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Chapter 3

Recyclable waste and goods trade of mainland China

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Abstract

China began importing recyclable waste in the 1990s because of a scarcity of raw materials in China. In order to secure the resources needed to support the high rate of economic growth, China imports various recyclable wastes. Although China is actively utilizing recyclable wastes from overseas, serious environmental pollution has been generated by improper recycling and cases of shipbacks and smuggling still continue. In this chapter, the author will try to characterize the current recyclable waste trade in China using custom statistics and field surveys, and to identify major trends and areas of progress that China faces in connection with recycling.

Keywords: China, Recycling, Recyclable waste import, E-waste

Introduction

China began importing recyclable waste in the 1990s because of a scarcity of raw materials in China (Yoshida et al, 2005). Economic growth has continued at a high level and China requires huge volumes of resources to support this economic activity. In order to secure the resources needed to support the high rate of economic growth, China imports various recyclable wastes. In addition, the low personnel costs in China make the recycling of low-grade recyclable waste economically feasible, unlike in the industrial nations of the world. Resource demand and cheap labor have acted as triggers for a huge wave of recyclable waste imports from overseas.

Although China is actively utilizing recyclable wastes from overseas, it is also well on the way to becoming what can only be termed “the world’s dumping ground.” Meanwhile, serious environmental pollution has been generated by improper recycling. In particular, the recycling of e-waste in areas such as Guiyu is leading to environmental

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pollution (Yoshida, 2005). The Chinese government has already taken various steps in an attempt to prevent environmental pollution, including the import license system, a ban on imports of waste household appliances, export standards, and pre-shipment inspection requirements. However, cases of shipbacks and smuggling still continue.

In this chapter, the author will try to characterize the current recyclable waste trade in China using custom statistics and field surveys, and to identify major trends and areas of progress that China faces in connection with recycling.

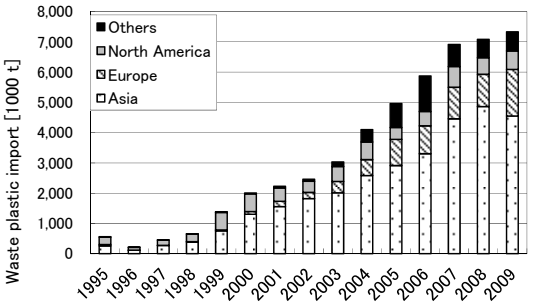
3.1 Basic trends in recyclable waste imports to China

3.1.1 Import trends in recyclable waste

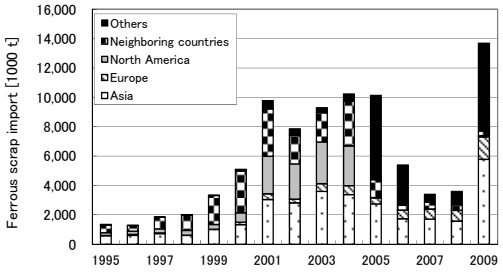
According to the Chinese customs statistics, in 2009 China imported 7.3 million tons of waste plastics, 27.5 million tons of used paper, 13.7 million tons of scrap iron, 4.0 million tons of scrap copper, and 2.6 million tons of aluminum scrap.

The amount of recyclable waste imported by China is growing every year. China imports recyclable waste from Japan, the EU, the USA, and neighboring countries (Fig. 1).

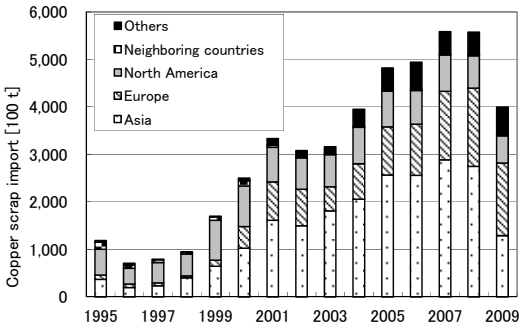
Approximately 60% of waste plastics are imported from Asian countries. Of the total imported waste plastics, Hong Kong accounts for 23% and Taiwan, Japan, and Thailand each provide approximately 10%. The EU has gradually increased its exports of waste plastics; however, Asian countries remain dominant. The amount from North America remains constant. The amount of ferrous metals (steel scrap) imported fluctuates a lot over time. There was sharp decrease in imports from 2005 to 2008 and a sharp increase in 2009. There are two reasons for this rapid change in the amount of imported steel scrap. First, the government enacted measures regarding small-scale electric furnaces to make steel production more efficient. Second, the price of scrap steel became very high, especially during 2007-2008 (Fig. 2). Imports of copper scrap decreased sharply from Asian countries in 2009. At the same time, there was a sharp increase in steel scrap imported from Asia. Therefore, it can be assumed that steel scrap replaced copper scrap in metal scrap exports. For Aluminum scrap, the ratio from Asia, EU and North America has remained constant. However, imported metal scrap from other countries and regions such as Australia and South America increased in 2005 and 2009.



