protection Department. (2019). Waste Statistics 2018. Environment Protection Department. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

Additionally, the EPD introduced a regulation on green procurement to require bureaus and departments to have environmental considerations during the procurement of goods and services, which has been adopted by all Government departments and bureaus since 2000, in order to support the environmental industry. For example, when purchasing furniture, 40% of the wood material must be recycled or waste wood and it must be certified by the Forest Stewardship Council (FSC).⁷⁸ Through purchasing products or services with green specifications, adverse environmental and human health impacts created during the production, use and disposal of these products may be minimised. The policy led to the establishment of a publicly accessible, online information portal that summarises green specifications in over 20 categories and 150 items, as well as a forum on green procurement in 2018 with over 300 participants. However, the current version of green specifications is dated in 2014 and need to be updated.

Lastly, a policy that the Government has been trying to introduce is the MSW Charging Scheme, which has been proposed since 2018, in order to drive behavioural changes among the public through financial incentives. Under the scheme, citizens are charged for disposing waste by designated garbage bags or weight. It is estimated that this policy can generate around 30% reduction in waste⁷⁹, which is crucial for circular economy. Although the bill was previously discontinued by the Bill Committee in the Legislative Council in June 2020, it has since been re-introduced to the Legislative Council in an extended session.

2.3.3 Financial incentives

In order to encourage the private sector to take action and contribute positively to the waste management industry, a number of financial incentives are provided by the Government to eligible companies. Currently, funding or financial support are mostly provided to the recycling industry, which may help a city advance towards a circular economy. These funding may facilitate recyclers in their operations, such as through capital financing, adapting new technologies or increasing employment opportunities in the sector.

The Recycling Fund is one of the main sources of funding for local recyclers. A total of HKD\$1 billion were offered in 2015 for the expansion of the industry. In the first 3 years, over HKD\$150 million were approved to support over 90 recycling projects on waste paper and waste plastics.⁸⁰ However, some recyclers have commented that the

⁷⁸ Environment Protection Department. (2014). *Green Procurement: Furniture*. Environment Protection Department. Retrieved from https://www.epd.gov.hk/epd/sites/default/files/epd/english/how_help/green_procure/files/furniture.pdf

⁷⁹ Environment Protection Department. (2018). *Legislative Council Brief: Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Bill 2018*. Environment Protection Department. Retrieved from https://www.legco.gov.hk/yr18-19/english/bills/brief/b201811021_brf.pdf

⁸⁰ Lam, S. (2019). *Information Note: Policy support to the recycling industry in selected places*. Research Office of the Legislative Council Secretariat. IN12/18-19. Retrieved from

eligibility criteria of the Recycling Fund are hard to meet. A study conducted by the HKBU in 2017 found that 90% of local recyclers have not applied for the Fund due to the perceived low success rate in obtaining funding.⁸¹ More recently, due to COVID-19, the Recycling Fund has allocated additional funds to help local recycling industry. As of May 2020, over 580 applications with subsidy over HKD\$90 million have been approved to aid local recyclers.⁸² Other similar funding schemes launched by the Government includes the Environment and Conservation Fund and the Innovation and Technology Fund, which provides financial support to companies within the environmental sector, but does not pertain specifically to circular economy.

Additionally, the Government established the EcoPark, an industrial park that provides recyclers with short-term tenancy sites at more affordable prices – about 10% of the market rent.⁸³ This initiative was in response to the aforementioned issues faced by local recyclers, including high land rental prices, which makes it difficult for recyclers to acquire land to set up their facilities. Currently, over 10 sites in the EcoPark have been leased to recyclers to recover different types of recyclables.⁸⁴ However, some sites may be too large and not suitable for smaller local recyclers, indicating difficulty in meeting the needs of all local recyclers. Moreover, there are many conditions and restrictions to leasing a tenancy site at EcoPark, further limiting the interest of recyclers to do so. In another example, the Hong Kong Science Park was also created to support R&D and innovation, including topics on green technology and material and precision engineering. The hub provides office rents at cheaper rates for companies working on these issues.

2.3.4 Non-financial Incentives

(i) Campaign

In order to engage the wider public, raise awareness and promote social mobilisation towards circularity, campaigns are one of the important non-financial incentives

<https://www.legco.gov.hk/research-publications/english/1819in12-policy-support-to-the-recycling-industry-in-selected-places-20190430-e.pdf>

⁸¹ Lam, S. (2019). *Information Note: Policy support to the recycling industry in selected places*. Research Office of the Legislative Council Secretariat. IN12/18-19. Retrieved from

<https://www.legco.gov.hk/research-publications/english/1819in12-policy-support-to-the-recycling-industry-in-selected-places-20190430-e.pdf>.

⁸² The Government of the Hong Kong Special Administrative Region. (2020, May 25). *\$90m disbursed to aid recyclers* [Press release]. Retrieved from

https://www.news.gov.hk/eng/2020/05/20200525/20200525_121039_192.html

⁸³ Lam, S. (2019). *Information Note: Policy support to the recycling industry in selected places*. Research Office of the Legislative Council Secretariat. IN12/18-19. Retrieved from

<https://www.legco.gov.hk/research-publications/english/1819in12-policy-support-to-the-recycling-industry-in-selected-places-20190430-e.pdf>

⁸⁴ EcoPark. (2020). *Latest Development: Tenancies of the phase 1 and phase 2 lots at EcoPark*. Retrieved from <http://www.ecopark.com.hk/en/tenancies.aspx>

provided by the Government. In Hong Kong, most campaigns focus on reducing waste. For example, the Food Wise Hong Kong Campaign aims to reduce the amount of food waste in Hong Kong, which is a major type of MSW generated from 2014 to 2018.⁸⁵ A character named Big Waster is also created to help advocate for the reduction of food waste at source.

(ii) Awards schemes

No award schemes were established in Hong Kong to recognise business and other efforts specifically in circular economy, however there are several existing awards that acknowledges successful green innovation and leadership, such as the Hong Kong Green Innovative Award and the Hong Kong Awards for Environmental Excellence.

(iii) Networks or platforms

Hong Kong is on the steering committee of C40 Cities Climate Leadership Group, which provides a platform for different cities to collaborate and communicate about different topical issues related to the environment.

(iv) Support for R&D and innovation

As aforementioned, hubs like the Hong Kong Science Park were established in 2001 to provide science and technology companies space to explore ideas, innovate and grow. The 890 technology companies and 9,000 R&D practitioners are supported by the Park's R&D facilities, infrastructure, as well as technical and professional advisory services.⁸⁶ Although the Park does not provide support to specifically circular economy companies, it covers topics that are important to circular economy, including materials and green technology.

Overall, Government legislations, policies and initiatives in Hong Kong are typically focused on waste reduction and management, as well as recycling. Meanwhile, other crucial aspects to the circular economy, such as design, repair, reuse, refurbishment and remanufacturing are not emphasised locally. There is an absence of information and incentives to nudge the private sector and the wider public towards these activities.

2.4 Sharing economy

Sharing economy is an alternative economic model, which promotes the sharing,

⁸⁵ Environment Protection Department. (2019). Waste Statistics 2018. Retrieved from <https://www.wastereduction.gov.hk/sites/default/files/msw2018.pdf>

⁸⁶ Hong Kong Science & Technology Parks Corporation. (2020). Who We Are | HKSTP. HKSTP. <https://www.hkstp.org/about-us/who-we-are/>

borrowing or leasing of assets or services, rather than encouraging ownership. A sharing economy, as opposed to a traditional economic model, aims to efficiently utilise under-used resources, advocate for access rather than ownership and boost peer-to-peer activities.

In general, the concept of a sharing economy is quite novel in Hong Kong. Although there are existing infrastructures in place that promotes the sharing of products or services, such as through the city's public transit system, public library etc., the concept of sharing economy is not common in Hong Kong, but is relatively more popular among the private sector, where businesses may operate with the new economy model. Even so, it remains a niche market. Among businesses that provide a platform or service to facilitate a sharing economy in Hong Kong, they include multi-national companies such as Uber (ridesharing), Airbnb (vacation rental), WeWork (office and workspace rental) etc. According to Airbnb, their business only contributed 3% of annual economic activity in Hong Kong.⁸⁷ Local business examples include BiciLine (bike rental service), WeUse (cutlery rental service for large-scale events), Wardrobista (clothing and accessories rental service), Gaifong (rental platform), Carshare (car rental service) etc. According to a research conducted by the Hong Kong Internet Registration Corporation in 2015, the most popular sharing activities among Hong Kong people are private car sharing, crowdfunding and room or flat rentals.⁸⁸ In the same study, it was also discovered that nearly 30% of the 1,500 Internet users that responded to the survey have engaged in the sharing economy in 2015. The most recent level of consumer engagement with sharing economy is unclear.

Despite growth in the sharing economy sector, some argue that the Government has not been providing sufficient support for the relevant start-ups or businesses, but instead has been focusing more on punishment and law enforcement to regulate such entities. Proponents of this argument cite the monetary fines and red tape imposed on Uber and Airbnb previously in Hong Kong. However, this sentiment and experience may not be shared among different companies, such as among some bike-sharing operators.

In spite of this, the success of businesses or start-ups in this realm is not solely determined by the regulatory environment. Issues that companies may face link with the strategy, planning and operation of businesses; the level of competitiveness in the market; or even the local constraints of operation in Hong Kong. For example, the availability of shared workspaces is partly driven by rent in the city.

⁸⁷ Yang, Y. (2018, 9 May). *Hong Kong should do more to foster development of sharing economy*. South China Morning Post. Retrieved from <https://www.scmp.com/tech/enterprises/article/2145237/hong-kong-should-do-more-foster-development-sharing-economy>

⁸⁸ Hong Kong Internet Registration Corporation Limited. (2015). *What Hong Kong People Think of the Sharing Economy?* Retrieved from <https://www.hkirc.hk/upload/event/40/self/5dca8d874b8fb.pdf>

2.5 Industrial symbiosis

Industrial symbiosis, a process where waste or by-products produced by one company becomes a valuable material for another, facilitates a reduction in the consumption of raw materials, water and energy. This process may lead to savings in water, material and a reduction in carbon emissions and pollutants emitted from production processes.

In Hong Kong, industrial symbiosis is non-existent. For example, companies in EcoPark do not and are not permitted to exchange materials or energy.

2.6 Water

In a circular economy, water has to be managed and used sustainably, with wastewater and other effluents designed out of the system, enabling the natural environment to regenerate. The current linear system has led to an unsustainable level of water abstraction and depletion, adversely affecting water quantity and quality around the world. It can also entail effluents or other pollutants being discharged back into the environment, affecting water systems and the physical environment. Water reuse and recycling offers an alternative solution to our current system by maximising the use and intrinsic value of water. It can also increase the resilience of an area's water supply.

Box 2: Terms about water to know

In Hong Kong, recycled water includes the following:⁸⁹

1. Reclaimed water, a resource produced from the processing of treated effluents from sewage treatment works
2. Treated grey water, a resource produced from the treatment of used water collected from baths, wash basins, kitchen sinks or similar fittings
3. Rainwater that is harvested in housing developments or facilities

In Hong Kong, 70-80% of freshwater comes from Dongjiang in the Guangdong Province of Mainland China. The remainder is from local catchments yields. Geographical and climate constraints, including the lack of natural lakes, rivers, as well as unsubstantial underground water sources and rainfall, mean that Hong Kong citizens cannot fully rely on the natural environment to meet their demand for freshwater, which averages at around 2.73 million cubic metres of potable water every

⁸⁹The Government of the Hong Kong Special Administrative Region. (2018, 19 October). *Public consultation on supply of recycled water in Hong Kong starts today*. [Press release]. Retrieved from <https://www.info.gov.hk/gia/general/201810/19/P2018101800546.htm>

day between 2019-20.⁹⁰ Meanwhile, the city uses lower grade water, mostly seawater, for flushing purposes and other non-potable uses. Around 80-85% of inhabitants in Hong Kong currently use seawater to flush. The remainder uses recycled water and freshwater. In 2019, the Water Supplies Department (WSD) planned to diversify water resources to secure supply beyond 2030 (see Figure 9).

