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Topic: E-waste in Hong Kong

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1. General Introduction

1.1 Definition of “e-Waste”

“E-Waste” is the abbreviation of “electronic waste”, which is an umbrella term covering most of the electrical and electronic equipment (EEE) that are discarded into the waste stream. Generally, examples of daily “e-Waste” include mobile phones, refrigerators, TVs, washing machines, stereo systems etc. Alarming, many EEE nowadays contain toxic and hazardous materials and which upon disposal would harm the nature thus the society. A couple of sources are found consistent with the above definition.¹

1.2 Current Situation of “e-Waste” in Hong Kong

According to an updated background brief prepared by the Legislative Council of Hong Kong on 22 November 2011 for the meeting of the panel on environmental affairs², it is reported that the WEEE generation in Hong Kong is around 70 000 tonnes annually. The consultation document prepared by the Environment Bureau of HKSAR in year 2010³ supported the data, suggesting that the majority, 80% of the e-waste generated are recycled and passed to the second-hand dealers. The dealers are shipping the e-waste away to developing countries both legally and illegally, especially China and Afghanistan etc., under the ordinary e-waste management procedures. And the 20% remaining are randomly disposed at landfills. Also, the document predicted that the e-waste output is increasing at a 2% (Table 1) rate annually.

Since the e-wastes contain a number of pollutants upon disposal, disposal before proper treatments bring contaminations and damages to the nature. Moreover, as the landfills in Hong Kong are soon being overloaded and the developing countries need less e-waste for boosting their economies, disposing methods, sites become great concern of e-waste issues, which the Hong Kong people should pay extra attention on.

¹ -“Ewaste ewasteguide.info” - Webpage- <http://ewasteguide.info/introduction/e-waste>

-Electronic Recyclers International, Inc.-Webpage - <http://electronicrecyclers.com/ewaste-defined.aspx>

-StEP Initiative - Webpage - http://www.step-initiative.org/index.php/Initiative_WhatIsEwaste.html

-LEUNG Oi Wah, Anna Assessment of Persistent Toxic Substances in China and Hong Kong with Emphasis on Uncontrolled Recycling of E-Waste, August 2006, p.1

² HKSAR, Legislative Council, Minutes for Panel on Environmental Affairs, 28 November 2011, p.2

³ HKSAR, Environment Bureau, Consultation Document – Safe and Sustainable: A New Producer Responsibility Scheme, for waste electrical & electronic equipment, 2011, p.5

1.3 Common Potential Environmental Pollutants from “e-Waste”

The major concern related to e-waste is the potential environmental pollutants they release to the nature during disposal management. A recent research concluded that there is a long list of potential environmental pollutants (Table 2) resulting from e-waste management, ranging from different kinds of halogenated compounds, heavy metals, radioactive substances and dusts etc (G. Gaidajis, K. Angelakoglou and D. Aktsoglou, 2010, p.195)⁴. These pollutants come from e-waste like transformers, cooling units, cable insulation, batteries, CRT screens and CRT tubes etc. which are our daily disposals.

1.4 Why are the “e-Waste” harmful?

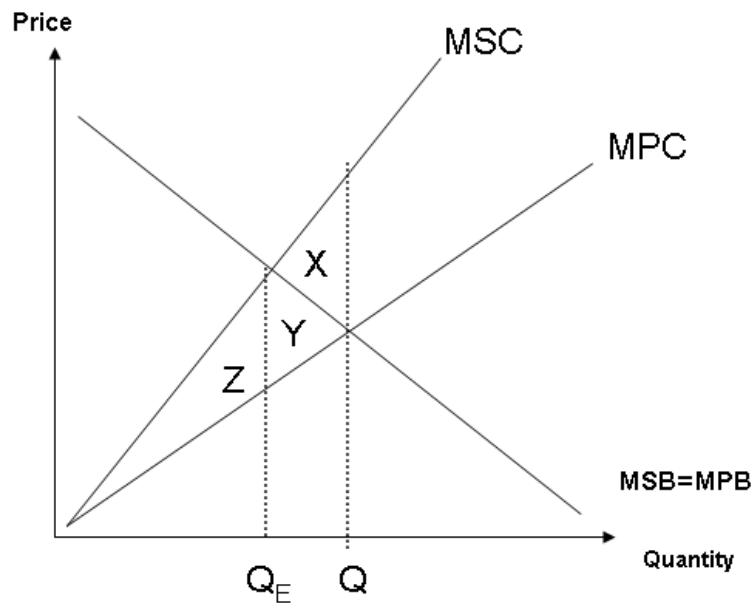
The “e-wastes” are harmful because of the pollutants they emit after disposal. Neither to the human community nor the nature are the pollutants welcomed. The pollutants are certainly harmful to the nature, for example, contaminating ground water, reducing the fertility of the soil, causing poorer air quality, jeopardizing species’ health and even endangering the food chain if not treated properly. Focusing on the metallic pollutants (Table 3 & 4), most of them are carcinogenic, causing different levels of carcinogens. Also, some causes inhalation and ingestion problems. Furthermore, some are effective in damaging body parts, like lungs and kidneys dysfunctions in serious cases⁵(LEUNG Anna, 2010, p.18-19). Hazardous pollutants can get into our daily lives through combustion, acid dissolution, and inappropriate disposal and even reuse (Table 5) (G. Gaidajis, K. Angelakoglou and D. Aktsoglou, 2010, p.196)⁶. How can we stand in such an unhealthy community when we can easily get contaminated and poisoned under the conventional e-waste flow route?