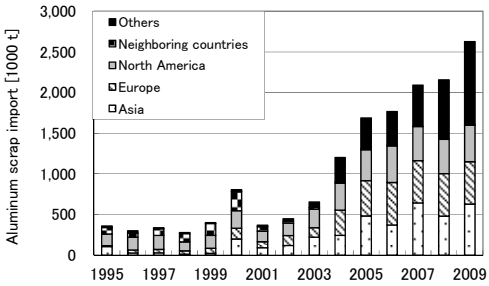
(1) Waste plastic



(2) Steel scrap



(3) Copper scrap



(4) Aluminum scrap

Fig. 1 Import volumes of recyclable waste by region

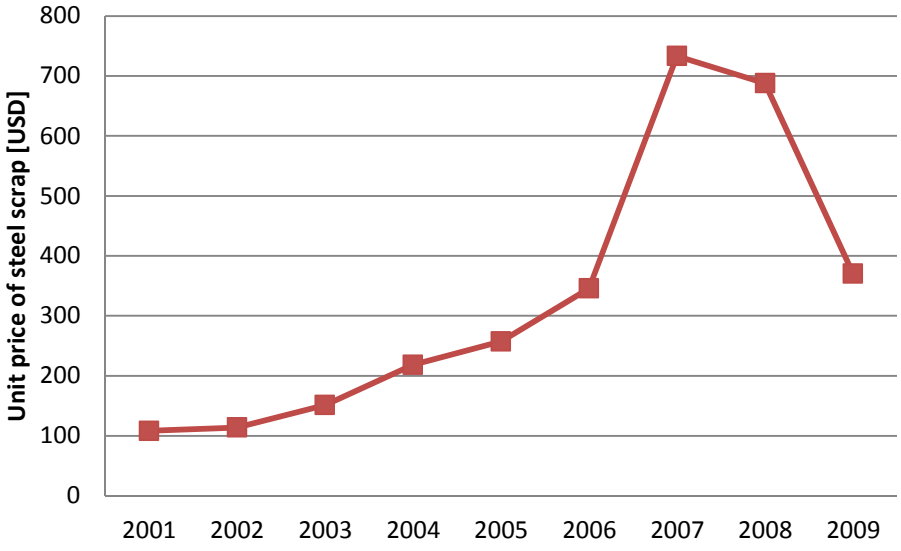
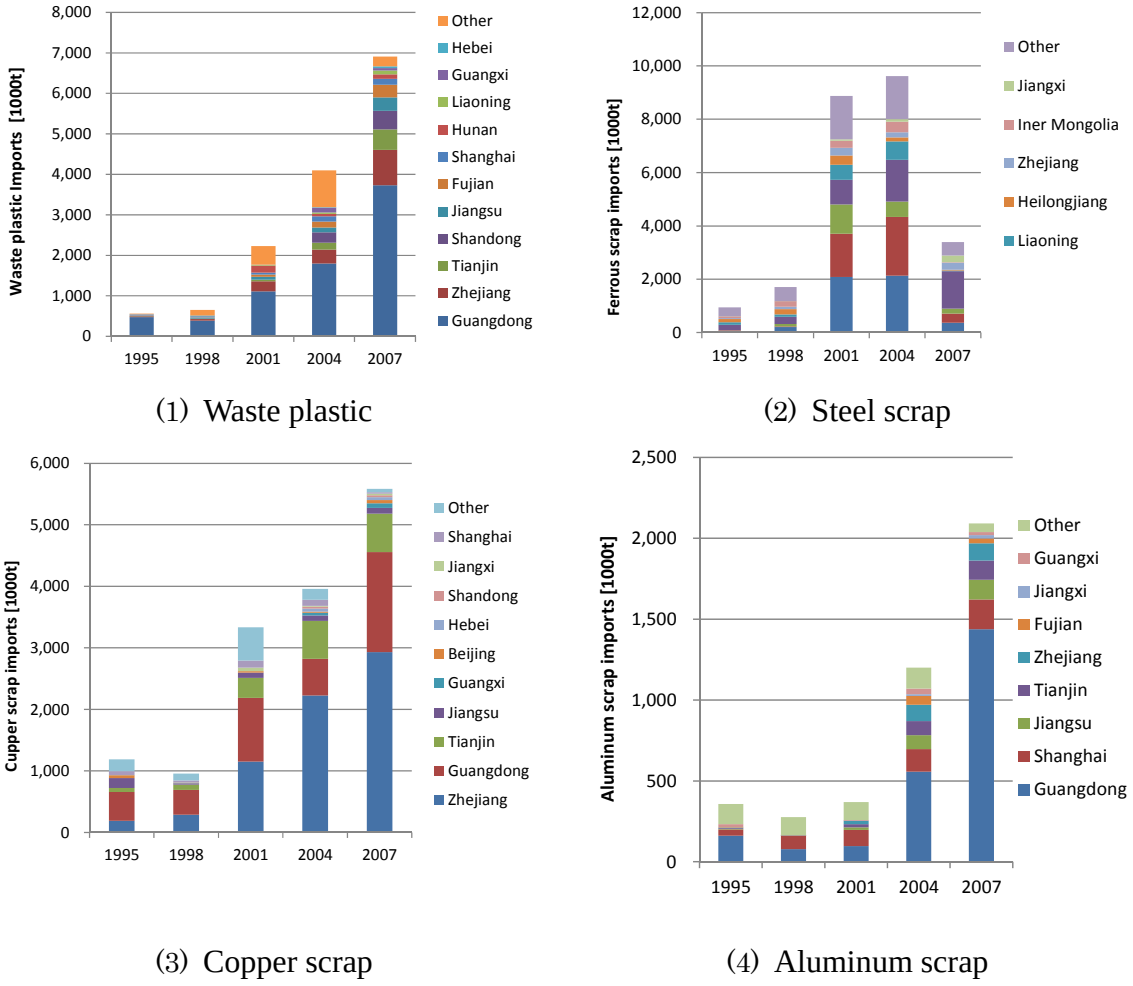


