2nd Market and Technological Study (2016/17)

Executive Summary

(HKPC Project Ref.: 10004978)

Prepared by

Environmental Management Division
Hong Kong Productivity Council

July 2018

(M:\emd\4104\PROJECTS_WM\10004978 2nd Market and Technology Study\Final Report\EPD Finalized 20180725\2nd Study - Executive Summary (English) 20180718 (clean).docx)

Background and Objectives

1. Hong Kong Productivity Council, as the Secretariat of the Recycling Fund, conducts studies on recycling markets and technologies under the Recycling Fund. The 2nd Market and Technological Study, which commenced in January 2017, aims to provide a continuous review of the recycling trade and industry in Hong Kong and to identify the key factors that determine the success of the Recycling Fund. Topics that are touched upon include, the latest status of waste and recyclables generation in Hong Kong, players of the recycling industry, typical/ latest recycling technologies for construction and demolition (C&D) waste, availability of buyers and markets of recyclables, etc.

2. In order to gain a more in-depth understanding of the recycling industry in light of the findings from the 1st Market and Technological Study, the following scope of works have been designed for the 2nd Study. The objective is to obtain the latest market and technological information related to recycling industry so as to facilitate the implementation of the Recycling Fund and to enrich the industry's knowledge on the latest market and technological developments.

3. This Study covers various key types of recyclables in Hong Kong, including papers, plastics, ferrous-metals, non-ferrous metals, waste electrical and electronic equipment (WEEE), used clothes /textiles wood, glass, rubber tyres, food wastes, yard wastes and used cooking oil (UCO). To identify means of support that the Recycling Fund can provide, this Study reviews the existing handling practices of mixed C&D waste generated in Hong Kong, as well as typical and latest recycling technologies for handling C&D waste both locally and in other countries.

4. The present Study includes four sections as follows:

   (i) To continuously review and update the current status of waste and recyclables handling in Hong Kong. A desktop research has been conducted to review the profile of recycling enterprises in Hong Kong from recyclable collection, processing for export. Surveys have been conducted with stakeholders in the recycling chain to reveal the situation of the industry.

   (ii) To find out the impacts and opportunities to the recycling industry arising from the new and future government policies through stakeholder engagement and desktop research. Means of support that the Recycling Fund can provide are suggested.

   (iii) To look into previous, current and potential markets/outlets for various types of recyclables. Import/export policies and control, export unit price trends, and potential markets in the key Southeast Asia jurisdictions are discussed.

   (iv) To review the existing handling practices of mixed C&D waste generated in Hong Kong and to explore possible business models for recyclers to work on and handle mixed C&D waste. Current typical business modes and technologies adopted in the recycling industry are discussed, and potential recycling technologies that are suitable for the local recycling industry are identified.