Future diversification of Hong Kong's water resources

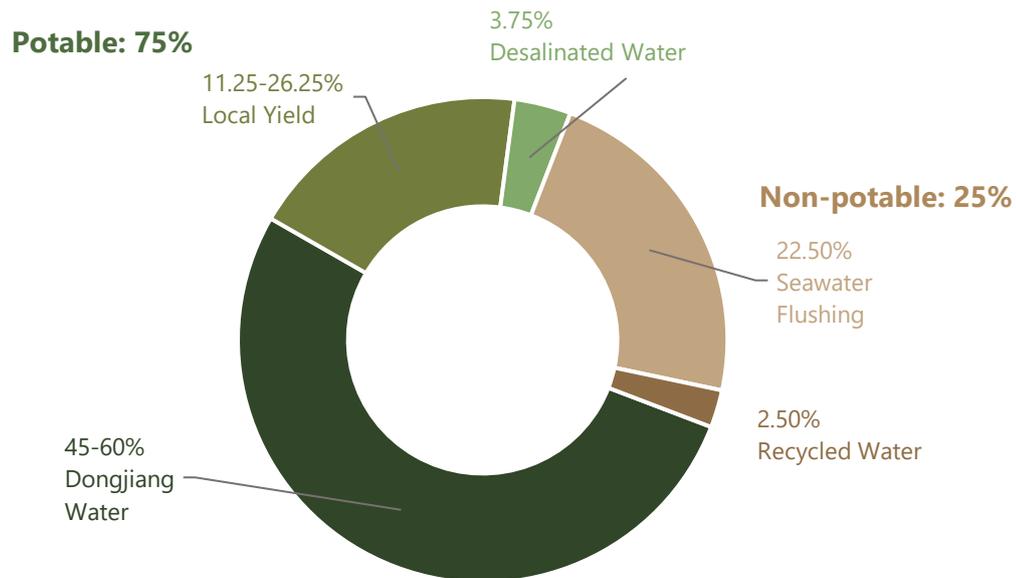


Figure 9: Future diversification of Hong Kong's water resources
Data source: Civic Exchange⁹¹, Water Supplies Department⁹²

Since the 2000s, Hong Kong has integrated recycled water in its strategies. In 2008, Hong Kong implemented the Total Water Management (TWM) strategy, which guides water conservation and management in the city. Infrastructure that promotes and provides reclaimed water has been built and operated, including Ngong Ping Sewage Treatment Works (NPSTW), Shatin Sewage Treatment Works (STSTW), Tai Po Sewage Treatment Works (TPSTW), Sai Kung Sewage Treatment Works (SKSTW) etc. Reclaimed water from these facilities is mainly for non-potable uses, such as for toilet flushing, rearing aquarium fishes, plant irrigation, as well as for irrigation and dilution of chemicals in sewage treatment works etc. In 2016-17, it was estimated that 1,300 cubic

⁹⁰ Water Supplies Department. (n.d.) *Hong Kong: The Facts – Water Supplies*. Retrieved from <https://www.wsd.gov.hk/en/publications-and-statistics/pr-publications/the-facts/index.html>

⁹¹ Civic Exchange. (2019). *Modernising Hong Kong's Water Management Policy Part II*. Retrieved from <https://civic-exchange.org/wp-content/uploads/2019/12/Sustainable-Water-Infrastructure-Full-Report.pdf>

⁹² Water Supplies Department. (2019). *Total Water Management Strategy 2019*. Water Supplies Department. Retrieved from https://www.wsd.gov.hk/filemanager/en/content_1866/twm-strategy-2019-e_V1.pdf

metres of reclaimed water were generated per day for non-potable uses.⁹³ Currently, the WSD is continuing to test and integrate new infrastructure and treatment technologies.

Meanwhile, guidelines have been released on grey water recycling and rainwater harvesting systems and have been incorporated in the joint Development Bureau and Environment Bureau on Green Government Buildings from April 2015. By mid-2019, these systems have been introduced in the new buildings of about 100 government projects.⁹⁴ In the near future, the WSD is looking to build and finalise a centralised grey water recycling system in the Anderson Road Quarry development site, for flushing purposes.

Recycled water produced for non-potable uses is important for Hong Kong as it can become an important alternative to freshwater. According to a research conducted by Civic Exchange, reclaimed water for non-potable uses in the city can be 35% cheaper than the cost of Dongjiang water at the time of the study.⁹⁵ This can become a strong incentive for areas in Hong Kong that still rely on freshwater for flushing to use reclaimed water instead. For example, WSD has found that reclaimed water can serve as a good alternative for flushing in New Territories, where freshwater and seawater flushing has been found to be less economical.

While reclaimed water, recycled grey water and harvested rainwater enable Hong Kong to better abide to the principles of circular economy, there are several issues that may hinder a more wide-spread use of recycled water in the city. For example, space constraints for the infrastructure, significant capital investments, high operation requirements of the technology, high hygiene requirements and lack of economic viability in certain cases may be one of the many aspects that require further consideration and R&D. Perceived hygiene concerns and acceptance by the public may also become an inhibiting factor if the use of recycled water becomes more mainstream and for potable purposes.

Lastly, although technology exists locally to treat industrial wastewater, it is unclear how much wastewater is treated in Hong Kong and if it would be reused afterwards.

2.7 Energy

In a city's transition towards a circular economy, the processes to design out waste and keep materials and products in the loop is underpinned by a city's energy system. For

⁹³ Drainage Services Department. (2019). *Reclaimed Water*. Retrieved from https://www.dsd.gov.hk/EN/Sewerage/Environmental_Consideration/Reclaimed_Water/index.html

⁹⁴ Water Supplies Department. (2019). *Total Water Management Strategy 2019*. Water Supplies Department. Retrieved from https://www.wsd.gov.hk/filemanager/en/content_1866/twm-strategy-2019-e.pdf

⁹⁵ Civic exchange. (2019). *Modernising Hong Kong's Water Management Policy Part II*. Civic exchange. Retrieved from <https://civic-exchange.org/wp-content/uploads/2019/12/Sustainable-Water-Infrastructure-Full-Report.pdf>

an economy to be sustainable and circular, its energy sources should be renewable, resilient and effective.

Due to the lack of indigenous primary energy sources in Hong Kong, energy is mostly derived from external sources, which are converted into secondary energy for subsequent use. In 2019, Hong Kong's consumption of primary and final energy per capita is 79,738 and 45,218 megajoules respectively.⁹⁶ While per capita consumption of primary energy fell from 2018, per capital consumption of final energy increased. Refer to Figure 10 for the city's per capita consumption of primary and final energy consumption from 2009-19 released by the Census and Statistics Department.

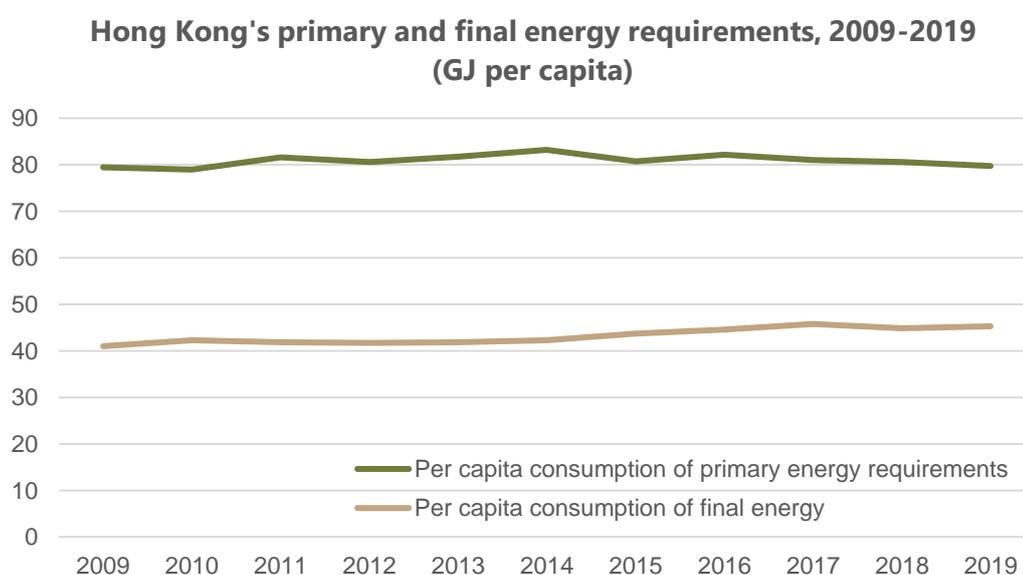


Figure 10: Hong Kong's primary and final energy requirements, 2009-2019 (gigajoules per capita)
Data source: Census and Statistics Department⁹⁷

From 2009-19, per capita GDP in real terms grew at an average annual rate of 2.1%, while primary energy requirements remained the same and final energy requirements increased by 1%.⁹⁸

As of 2019-20, coal is the dominant fuel for electricity generation in Hong Kong,

⁹⁶ Census and Statistics Department. (2020). *Hong Kong Energy Statistics: 2019 Annual Report*. Census and Statistics Department. Retrieved from <https://www.statistics.gov.hk/pub/B11000022019AN19B0100.pdf>

⁹⁷ Census and Statistics Department. (2020). *Hong Kong Energy Statistics: 2019 Annual Report*. Census and Statistics Department. Retrieved from <https://www.statistics.gov.hk/pub/B11000022019AN19B0100.pdf>

⁹⁸ Census and Statistics Department. (2020). *Hong Kong Energy Statistics: 2019 Annual Report*. Census and Statistics Department. Retrieved from <https://www.statistics.gov.hk/pub/B11000022019AN19B0100.pdf>

accounting for around 45% of the city's fuel mix.⁹⁹ Natural gas and non-fossil fuels, including imported nuclear power, contributed 29% and 26% to the fuel mix respectively. It is planned that coal-fired generation will drop and that these units will gradually be replaced by gas-fired units and non-fossil fuel sources over time. Currently, Hong Kong's existing gas plants and coal plants have an average efficiency of 45-60% and 37% respectively.¹⁰⁰

Meanwhile, renewable energy contributions to the city's fuel mix remains minimal. Part of the reason is the absence of provisions for increasing renewable energy mix within the Scheme of Control Agreements (SCA) that govern the 2 key electric companies in Hong Kong. Since the 2000s, Hong Kong has had several renewable energy initiatives around the city, including the development of a small-scale wind power generation; use of landfill gas as fuel for gas production; inclusion of biodiesel in oil products; and installation of photovoltaic (PV) in schools and rooftops of public sector buildings etc. Overall, Hong Kong has a low renewable energy potential, at around 5%, due to the city's geographical and climate constraints. In spite of this, it is the Government's intention to develop the city's capacity for renewable energy to 3-4% using wind, solar, and WtE until 2030.¹⁰¹ To achieve this, the Government has introduced feed-in tariffs (FiT) and Renewable Energy Certificates (RECs) to promote the development of renewable energy. However, there are no provisions to allow large renewable energy system providers to negotiate on behalf of individuals. Recommendations have also been set out by the Council for Sustainable Development to explore the possibility of RE import from other countries and to enhance regional co-operation on energy.