Fig. 2 Unit price of steel scrap (2001-2009)

3.1.2 Destination of recyclable waste

In order to determine the destination of secondary material flow, we analyzed import data (by country, destination, and trade type) from Chinese customs statistics. The destination of each secondary material from 1995 to 2007 is shown in Fig. 3.



(1) Waste plastic　　(2) Steel scrap

(3) Copper scrap　　(4) Aluminum scrap

Fig. 3 Destination of recyclable waste imported to China (1995-2007)

According to Chinese customs statistics in 2007, nearly 50% of imported waste plastics concentrated in Guangdong Province and approximately 30% goes to the Huadong area (Shanghai, Zhejiang, Jiangsu, Shandong, Jiangxi, and Anhui Provinces).

Guangdong Province, well-known for consignment manufacturing (processing and assembling, processing with imported materials), imports waste plastic through Hong Kong, and then exports 100% of their plastic products to other countries. Inputs are imported free of duties and VAT (value added tax). The amount of plastic scrap imported into the Huadong area as a percent of total imports has expanded from 9% to

27%, as the market price in this area is higher due to the growing textile industry. Waste PET is mainly concentrated in Zhejiang (50%) and Jiangsu (30%) Provinces because there are many textile companies that can recycle PET flakes into short polyester fiber (Fig. 4).

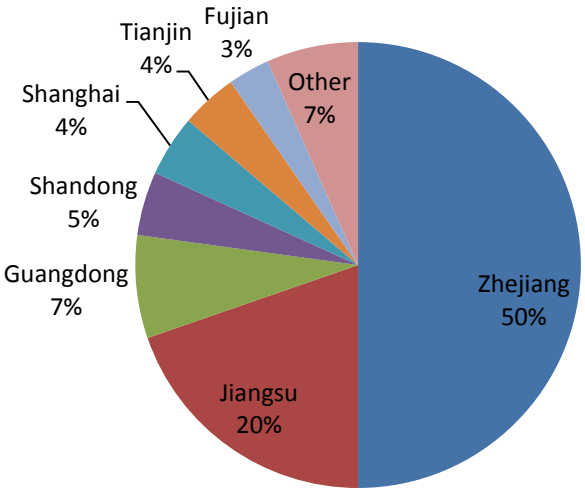


Fig. 4 Destination of waste PET in 2007

Approximately 40% of steel scrap was imported into Guangdong Province, 20% to the Huadong area, and 10% to the Xinjiang Uyghur Autonomous Region (Xinjiang region). Approximately half of copper scrap imports were concentrated in the Huadong area and approximately 70% of aluminum scrap was imported to Guangdong Province. Chinese imports of copper and aluminum scrap from the neighboring countries has shifted to higher-quality scraps, whereas import of steel scrap has shifted to lower-quality ones.