⁴G. Gaidajis, K. Angelakoglou and D. Aktsoglou, 2010 ,E-waste: Environmental Problems and Current Management, Greece, August 2010, p.195

⁵ LEUNG Oi Wah, Anna Assessment of Persistent Toxic Substances in China and Hong Kong with Emphasis on Uncontrolled Recycling of E-Waste, August 2006, p. 18-19

⁶ G. Gaidajis, K. Angelakoglou and D. Aktsoglou, 2010 ,E-waste: Environmental Problems and Current Management, August 2010, p. 196

1.5 “E-Waste” with Externalities



The e-waste problem in the Hong Kong society can be addressed with a detrimental externalities model with a divergence between marginal social cost (MSC) and marginal private cost (MPC). Marginal social benefit (MSB) is considered equivalent as marginal private benefit (MPB). External cost (Area X+Y+Z) of producing e-waste is incurred, such as, ground water contamination, soil fertility reduction, poorer air quality, and jeopardizing species' health etc. which should have been included into the production of e-waste. With having the e-waste problem in Hong Kong, the disposal (production of e-waste) is seen as inefficient to the economy, overproduction together with deadweight loss (Area X) occurred.

Traditionally, Pigouvian and Coasian solutions, which are two different perspectives, are suggested in easing externalities problems. On one hand, the Hong Kong Government can impose corrective tax, e.g. per unit tax on WEEE disposal, on the other hand, affected communities can negotiate with the e-waste producers for mutually beneficial solutions to the problem. However, difficulties are seen inside both solutions. Firstly, taxing consumers on e-waste disposal is difficult, e-wastes do not have homogeneous or proportional sizes and weights, the criteria for taxing are hard to be set. Secondly, the affecting parties and affected parties are hard to be identified, as all consumers dispose and receive pollutants in their daily lives. Also, the population involved is large, it is therefore difficult for the people to get together to negotiate over their rights and responsibilities. As a result, the market is working hard figuring out other alternative solutions which have been included in the later part of the report.

2. Market Solution to “e-Waste” Issues

2.1 “E-Waste” Trade

Previously, the e-wastes produced in Hong Kong and those imported from other developed countries like the USA, are exported to the Mainland China and other developing countries for recycling and reuse, as the recycling and reusing processes create business opportunities and employment vacancies at the time when the countries are developing. However, treating disposed WEEE has become a problem in Hong Kong after the ban of China’s import of e-waste in 2000⁷.

Recently, the Greenpeace has tracked that the developed countries are still exporting their e-waste to Hong Kong as the legislation here does not require tax on e-waste processing and production. Also, the dealers have started to trafficking e-waste to other banned developing countries, including China, which is an illegal act⁸. For the reasons above, the e-waste issues is still a problem, even related to legal matters nowadays. Although trafficking is a crucial issue arisen from e-waste disposal worldwide, the Hong Kong Government has showed efforts in stopping this illegal act, it is because the prosecution statistics showed a decreasing trend of hazardous shipments shipping into the Hong Kong port, from 112 shipments in year 2008⁹ to 38 shipments in year 2010¹⁰ and eventually to 15 shipments in year 2012¹¹. Thus, it is believed that the e-waste problem, especially on the legal matters is being rectified.