2.8 Circular economy market, private investments and jobs

As circularity becomes more mainstream, with a greater recognition of the opportunities that lies in a circular economy market, the amount of private investments, jobs, disruptive technologies and private initiatives in the market will grow. Globally, the market for circularity is expanding. In Hong Kong, though there is a similar trend due to a small but rising level of awareness of circular economy locally, the development of a circular market remains slow and the overall market share is small. In terms of the city's environmental industry (partly including the circular economy sector), the value added grew by 5.8% year on year to HKD\$ 9.9 billion in 2018 (or 0.4%

⁹⁹ The Hongkong Electric Company Limited. (2019). *About HK Electric*. The Hongkong Electric Company Limited. Retrieved from https://www.hkelectric.com/en/CorporateInformation/Documents/19_20_CIB_E_3_About_HK_Electric.pdf and CLP Power Hong Kong Limited. (2019). *CLP Information Kit*. CLP Power Hong Kong Limited. Retrieved from <https://www.clp.com.hk/en/about-clp-site/media-site/resources-site/publications-site/Documents/CLP-Information-Kit-English.pdf>

¹⁰⁰ Environment Bureau. (2017). *Hong Kong's Climate Action Plan 2030+*. Environment Bureau. Retrieved from <https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf>

¹⁰¹ Environment Bureau. (2017). *Hong Kong's Climate Action Plan 2030+*. Environment Bureau. Retrieved from <https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf>

of GDP).¹⁰²

Whilst it is unclear what the overall level of private investment is in the circular economy sector in Hong Kong due to limited information, there are examples of private investments, as well as private financing options allocated for waste recycling, water recycling, renewable energy and the sharing economy, all of which falls under the scope of circular economy. For instance, EcoPark, an industrial park built to promote the local recycling industry, attracted companies like New Life Plastics Limited, a joint venture by ALBA Group, Baguio Green Group Limited and Swire Coca-Cola Limited to tackle Hong Kong's plastic waste problem. They had recently secured a sustainability-linked loan from HSBC for its polyethylene terephthalate (PET) and high-density polyethylene (HDPE) recycling facility in Hong Kong.

Meanwhile, among the different types of private financing options available, green bond issuances for waste in Hong Kong remain less popular, with most proceeds allotted to low-carbon buildings. Only 8% were issued for waste, 6% for water and 5% for energy.¹⁰³ Examples of green bonds issued for waste includes Hysan Development Company Limited, which issued four green bonds (US\$197 million) in 2019, one of which was dedicated to waste management;¹⁰⁴ the Hong Kong and China Gas Company Limited, which issued two green bonds (HKD\$600 million and JPY¥ 2 billion) financing for WtE projects in 2017 etc.¹⁰⁵ On the other hand, waste, water and energy companies also rely on private equity and venture capital to further their work in these sectors. Some companies raise funds by going publicly listed. In the meantime, while there are many external venture capital funders in Hong Kong, it is unclear how much is allocated to circular economy-related companies and projects. Within the financing landscape, firms in Hong Kong also have access to public funds, such as the aforementioned Recycling Fund etc. discussed in Section 2.3.3.

Additionally, there has been a growing number of private and public initiatives that enables circularity, as well as a greater adoption of circular business models in Hong Kong. Accenture identified 5 different types of models that businesses can adopt, including circular supplies (i.e. providing renewable energy, recyclable materials or inputs etc.); resource recovery; product life extension (through repairing, upgrading, reselling etc.); sharing platforms (which involves sharing the use, access and ownership

¹⁰² Hong Kong Trade Development Council. (2020, 15 July). *Green Technology & Environmental Services Industry in Hong Kong*. Retrieved from <https://hkmb.hktdc.com/en/MzEzOTE3Mzkz/hktdc-research/Green-Technology-%26amp%3B-Environmental-Services-Industry-in-Hong-Kong>

¹⁰³ Lau, I., Almeida, M., Meng, A. and Giorgi, A. (2020). *Green Bond Market Briefing: Hong Kong*. Climate Bonds Initiative. Retrieved from https://www.climatebonds.net/files/reports/cbi_hk_briefing_2020_02c.pdf

¹⁰⁴ Charltons. (2020). *Guide to Issuing and Listing Green Bonds on The Stock Exchange of Hong Kong Limited*. <https://www.charltonslaw.com/hong-kong-law/a-guide-to-issuing-and-listing-green-bonds-on-the-stock-exchange-of-hong-kong-limited/>

¹⁰⁵ The Hong Kong and China Gas Company Limited. (2017). *Towngas issues its First 10-year Green Bond to Fund Environmentally-Friendly Waste-to-Energy Investments*. Retrieved from https://www.towngas.com/getmedia/a337d814-06bb-4684-9f74-086066bcec3b/20171114_PressRelease_Towngas-issues-its-First-10-year-Green-Bond_Eng_1.pdf.aspx?ext=.pdf

of products); and product as a service (i.e. allowing access to and use of a product while discouraging ownership).¹⁰⁶ Businesses can adopt these models in silo or together.

In Hong Kong, there are several examples of businesses that do circular supplies, such as CLP Power Hong Kong, the Hongkong Electric Company, and The Hong Kong and China Gas Company, which have been focusing on diversifying the fuel mix to include more renewable sources. Resource recovery companies, which include but not limited to Suez, Veolia, ALBA Integrated Waste Solutions are carrying out continuous R&D, as well as testing and identifying appropriate technological solutions to best recapture reusable materials. There are also many examples of businesses that extend the lifespan of products through product repairs, as it is often offered to customers as a type of after-sales service. This includes many electronic companies such as Siemens, Toshiba Corporation and so on, as well as other types of companies such as vehicles companies. Many local repair and maintenance stores also provide similar services. On the other hand, second-hand marketplaces can also lengthen the lifespan of a product through reselling the product online or in physical stores, as well as through online exchange platforms. An example of an online exchange or trading platform includes Carousell, which facilitates consumer to consumer or business to consumer sales of second-hand products. On the other hand, some retail or charity shops also sell second-hand clothing, toys or even books, such as Oxfam Hong Kong, The Salvation Army etc. Examples of sharing platforms and businesses that provide products as a service are detailed in Section 2.4. Overall, it is unclear how many businesses have adopted these models in Hong Kong.

To further facilitate circularity, there is also a rising number of public-private collaborations in the market, such as groups like Drink Without Waste, which encourage dialogues between beverage companies and non-governmental organisations (NGOs) on how to reduce single-use beverage packaging. Another group that encourages the exchange of circular ideas is BEC's Circular Economy Advisory Group, where many businesses come together to discuss and share insights on becoming more circular. Increased interactions as such demonstrate a rising awareness of circularity among the private sector in the city and may even encourage more businesses to incorporate circular business models or principles into their operations.

Another key consideration of the circular economy market is the number of people employed within the market, and the availability of training for workers and students in circular economy trades or occupation. In 2018, 44,130 persons were employed in the environmental industry in Hong Kong.¹⁰⁷ In 2014, it was estimated that 13,000

¹⁰⁶ Accenture. (2014). *Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth*. Accenture. Retrieved from https://www.accenture.com/t20150523T053139_w_us-en_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf

¹⁰⁷ Census and Statistics Department. (2019). *Hong Kong Monthly Digest of Statistics: The Four Key Industries and Other Selected Industries in the Hong Kong Economy*. Census and Statistics Department.

persons were employed in the waste recycling industry.¹⁰⁸ Overall, there is no information on how many people are employed in the circular economy industry and no updated data on the above.

Recently, the Government introduced the Graduates Subsidy Programme, which provides subsidies to companies and other eligible organisations to employ graduates working in the environmental field, which may include the circular economy sector. The programme will cover around 200 jobs and will be implemented in 2020-21. Certain programmes offered by vocational training schools as well as universities also help students become more prepared for and well versed in circular economy-related occupations. While there is no course specifically on circular economy, some programmes with environmental components may touch upon the topic in class.

Lastly, a key measure of the circular economy market also includes the number of patents from the city related to circular economy and the number of these patents applied at a city-level. Although there are no latest accessible figures on this front, there are many examples of local as well as foreign innovations be created or used relevant companies in Hong Kong. For instance, Hong Kong was granted a patent of waste treatment apparatus and method from a company in the UK, which facilitates better separation of recyclables and non-recyclables.¹⁰⁹ Universities also play a huge role in developing new patents that may help the city transition to a circular economy.

Retrieved from <https://www.statistics.gov.hk/pub/B71905FA2019XXXXB0100.pdf>

¹⁰⁸ Lam, S. (2019). *Information Note: Policy support to the recycling industry in selected places*. Research Office of the Legislative Council Secretariat. IN12/18-19. Retrieved from <https://www.legco.gov.hk/research-publications/english/1819in12-policy-support-to-the-recycling-industry-in-selected-places-20190430-e.pdf>

¹⁰⁹ PyroPure Limited Granted Hong Kong Patent for Waste Treatment Apparatus and Method. (2014). Global IP News. Environmental Patent News, pp. Global IP News. Environmental Patent News, 2014-03-04.

3. Circular Economy-related Indicators in Hong Kong

Indicators are crucial to understanding the scope and severity of issues faced by a city, and to measuring a city’s performance over time towards circularity.

As aforementioned, this report compiles city-level circular economy indicators from institutional, academic and municipal documents, which were then screened by BEC and local practitioners to identify ones that are more applicable to the context of Hong Kong. Additional indicators were also added to the list of circular economy indicators for Hong Kong, as the findings from this report and suggestions made by industry experts concluded that further indicators were needed to better capture and track circularity in Hong Kong. Major categories of indicators were developed based on the finalised list, which shaped the scope of discussion in Section 2.

Table 2 summarises the said indicators and specifies the availability of each indicator in Hong Kong, its source (if the indicator is available) and its relevance for Hong Kong. Indicators that are more relevant for Hong Kong were determined by the results from the questionnaire and the analysis of this report. Additional indicators proposed by questionnaire participants and BEC are marked with an asterisk (*) in the table below. Refer to Appendix C and D for the full list of indicators taken from institutional and municipal documents respectively before they were screened.

Table 2: Compilation of circular indicators for Hong Kong

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
Category 1a: Primary raw materials				
1	Input of virgin materials (per capita)	N		N
Category 1b: Secondary raw materials				
2	Rate of cyclical material use (the share of material recovered and fed back into the	N		Y

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
	economy in overall material use)			
3	Trade in recyclable raw materials within a city	N		N
4	Amount of imports and exports of selected recyclable raw materials	N		N
Category 2: Waste management process and infrastructure				
5	Volume of waste generated (per capita)	Y	Environmental Protection Department	Y
6	Collection rate of separate waste systems	N		Y
7	Collection rate of informal collectors (e.g. scavengers) *	N		Y
8	Collection rate in different sectors (e.g. hotel industry, food and beverage industry) *	N		Y
9	Evaluation of waste collection system in city planning	N		Y
10	Volume and rate of resource recovery	Y	Environmental Protection Department	Y
11	Volume of resources recycled in community collection points (e.g. Community Green Stations) *	N		Y
12	Volume of and degree to which resources are recovered locally *	Y	Environmental Protection Department	Y
13	Volume of recyclables exported for recycling *	Y	Environmental Protection Department	Y
14	Volume of waste imported for local recycling *	N		Y
15	Degree to which collection, repair, reuse and recycling infrastructure is in place	Y	Environmental Protection Department	Y
16	Volume of waste disposed in landfills and/or other waste disposal facilities *	Y	Environmental Protection Department	Y

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
Category 3: Government legislations and initiatives				
17	Availability of a roadmap for resource management	Y	Environment Bureau	Y
18	Degree to which economic incentives, legislation or comparable rules are in place and enforced regarding product standards, better materials management etc.	Y ¹¹⁰	Environmental Protection Department	Y
19	Degree to which systems are in place for making more efficient use of resources (e.g. arrangements for sharing products, exchange of information on the availability of reusable materials etc.	Y	Environmental Protection Department	Y
20	The integration of circular aspects in public procurement schemes	Y ¹¹¹	Environmental Protection Department	Y
21	Number of enterprises receiving financial support in connection with circular economy, and the amount allocated	Y	Recycling Fund	Y
22	Budget amount allocated to projects or living labs, and number of companies having benefitted	Y	Recycling Fund	Y
23	Degree to which there are voluntary collaboration schemes in place encouraging value chain and cross-sectoral initiative and information sharing	N		Y
24	Degree to which businesses are involved in managing material cycles in a circular way and is empowered to make	Y	Environmental Protection Department	Y