3.1.3 Trade type

Trade type can be categorized into ordinary trade, processing and assembling, processing with imported materials, border trade, and other. The current distribution among these categories is dramatically different from that in the early 1990s. Ordinary trade of waste plastic has increased from 13% to 95%, whereas processing and assembling, processing with imported materials have decreased significantly (Fig. 5).

In 2001, steel scrap and aluminum scrap from neighboring countries such as Russia and Kazakhstan are imported by border provinces, i.e., the northeast provinces and the Xinjiang region), through border trade, whereas scrap materials from other

countries are imported by coastal regions through ordinary trade. Most high-quality non-ferrous scrap is imported as processing and assembling or border trade by border provinces such as the northeast provinces and the Xinjiang region (Yoshida et al. 2005).

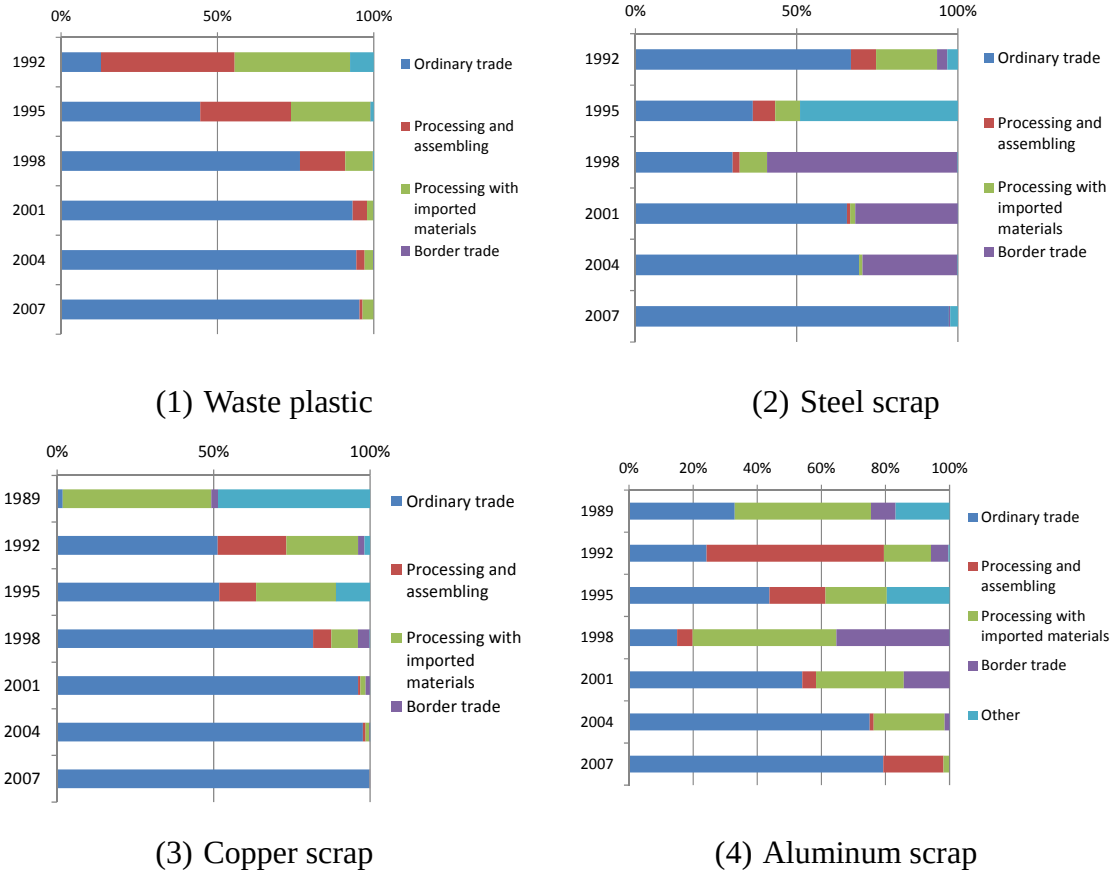


Fig. 5 Import of recyclable waste (by trade type)

Border trade accounted for 60% of the total amount of imported steel scrap in 1998, which consisted mostly of low-quality scrap imported from neighboring countries. However, since then, the ordinary trade has been growing faster than border trade. Ordinary trade accounted for 97% of the total amount of imported steel scrap in 2007, whereas border trade made up only 0.4% of total imported steel scrap. Steel scrap from Russia and Kazakhstan is imported by the northeast provinces and the Xinjiang region through border trade, whereas steel scrap from other countries is imported by coastal provinces such as Shanghai and Guangdong Provinces through ordinary trade.