⁷ Daniel Powell, Assessing and Improving China’s E-waste Problem, Our World - Brought to you by the UN University, 08-04-2013
<http://ourworld.unu.edu/en/assessing-and-improving-the-e-waste-problem-in-china>

⁸ Greenpeace Webpage– Feature Story - Illegal e-waste exposed 14 June 2008 <http://www.greenpeace.org/international/en/news/features/illegal-e-waste-exposed140708/>
Greenpeace Webpage – Press Release – Greenpeace intercepts illegal US electronic shipments to Hong Kong 14 June 2008
<http://www.greenpeace.org/international/en/press/releases/greenpeace-intercepts-illegal/>

⁹ Environmental Protection Department – Webpage - Control on Import and Export Waste – Prosecution Statistics – Year 2008
http://www.epd.gov.hk/epd/english/environmentinhk/waste/guide_ref/stat_pro_ship_08.html

¹⁰ Environmental Protection Department – Webpage - Control on Import and Export Waste – Prosecution Statistics – Year 2010
http://www.epd.gov.hk/epd/english/environmentinhk/waste/guide_ref/stat_pro_ship_10.html

¹¹ Environmental Protection Department – Webpage - Control on Import and Export Waste – Prosecution Statistics – Year 2012
http://www.epd.gov.hk/epd/english/environmentinhk/waste/guide_ref/stat_pro_ship_12.html

3. Households solution to “e-Waste” Issues

3.1 Brief description

E-waste is known as Waste electrical and electronic equipment (WEEE). Households are one of the main producers of e-waste. Hong Kong produces around 70 000 tons of WEEE every year and it is on an increasing trend of 2% annually in recent years.¹² The reason is that technology is advanced nowadays, it is common for people upgrading their electronic devices continuously. Mobile phone and computer are the typical example.

WEEE contains toxic components, which cause damages to the environment and human health if not being handled or disposed of in a careful way.¹³ Currently, consumers are dealing with e-waste in a few ways, including selling to ragmen, and through public waste collection or disposal service.

3.2 Methods for dealing with e-waste

3.2.1 Selling to ragmen (收賣佬)

Ragmen acts as e-waste recyclers. Some of the consumers sell their electronic devices to ragmen after consumption. Referring to a survey conducted by Friends of the Earth in Hong Kong, around half of interviewees (491 individuals) expressed that they will vend their aged TV sets to ragmen.¹⁴ A trading market of old electronic products is created between households and ragmen to recycle e-waste. Households bargain with the ragmen and get some compensation. Then the ragmen recycle those e-wastes. This reduces environmental impacts that brought by the e-waste disposal.

Ragmen is a distinctive way for handling used electronic materials in Hong Kong.



Source: http://the-sun.on.cc/cnt/news/20121120/00410_098.html

¹² Legislative Council. (2011, Nov 22). *Updated background brief on a new producer responsibility scheme for waste electrical and electronic equipment*. Retrieved from <http://www.legco.gov.hk/yr11-12/english/panels/ea/papers/ea1128cb1-424-4-e.pdf>

¹³ Environment Bureau Hong Kong SAR Government. (2010). *Safe and sustainable: a new producer responsibility scheme for waste electrical & electronic equipment*. Retrieved from http://www.epd.gov.hk/epd/english/resources_pub/policy/files/weee_consultation_eng.pdf

¹⁴ Friend of the Earth. (2008, Jan 11). *E-waste transfer poisoning our environment*. Retrieved from http://www.foe.org.hk/welcome/geten.asp?id_path=1,+7,+28,+150,+3781,+3788

Another two common devices they collected are mobile phone and computer. After changing these two items, apart from those who afraid of their personal information been stolen after dumping their computers and mobile phones, most of the people in Hong Kong do not know where or how to dispose their electronic equipment. A research conducted by Chinese University of Hong Kong showed that there are merely 23% and 17% of peoples will sell or recycle their phones and computers to ragmen respectively.¹⁵ Others will keep at home. Some even trash them in the garbage and those e-waste will ended up in the landfill. One of the possible reasons is that they don't have enough information about recycling channels and management from the government.

3.2.2 Through public waste collection or disposal service



Source:
https://www.wastereduction.gov.hk/en/materials/info/wr_msw.pdf

In fact, some consumers also handle e-waste through the activities held by the government. Environmental Protection Department has introduced three voluntary programmes for recycling e-waste such as WEEE Recycling Programme and District WEEE Recycling Days. Under the Recovery Programmes for WEEE during 2011, consumers donate more than 46 900 units of waste appliances and 66 000 units of computers.¹⁶ For the Mobile WEEE Collection Centre Service, consumers contribute almost 18000 electrical devices, fluorescent lamps and accessory items respectively as at 2011, also above 8000 computer equipment items and 3000 rechargeable batteries.

However, the effectiveness is low. Considering such a huge amount of e-waste, there is barely 1% of the local generation of WEEE handled under these voluntary programmes.¹⁷ The programmes are appeared to be ineffective enough. The low percentage of WEEE being collected is probably because most of the Hong Kong people do not have clear information about the sites for disposing e-waste and the recycling facilities.