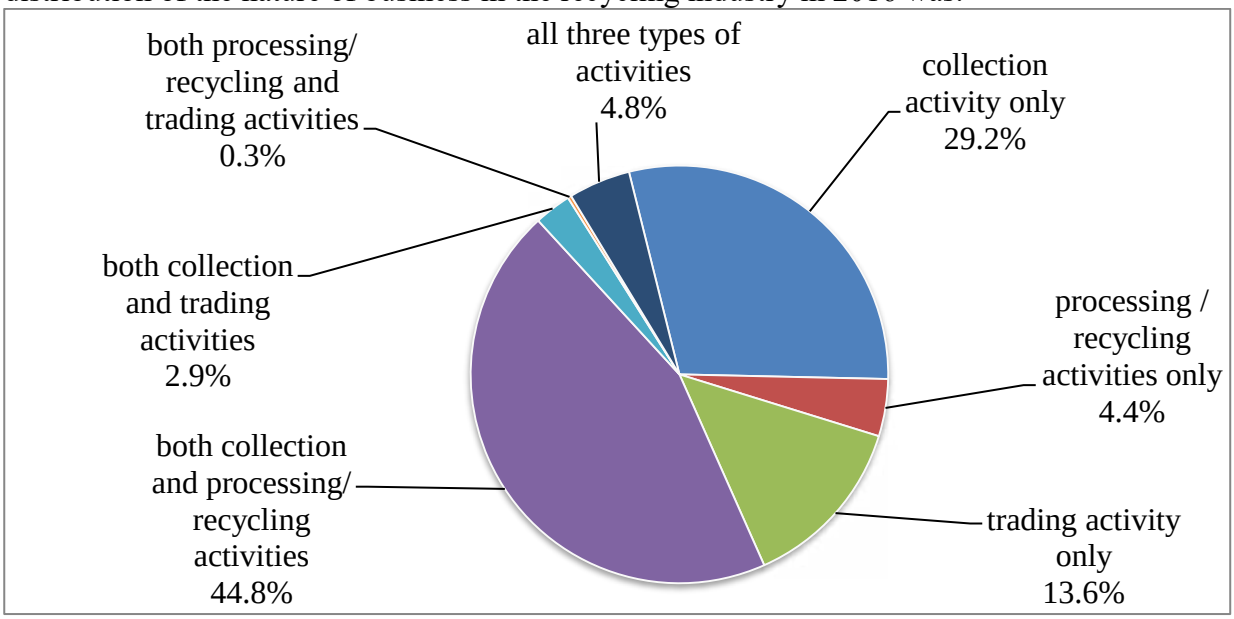
Key Findings of Section I - Profile of the Local Recycling Industry

5. This Study has used four databases, which included the complied Hong Kong Collector / Recycler Directory (available the in Hong Kong Waste Reduction Website), Census and Statistics Department's (C&SD) database, Hong Kong Productivity Council's (HKPC) in-house database, and Yellow Page's information. Some 177 companies were found to have their ceased operating after 2015 and another 371 businesses were found to have newly opened in the same period. The current number of waste collection and recycling companies is 1,920 which is more than that identified in 2015 (1,726).

6. Among the companies with known employment size information, about 89% were small-sized companies with 1 to 9 employees, while about 6% and 3% were medium-sized companies with 10 - 19 and 20 - 49 employees respectively. On the other hand, less than 2% of them had more than 50 employees. This shows that the recycling industry is dominated by small and medium sized enterprises.

7. For both ceased and newly opened companies, ~99% of them were small-sized companies with 1 to 9 employees; particularly, over 90% were companies with less than 5 employees. It reveals that small-sized companies might be more susceptible to market fluctuation. The majority of enterprises ceased operations after 2015 were companies involved in all three types of activities (37.1%) while those newly opened companies were mainly involved in both collection and recycling activities (62.4%), collecting mostly metals, paper, and plastics.

8. Based on the available information for the nature of business in the consolidated database, the distribution of the nature of business in the recycling industry in 2016 was:



9. Most companies only process recyclables with readily available market outlets, including metals (~1,100 companies), paper (~900 companies), plastics (~800 companies), WEEE (including computer product and electrical appliances) (~600 companies) and textile (~350 companies). Other recyclables with uncertain market outlets like glass, wood, rubber tyres and food waste were handled by less collector/ recyclers (~100 companies).

10. Among the ~1,900 companies and organisations engaged in recycling operations in Hong Kong in 2016, roughly 50% of them were registered to non-ground floor multi-storey buildings and it was observed that most of these were used as office premises of trading companies, and some were used as temporary storages of recyclables. 29% registered themselves to ground floors (e.g. street-level recycling shops), which is slightly less than that of 2015. 16% of the companies were registered on sites. There were also some recyclable collectors/ recyclers (~5%) who were registered to residential buildings and the majority of them were small sized companies with less than 10 employees.