¹¹⁰ While Hong Kong do have some indicators available on this front, more aggressive circular economy indicators, such as product durability standards, recycled content requirements are missing

¹¹¹ Though the Government has introduced the green procurement scheme, the green specifications are outdated

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
	the right decisions, either on an obligatory or voluntary basis (e.g. availability of innovative schemes, awards for circular businesses etc.)			
25	Degree to which citizens are involved in managing materials cycles in a circular way and are empowered to make the right decisions	Y	Environmental Protection Department	Y
26	Number of public seminars organised on circular economy under a city-wide circularity strategy	N		N
27	Number of new neighbourhoods incorporating the principles of the circular economy	N		N
28	Degree of cross-learning and exchanges with other cities on circular economy	N		Y
Category 4: Sharing economy				
29	Degree of a sharing economy from businesses and the regulatory environment	N		Y
30	Degree of a sharing economy in different sectors of a city	N		N
31	Value added of the sharing economy industry	N		Y
Category 5: Industrial symbiosis				
32	Number of companies engaged in industrial symbiosis	N		N
33	Environmental impact of industrial symbiosis (i.e. water, CO2, material savings etc.)	N		N

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
Category 6: Water				
34	Rate of industrial water reuse	N		N
35	Rate of urban reclaimed water utilisation	Y	Water Supplies Department; Drainage Services Department	Y
36	Rate of treated grey water utilisation *	N		Y
Category 7: Energy				
37	Fuel mix for power generation	Y	Census and Statistics Department	Y
38	Total energy consumption	Y	Census and Statistics Department, Electrical and Mechanical Services Department	Y
39	Decrease in energy consumption per GDP	Y	Census and Statistics Department, Electrical and Mechanical Services Department	Y
Category 8: Circular economy market, private investments and jobs				
40	Gross value added in circular economy sectors	N		Y
41	Amount of private investments in circular economy	N		Y
42	Degree of awareness of circular economy in the private sector	N		Y
43	Degree to which circular business models are adopted	N		Y
44	Number of patents related to waste management and recycling applied at city-level	N		Y
45	Availability of university courses on circular economy	Y	Respective websites of local	Y

No.	Indicators	Availability in Hong Kong	Source (if available)	Current relevance for Hong Kong
			universities	
46	Number of people trained in circular economy trades	N		Y
47	Number of students trained in circular economy occupations	N		Y
48	Total number of persons employed in eco-industries and circular economy	Y	Census and Statistics Department	Y

Based on Table 2, most circular economy-related indicators are not available in Hong Kong. The most commonly available indicators in the city fall under the “waste management process and infrastructure” category, which are typically quantitative indicators related to waste that are recovered, recycled, disposed etc. Indicators on “government legislations and initiatives” are also more widely available in Hong Kong. Currently, most information in the city is collected by the EPD. Indicators under the following categories: “sharing economy”, “industrial symbiosis” and “circular economy market, private investments and jobs” are less common locally, as these topics as well as the general concept of circular economy are relatively niche in the Hong Kong. As a result, information obtained in the city most typically are about waste management and less about other aspects in circular economy.

Regarding the indicators that are not available in Hong Kong at this moment, participants of the survey suggested several ways to collect the data. It was most commonly recommended to rely on digital tools to collect such information. For example, smart meters or platforms can be adopted to obtain quantitative data on the waste or resources collected, recycled and disposed etc. Data that are more related to the private sector can be taken from sustainability reports produced by different companies. Overall, the responsibility to collect information lies on both the Government and industry leaders.

In addition, many indicators are currently relevant for Hong Kong, meaning that they are applicable and appropriate for the city at the time that this report was written. For indicators that are currently relevant but not available, collection of such data should be started. For indicators that

are not available and currently relevant, they may become relevant in the future once more policies, collaborations and private sector initiatives become more mainstream. For example, indicators on secondary raw materials may become more applicable to Hong Kong once local demand or regional demand is created, and data on this front should be collected once the indicator becomes relevant.

4. Conclusions and Recommendations

4.1 Conclusions

Overall, Hong Kong is still a very linear city, with limited progress in circularity. Areas crucial to circular economy, including design, repair, reuse, refurbishment and remanufacturing are not well understood concepts by the Government and the wider public, and therefore are not common activities carried out in the city. Waste management in Hong Kong, including recycling and waste reduction, is fraught with difficulties that prevent the industry from better delivering circularity. High production of waste at source; public distrust towards the handling of recyclables; unstable collection rates; small local recycling capabilities; fluctuating market prices for recyclables; limited land supply and high land rental prices for facilities; contamination of recyclables; high operation costs of recyclers; and restrictions in the global waste trade dampens the city's ability to recycle and reduce waste. Meanwhile, although there have been efforts in scaling up the use of recycled water and renewable energy in Hong Kong, the potential to use these resources locally is limited due to the city's geography, the state of technology and the lack of economic feasibility in certain cases. While there are a handful of Government legislations and initiatives on waste, water and energy in the city, these policies have typically been promulgated in silo, without the strategic consideration of circular economy. Policy documents not specifically related to circular economy, such as building policies, development policies and so forth have minimal to no permeation of circular economy principles. The development of industrial symbiosis, a sharing economy, secondary raw materials market, as well as circular economy jobs and market are in its infancy.

If Hong Kong is to transition to a circular economy on its own, it may run into structural and fundamental barriers. The city's economic structure – a service-based economy with the lack of diverse industries has led to a recycling gap in the city, as there is a lack of demand and use for recycled materials. Another underlying issue is the city's reliance on imported goods and resources, which makes reverse logistics to recover resources difficult to implement. As a result, efforts to become circular in the city tends to focus on the bottom levels of the waste hierarchy and lead to a 'waste management' approach. A third constraint to circularity in Hong Kong is its geography, climate and size (as mentioned above), which limits the city's potential for renewable energy and leads to insufficient land allocation to resource recovery industries and other related industries.

Additionally, the lack of understanding and awareness of the concept of circular economy is a key hindrance to more widespread circular economy adoption and thinking at all levels. In Hong Kong, circular economy is still a very new and niche idea. Most public and private efforts that contribute to circularity are typically carried out under the guise of recycling and waste reduction. This trend is reflected in the types of indicators and data available in Hong Kong, where indicators and information on waste and recycling are most common and readily accessible.

Other obstacles to circular economy include the lack of government actions and enabling policies; lack of a clear regulatory framework and roadmap on circular economy; lack of financial drivers and incentives to reduce waste, encourage the use of recycled materials etc.; lack of existing regulations that require the use of virgin materials; lack of waste processing facilities and downstream waste management options; inability to achieve economies of scale in recycling; lack of coherent and aligned efforts along the resource management value chain; lack of awareness among the wider public to recycle correctly; lack of research and studies on circular economy in Hong Kong; and lack of transparent and timely information on available resources etc.

4.2 Recommended actions

To better achieve circularity in Hong Kong, there are several possible actions that can be taken up by the Government and the private sector.

4.2.1 Introduction of a roadmap and other holistic Government support

To introduce and integrate circular economy into Hong Kong's economy, BEC recommends the Government to adopt a circular approach to resource management to reduce waste at source; maximise the value of materials and products; and reduce carbon emission from the waste, water and energy sector. Creating an action plan or a roadmap with a clear vision, measurable targets and critical milestones is an important first step to the city's transition towards a circular economy.

The action plan should also detail the supporting regulations, policies and standards, such as extending the PRS to include other waste streams. In particular, the Government should also look to introducing more guidelines and incentives to promote circular design, repair, reuse, refurbishment and remanufacturing in Hong Kong. This can include, for example, requirements on the use of recycled materials for products or buildings; regulations on eco-packaging; integration of circular economy principles into construction and demolition and city planning etc. The Zero Waste Design Guidelines¹¹² released in NYC is a good example of how building design can help facilitate zero waste through the promotion of leaner construction, design of multi-purpose spaces, design of more accessible sorting and recycling facilities and so on.

Among the different policies and regulations to promulgate, it is strongly recommended for the Government to continue to push for the MSW Charging Scheme, as providing the proper financial incentive can reduce waste at source and ensure

¹¹² Center for Zero Waste Design. (2017). *Zero Waste Design Guidelines*. Retrieved from https://www.zerowastedesign.org/wpcontent/uploads/2017/10/ZeroWasteDesignGuidelines2017_Web.pdf

greater economic stability in the resource recovery industry. More recently, providing health and safety standards for the use of recycled or alternative materials is also crucial and timely in light of the global pandemic, and will provide greater quality assurance for consumers. The Government can refer to the approaches in other existing city-level circular economy strategies (see Section 1.3). Funding can also be used to provide further support and increase employment opportunities in the circular economy and resource recovery industry, as well as to encourage smaller-scale projects and trials to facilitate R&D and build expertise. In addition, education and training to the wider public and relevant stakeholders along the resource value chain is important to increase awareness and proper understanding of circular economy and how to achieve it. It is also vital to better communicate the importance of washing and sorting wastes to lower the level of contamination among recyclables. Refer to Box 3 as an example of a roadmap in Singapore. It should be noted however that Singapore has an aspiration goal of zero waste and not specifically circular economy.

The combination of introducing requirements on the use of recycled materials; and directing more support and investment for R&D and technological innovation as mentioned above; as well as leading by example through green and circular public procurement, can potentially help drive Hong Kong's demand for recycled materials. For example, requirements on the use of recycled materials can take the form of a mandate (e.g. California recently passed a legislation requiring 50% post-consumer recycled content in plastic beverage bottles by 2030)¹¹³ or a tax (e.g. England proposed a tax on plastic packaging with less than 30% recycled plastic content).¹¹⁴ A requirement on recycled content may increase local recycling incentives and rates; establish more stable recycled material prices; and reduce environmental impact of materials and products that can absorb recycled content. However, the introduction of such measures require an in-depth feasibility study regarding minimum requirements of recycled content in products; improvement in the collection, sorting and washing of materials to ensure the quality and quantity of materials recovered for processing; a robust quality assessment and assurance of these recycled materials for consumers and other end users; as well as a deep consideration on how such requirements can be implemented in Hong Kong when most of the city's goods and services are imported. These policy instruments need to be designed with the consideration of the complexities and intricacies of different but relevant markets both locally and internationally. Meanwhile, R&D and sufficient investment is also key to indirectly inducing demand for recycled materials, as the improvement and commercialisation of circular technologies and alternative materials can lead to more competitive prices of recycled materials compared to virgin materials in the long run. Singapore also focused

¹¹³ Felton, D. (2020, October 13). *Recycled Content Mandates: Pros and Cons*. Packaging World. <https://www.packworld.com/issues/sustainability/article/21197144/recycled-content-mandates-pros-and-cons>

¹¹⁴ Government of the United Kingdom. (2018). *Our Waste, Our Resources: A Strategy for England*. Government of the United Kingdom. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf

part of its efforts in pushing innovation in the realm of circular economy (refer to Box 3). Meanwhile, public procurement can generate direct demand for recyclable materials or products with recycled content, and potentially have a knock-on effect on the private sector by prompting them to follow such practices. Another solution to develop the market for recycled materials in Hong Kong includes collaborating with other locations to compensate for the lack of local demand for recyclables (discussed further below).

Box 3: Singapore's Zero Waste Masterplan

Released by the Singapore Ministry of Environment and Resources in 2019, the Zero Waste Masterplan details the vision, targets, approach, legislations and initiatives to be taken in order for Singapore to attain zero waste. It is envisioned for Singapore to strengthen 3 resiliences, including climate, resource and economic resiliences, which can be achieved by adopting a circular economy approach. In the Masterplan, Singapore is to meet 3 targets, including (i) Extend Semakau Landfill's lifespan beyond 2035; (ii) Reduce the amount of waste sent to landfill per capita per day by 30% by 2030; and (iii) By 2030, achieve a 70% overall recycling rate: 81% non-domestic recycling rate and 30% domestic recycling rate.¹¹⁵ In order to meet these targets, 4 measures were introduced and explained in the Masterplan, including legislations; support for R&D and new infrastructure; transforming the environmental services industry; and co-creating solutions with the community.