¹⁵ Chinese University of Hong Kong. (2012, Aug 22). *AIA survey of e-devices: general public findings*. Retrieve from http://www.wecareaboutewaste.com/documents/cuhk_aia_e-devices_survey_gen_public_findings_chi.pdf

¹⁶ Environmental Protection Department. (2012, Mar). *Waste reduction and recovery factsheet no.1*. Retrieved from https://www.wastereduction.gov.hk/en/materials/info/wr_msw.pdf

¹⁷ Legislative Council. (2011, Nov 22). *Updated background brief on a new producer responsibility scheme for waste electrical and electronic equipment*. Retrieved from <http://www.legco.gov.hk/yr11-12/english/panels/ea/papers/ea1128cb1-424-4-e.pdf>

3.3 Suggestions for consumers

Consumers of goods are the producers of e-waste. They should bare the responsibilities to deal with the problem of e-waste before it is too late. To reduce e-waste, consumers have to take part on it. Ramachandra & Saira has suggested some of the following solutions.¹⁸

Firstly, consumers should reduce their own e-waste by buying items only what they need and use. If it is necessary to buy electronic equipment, consumers can avoid buying products that are not reusable and recyclable. Citizens are also encouraged to buy products, which are designed for simple upgrading or disassembly. When a new version of the products is released, consumers can just upgrade their products rather than buying new electronic equipment. Apple Inc.'s IOS system is a good example. Customers can enjoy the new IOS system by updating the software rather than buying a new product. It is convenient for customers as well as more eco-friendly.



Source:

<http://imaczone.wordpress.com/2013/05/04/apple-releases-ios-6-1-4-for-iphone-5-with-updated->

Consumers should also check if the products consist of harmful components, such as Chromium, when they are choosing the electronic products. Buying the products, which are made of fewer toxic constituents, can protect the environment.

Besides, consumers can consider products that are offering leasing or taking back option. When the equipment is no longer needed, it can be returned to the manufacturer or can be leased to someone who needs it. Moreover, consumers can check around local organizations to see if they can donate their surplus appliances to those institutions. If the electronic equipment is damaged and irreparable, consumers can take them to electronic recycle center such as WEEE Recycling Centre in Tuen Mun.

¹⁸ Ramachandra, T.V. & Saira, V. K. (2004, Mar). *Envis journal of human settlements: Environmentally sound option for e-wastes management*. Retrieve from <http://www.ces.iisc.ernet.in/energy/paper/ewaste/ewaste.html>

In addition, consumers should develop their consciousness of how to dispose their e-waste in an appropriate way like Singaporean. Singaporean are very aware of how to deal with their e-waste that they take part in the take back scheme that launched by private company such as Hewlett-Packard (HP). HP had collected more than 800 units of old electronic devices during the HP National Recycling Week.¹⁹ Hundreds of people participated in it and discarded all kinds of unwanted electronic goods at 20 SingPost outlets in Singapore.

Actually, there are some channels for Hong Kong citizens to recycle e-waste. For example, recycling service provided by Shenzhen Global Technology Company.²⁰ They are glad to collect all kinds of e-waste. A price will be offered to customers.



Source: <http://www.e-waste.hk/En/Service.aspx?ID=7109>

4. Producers solution to “e-Waste” Issues

4.1 Brief description

Since there is no big electronic manufacturer in Hong Kong, it is difficult for large producers, such as Samsung, Panasonic, to take the leading role in e-waste recycling. The electronics market in Hong Kong is very small and competitive when comparing with other countries. Besides, as Hong Kong lacks the parts of recycling and production in supply chain, it is not cost-effective for producers to set up facilities with advanced recycling technology in Hong Kong.

¹⁹ Deepalishinha. (2007, Apr 25). Over 800 units of e-waste collected during HP Recycling Week. Retrieve from <http://www.wildsingapore.com/news/20070304/070420-4.htm>

²⁰ Shenzhen Global Technology Company (2010). Recycling service: E-waste recycling. Retrieve from <http://www.e-waste.hk/En/Service.aspx?ID=7109>

4.2 Behaviors for reducing e-waste

4.2.1 Producers' take-back programs in Hong Kong

Although many producers launch take-back programs to recycle their old products, echoes are not high enough to draw public attention and some of them even do not take place in Hong Kong. For example, Microsoft's Hardware Recycle scheme²¹, Sony's Trade-In and Recycling Program²² and Samsung's mobile take-back program²³. Those companies have no recycling collection point in Hong Kong.