11. Recyclables were usually collected from: (i) imports, (ii) local waste producers and (iii) local supply chain. Among the surveyed companies engaging in recycling operations in Hong Kong, the order of such three sources is: local waste producers (82%), local recycling chain (12%) and import (6%). Among recyclables obtained from local upstream of recycling chain, the major way to obtain recyclables was from local collectors (91% of recyclables weight), followed by local pre-processors (8% of recyclables weight) and importers (1% of recyclables weight).

12. Local collectors and recyclers collect recyclables from five main sources. Over half of the companies collected recyclables from individual C&I producers (53%), followed by scavengers (27%), construction sites (11%), domestic and C&I waste from property management companies (7%), and through government contract (2%).

13. Two major collection channels in the recycling trade were, delivery from waste producers (56%), and collection at source in person (39%). Sources for direct collection of recyclables mainly include scavengers and property management companies of housing estates and C&I premises, but can also be from construction sites, cleansing companies, individual commercial companies (including restaurants, hotels, publishers, supermarkets), schools, or even via online platforms. Other channels to obtain recyclables include collecting through third party (4%), e.g. traders, re-processors/ recyclers, government waste management contractors, non-governmental organizations and single block buildings, etc. and purchasing from mobile collection vehicles (1%).

14. According to the exportation figures of recyclables from the report of Census and Statistics Department (C&SD) in 2016, around half of recyclables by weight were exported to Mainland China, followed by other Southeast Asian jurisdictions such as Vietnam and Indonesia. The proportion of recyclables being exported to Mainland China dropped from 50.4% in 2015 to 45.8% in 2016. This is due to the tightening policy of importing recyclables to Mainland China. Export destinations of recyclables had since started to shift to Southeast Asian jurisdictions such as Vietnam, Indonesia, India, etc. and the proportion of export recyclables to these countries had increased from 2015 to 2016.

15. Among the 150 companies engaging in recycling operations in Hong Kong, 49% and 48% of the respondents considered that high land cost and inadequate land for recycling industry, and high labour cost were the major limiting factors affecting the local recycling business operation.

16. Hence, most respondents hope to get support from the Recycling Fund to lessen the burden of operation cost (mainly labour cost). Over half (51%) of the overall cost was found to be labour cost. Around one quarter of overall cost was logistic cost, followed by rental and land cost. In general, although only 14% of operating cost was spent on rental/land, insufficient land resources for the recycling industry still influence the business decision on the type of recyclables to be collected / recycled.

17. For nuisances generated from processing, treatment and other industrial procedures, over half of the surveyed companies (54%) were concerned about the problem of space occupation, by the storage of recyclables and unwanted materials separated from recyclables. The second most concerned nuisance was odour (13%), which mainly came from the emission of machinery exhaust and heating processes during treatment of recyclables (e.g. asphalt, plastic). There were also other types of nuisances (5%) concerned by the surveyed companies, including illegal parking, waste hygiene issue and occupational health & safety. Having said that, there were still 39% companies that expressed no concerns on the nuisances incurred from their operation.

18. Among the surveys of 150 companies engaging in recycling operations in Hong Kong, around 86% of their employees did not obtain any special qualification. Among the remaining 14% who have obtained special qualification, over three quarters (77%) of them were driving license holders of various goods vehicles. In particular, 14% of these employees held the Certificate of Safety Training Course for Recycling Industry

19. Regarding the five key policies and facilities established by the Government aiming to tackle waste generation and disposal, which were the MSW charging, Producer responsibility scheme (PRS) on WEEE, PRS on glass beverage bottles, Community Green Stations and Organic Resources Recovery Centre. 80% of the recycling companies have heard of the new coming MSW

Charging, and around half and one third of companies heard of the coming PRS on WEEE and PRS on Glass Beverage Bottles respectively. Only 15% of companies have heard of the newly established Community Green Stations and the Organic Resources Recovery Centre. Among those companies having heard of these policies and facilities, the majority expressed that these policies and facilities would derive no significant impact on their collection quantity of recyclables and operating income.