For copper scrap and aluminum scrap, ordinary trade has been growing faster than processing and assembling, processing with imported materials, and border trade. Ordinary trade made up 99.7% and 79% of the total amount of imported copper scrap

and aluminum scrap, respectively, in 2007. High-quality aluminum scrap is imported for processing with imported materials or through border trade (Table 1).

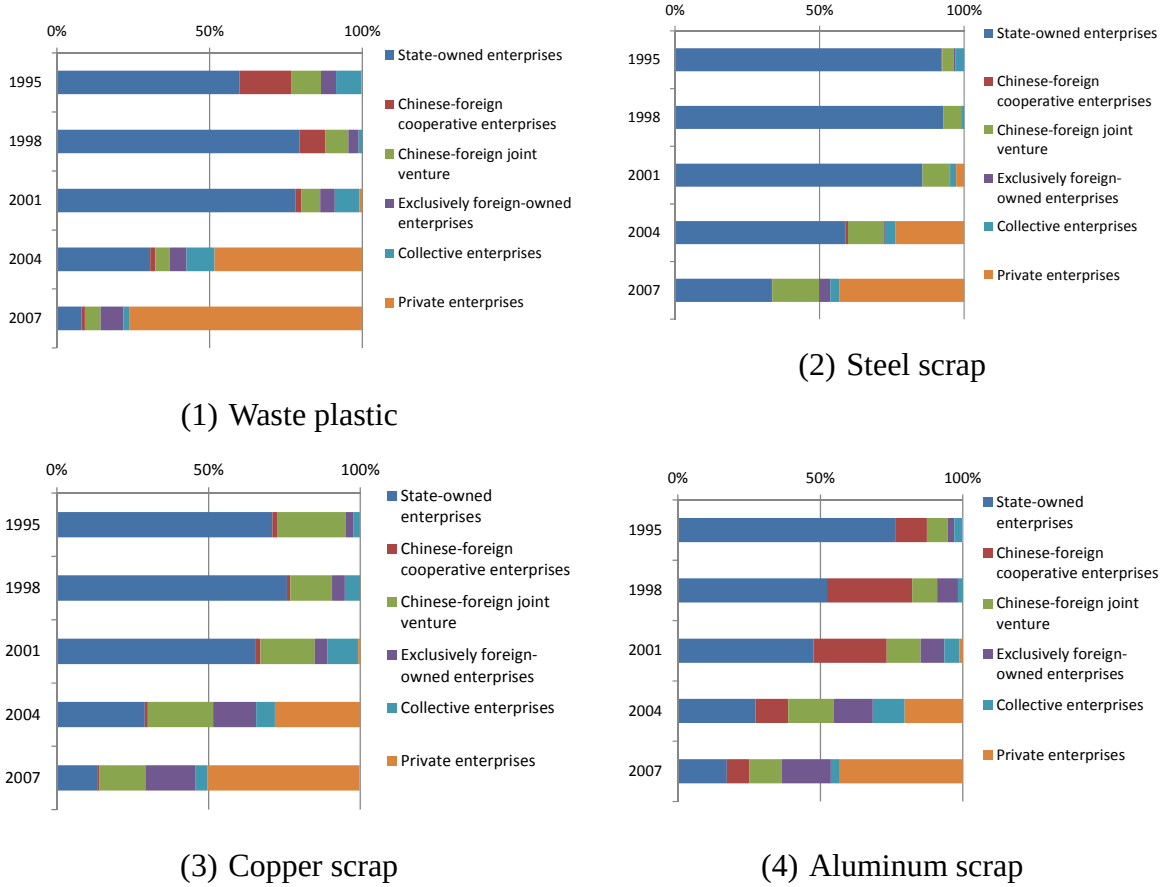
Table 1. Unit value of secondary material by trade type, 2007

Unit: USD/ kg

	Plastic	Steel	Copper	Aluminum
Ordinary trade	0.46	0.75	1.13	1.02
Processing and assembling	0.45	0	0	1.75
Processing with imported materials	0.67	3.26	5.69	1.82
Border trade	0.35	0.22	3.58	2.05
Other	0	0.35	0	0
Total	0.46	0.74	1.14	1.17

3.1.4 Enterprise type

In 1995, state-own enterprise accounted for 60%, 92%, 71% and 76% of imports of plastic, steel, copper and aluminum scrap, respectively (Fig.6). Three-fourths of enterprises that import waste plastic have been changed to private enterprises. Among steel scrap importers, Chinese-foreign cooperative enterprises, Chinese-foreign joint venture, and private enterprises has increased while state-own enterprises have decreased. For copper scrap, the share of exclusively foreign-owned enterprises and private enterprises has increased; for aluminum scrap, the share of the Chinese-foreign joint ventures, exclusively foreign-owned enterprises, and private enterprises has increased.