As for those offered in Hong Kong, outcomes are still suspected. Hewlett-Packard's Planet Partners Recycling Program in Hong Kong does not directly reach end-users but through the local recyclers, which means the effects of this scheme basically depends on how large the groups of local recyclers Hewlett-Packard reach, while recyclers who join the program must fulfill a series of strict standards on different products.²⁴ As no figures or statistics on recycled products in Hong Kong have been provided to public, the program still shows low transparency.

Among those famous international electronic companies, Apple Inc. provides more details and information on what they have done in recycling work. Apple introduces Apple Store Gift Card to encourage people to recycle or trade in their old devices, including all iProduct.²⁵ People who recycle their devices can pay extra money to get a new product. It also renders free shipping service for end-users sending the old products. Apple will then determine if the collected products qualify for reuse. Once it still has monetary value, it will be sold in the secondary electronics market after amendment. On the contrary, it will enter recycling processes. "Glass and metal can be reprocessed for use in new products. A majority of the plastics can be pelletized into a raw secondary material. With materials reprocessing and component reuse, Apple often achieves a 90 percent recovery rate by weight of the original product."²⁶ Apple Inc. takes lots of incentive in recycling work.

²¹ Microsoft Corporation. (2013). *Recycle hardware: Packaging and batteries*. Retrieved from <http://www.microsoft.com/environment/what-you-can-do/recycle-hardware.aspx>

²² Sony Electronics Inc. (2013). *Trade-in and recycling program*. Retrieved from <http://store.sony.com/-cms-page.sony.tradein>

²³ SAMSUNG. (2013). *Take back & recycling programs*. Retrieved from <http://www.samsung.com/us/aboutsamsung/sustainability/environment/takebackrecycling/takebackrecyclingprograms.html>

²⁴ Hewlett-Packard Development Company. (2013). *Recycle resources*. Retrieved from <http://www8.hp.com/us/en/hp-information/environment/resources.html>

²⁵ Apple Inc. (2013, Jan). *Apple recycling program*. Retrieved from <http://www.apple.com/recycling/gift-card/>

²⁶ Apple Inc. (2013, Jan). *Apple recycles responsibly*. Retrieved from <http://www.apple.com/recycling/gift-card/>

4.2.2 New design against E-waste

Design groups in big companies come up with new ideas to alleviate the rapid increase in e-waste. Canon introduces 3D-CAD technologies to develop their products. Functions, operability and quality tests are processed in computers. Therefore, it eliminates the number of prototypes and materials use. At the same time, their products are made of renewable plastic, such as Canon PIXMA MG5270 printer and Canon X MARK I calculator. Advance Halogen-free printed circuit boards also reduce the adverse impacts on environment after the products become e-waste. Moreover, “Closed loop” ink cartridge produced by Hewlett-Packard in current decade are designed for recycling. Recycled plastic bottle materials are added to recycled plastic from HP ink cartridges to create new Original HP ink cartridges.²⁷ Up till now, over 1 billion Original HP ink cartridges are made of recycled materials. The product design can truly reduce e-waste produced although it is a small step.



Lead-free	✓
BFR-free	✓
PVC-free ²	✓
Mercury-free	✓
Arsenic-free glass	✓

Source: <http://www.apple.com/environment/our-footprint/>

Besides, Apple Inc. considers product recyclability in the design stage. Their engineers try to reduce the material use, choose to use environmentally conscious materials and give up all toxic substance in products. “The latest iMac features a process called friction-stir welding, which helps enable iMac to use 68 percent less material.” “Fan assemblies in Mac Pro use advanced materials derived from repolymerized plastic bottles.”²⁸ They also lengthen the product life cycle by developing longer-lasting battery. Their product design can alleviate industrial e-waste disposal.

²⁷ Hewlett-Packard Development Company. (2013). *HP "closed loop" ink cartridge recycling*. Retrieved from <http://www8.hp.com/us/en/hp-information/environment/hp-closed-loop-ink-cartridge-recycling.html#UqAamMQW2-s>

²⁸ Apple Inc. (2013, Jan). *Apple and the Environment: Our Footprint*. Retrieved from <http://www.apple.com/environment/our-footprint/>

To counter e-waste problem, a Dutch design group proposes an ideal mobile phone model, called Phonebloks.²⁹ Designers divide the phone into three main parts, the screen, the base, and blok components. Users can customize the phones according to their personalities. The phone is made of biodegradable plastic. When part of the phone broke, people only need to replace that part in Blokstore. However, they are still looking for powerful supporters to let it come true as the technology is not mature enough.