20. After conducting the desktop review and engaging the stakeholders of the recycling industry to gauge their views, several bottlenecks and constraints that were limiting the development of the local recycling industry have been revealed. They include manpower shortage, high rental cost and inadequate land, low value-added products, improper sorting of recyclables in the "recycling chain" and unstable market situation.

21. One of major constraints faced by the recycling industry in their daily operation and business development is the insufficient land supply in Hong Kong. Four potential measures to optimise land use have been identified through desktop study, including 1) implementation of the "5S" Practice, 2) specialisation of work, 3) standardisation of procedure and material and 4) optimisation of turnover/ minimisation of stock inventory.

22. In Hong Kong, upcycling activities / businesses are mainly carried out by several groups, which include social enterprises, charity organizations, non-profit organizations (NPOs), and design companies and this kind of upcycling activities / businesses started to develop in this decade. Upcycling products are commonly manufactured by hand (e.g. bags, accessories) and require relatively low skill for the hand-made process. The operation of NPOs are generally supported and funded by programmes like the Sustainable Development Fund, Social Innovation and Entrepreneurship Development Fund, etc. Thus upcycling products are generally distributed or sold in a lower price to communities as cost recovery of their upcycling operations is not the prime concern. Some upcycling businesses may be run by enterprises under the fashion and textile or product design trade, and aiming to manufacture high value upcycling product. These enterprises do expect to make profit out of the business. However, they may still collaborate with NPOs for a stable supply of waste materials and recyclables.

Key Findings of Section II - Study on the Impacts and Opportunities to The Recycling Industry by the New / Coming Government Policy

23. In Section 2, the impact and opportunities to the recycling industry presented by new / coming policies, and the potential need of supports from the Recycling Fund were evaluated. After reviewing recent waste management policies, the following five waste management policies / legislations are further discussed as they will have greater influence to the recycling industry in handling recyclables and will provide opportunities in developing new business / expanding their current operation. The five new / coming policies are: 1) Municipal Solid Waste (MSW) Charging, 2) Organic Resources Recovery Centre (ORRC), 3) Mandatory PRS on Glass Beverage Containers, 4) Mandatory PRS on Waste Electrical and Electronic Equipment (WEEE) and 5) Community Green Stations (CGS).

24. From the point of views of recyclers, even though the quantity of low value recyclables will increase after the implementation of the MSW Charging, recyclers do not consider this as an incentive to handle new recyclable types in their business. The major consideration is the revenue generated by handling additional recyclable types. If they start handling new recyclable types, they may need to invest on additional facilities, as well as to establish collection network and sales outlet. Further capital investment under uncertain market situation is in doubt, especially for low value recyclables without a lucrative market. Therefore, they tend to be conservative in considering expanding their business to low value recyclables.

25. The operation of ORRC provides a new business opportunity for the recycling trade in the collection of food waste from C&I sectors. High transportation cost and shortage of frontline workers are the major issues hindering the expansion of business to food waste collection service. The challenge lies on setting a reasonable service fee whilst covering the high logistic cost and maintaining the business profitable. On the other hand, different companies, including property management companies, logistics companies and recyclers have expressed interests in the collection business and wish to obtain financial support through Recycling Fund.

26. Currently, recycling companies are not willing to collect glass beverage bottles, not only because of a limited local and overseas market, but also because of the high transportation cost to deliver glass beverage bottles with low density, which cannot be compressed. To increase the profit margin per trip of delivery, it is suggested to set up a glass imploder at source, that will break the glass beverage bottles into pieces before delivery. Glass imploder can be installed at collection points where the large amount of glass bottles can be converted into cullet to save storage space prior to delivery for recycling. Some recyclers have shown interests to install such facilities at collection points and for financial support through the Recycling Fund.