(1) Waste plastic

(2) Steel scrap

(3) Copper scrap

(4) Aluminum scrap

Fig. 6 Enterprise type of recyclable waste importer (1995-2007)

3.2 legal traffic in secondhand electric and electronic equipment and e-waste scrap to China

3.2.1 Secondhand electric and electronic equipment import to China

Many home appliances at the end of their useful life that are discarded in Japan are reused in Southeast Asia (Yoshida, et al. 2010). Material flow of secondhand electric and electronic equipment (EEE) around Vietnam was surveyed by Shinkuma and Huong (2009), who found that secondhand EEE and E-waste scrap are still being imported to China through Hong Kong, which is a free port. to Guangdong Province, even after the import ban by Chinese government took effect.

The government of Hong Kong has also taken various measures for tackling waste EEE imports to the region. In April 2006, Hong Kong strengthened the border control on CRT televisions and monitors by discouraging the import of any unit that is

more than 5 years from the date of manufacture. Thailand restricts the import of secondhand EEE that is more than 3 years from the date of manufacture. Due to this measure, the export amount of secondhand CRT televisions from Japan to Hong Kong was dramatically decreased. Instead, these CRT televisions were exported to Macao or Vietnam (Fig.7). While Vietnam also bans the import of secondhand EEE (except laptop personal computers) in law, in practice they are imported. More than 50,000 units of secondhand CRT televisions are imported into Vietnam each month, and it is hard to see demand at such a level domestically. Most likely these imported EEE are ultimately transferred to mainland China through region with looser import controls.

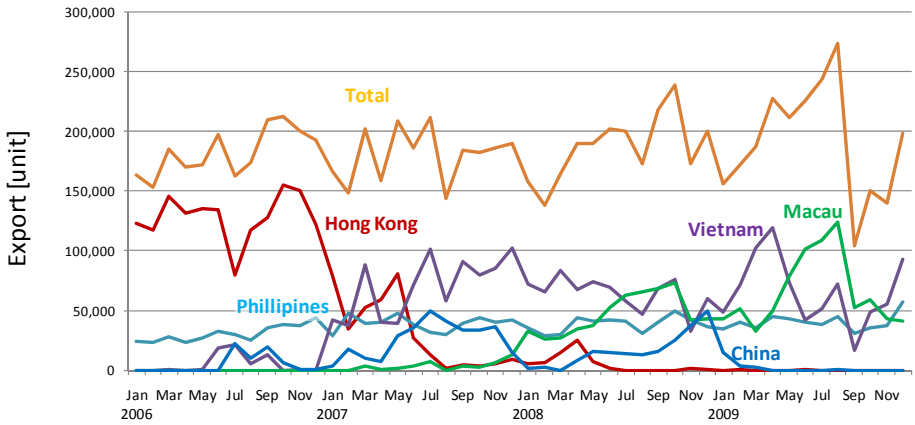


Fig. 7 Destination of secondhand CRT televisions exported from Japan

There are limited data available for understanding the flow of secondhand EEE to China. However, detailed Chinese customs data on CRT monitors and Televisions by trade type and transport method were analyzed. As a result, we estimate that approximately 750,000 units of CRT monitors and 870,000 units of CRT televisions were imported by river or marine transport to Guangxi Province and nearly 200,000 CRT monitor and televisions were imported to Guangdong Province by land transportation. Since these imports were classified as processing with imported materials, it can assume that the imported items were processed (refurbished) then exported again to other countries. In 2007, approximately 668,000 units of CRT monitors and 900,000 units of CRT televisions were exported under the trade type processing with imported materials.

3.2.2 Imports of e-waste parts and scrap to China

Although the Chinese government bans the import of e-waste parts and scrap from all countries, there are many other Asian countries that export e-waste to China.

Field surveys in Vietnam, the Philippines, and China in 2009 and 2010 show that separated materials from e-waste such as plastics, printed circuit boards, and CRT television tubes and glass are often exported to China (NIES et al., 2010). Exports of e-waste to China happen for several reasons. Printed circuit boards are exported to China because China has techniques to reuse integrated circuit parts for manufacturing other new EEE such as electronic toys. Also, China has the technology and facilities to recovery copper from printed circuit boards, whereas other Southeast Asian countries do not.