Source: <https://phonebloks.com/>

4.3 Suggestions for producers

Hong Kong electronic producers may also follow American countries to do recycle like providing 'Trade In' service. This kind of recycle service can improve the e-waste problem since the old electric applicants still contains a lot of hardware, which is useable and can be updated.

Fortress Hong Kong provides collection of old goods to customers. They offer free service for removing customers' old machine for disposal when customers purchase certain products from Fortress. A wide range of products is included. For instance, televisions (any traditional televisions (DLP/Tube TV) over 33 inches are not included), refrigerators (with capacity below 300ml), washing machine, and dryers.³⁰

Other producers or sellers can take Fortress Hong Kong as a reference and provide similar e-waste collection services. This is a market approach, which is an incentive-based policy, favored by economists. Since Fortress collects used electronic products form customers, it gives convenient and encourages customers to reduce the disposal of e-waste to landfills directly.

²⁹ Phonebloks. (2013). *Our goals*. Retrieved from <https://phonebloks.com/>

³⁰ Fortress Hong Kong. (2013). *Service and support*. Retrieved from <http://www.fortress.com.hk/en/services/index.php>

5. Government Solution to “e-Waste” Issues

5.1 Approaches of Hong Kong Government on treating the E-waste

5.1.1 Voluntary recycling Scheme

Since year 2003, voluntary recycling scheme has been launched by the Hong Kong Government.³¹ However, this scheme only deals with 1% of the e-waste (approximately equals to only 7,000 tons per year), which is not really effective in tackling the e-waste problem. It promotes that people can donate the electrical appliances, which they don't want, to the poor in Hong Kong. Also, any broken appliances can be repaired before throwing away. Overseas countries will collect the metals for usage once they have collected them. The Hong Kong Government has set up a recycling centre in Kowloon Bay for further collection of the materials in the battery.

5.1.1.1 Computer recycling program

The program started from January 2008. It is held by the Hong Kong Government and also the Hong Kong WEEE Recycling Association. It aims at processing different types of computer and also different components such as the system units. Moreover, this project allows poor people to pick up the computer they want in a specific area for collecting the computers. Thus, poor people can use second-hand computers although they can't afford to buy a new computer. This benefits to the society.



Source:

https://www.wastereduction.gov.hk/en/materials/info/wr_msw.pdf

³¹ Hong Kong WEEE Recycling Association. (2013). 回收計劃. Retrieved from <http://www.hkwra.org.hk/crp.html>



Source:
https://www.wastereduction.gov.hk/en/materials/info/wr_msw.pdf

5.1.1.2 The Rechargeable Batteries recycling Scheme

For Rechargeable batteries, the approaches used in Hong Kong is to pack the batteries type by type and then export them to facilities in overseas for recycling. This is a long-term programme, which is managed by the Hong Kong WEEE Recycling Association. It aims to reduce the toxic substances released by the batteries to the nature. This targets at the general public. Most likely it also encourages students to follow the rules set up by the organization. In the market perspective, it is not a command-and-control approach since it is not regulating people through rules. Instead, it is a voluntary-based policy, so it is less efficient in market outcome and less favored by the economists.

5.1.2 Waste Disposal Ordinance (WDO)

The imports and exports of hazardous e-waste, such as cathode ray tubes in waste computer monitors and TV sets, were subject to permit control. A permit is required before any waste could be imported into or exported from Hong Kong, unless the waste is uncontaminated, as specified in the Sixth Schedule of WDO and is for the purpose of reprocessing, recycling, recovery or reuse.

For imports of waste into Hong Kong, the disposer or the importer shall apply for the permit; for exports of waste from Hong Kong, the waste producer or the exporter have to apply permits. The application shall be made at least 90 days prior to the intended shipment date.

The policy is a command-and control approach since the polluters are being regulated through rule, which is application of permits. It requires polluters to have the right to export e-waste under the ordinance. However, it is usually less efficient since some polluters may try to evade the law by illegal shipment.

With the enforcement of permit system, this allocates the right to export e-waste to specific producers. Deadweight loss is resulted because the consumer and producer surplus are not maximized.

5.1.3 Exporting E-waste to southern China

Partners of Hong Kong include the USA, Japan, and other regions in southern China. In general, e-waste from Hong Kong is mainly shipped to southern China. China is the biggest place to import E-wastes from Hong Kong. The majority of the recyclable non-hazardous waste is treated in Hong Kong.³²

The manufacturing and industrial activities in southern China cause substantial volume of waste import, export and re-export activities since they demand a lot of raw materials like recovered scrap metals. It is beneficial for Hong Kong to export E-wastes to the Mainland China as Hong Kong lacks enough place to treat the E-wastes produced by different stakeholders like consumers and companies.³³

5.2 Suggestions to government

We would like to give some suggestion to Hong Kong society in order to improve the e-waste problem and encourage more recycle industry work on e-waste in Hong Kong.