Key Findings of Section III – Market Study on Major Types of Recyclables

27. The historical, current and potential markets/outlets for 12 types of recyclables, including paper, plastic, ferrous-metals, non-ferrous metals, waste electrical and electronic equipment (WEEE), used clothes / textiles, wood waste, glass, rubber tyres, food waste, yard waste and UCO were reviewed. In 2016, over 90% of the recyclables exported were paper, plastics, ferrous metals and non-ferrous metals. Most of Hong Kong's recyclable were exported within Asia. The top five jurisdictions for Hong Kong's recyclables export in terms of weight were: Mainland China, Vietnam, Indonesia, Taiwan and India.

28. In 2016, Mainland China was the major market for paper, plastics, non-ferrous metal, textiles / used clothes and wood recyclables. Vietnam was the major market for ferrous waste and scrap, which had a share of nearly 50% of all ferrous metal waste and scrap exported from Hong Kong. For non-ferrous metal, Mainland China, along with Korea were the main markets, each taking about one-third of Hong Kong's non-ferrous metal . For WEEE, major refurbished home appliances such as television, air conditioner, refrigerator, washing machine / dryer and computer products were exported to jurisdictions such as Mainland China and Southeast Asia. For glass, the export quantity of glass scrap was relatively low in the past five years, which shows that glass scrap is unfavourable to be exported and the demand in export market is limited. Similar the recycling rate for waste tyres was low and local retreaded tyres for export were limited. Local market should be explored for processing the glass scrap and waste tyre generated. For food waste in the form of flours, meals and pellets made of meat of meat offal (unfit for human consumption) and greaves, Taiwan was the major export market in 2016, which accounted for over 70% of the total export quantity of food waste. For UCO, it was exported to the Netherlands, England and Spain. With consideration in geographical advantage and selling price of UCO, Korea is suggested as a potential market for UCO in the coming years.

29. In general, decreasing price trends of paper, plastics and non-ferrous metal were identified. Between 2016 and 2017 in Mainland China, the average price of different kinds of waste paper rose ~46%; and for plastics, the prices of PVC, PET and HDPE recyclables were steady with a fluctuation within 5%; for non-ferrous metals, both nickel and copper scraps had risen in unit trading price, increasing by 22% and 36% respectively.

30. Mainland China has been a major export market of Hong Kong's recyclables. As a result of the implementation of Mainland China's Operation Green Fence (OGF) since 2013, interception of waste has been stepped up. This has led to an increase in the local operation cost in processing

recyclables. Some kinds of recyclables have even been prohibited from being imported to Mainland China. With such reason, some local recyclers preferred to sell collected materials to Southeast Asia counties with less restricted standard on the recyclables, such as Vietnam, Indonesia, and Malaysia, as an alternative. The estimated affecting factors include processing cost, relative supply and demand of nearby jurisdictions and transportation cost.

31. In order to prohibit the import of hazardous solid waste and solid waste with strong concern from the public, Mainland China announced the "Implementation Plan for Prohibiting the Entry of Foreign Garbage and Advancing the Reform of the Solid Waste Import Administration System (關於禁止洋垃圾入境推進固體廢物進口管理制度改革實施方案)" in April 2017. In July 2017, Mainland China further submitted a revision of import waste policy to the World Trade Organization (WTO), which prohibited the import of 24 types of municipal solid waste, including highly polluted solid waste, waste plastic, un-sorted waste paper, etc. In April 2018, the Mainland Authority announced the further prohibition of another 32 types of imported waste by 31 December 2018 and 31 December 2019 respectively.

32. In September 2016, Vietnam published the Decree No. 134/2016/ND-CP on tax exemption regulations on specified proportion of scrap in the production of export products. The regulation stated that "surplus imported scrap, waste and raw materials and supplies actually imported under processing contracts are exempted from import duty tax when they are sold for domestic consumption, but must be declared and paid Value Added Tax, excise tax, and environmental protection tax (if any) to the Customs authorities". Thus, the export price to Vietnam has been increasing recently. Traders need to apply for a Certificate of Eligibility, granted by the Natural Resources and Environment Service of the locality where the trader's production establishment is located, for scraps to be imported into the country.