3.2.3 Border trade between Vietnam and China

In south Vietnam, one large dealer in Ho Chi Minh City exports 100 tons of waste plastics and 60-70 tons of printed circuit boards to China each month. Based on our interview, those materials are shipped to Mong Cai, the border region of Vietnam and China. The shipment route is both by ship and land. There are seven large Chinese brokers in Ho Chi Minh City, so that many types of materials for export are concentrated in Ho Chi Minh City, including some printed circuit boards from Cambodia and central Vietnam. Also, many people at recycling villages in north Vietnam stated that a variety of materials are exported to China, especially plastics, printed circuit boards, and CRT tube and glass.

Although evidence shows that much material is going from Vietnam to China, Chinese custom statistics show that only 590 ton of waste plastics were imported from Vietnam in 2009. Therefore, a large portion of recyclable wastes from border trade are imported without passing through customs, i.e., smuggling.

3.3 Recent trends in recycling in China

3.3.1 The recent situation of Guiyu, a famous e-waste recycling town

In rural agricultural and fishing communities in China, recycling is done by smaller private businesses or as cottage industries by individual farmers. As a result, the inappropriate disposal of e-waste is resulting in the spread of environmental pollution.

In 2002 the Basel Action Network (BAN) and the Silicon Valley Toxics Coalition (SVTC) issued a report on the recycling industry in China entitled “Exporting

Harm: The High-Tech Trashing of Asia." This report stated that residues from the treatment of e-waste exported by industrial nations are being illegally dumped in China and that contaminated water is being released, unprocessed, into national waters.

Guiyu is a town with a population of 139,000 people. Annually, nearly 1 million tons of printed circuit boards and 3 million e-waste parts are treated in Guiyu. In 2008, the sales amount from the collection and treatment of e-waste and waste plastics was 2 billion CNY (304 million USD, 1USD = 6.58 CNY). Most e-waste is mobile phone and personal computer scrap, and rarely, television sets and refrigerators. According to the report published on December 18, 2009 by the local government in Guiyu, e-waste dismantling and processing was conducted in 21 villages by 300 enterprises, 5,500 individual enterprises, and 60,000 workers. However, due to the economic crisis, the number of migrant workers was reduced by two-thirds (40,000). On average, workers earn 50 CNY (8 USD) per day.

Concerns about air, water and soil pollution and about the damage to human health have been expressed, since the waste was being recycled using primitive methods, including simple manual sorting and dismantling work, open burning of plastic-coated wires, burning of soldered circuit boards, and strong-acid waste treatment (Yoshida, 2005).

Though our field survey in December 2009, we were able to confirm that several companies operating with the permission of the local government collected integrated circuits and other parts from printed circuit boards in waste mobile phones and personal computers. The collected parts were supplied to toy manufacturing factories. Also, the cottages using acid-bath for recovering precious metals along the river side were closed and removed. Instead, large scale copper smelting facilities were established, which represented a great improvement in infrastructure for e-waste recycling.

3.3.2 Old-for-new policy and WEEE collection and recycling in China

The Regulation for the Administration of the Recovery and Disposal of Waste Electric and Electronic Products was issued by the State Council and enforced beginning January 1, 2011. It targets 5 items: television sets, refrigerators, washing machines, air conditioners, and personal computers. The order outlines the responsibilities and duties of producers, retailers, consumers, and recycling companies. Producer and retailers of EEE and after-service organization are responsible for collecting used EEEs. The state government issues qualification permits to e-waste recycling companies, which are

approved by the municipal-level environmental protection department. Based on the concept of extended producer responsibilities (EPR), the state government established a fund for e-waste disposal. Manufacturers of EEEs and consignees for imported EEE are required to contribute to the fund.

To prepare for the enforcement of the regulation, the state government has started the "old-for-new policy" since June 2009 to encourage the replacement of old EEE with new EEE in 9 selected provinces and cities (Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Shandong, Guangdong, Fuzhou and Changsha). The first phase lasted until May 31, 2010, however the Chinese government expanded the program to an additional 19 provinces and cities, to a total of 28 provinces and cities, and extended the policy through December 2011. Consumers can receive a subsidy of 10 percent off the sales price of new appliances if they provide their old appliances to collectors or retailers. The maximum subsidies are 400 CNY for televisions, 300 CNY for refrigerators, 250 CNY for washing machines, 350 CNY for air conditioners, and 400 CNY for personal computers.