5.2.1 Set standards or quota

Firstly, considering about the Government aspect of Hong Kong, unlike other countries with large area of land and numerous industries, Hong Kong is a famous economic base and innovative city in the world. In the recent years, Hong Kong have been developing technological innovation works, but the upcoming side effects are that over 70,000 tons of e-waste are being generated every year. Since Hong Kong has limited flat land and high population density, 80% of the e-waste are exported, however the left 20% are disposed in Hong Kong.

We suggest Hong Kong Government considering European Union's policy in e-waste treatment, setting recycling standards and regulating toxic materials for import electronic products using command-and-control approach.

³² Environmental Protection Department. (2013). *Control on import and export of waste*. Retrieved from http://www.epd.gov.hk/epd/english/environmentinhk/waste/guide_ref/stat_wt.html

³³ Robin, I. (2013, Jun 14). *Why we should ship our electronic "waste" to China and Africa*. Retrieved from <http://motherboard.vice.com/blog/e-waste-recycling-exports-are-good>

Government can also set quota of producing e-waste and provide a tradable quota for different industries to help reduce e-waste in Hong Kong using market-based approach. It controls the amounts of e-waste produce. This method can keep on working in future and reduce the disposal of toxic materials in every years. In long term, the environment can be protected. All in all, limiting the e-waste by this method can reduce toxic materials released in Hong Kong and improve the living standard and environment in Hong Kong.

5.2.2 Offering subsidy to recycling industry

Secondly, as for the recycling industry in Hong Kong, it seems there is lack of recycling companies about those electrical applicants. Therefore, the government can provide subsidy to recycling industry, and even producers to encourage recycling more and reduce toxic materials produced by e-waste. For example, HP Metal Recycling (HK) Ltd in Fanling, where they address the collected old products, trying to recover their material values, maximize recovery rates and minimize the materials to landfills.

Those similar firms in the existing recycling industry could be the primary target. The development of recycling industries can help to increase the job opportunities and provide a sustainable development in Hong Kong. Moreover, Hong Kong may introduce Extended Producer Responsibility. This scheme provides financial incentives to producers design environment products.³⁴

Subsidy is a market-based approach. The goal of the subsidy is to internalize the positive externality associated with the recycling industry. Offering subsidy can increase the number of firms in the recycling industry.

At last, we are looking forward to Government policy in later years and electronic producer recycle scheme. This can make our environment more clean and beautiful.

³⁴ OECD. (2013). *Environmental policy tools and evaluation: extended producer responsibility*. Retrieved from <http://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm>

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7. Indices

Table 1

Growth in Waste Electrical and Electronic Equipment 2005 - 08

	Recycled	Disposed	Total WEEE Generation	
	('000 TONNES)	('000 TONNES)	('000 TONNES)	% CHANGE
2005	53.0	14.2	67.2	--
2006	58.0	10.6	68.6	2.08%
2007	59.0	11.1	70.1	2.19%
2008	58.8	12.6	71.4	1.85%

Table 2

Table 4. Potential environmental pollutants produced from e-waste management procedures.

Substance	Occurrence in e-waste
<i>Halogenated compounds:</i>	
PCB	Condensers, Transformers
TBBA, PBB, PBDE	Fire retardants for plastics (thermoplastic components, cable insulation)
CFC	Cooling unit, Insulation foam
PVC	Cable insulation
<i>Heavy metals and other metals:</i>	
Antimony	Fire retardant, plastics
Arsenic (As)	Small quantities in the form of gallium arsenide within light emitting diodes
Barium (Ba)	Getters in CRT
Beryllium (Be)	Power supply boxes which contain silicon controlled rectifiers and x-ray lenses
Cadmium (Cd)	Rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
Chromium (Cr)	Data tapes, floppy-disks
Copper (Cu)	Cabling
Lead (Pb)	CRT screens, batteries, printed wiring boards
Lithium (Li)	Li-batteries
Mercury (Hg)	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches
Nickel (Ni)	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT
Rare Earth elements	Fluorescent layer (CRT-screen)
Selenium (Se)	Older photocopying-machines (photo drums)
Tin (Sn)	Solder metal glue, LCD
Zinc sulphide	Interior of CRT screens, mixed with rare earth metals
<i>Others:</i>	
Toner Dust	Toner cartridges for laser printers / copiers
Radio-active substances	Medical equipment, fire detectors, active sensing element in smoke detectors