33. India restricts the import of hazardous wastes and other wastes except waste for recycling, recovery, reuse and utilization including co-processing. Import/export of hazardous and other waste must submit an online application to the Ministry of Environment, Forest and Climate Change, Government of India's for their review. Importers must have an Importer License which is issued by the Regional Authority of Director General of Foreign Trade.

Key Findings of Section IV – Review on Existing Business Models and Recycling Technologies for Handling Mixed Construction and Demolition (C&D) Waste

34. In Section 4, the current business models handling C&D waste generated in Hong Kong were reviewed. In order to facilitate the reduction of C&D waste to be disposed of at landfills, the latest and most typical local and overseas recycling technologies for recycling C&D waste were reviewed so as to identify suitable recycling technologies that can be applied in Hong Kong the through Recycling Fund.

35. Currently, recyclers in Hong Kong approach the recycling of C&D waste in 4 major types of business models. Through these business models, they make profit not only by charging service fee for the transportation or reception of C&D waste, but also from selling or exporting useful/valuable recyclables (e.g. metal scraps, copper wires, paper, plastic, etc.) of C&D waste after treatment. These four models include:
    (i) Sorting Site Located at Urban Area
    (ii) Sorting Sites Located at Rural Areas near Landfill
    (iii) Direct Collection from Waste Producers / Upstream Collectors
    (iv) Recycling C&D Waste into Useful Construction Materials/Products

36. In view that some materials of the C&D waste have the recycling value for reuse, local and overseas typical and latest recycling technologies for C&D waste, e.g. recycled aggregates, metals, plastics, have been explored.

37. In Hong Kong, most of the recycling technologies of C&D waste are developed by the Department of Civil Engineering, The Hong Kong Polytechnic University (PolyU), including: partition wall block, cement-bonded particleboard, waste plastic additives in reclaimed asphalt pavement mixtures, rapid-shaping magnesia-phosphate cement particleboard, water-resistant magnesia-phosphate cement particleboard, enhancing anti-microbial, properties of wood-plastic composites, potential applications of rejected fly ash, use of recycled aggregates as subbase materials, etc.

38. The research and development of C&D waste recycling technologies overseas were studied. They include: glassy materials, low-cost bricks, cold asphalt mixture, alternative heavy metal immobilising agent, eco-mortar, filling material for geosynthetic reinforced structures, low formaldehyde-emission particleboard, wood waste to energy.

Conclusion

39. The current situation and profile of the recycling industry in Hong Kong on recyclables' generation, processing and outlets have been reviewed in this study. Surveys have been conducted with key stakeholders to reveal the outlook of the recycling industry. Constraints/challenges encountered by the "recycling chain", and desired support for the trade have also been discussed. Bottlenecks in relation to manpower shortage and cost issues are still key factors limiting the development of local recycling industry. Recycled products of low value and the implementation of Operation Green Fence in China in 2017 also constrained the export of recyclables from Hong Kong.

40. To tackle the key needs and bottlenecks encountered by the recycling industry identified in this study, two actions to undertake are recommended for further considerations and discussion:
    - To explore and implement measures for premises utilisation, which include: implementing "5S" practices in the recycling industry, the standardisation of work to simplify process steps, and standardising of procedures and materials to enhance efficiency.
    - To identify trends and types of new waste collection and recycling operations methods to raise the value added to recycled products, such as upcycling.

41. This study has also evaluated the impacts and opportunities to the recycling industry when new waste management policies and legislations come into force, in addition to that, support needed from the Recycling Fund were explored. It has been found that the three waste management policies and/or legislations, that were the MSW Charge, ORRC and Mandatory PRS on Glass Beverage Containers, have great influence to the recycling industry in handling recyclables. Opportunities for expansion or development of new businesses will also arise. For example, the MSW Charge will drive behavioural changes in waste generation and recycling, thus reduce the overall amount of waste disposed of and increase the amount of materials for recycling. This provides the recycling industry a larger supply of recyclables, favouring their expansion in operation and revenue. The operation of ORRC will create business opportunities for the recycling trade in collecting food waste from F&B companies or food factories for recycling. The Mandatory PRS on Glass Beverage Containers also creates additional business opportunities for the recycling trade to collect and recycle low value glass beverage containers.