Among the legislations promulgated, the Resource Sustainability Act introduces mandatory packaging reporting; extended producer responsibility for electronic-waste and packaging (including plastics); and mandatory food waste segregation for treatment. The Ministry also identified IWMF, WtE and other technologies to be the core focus of R&D efforts in the near future. To push for greater innovation, the Ministry has developed partnerships, such as the Innovating Curating Better Automation and Technologies for Environmental Services (INCUBATE) partnership that was set up to bring public and private sector stakeholders to prototype, pilot and profile solutions.¹¹⁶ Currently, they are examining the potential of employing smart solutions, such as smart compactors, in-sink grinders with on-site food waste treatment systems to achieve zero waste.¹¹⁷ In addition, workers in the environmental services industry are to be upskilled in order to transform the sector, and companies, households and general citizens are to be consulted on methods to improve recycling

¹¹⁵ Ministry of the Environment and Water Resources Singapore. (2019). *Zero Waste Masterplan*. Ministry of the Environment and Water Resources Singapore. Retrieved from <https://www.towardszerowaste.gov.sg/images/zero-waste-masterplan.pdf>

¹¹⁶ Ministry of the Environment and Water Resources Singapore. (2019). *Zero Waste Masterplan*. Ministry of the Environment and Water Resources Singapore. Retrieved from <https://www.towardszerowaste.gov.sg/images/zero-waste-masterplan.pdf>

¹¹⁷ Ministry of the Environment and Water Resources Singapore. (2019). *Zero Waste Masterplan*. Ministry of the Environment and Water Resources Singapore. Retrieved from <https://www.towardszerowaste.gov.sg/images/zero-waste-masterplan.pdf>

practices.

Singapore is also working on building international partnerships. For example, the Nanyang Technology University in Singapore set up a research centre with the French Alternative Energies and Atomic Energy Commission to explore methods in recycling lithium-ion batteries in an eco-friendly manner, as well as in extracting metals from printed circuit boards. Several local companies have already expressed interest in collaborating in this project to carry out pilot testing and to develop the technologies further.

The Government can also re-examine existing regulations and consider how new circular businesses can operate legally and in parallel with other businesses in the city. Appropriate safety and health provisions should be provided to protect users and consumers.

Overall, it is suggested that the Government should consider resource management in a more long-term and holistic manner. The Government and various government agencies need to move away from their current piecemeal approach to a holistic mindset of achieving circular economy and to integrate clear circular economy principles across its functions and policies, as well as embed circular economy principles across government departments. Given the development of the global pandemic, health and well-being of people should be placed at the centre of circular city strategies. There should also be better synergies between climate change and circular economy strategies, initiatives, analyses and policy efforts, as they share many of the same goals.

4.2.2 Collaboration with other regions

As aforementioned, Hong Kong cannot achieve circularity on its own. Instead, the Government can explore possible avenues of collaboration with other regions, such as with the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) in order to overcome the city's recycling gap. Greater policy coordination with the GBA, such as the removal of regulatory barriers; consensus on the types of materials or recyclables to be collected and traded; and the streamlining of cross-border waste delivery processes and so forth can enable Hong Kong to better achieve circularity. With good collaboration and sound regulations, this exchange can also present new business opportunities to Hong Kong companies and generate economies of scale. A few examples of cross-border cooperation, though not directly related to resource recovery and circular economy, includes the Cleaner Production Partnership Programme (CPPP), which promotes cleaner production processes and technology adoption; and the Framework Agreement on Hong Kong-Guangdong Cooperation, which maps out the macro long-term development policies between the two areas.

Though sensible from a resource-based perspective to achieve circularity, such

cooperation with Mainland China may be controversial given Hong Kong's current political climate.

4.2.3 Information collection, conducting circular economy-related studies and use of digital tools

Part of achieving circularity and building sound collaboration with other regions involves understanding a city's state and potential for circularity. To do so, relevant information must be routinely collected and interpreted, and should be accessible by the wider community. This report compiled a list of indicators from institutional, academic and existing city-level documents, and suggested a preliminary framework (see Section 3) for cities to measure, track and assess their progress towards a circular economy (see Appendix C and D). The applicability of each indicator depends on the city's context and its vision for circularity.

It is important to start collecting the relevant data now, as that will facilitate the collection of time series data, which will inform policymakers and other key stakeholders on the changes of different circular components in a city overtime. Although this report has found that some indicators suggested are not currently relevant to Hong Kong, they may become relevant later as more policies, collaborations and private sector initiatives are introduced, and data should be collected accordingly when that happens. As mentioned above, this information cannot be collected solely by the Government, as the private sector also plays a key role in collating and disclosing the relevant information on a city's circularity, especially with regards to a city's circular economy market, private investments and jobs etc.

After the data is collected, it can be analysed and published into useful studies to inform the next steps that should be taken by the Government, businesses and the general public. For example, data can be interpreted using material flow analyses and displayed using Sankey diagrams to understand a city's material flows. These studies can be conducted by the Government or external parties that have a comprehensive understanding of circular economy.

Accurate and transparent data and information may have a knock-on effect on circular economy-related industries, as it may encourage development of new data driven solutions or services and attract greater levels of investments towards this sector in the city.

4.2.4 Encouraging green finance for circular economy

Green finance could become a strong driver for circular economy. Investors, banks, insurers, governments and other public sector bodies can channel investments and set regulatory frameworks to prompt sustainable production and consumption alongside crucial technology change, which can complement and enable structural shifts in the

private sector. In particular, investments can be re-oriented towards circular business models, restorative and regenerative activities and sustainable technologies. For example, BlackRock, an asset management firm launched a BGF Circular Economy fund in 2019, in collaboration with the Ellen MacArthur Foundation, to drive investments in companies contributing or benefiting from circular activities.

To encourage more investments for circular economy, governments can directly invest in circular activities and technologies. Financial regulators and institutions can incorporate circular economy concepts into risk assessment and modelling. Regulators can also look to standardising definitions and metrics on circular activities and heighten the need for proper and greater disclosure among the private sector. These measures will enhance the transparency, consistency and quality of data on circular performances. Globally, existing frameworks such as the Task Force on Climate-related Financial Disclosure (TCFD) can also incorporate more circularity concepts and metrics to further drive the circular economy agenda.

Overall, there is a growing opportunity for the global financial system to increase its investments in this sector, as green finance dedicated to circular economy more holistically, as opposed to climate change or waste management, remains nascent.

4.3 Business opportunities in circular economy

While the Government is important in kick-starting and facilitating the transition to a circular economy, businesses also play a key role in accelerating the process. Accenture estimates that applying circular economy principles could represent a USD\$4.5 trillion global growth opportunity by 2030.¹¹⁸ In Europe, it is estimated that circular economy can unlock the region's GDP by an additional 0.5% by 2030 and create around 700,000 jobs.¹¹⁹

On a micro-level, the adoption of circular principles and practices by a business may drive growth, through the potential expansion into new markets which includes the repairs, remanufacturing, refurbishing, products-as-services or sharing economy markets; stimulation of innovation; and reduction of operating costs (by moderating the resources used). For example, it is estimated that the size of global recycling industry reached USD\$200 billion in 2019¹²⁰; the size of global repair and maintenance market was USD\$1,267.8 billion in 2019¹²¹; the sales revenue from sharing economy

¹¹⁸ McGuinness, M. (2015). *The Circular Economy Could Unlock \$4.5 trillion of Economic Growth, Finds New Book by Accenture*. Accenture. Retrieved from <https://newsroom.accenture.com/news/the-circular-economy-could-unlock-4-5-trillion-of-economic-growth-finds-new-book-by-accenture.htm>

¹¹⁹ Eurocities. (n.d.). *Circular Economy*. <https://eurocities.eu/goals/circular-economy/#:%7E:text=The%20circular%20economy%20in%20Europe,environmental%20footprint%20and%20GHG%20emissions>

¹²⁰ Savut, I. (2019). *Circular Economy: Global Policy Trends*. Bloomberg Finance L.P.. Retrieved from BloombergNEF Circular Economy Policy Database.

¹²¹ Research and Markets. (2020). *Repair and Maintenance Global Market Report 2020-30: Covid 19 Impact and Recovery*. <https://www.researchandmarkets.com/reports/5019796/repair-and-maintenance->

companies will grow from USD\$15 billion to USD\$335 billion globally.¹²² The World Business Council for Sustainable Development also noted that circular business models may increase a company's competitiveness by improving brand and customer loyalty and through market differentiation of its products and services.¹²³ In doing so, relationships with customers, employee and providers may be strengthened.

Adopting circular business models may also allow businesses to increase their resilience by mitigating their risks from operating in a linear manner. The largest risks posed to businesses not transitioning to a circular economy includes volatile resource prices; vulnerable supply chains and resource insecurity; technological disruptions; and potential regulatory and reputational challenges. The Ellen MacArthur Foundation found that the real prices of natural resources increased significantly and price volatility levels for metals, food and non-food agricultural output in the first decade of the 21st century were higher than in any single decade in the 20th century.¹²⁴ Increasing physical climate risks over time may also lead to greater supply constraints and uncertainty, further driving up resource prices. Disruptive innovation, such as material and technology innovation may reduce the costs of material recovery and product manufacturing in the long run, although so far, R&D in this area, especially on alternative materials has not been able to dramatically shift common practices around the world. Businesses may also consider mitigating their risks to emerging regulatory and reputational risks from inaction. Globally, governments have been moving quickly to introduce circular economy policies, which commonly include landfill taxes and bans; laws on materials that are hard to recycle or harmful to the environment (e.g. single-use plastic bag bans); and extended producer responsibility (EPR) schemes, particularly on packaging. More recently, COVID-19 has also highlighted risks to supply chain and production that are inherent in a linear economy.

The circular economy is also critical to tackling climate change and other Environmental, Social and Governance (ESG) issues related to responsible and sustainable supply chains. For example, minimising the use of virgin materials may reduce scope 3 emissions,¹²⁵ which often make up a significant proportion of a company's total

[global-market-report-2020?utm_source=dynamic&utm_medium=BW&utm_code=774mcv&utm_campaign=1384029+-+Global+Repair+and+Maintenance+Market+2020-2030%3a+COVID-19+Impact+and+Recovery&utm_exec=joca220bwd](https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf)

¹²² PriceWaterhouseCoopers Magyarország Kft. (2015). *Sharing or paring? Growth of the sharing economy*. PriceWaterhouseCoopers. Retrieved from

<https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf>

¹²³ World Business Council for Sustainable Development. (2017). *8 Business Cases for the Circular Economy*. World Business Council for Sustainable Development. Retrieved from

<https://www.cbd.int/business/case-studies/wbcd-8-business-cases-for-the-circular-economy-en.pdf>

¹²⁴ Ellen MacArthur Foundation. (2013). *Towards the Circular Economy*. Ellen MacArthur Foundation.

Retrieved from <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf>

¹²⁵ Scope 1: Direct emissions from company's owned or controlled sources, including the combustion of fuels in mobile and stationary sources

Scope 2: Indirect emissions from purchased electricity

Scope 3: All indirect emissions (excluding Scope 1 and 2 emissions) that occur in the value chain of the

greenhouse gas emissions along its value chain. Companies potentially also face pressure from their upstream and downstream business partners, as they are also part of other companies' scope 3 emissions.

Several businesses have already begun their journey in becoming more circular, with several examples depicted in Section 2.4, as well as prominent international examples such as Philips, Patagonia, Renault (see Box 4, 5 and 6 for more detail on these companies) etc.¹²⁶ Groups committed to achieving circular economy has also emerged, such as the Alliance to End Plastic Waste and Circular Economy 100, which encourage companies from different sections of the supply chain to share resources and expertise.