Table 3

Table 1.4 Potential adverse human health effects from environmental exposure to trace metals

Metal	Health effects	Reference
Cadmium (Cd)	Carcinogenicity (by inhalation): Group 2A (probably carcinogenic to humans) Group B1 (probable human carcinogen) Symptoms of poisoning Inhalation and ingestion may cause irreversible damage to lungs, kidneys, liver and blood Fertility compromised, prostate cancer	WHO, 1996 IRIS, 2005 ATSDR, 1999
Chromium III [Cr(III)]	Carcinogenicity: Group 3 (not classifiable as to carcinogenic potential) Irritation to nose, skin allergies	IARC, 1990 ATSDR, 2000
Chromium VI [Cr(VI)]	Carcinogenicity: Group 1 (human carcinogen) DNA damage, birth defects Inhalation causes lung cancer asthmatic bronchitis, allergic reactions, nosebleeds Ingestion causes ulcers, convulsions, kidney and liver damage and death Dermal exposure causes skin ulcers	IARC, 1990 ATSDR, 2000c
Copper (Cu)	Carcinogenicity: Group 3 (unclassifiable as to its carcinogenicity to humans) Copper dust can irritate nose, mouth, eyes Can cause headache, dizziness, nausea, diarrhea, vomiting, stomach cramps High intakes can cause liver and kidney damage and death	IARC, 2002 ATSDR, 2004d
Cobalt (Co)	Carcinogenicity: Group 2B (possibly carcinogenic to humans) No cancer classification by US EPA Exposure to high levels of cobalt can result in lung and heart effects and dermatitis	IARC, 2001 IRIS, 2000 ATSDR, 2004

Table 4

Table 1.4 Potential adverse human health effects from environmental exposure to trace metals (con't)

Metal	Health effects	Reference
Lead (Pb)	Carcinogenicity: Group B2 (probable human carcinogen) Group 2A (possibly carcinogenic to humans) Damage to central and peripheral nervous systems, immune and vascular systems, reproductive system, kidneys Lead in the body is eventually stored in bones and teeth Serious negative effects on children's brain development (diminishing IQ)	IRIS, 2005 IARC, 2004c ATSDR, 2005
Manganese (Mn)	Development of mental and emotional disturbances Weakened motor skill Inhalation to high levels may cause respiratory problems and sexual dysfunction	ATSDR, 2001
Nickel (Ni)	Carcinogenicity (by inhalation): Nickel compounds - Group 1 (carcinogenic to humans) Metallic nickel - Group 2B (possibly carcinogenic to humans) Nickel refinery dust - Group A (human carcinogen) Inhalation of high levels may cause chronic bronchitis, reduced lung function Dermal sensitivity causing skin rashes	IARC, 1990 IARC, 1990 IRIS, 2005 ATSDR, 2005
Zinc (Zn)	Inhalation of large amounts can result in metal fume fever Ingestion of high levels can result in stomach cramps, nausea, vomiting, anemia, pancreas damage Stomach cramps, nausea, vomiting, anemia, pancreas damage Dermal exposure may cause skin irritation	ATSDR, 2005

Table 5

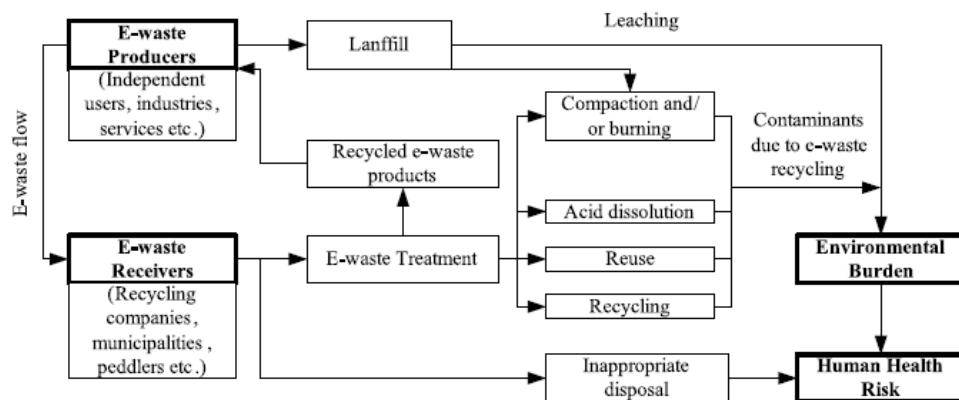


Figure 2. E-waste routes.