42. To provide support for the recycling trade, the Recycling Fund can consider:
    - supporting the recycling industry in the purchase of compactor trucks for recyclables

collection, with a view to enhance their operation efficiency;

- supporting various pilot projects for to enhance waste separation at source. More active outreach programme and improved collection system / machinery such as reverse vending machines can be examined in different pilot projects to engage the public/trade in clean recycling and waste separation;
- exploring the possibility for property management companies (PMC) to receive financial support through joint application with recyclers for Recycling Fund programmes, considering their role in waste or recyclables collection;
- subsidising the recycling operations or NGOs in organising trial outreach programmes in the collection or recycling of recyclables, especially those with lower values to create new business trends within the industry, and to motivate communities to separate these recyclables at source for collectors / recyclers;
- subsidising food waste recyclers in the purchase and maintenance of transportation equipment. A thematic scheme can be launched upon the completion of testing and commissioning of ORRC; and
- subsidising glass beverage bottles producers in setting up glass imploders at collection points, where glass bottles can then be broken into cullet prior to delivery, to save storage space and transportation cost, thus enhance collection efficiency.

43. In view of the market situation of recyclables in Hong Kong, over 90% of the local recyclables exported are paper, plastics, ferrous metals and non-ferrous metals. In 2016, the top five jurisdictions for Hong Kong's recyclables export in terms of weight were, in descending order: Mainland China, Vietnam, Indonesia, Taiwan and India. About half of the recyclables generated in Hong Kong, about 1 million tonnes, were exported to Mainland China. It was followed by Vietnam (27.7%), Indonesia (7.5%), Taiwan (6.5%) and India (5.6%). Mainland China was the major market of paper, plastics, non-ferrous metal, textiles, wood and yard waste. Vietnam was the major market of ferrous waste and scrap, which took more than 50% share of all ferrous metal waste and scrap. Mainland China and Korea were the major markets of non-ferrous metal. Macau was the unique market for retreaded tyres' export with very a small export amount. Taiwan was the major market of food waste product. For UCO, the major market was Spain and the major market for glass was Thailand.

44. Owing to the public's strong concern, Mainland China has announced the "Implementation Plan for Prohibiting the Entry of Foreign Garbage and Advancing the Reform of the Solid Waste Import Administration System (關於禁止洋垃圾入境推進固體廢物進口管理制度改革實施方案)" in April 2017 to prohibit the import of hazardous solid waste. In July 2017, the Mainland further submitted a revision of import waste policy to the World Trade Organization (WTO), which prohibited the import of 24 types of municipal solid waste, including highly polluted solid waste, waste plastic, un-sorted waste paper, etc. In April 2018, the Mainland Authority announced the further prohibition of 32 types of imported waste by 31 December 2018 and 31 December 2019 respectively.

45. Last but not least, this Study has presented the characteristics and composition of construction and demolition (C&D) waste and the four business modes most commonly observed in the recycling industry of Hong Kong. The way that inert and non-inert C&D waste are sorted, recycled, and handled by each of these respective models have been investigated. Current recycling technology adopted by local recycling, along with recently developed C&D waste recycling technologies locally and overseas, and research and development of C&D waste recycling technologies have been introduced. Amongst all, some technologies developed by PolyU in recycling C&D waste (e.g. production of partition wall block and cement-bonded particleboard) have been considered suitable for commercialisation in Hong Kong with the support of the Recycling Fund. If these technologies and skills can be transferred to local recyclers / manufacturers for the transformation of C&D waste into useful construction products, the amount of C&D waste being disposed of at landfills will greatly reduce.

- End of Executive Summary -