Box 4: Philips

Philips, a Dutch health technology company, is restructuring its business model and has since implemented various circular strategies and initiatives. A number of targets were set by the firm for 2025, including (i) generate 25% of sales from circular products, services and solutions; (ii) close the loop by offering trade-in on professional medical equipment and taking care of responsible repurposing; (iii) embed circular practices at our sites and send zero waste to landfill.¹²⁷

Instead of selling its equipment, Philips is offering customers access to its product as a service. For example, Philips introduced the sales of light as a service, where customers only pay for the light that is used, while the company bears the cost of the equipment, installation and maintenance. The company is also introducing circular approaches for its services provided to hospital and health care providers, allowing it to directly control and manage equipment upgrade and systems refurbishment. Long-term partnerships are formed with stakeholders in the medical sector in order to ensure shared accountability to manage costs, complexity and risk.¹²⁸ Additionally, the company is also continuously improving its own design rules to better enable product repairability, modularity, implementation and maintenance.

Since the implementation of its circular initiatives, Philips has achieved 50-90% material reuse (depending on the product) through refurbishment and reused 940 tonnes of refurbished medical imaging equipment in 2016.¹²⁹ As of 2016, 9% of Philip's total revenues were circular.¹³⁰

company

¹²⁶ World Business Council for Sustainable Development. (2017). *8 Business Cases for the Circular Economy*. World Business Council for Sustainable Development. Retrieved from <https://www.cbd.int/business/case-studies/wbcd-8-business-cases-for-the-circular-economy-en.pdf>

¹²⁷ Koninklijke Philips N.V.. (2020). *Decoupling growth from resource consumption*. <https://www.philips.com/a-w/about/sustainability/circular-economy.html>

¹²⁸ Koninklijke Philips N.V. (2020). *Long-term strategic enterprise partnerships with Philips*. Philips. <https://www.usa.philips.com/healthcare/about/enterprise-partnerships>

¹²⁹ World Business Council for Sustainable Development. (2017). *8 Business Cases for the Circular Economy*. World Business Council for Sustainable Development. Retrieved from <https://www.cbd.int/business/case-studies/wbcd-8-business-cases-for-the-circular-economy-en.pdf>

¹³⁰ World Business Council for Sustainable Development. (2017). *8 Business Cases for the Circular Economy*. World Business Council for Sustainable Development. Retrieved from

Box 5: Patagonia

Patagonia, an American company that sells outdoor clothes and gears, has a circular business model that aims to manufacture high quality and durable products and extend their lifetimes by encouraging reuse and repair. In 2013, Patagonia introduced its Worn Wear initiative, with the message "If It's Broke, Fix It". The initiative encourages customers to look after their gear, repair instead of purchase new products where possible and recycle garments once they reach the end of their product lifetime. The e-commerce platform was launched in 2017, which allows customers to purchase used Patagonia items, or trade them in and receive credit for a used or new product from the company.

To encourage repairs, they help customers repair over 45,000 items per year in their facility in Reno, Nevada or in their retail repair stations.¹³¹ Customers can also obtain free tools to repair their own clothing. With these initiatives, the company saw a 40% growth in revenue in 2019, reaching new customers, which were typically 10 years younger than their usual customers.¹³²

Box 6: Renault

Renault, a French automobile manufacturer, introduced circular strategies throughout all stages of a vehicle life cycle. First and foremost, Renault focuses on dematerialising through design and increasing the amount of recycled content in its vehicles. The company also aims to recover materials and mechanical parts at their vehicle's end-of-life, which are either transformed into usable materials for the production of new vehicles or repaired. Additionally, lifecycle of batteries is extended, such as by storing renewable energy to power buildings.

Simultaneously, Renault implemented other circular economy initiatives, such as developing their ride-hailing services to encourage carpooling, car-sharing and short-term car renting. 3 subsidiaries were also formed to better manage and harmonise the company's circular activities, which includes INDRA, a joint venture with Suez Environment to recycle end-of-life vehicles; Boone Conemore, also a joint venture with Suez to handle metal scrap on their sites; and Gaia, a subsidiary to interact with diverse stakeholders related to circular economy and their operations. It was estimated that Renault's remanufacturing division is more than a EUR€200 million business and the company has a EUR€370 million turnover for dismantling and material recycling.¹³³

<https://www.cbd.int/business/case-studies/wbcd-8-business-cases-for-the-circular-economy-en.pdf>

¹³¹ Byars, T. (2017). *PATAGONIA WINS CIRCULAR ECONOMY MULTINATIONAL AWARD AT WORLD ECONOMIC FORUM ANNUAL MEETING IN DAVOS*. Patagonia Works.

<http://www.patagoniaworks.com/press/2017/1/17/patagonia-wins-circular-economy-multinational-award-at-world-economic-forum-annual-meeting-in-davos>

¹³² Ryan, T. J. (2020). *Worn Wear Taking Off For Patagonia*. SGB Media Online.

<https://sgbonline.com/worn-wear-taking-off-for-patagonia/>

¹³³ World Business Council for Sustainable Development. (2017). *8 Business Cases for the Circular Economy*. World Business Council for Sustainable Development. Retrieved from <https://www.cbd.int/business/case->

For other businesses to make a start, they should identify and assess material flows within company boundaries, their resource efficiency, as well as their risks from operating with a linear economy model. They also need to examine the potential opportunities within the context of their businesses and operations to better understand how they can optimise and enhance their structures and systems to capitalise on circular economy. Businesses may apply existing company-level indicator frameworks to better understand their business and the potential value added by adopting circularity¹³⁴. In doing so, businesses can identify what type of circular business models or principles can best be adopted and integrated into their business structure, including the models mentioned in Section 2.8, which may entail the use of circular supplies, resource recovery, product life extension, utilisation of sharing platforms and transformation of products as a service. As governments, consumers and other companies become increasingly aware of the importance of a circularity, there is a growing business case to integrate circular economy principles into a company's structure, strategies and operations.

[studies/wbcds-8-business-cases-for-the-circular-economy-en.pdf](#)

¹³⁴ Example of existing company-level indicator frameworks include the World Business Council for Sustainable Development's (<https://www.wbcds.org/>) Circular Transition Indicators v2.0 launched in February 2021 (<https://www.wbcds.org/Programs/Circular-Economy/Factor-10/Metrics-Measurement/Resources/Circular-Transition-Indicators-v2.0-Metrics-for-business-by-business>)

Glossary

AFCD	Agriculture, Fisheries and Conservation Department
BEC	Business Environment Council
CGS	Community Green Stations
CPPP	Cleaner Production Partnership Programme
EPD	Environment Protection Department
EPR	Extended producer responsibility
ESG	Environment, Social and Governance
FEHD	Food and Environmental Hygiene Department
FiT	Feed-in tariffs
FSC	Forest Stewardship Council
GBA	Greater Bay Area
GDP	Gross domestic product
GJ	Gigajoules
HDPE	High-density polyethylene
HKBU	Hong Kong Baptist University
INCUBATE	Innovating Curating Better Automation and Technologies for Environmental Services
IWMF	Integrated Waste Management Facilities
LCSD	Leisure and Cultural Services Department
MSW	Municipal solid waste
NGOs	Non-governmental organisation
NPSTW	Ngong Ping Sewage Treatment Works
R&D	Research and development
RECs	Renewable Energy Certificates
PET	Polyethylene terephthalate
PPE	Personal protective equipment
PRS	Producer Responsibility Scheme
SCA	Scheme of Control Agreements
SEA	Southeast Asia
SDGs	Sustainable Development Goals
SKSTW	Sai Kung Sewage Treatment Works
SMEs	Small and medium-sized enterprises
STSTW	Shatin Sewage Treatment Works
TCFD	Task Force on Climate-related Financial Disclosure
Tpd	Tonnes per day
TPSTW	Tai Po Sewage Treatment Works
UK	United Kingdom
US	United States
WEEE	Waste electrical and electronic equipment
WSD	Water Supplies Department
WtE	Waste to energy

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Appendices

Appendix A: Institutional Descriptions of Circular City

Organisation	Description of a Circular City
Ellen MacArthur Foundation ¹³⁵	<p>(i) Planning in cities:</p> <ul style="list-style-type: none">- Greater proximity between where people live, work, and play- The air gets cleaner as vehicles switch to zero-emission engines and congestion reduces as shared transit increases- More people walk and cycle to work, boosting health and interactions with local businesses and communities- Valuable land previously dedicated to roads and car parks is freed up for green spaces, commerce, offices, houses, and recreation- The layout and design of cities changes the way materials and products move around them- A new distributed system of resource management, nutrient flows, and reverse logistics makes the return, sorting, and reuse of products possible- Materials stay in use <p>(ii) Designing in cities:</p> <ul style="list-style-type: none">- Infrastructure, vehicles, buildings, and products are designed to be a combination of durable, adaptable, modular, and easy to maintain and repurpose- Nature inspires design- Materials are non-harmful, locally sourced – and from renewable feedstocks where appropriate, and can be composted, recycled, and reused- Renewable energy powers cities <p>(iii) Accessing in cities:</p> <ul style="list-style-type: none">- People gain access to the things they need – be it space, products or transport – in new ways. This can be through sharing rather than owning, which can connect people to their neighbours and communities, or through product-as-a-service contracts- Modular designs allow for the reconfiguration of buildings and vehicles as needs change <p>(iv) Operating and maintaining in cities:</p>

¹³⁵ Ellen MacArthur Foundation. (n.d.). *A vision for a circular economy in cities*.

<https://www.ellenmacarthurfoundation.org/our-work/activities/circular-economy-in-cities/vision>

Organisation	Description of a Circular City
	<ul style="list-style-type: none"> - Products are no longer used just once. People repair and refurbish their products. These activities occur at the individual, community, and commercial level - Vehicles and infrastructure, from roads to streetlights, are operated and maintained so that materials, energy, and water are used effectively and can be reused and recycled - Buildings are refurbished, improving how they are used and operated - New possibilities and jobs emerge - Cities that embed circular economy principles become more thriving, liveable, and resilient
European Investment Bank ¹³⁶	<p>(i) Buildings:</p> <ul style="list-style-type: none"> - Modular and flexible building designs for reuse or repurposing, to enable effective utilisation, and for disassembly rather than demolition, to facilitate reuse and recycling - They use renewable, local energy production, e.g. powered by the sun, wind or secondary resources to the extent possible <p>(ii) Citizens use shared, clean and effective mobility systems, powered by renewable energy to the extent possible, and where possible automated with sharing and on-demand services</p> <p>(iii) A local urban bio-economy:</p> <ul style="list-style-type: none"> - That ensures that all organic waste and by-products are recovered and used as feedstock for nutrient or chemical recovery, with residues used for energy generation and later returned to the soil - Urban farms recycle organic waste and by-products, reuse water and waste heat and produce vegetables for the local market <p>(iv) Waste and wastewater generation is minimised, with maximum value recovery, and residues are processed for return to soil or use in urban farming</p> <p>(v) Production and industrial symbiosis:</p> <ul style="list-style-type: none"> - Production and consumption are localised to the extent possible, with local product and material return loops and residue recovery

¹³⁶ Byström, J. (2018). *The 15 circular steps for cities*. European Investment Bank. Retrieved from https://www.eib.org/attachments/thematic/circular_economy_15_steps_for_cities_en.pdf