The "old-for-new policy" has two objectives: (1) tackle the economic crisis and stimulate domestic consumption, and (2) explore practical collection channels and funding mechanisms for regulation. By May 23, 2010 toward the end of the firstyear,13.875 million units of e-waste had been collected and 13.128 million units new appliances had been sold, with a sales value of more than 50 billion CNY (7.94 billion USD), according to data from the Chinese Ministry of Commerce. By December 2010, about one and a half years into the program, the sales volume of home appliances under the government subsidy scheme surpassed 30 million units and the home appliance replacement program stimulated more than 112.69 billion CNY (16.9 billion USD) in consumer spending.

Before the replacement program started, recycling companies could not collect enough e-waste for their operations. After the program, the amount of old appliances collected increase more than 10 fold. However, some recyclers indicated in our interviews that there were some problems with storage space, and a lack of standards and criteria for proper storage, dismantling or disposal of the used appliances. Because this system allows consumers to submit any of the five types of old appliances, a large amount of CRT televisions were collected at recycling facilities. Since many black and white CRT televisions were also collected, it can be assumed that some consumers discarded old appliances that they obtained from different users, including by purchasing very old appliances from the market.

3.3.3 Compost import from Japan

A compost manufacturing factory in Nagoya Prefecture exports food-waste-recycled compost to Shandong province, China. The export amount reaches 400-700 tons/month, accounting for 50-80% of total production.

The company's headquarter is located in Kumamoto Prefecture. A factory was established in Nagoya because of the invitation from the city government. The Nagoya city government implemented measures to significantly reduce waste in order to preserve Fujimae-Higata (wetlands designated under the Ramsar Convention) by preventing the establishment of landfills.

The company collects food waste from restaurants and convenience stores and produces the compost through the fermentation of food residue in closed conditions. The compost is sold for agricultural industries and household gardening. Because of the high quality of its product, there is also demand from abroad.

In Nagoya Prefecture, the company motivates local production for local consumption, referred to as *Okaeri-yasai* (returning vegetables), which is producing and consuming vegetables by using local compost. However, because of the exports of compost to China, the company sometimes is criticized by citizens in Nagoya that their exports discourage local production for local consumption.

Recently, the treatment method of municipal solid waste in China has been shifted from landfill to incineration (Table 2).

Table 2. Number of municipal solid waste treatment facilities in China

Year	Collected MSW	Number of treatment facilities			
		Total	Sanitary landfills	Composting plants	Incineration plants
2003	148,565	575	457	70	47
2004	155,093	559	444	61	54
2005	155,768	471	324	46	69
2006	148,413	419	324	20	69
2007	152,145	460	366	17	66
2008	154,377	509	407	14	74

At the same time, the number of composting facilities has decreased from 70 to 14 facilities from 2003 to 2008. This decline in domestic composting facilities implies that China needs high quality compost manufacturing technology and facilities.

Conclusion

The major destination of recyclable waste transferred to China is Guangdong Province, but also is expanding into the Huadong area (Shanghai, Zhejiang, Jiangsu). Ordinary trade has become the dominant type of trade for transfer of recyclable waste since the late 1990s. In 2007, ordinary trade accounted for 95%, 97%, 99.7% and 79% for plastic, steel, copper and aluminum scrap, respectively.

The quantity and volume of secondhand electric and electronics equipment and e-waste scrap to China is hard to grasp because most of these items are traded without passing through customs. However, the Chinese custom statistics on CRT monitors and televisions shows that 750,000 units of CRT monitors and 870,000 units of CRT Televisions were imported by river or marine transport to Guangxi Province; nearly 200,000 CRT monitor and televisions were imported to Guangdong Province by land transportation under the trade type processing with imported materials. Approximately, the same amount of televisions and monitors were re-exported from China.

The author also reviewed the recent situation and trends in e-waste recycling in China and compost product trade between Japan and China. In an e-waste recycling area such as Guiyu, some improvements in the technological level were observed. Increasing amounts of e-waste are collected by the appropriate e-waste recycling facilities under the replacement programs. However, we need to pay attention to these trends because the “old-for-new” policy is not a permanent system. At the same time, China is experiencing rapid growth in the municipal solid waste incineration market and the development of technology, and the number of composting facilities is decreasing. Even though Japanese compost receives recognition for its high quality, it is ironic to see the demand of imported compost in China. Demand for Japanese compost may reflect the fact that China has yet to develop appropriate technology for composting MSW.

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