Organisation	Description of a Circular City
	<ul style="list-style-type: none"> - Companies are located in industrial clusters and matched to facilitate and enable industrial symbiosis where residues, by-products or waste heat/water generated by one company can be used by another, thereby saving feedstock costs for one company and waste management costs for the other <p>(vi) Transport companies increase the efficiency of their operations by engaging in reverse logistics for take-back and returns of products for reuse, repair and remanufacturing for products and recycling for materials</p> <p>(vii) Circular test-labs, repair shops and sharing centres are available throughout the city to enable and encourage citizens and entrepreneurs to test and practice their new circular ideas and business models</p> <p>(viii) Digital tools facilitate asset or material tracking, and product, material or service exchanges facilitate sharing applications, industrial symbiosis and monitoring of circular progress</p> <p>(ix) Circular cities are regenerative and resilient to diminishing resource supplies and to climate change. They are also clean, prosperous, liveable, and therefore attractive for citizens and companies, and for city planners and decision-makers</p>
CSCP ¹³⁷	<p>(i) A built environment:</p> <ul style="list-style-type: none"> - Designed in a modular and flexible manner, sourcing health materials that improve the life quality of the residents and minimize virgin material use - Components of buildings will be maintained and renewed when needed, while buildings will be used where possible to generate rather than consume, power and food by facilitating closed loops of water, nutrients, materials and energy, to mimic natural cycles <p>(ii) An urban mobility system:</p> <ul style="list-style-type: none"> - That is accessible, affordable and effective - A multi-modal mobility structure that will incorporate public transportation, with on-demand cars as a flexible last-mile solution - Transportation will be electric powered, shared and automated

¹³⁷ Dhawan, P. (2019). *Circular Economy Guidebook for Cities*. Collaborating Centre for Sustainable Consumption and Production. Retrieved from https://www.scp-centre.org/wp-content/uploads/2019/03/Circular_Cities_Publication.pdf

Organisation	Description of a Circular City
	<ul style="list-style-type: none"> - Central to vehicle design will be remanufacturing, durability, efficiency and easy maintenance (iii) An urban bio-economy where nutrients will be returned to the soil in an appropriate manner while generating value and minimizing food waste (iv) Energy systems that are resilient, renewable, localized, distributed and allow effective energy use, reducing costs and having a positive impact on the environment (v) Production systems that encourage the creation of 'local value loops'. Meaning more local production and increased and more diverse exchanges of value in local economies
ICLEI ¹³⁸	<ul style="list-style-type: none"> (i) Urban spatial planning and governance: Mapping the urban metabolism with urban spatial planning to identify cities' potentials and opportunities and to reflect on local policies and decisions (ii) Green or circular public procurement and green supply chain: Mainstreaming the circular approach in the process of public procurement to close material loops (iii) Circular industrial park (industrial symbiosis): Facilitating local governments to enhance the collaboration between individual companies on resources and by-products exchange with the consideration of both physical and virtual geographic proximity (iv) Municipal resource management: Identifying municipal waste stream, minimizing the generation of waste, recovering waste into resources, and maximizing the demand of secondary materials within cities (v) Buildings and construction: Mainstreaming the circular approach and life cycle assessment in local governments' building code regulation (vi) Water-food-energy nexus: Implementing systematic process to link and to close the loops between food-water-energy, and applying nature-based solutions to regenerate Green Circular Cities with nature features

¹³⁸ ICLEI. (n.d.). *Green Circular Cities Coalition*. http://eastasia.iclei.org/work/featured_activities/450.html

Appendix B: BEC Questionnaire for the Circularity Assessment of Hong Kong

Thanks for agreeing to take part in this questionnaire. This questionnaire is part of BEC's study on Hong Kong's circularity, with the aim of creating a framework to measure the city's progress to a circular economy.

There are three parts to this questionnaire, which will take you approximately 10-15 minutes to complete:

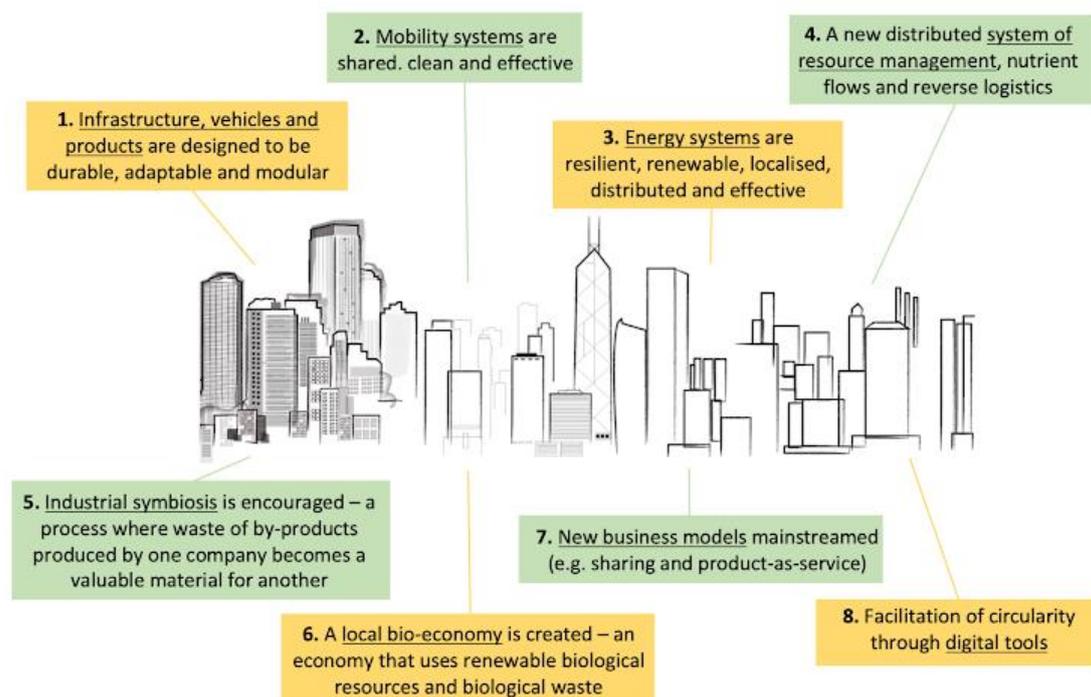
Part I: What is your vision for Hong Kong as a circular city?

Part II: What indicators do we need to measure Hong Kong's progress to circularity?

Part III: What can Hong Kong learn and adapt from other existing city strategies?

Part I: Hong Kong as a circular city

The image below is a general description of Hong Kong as a circular city, compiled from different organisation's definitions of a 'circular city'. Please read the description before answering the questions in this section.



Q1.1: Do you generally agree with the above description of a circular city for Hong Kong? (Yes/No)

Q1.2: Are there any descriptions you would change/remove/add? If so, what?

Part II: Indicators

This section will ask you to identify which indicators are important to evaluating Hong

Kong's circularity under key topics in 'circular economy'. The indicators below are taken from institutional and existing city frameworks, and further screened to remove ones that are too theoretical or not applicable to Hong Kong.

For many of the indicators below, the data may not currently be available in Hong Kong. In spite of this, we are asking you to choose the indicators that best measures the city's circularity based on your vision of Hong Kong as a circular city.

Q2.1: Of the indicators below, which are the most important for Hong Kong to measure its own circularity progress? (Rank the indicators as 'Not important'/'Somewhat important'/'Very important')

(i) Indicators on 'raw materials':

- Input of virgin materials (per capita) (Quantitative)

(ii) Indicators on 'waste management and infrastructure':

- Volume of waste generated (Quantitative)
- Collection rate of separate waste streams (Quantitative)
- Volume and rate of resource recovery (Quantitative)
- Degree to which collection, repair, reuse and recycling infrastructure is in place (Qualitative)
- Evaluation of waste collection planning in a city (Qualitative)

(iii) Indicators on 'industrial symbiosis' (definition: a process where waste of by-products produced by one company becomes a valuable material for another):

- Number of companies involved in industrial symbiosis (Quantitative)
- Number of eco-industrial parks (Quantitative)
- Investment in industrial symbiosis (Quantitative)
- Environmental impact of industrial symbiosis (i.e. water, CO₂, material savings etc.) (Quantitative)

(iv) Indicators on 'secondary raw materials':

- Rate of cyclical material use (definition: the share of material recovered and fed back into the economy in overall material use) (Quantitative)
- Trade in recyclable raw materials within a city (Quantitative)
- Amount of imports and exports of selected recyclable raw materials (Quantitative)

(v) Indicators on 'governance':

- Availability of a roadmap for resource management (Qualitative)
- The integration of circular aspects in public procurement schemes (Qualitative)
- Degree to which economic incentives, legislation or comparable rules are in place and enforced regarding product standards, better materials

- management etc. (Qualitative)
- Degree to which systems are in place for making more efficient use of resources (e.g. arrangements for sharing products, exchange of information on the availability of reusable materials etc.) (Qualitative)
- Number of new neighbourhoods incorporating the principles of the circular economy (Quantitative)
- Degree to which there are voluntary collaboration schemes in place encouraging value chain and cross-sectoral initiative and information sharing (Qualitative)
- Degree of cross-learning and exchanges with other cities on circular economy (Qualitative)

(vi) Indicators on 'engagement with private sector':

- Degree to which businesses are involved in managing material cycles in a circular way and is empowered to make the right decisions, either on an obligatory or voluntary basis (e.g. availability of innovative schemes, awards for circular businesses etc.) (Qualitative)
- Budget amount allocated to projects or living labs, and number of companies having benefitted (Quantitative)
- Number of enterprises receiving financial support in connection with circular economy, and the amount allocated (Quantitative)

(vii) Indicators on 'engagement with civil society':

- Degree to which citizens are involved in managing material cycles in a circular way and are empowered to make the right decisions (Qualitative)
- Availability of university courses on circular economy (Qualitative)
- Number of public seminars organised on circular economy under a city-wide circularity strategy (Quantitative)

(viii) Indicators on 'sharing economy':

- Degree of a sharing economy in different sectors of a city (Qualitative)
- Degree of a sharing economy from businesses and the regulatory environment (Qualitative)

(ix) Indicators on 'circular economy market, private investments and jobs':

- Degree of awareness of circular economy in the private sector (Qualitative)
- Degree to which circular business models are adopted (Qualitative)
- Amount of private investments in circular economy (Quantitative)
- Number of people trained in circular economy trades (Quantitative)
- Number of students trained in circular economy occupations (Quantitative)
- Total number of persons employed in eco-industries and circular economy (Quantitative)
- Gross value added in circular economy sectors (Quantitative)
- Number of patents from the city related to waste management and

- recycling (Quantitative)
- Number of patents applied at city-level (Quantitative)

(x) Indicators on 'energy':

- Total energy consumption (Quantitative)
- Decrease in energy consumption per GDP (Quantitative)
- Fuel mix for power generation (Quantitative)

(xi) Indicators on 'water':

- Rate of urban reclaimed water utilisation (Quantitative)
- Rate of industrial water reuse (Quantitative)

Q2.2: Do you have any other suggestions for indicators in Hong Kong under the above categories? If yes, what?

Q2.3: How should indicators with missing data be collected?

Q2.4: Who should be in charge of collecting the missing data?

Part III: Other existing city strategies

This section will introduce city-level circular economy strategies from Singapore, Phoenix (USA), Glasgow (UK) and Shenzhen (China). Before answering the questions, please have a look at the tables below to get an overview of each city's municipal targets, as well as the drivers and enablers behind each city's strategy.

Municipal targets:

Singapore	Phoenix	Glasgow	Shenzhen
Extend Semakau Landfill's lifespan beyond 2035	Increase the city's waste diversion rate to 40% by 2020	Become Scotland's first circular city	By 2020,
Reduce the amount of waste sent to landfill per capita per day by 20% by 2030	Get to zero waste by 2050	Become the first 'net zero' city in the UK	- Energy consumption per unit of GDP to decrease 18.5%
Achieve a 70% overall recycling rate by 2030			- Water output rate to increase to 0.118 million yuan / m ³
			- Land output rate to increase to 13,100 million yuan / km ²
			- Resource recycling rate increase to 60%
			- Construction waste recycling capacity to reach 8 million tonnes
			- Residential waste recycling standards to cover 90% or more communities
			- Shenzhen demonstration areas to enhance ecological civilisation

Drivers to achieve circular economy:

Singapore	Phoenix	Glasgow	Shenzhen
Semakau (Singapore's only landfill) is going to reach its maximum capacity by 2035	To repair the city's environmental-sustainability image To meet Phoenix's city-wide sustainability goals by 2050	To be the first circular city in Scotland, after the region has announced its targets for circular economy	To be a successful low-carbon and waste-free pilot city in China To abide to the national circular economy law

City enablers to achieve circular economy:

Singapore	Phoenix	Glasgow	Shenzhen
Roadmap: Zero Waste Masterplan with targets	Roadmap: Reimagine Phoenix initiative with targets	Financial incentives: funding to SMEs	Roadmap: Shenzhen Circular Economy 13 th Five-Year Plan
Legislation: Resource Sustainability Act	Financial incentives: funding from business incubators	Non-financial incentives: provide advisory services to businesses; incubation programmes	Legislation: Shenzhen Special Economic Zone Circular Economy Promotion Regulation etc.
Financial incentives: funding for companies to conduct R&D, do further campaign work, or ground-up projects etc.	Non-financial incentives: provide advisory services to businesses; incubation programmes; programmes that facilitate public-private partnerships; designated area to provide circular businesses cheaper land leases; community outreach	Digital tools: a platform to connect circular businesses; an online tool for businesses to learn about circular operations	Financial incentives: funding for businesses in the industry
Non-financial incentives: encourage partnerships with industry and other countries; upskill industry workers; public campaigns		Others: commissioned a study on the opportunities for circular economy in the city	Non-financial incentives: designated pilot parks for circular economy projects
Others: consultations with the general public on the Masterplan			

Q3.1: Based on the strategies above, which city's strategy is the most applicable to Hong Kong? (Singapore/Phoenix/Glasgow/Shenzhen)

Q3.2: What can Hong Kong learn from other city strategies?

Q3.3: What do you think are missing drivers for a circular economy strategy in Hong Kong? (e.g. understanding of the concept; awareness; research etc.)

Q3.4: What do you think are the missing enablers for circularity in Hong Kong? (e.g. legislation and regulation; partnerships; infrastructure; financial support; technology etc.)

Q3.5: What are some other barriers to circular economy in Hong Kong?

Q3.6: [Optional] Please leave your name if you would like to talk about this topic further

Appendix C: Existing institutional circular economy indicators by key areas

Key areas	Institutional indicators
Raw materials	<ul style="list-style-type: none"> - Share of a selection of key materials (including critical raw materials) used in the EU that are produced within the EU (EU Circular Economy Package) - Input of virgin materials per capita (Urban Agenda for the EU) - Water used for production (Urban Agenda for the EU) - Prevention of plastic (including single use) (Urban Agenda for the EU) - Prevention of hazardous waste generation (Urban Agenda for the EU) - Raw material consumption (global material use associated with domestic production and consumption activities = domestic extraction used + imports in raw material equivalents – export in raw material equivalents) (Summa Circular Economy)¹³⁹ - Material system analysis (bulk material flows in a circular economy) (Summa Circular Economy) - Material flow monitor (set of indicators providing insight into the physical material flows in kilos to, from and within an economy) (Summa Circular Economy)
Waste management	<ul style="list-style-type: none"> - Generation of municipal waste per capita (EU Circular Economy Package) - Total waste generation (excluding major mineral waste) per GDP unit (EU Circular Economy Package) - Total waste generation in relation to domestic material consumption (EU Circular Economy Package) - Indicators on separate collection (Urban Agenda for the EU) - Reuse rates (Urban Agenda for the EU) - Waste taken back by the industry for reuse/recycling (Urban Agenda for the EU) - Qualitative indicators on single use plastics (Urban Agenda for the EU) - Waste collection planning in cities (Urban Agenda for the EU) - Leakages from material cycles (Summa Circular Economy)
Recycling	<ul style="list-style-type: none"> - Imports and exports of selected recyclable raw materials (EU Circular Economy Package) - Recycling rate of municipal waste and of all waste except major mineral waste (EU Circular Economy Package)

¹³⁹ An, V., Maarten, C., Veronique, V. H. (n.d.). *Indicators for a Circular Economy*. Retrieved from https://circulareconomy.europa.eu/platform/sites/default/files/summa_-_indicators_for_a_circular_economy.pdf

Key areas	Institutional indicators
	<ul style="list-style-type: none"> - Recycling rate of overall packaging waste, plastic packaging, wood packaging, WEEE, recycled biowaste per capita and recovery rate of construction and demolition waste (EU Circular Economy Package)
Secondary raw materials	<ul style="list-style-type: none"> - Secondary raw materials' share of overall materials demand – for specific materials and for the whole economy (EU Circular Economy Package) - Trade in recyclable raw materials within cities (Urban Agenda for the EU) - Reduction in imported secondary raw materials (Urban Agenda for the EU) - Reused public buildings and spaces (sq m) (Urban Agenda for the EU) - Cyclical material use rate (Summa Circular Economy)
Governance and infrastructure	<ul style="list-style-type: none"> - Awareness raising – motivating stakeholders to take up circular economy measures (Urban Agenda for the EU) - Number of pilot projects on circular economy (e.g. on involving retailers) (Urban Agenda for the EU) - Citizens involvement (Urban Agenda for the EU) - Share of major public procurements in the EU that include environmental requirements (EU Circular Economy Package) - Actions by the city intended to encourage the procurement of articles that use secondary raw materials (Urban Agenda for the EU) - Availability of a roadmap for resource management (Urban Agenda for the EU) - Availability of innovative schemes for businesses at the city level, which are related to circular economy (not just for CO2 emissions trading) (Urban Agenda for the EU) - Extra courses for circular economy in universities - Awards for circular businesses (e.g. stamps, stickers) (Urban Agenda for the EU) - Cross-learning and exchanges between cities (Urban Agenda for the EU) - Degree to which collection, repair, reuse and recycling infrastructure is in place (Summa Circular Economy) - Degrees to which economic incentives, legislation or comparable rules are in place and enforced regarding product standards, standards for reused or recycled products/raw materials, waste management, better materials management (Summa Circular Economy)

Key areas	Institutional indicators
	<ul style="list-style-type: none"> - Degree to which business is involved in managing material cycles in a circular way and is empowered to make the right decisions, either on an obligatory or voluntary basis (Summa Circular Economy) - Degree to which circular business models are adopted (Summa Circular Economy) - Degree to which citizens are involved in managing material cycles in a circular way and are empowered to make the right decisions (Summa Circular Economy) - Degree to which systems are in place for making more efficient use of resources, such as arrangements for sharing products or repairing and reusing them, exchange of information on availability of reusable or recyclable materials (for instance for enhancing industrial symbiosis) (Summa Circular Economy) - Degree of information, education and awareness about circular economy (integration into school and university curricula, public communication and information campaigns) (Summa Circular Economy) - Degree to which there are voluntary collaboration schemes in place encouraging value chain and cross-sectoral initiatives and information sharing (Summa Circular Economy) - The integration of circular aspects in public procurement schemes (Summa Circular Economy) - Product standards related to defined circular strategies (Summa Circular Economy) - Activities performed by cities that encourage the implementation of eco-design measures (e.g. promoting extend product lifetime, ability to reuse components or recycle materials from products at end-of-life, use of re-used components and/or recycled materials in products) (Urban Agenda for the EU)
Consumption	<ul style="list-style-type: none"> - Consumption-based GHG emissions (consumption of goods and services produced in the cities) (Urban Agenda for the EU)
Industrial symbiosis	<ul style="list-style-type: none"> - Number of companies involved in industrial symbiosis (Urban Agenda for the EU) - Investment in symbiosis (Urban Agenda for the EU) - Number of eco-industrial parks (Urban Agenda for the EU) - Million cubic metres of water saved (Urban Agenda for the EU) - Million collective annual savings across firms (Urban Agenda for the EU) - Tons per year in CO2 savings (Urban Agenda for the EU)

Key areas	Institutional indicators
	<ul style="list-style-type: none"> - Million tonnes of landfill diversion (Urban Agenda for the EU) - Million tonnes of materials recovered and reused (Urban Agenda for the EU) - Billion in cost-savings (Urban Agenda for the EU) - Tonnes of virgin resources saved (Urban Agenda for the EU) - Tonnes of waste turned resources (Urban Agenda for the EU)
Collaborative economy	<ul style="list-style-type: none"> - Composite indicator representing the combined scores of the business and regulatory environment surrounding the collaborative economy (Urban Agenda for the EU) - Thematic indicators (on regulatory environment): accommodation, transport, finance, public administration and business support (Urban Agenda for the EU)
Private investments, jobs	<ul style="list-style-type: none"> - Private investments (EU Circular Economy Package) - Number of persons employed in eco-industries and circular economy (EU Circular Economy Package) - Gross value added in the circular economy sectors (EU Circular Economy Package)
Innovation	<ul style="list-style-type: none"> - Number of patents related to waste management and recycling (EU Circular Economy Package) - Actually applied patents at city level (Urban Agenda for the EU)

Appendix D: Existing city-level circular economy indicators by key areas

Key areas	City-level indicators
Raw materials	<ul style="list-style-type: none"> - Value preservation or raw material efficiency (indicating possible waste reduction in production of goods, measured in kg of waste per €1,000 output) (Amsterdam) - Use of renewable resources (percentage of imports (net and domestic) consisting of biomass compared to total imports) (Amsterdam) - Rate of land output (100 million yuan/square kilometre) (Shenzhen)
Energy	<ul style="list-style-type: none"> - Decrease in energy consumption per GDP (%) (Shenzhen) - Total energy consumption (metric tonnes of coal) (Shenzhen)
Water	<ul style="list-style-type: none"> - Rate of water output (10,000 yuan/cubic metres) (Shenzhen) - Industrial water reuse rate (%) (Shenzhen) - Rate of urban reclaimed water utilisation (%) (Shenzhen)
Economic impact	<ul style="list-style-type: none"> - Gross Value Added per person (economic value in € per person) (Amsterdam) - Circular services (the percentage of services related to the circular economy compared with Gross Value Added) (Amsterdam)
Ecological impact	<ul style="list-style-type: none"> - Environmental costs (the costs of exhaustion, water pollution, CO₂-emissions, toxicity and land use in € per kg) (Amsterdam) - CO₂ emissions (the amount of CO₂ which is released into the atmosphere in kg of CO₂ per person) (Amsterdam)
Waste management	<ul style="list-style-type: none"> - Industrial solid waste disposal utilisation rate (%) (Shenzhen) - Volume of key resource recovery (10,000 tonnes) (Shenzhen) - Key resource recovery rate (%) (Shenzhen) - Construction waste recycling capacity (10,000 tonnes) (Shenzhen) - Residential garbage incineration power generation capacity (MW) (Shenzhen) - Coverage of residential waste separation standards in communities (%) (Shenzhen)
City circular economy initiatives	<ul style="list-style-type: none"> - Number of legislative and normative barriers to circular economy identified and resolved (Brussels) - Number of legislative and normative incentives for circular economy created (Brussels) - Number of pilot cases set up via calls for projects or living labs (Brussels)

Key areas	City-level indicators
	<ul style="list-style-type: none"> - Number of seminars organised on circular economy under the BRPcircular economy (Brussels) - Number of economic operators sensitised on circular economy (Brussels) - Budget amount allocated to calls for projects or living lab made or implemented and number of companies having benefitted (Brussels) - Budget amount and number of pilot public markets in circular economy developed in Brussels-Capital Region (Brussels) - Number of companies informed or aware of the opportunities of Brussels public markets (Brussels) - Number of new neighbourhoods incorporating the principles of the circular economy (Brussels) - Total green building area (10,000 square metres) (Shenzhen) - Number of enterprises receiving financial support in connection with the circular economy (Brussels) - Amount of financial aid granted to companies in connection with the circular economy (Brussels) - Number of economic operators accompanied in circular economy (Brussels)
Private investments, jobs	<ul style="list-style-type: none"> - Number of job seekers put to work following training developed in the context of PREC (Brussels) - Number of people trained in circular economy trades (Brussels) - Number of students trained in circular economy occupations (Brussels)