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Survey and analysis of consumers' behaviour of waste mobile phone recycling in China

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ABSTRACT

The aim of this paper is to investigate the behaviour of consumers toward waste mobile phone recycling on a national scale in China. With this goal in mind, a questionnaire survey was performed on a nationwide scale to explore consumers' behaviours, attitudes and willingness to pay (WTP) for recycling waste mobile phones. There were 1035 effective questionnaires, and the questionnaire was analysed with principal component analysis and multinomial logistic regression analysis. The results revealed that the actual service life of mobile phones in China is generally shorter than three years. Due to the current level of economic development and the traditional concept, only 47.9% of consumers agreed to pay for waste mobile phone recycling, and most consumers' WTP was 0–5% of the recycling costs. The main factors affecting the consumers' WTP were region, education level and monthly income. Therefore, mobile phone producers and the government should mostly share the responsibility of waste mobile phone recycling. With an improvement in public environmental awareness, it may be possible for consumers to afford recycling fees in the future, through either a prepaid deposit, or purchasing the product with the fee embedded in the price. In addition, it is important to support environmental education to promote environmental awareness.

1. Introduction

With the rapid economic development and the continuous improvement of people's living standards, the electronic communications industry has experienced a trend of rapid growth in China. As of 2004, China became the largest producer and consumer of mobile phones in the world (MIIT, 2005). The production of mobile phones has reached 1.13 billion units, accounting for 70.6% of the global production. In 2011, there were 986.25 million users, which brought the popularising rate reach to 73.6% in China (ITU, 2011; MIIT, 2012). Moreover, the service life of mobile phones in China is generally less than three years and is even close to one year in a portion of cases, due to the pursuit of fashion and the desire to acquire new mobile phone functions (Ha et al., 2010; Ongondo and Williams, 2011; Polák and Drápalová, 2012). There are approximately 70 million waste mobile phones being generated every year in China (Yu et al., 2010; Wang et al., 2011). It is estimated that by 2020, the annual amount of discarded mobile phones will be approximately seven times greater than the amount in 2007 (UNEP, 2009). Compared to traditional municipal wastes, obsolete mobile phones contain both highly toxic substances and valuable materials that can be recovered, such as copper, silver, gold and palladium. Therefore, recycling of waste mobile phones is required to garner the double value of both environmental protection and resource conservation. In China, however, there is still a shortage of appropriate management policies and collection systems on waste mobile phones, and recycling treatment infrastructures still need to be developed (Li et al., 2012; Polák and Drápalová, 2012; Song et al., 2012; Yu et al., 2010).

There is a large amount of legislation (e.g., the Basel Convention) concerning e-waste, including waste mobile phone legislation enacted to control waste electrical and electronic equipment (WEEE) around the world (www.basel.int). Since the European Union (EU) has implemented the restriction on hazardous substances (RoHS-Directive, 2002/95/EC) and waste electrical and electronic equipment (WEEE-Directive, 2002/96/EC), many countries have paid considerable attention to WEEE management. Extended producer responsibility (EPR), one of the most potent principles incorporated into e-waste management, states that producers and importers should extend their responsibility to reclaim e-scrap (Afroz et al., 2013; Wang et al., 2011).

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However, beyond the responsibility of producers and importers, the government and mobile phone customers also play important roles in e-waste recycling (Hicks et al., 2005; Nnorom et al., 2009). There have been many scientific studies focussing on successful e-waste management and collection systems (Dwivedy and Mittal, 2012; Dindarian et al., 2012; Oliveira et al., 2012; Torretta et al., 2013). Research has also been conducted on the behaviour of customers regarding e-waste recycling or willingness to pay for e-waste recycling in foreign countries (Afroz et al., 2013; Dwivedy and Mittal, 2013; Darby and Obara, 2005; Saphores et al., 2012), of which some studies have focused on used and end-of-life mobile phones (Jang and Kim, 2010; Nnorom et al., 2009; Ongondo and Williams, 2011; Polák and Drápalová, 2012).

As an important stakeholder of waste mobile phone recycling and treatment, the socioeconomic characteristics of consumers, such as gender, age, income and education level, play important roles in the behaviour or willingness of the general public (Saphores et al., 2012; Song et al., 2012; Yoo and Kwak, 2009). Previous studies based on a questionnaire survey in China have examined residents' behaviours, attitudes and their willingness to pay for e-waste recycling in developed regions, such as Beijing (Wang et al., 2011), Macau (Song et al., 2012) and the medium-sized city of Taizhou (Streicher-Porte and Geering, 2010). Nevertheless, the characteristics are different from large WEEE to small e-waste, with mobile phones serving as a typical example. As small WEEE, mobile phones have a minor share of WEEE by weight, various material compositions, defective reuse and recycling systems. However, mobile phones are the vast majority by number and their environmental and health impacts would not be negligible (Chancerel and Rotter, 2009; Darby and Obara, 2005; Polák and Drápalová, 2012; Xu, 2011). Most recently, China has been undergoing rapid urbanisation and faces both developing and developed country problems, due to the wide geographical area and high heterogeneity among population groups in China. Therefore, how to collect waste mobile phones effectively and efficiently, especially on a national scale, is still a primary challenge for the Chinese government (Qu et al., 2013).

In our study, we first introduced a review of the e-waste policy and practice situation in China, and then we analysed the questionnaire survey on a national scale. Based on our detailed analysis, we provide several positive suggestions for methods of waste mobile phone collection in the future. In addition, we encourage policy makers to develop more effective management policies for small WEEE disposal in China, as well as in other developing and developed countries.

2. Management of waste mobile phones in China

2.1. Laws and regulations on waste mobile phone recycling in China

As the largest manufacturer and consumer of electronic appliances, the Chinese government has made efforts to tackle problems associated with the recycling and disposal of waste electrical and electronic equipment since 2001. The driving forces behind these efforts come from both home and abroad. The regulations on electronic products and e-waste recycling management systems in other countries/regions (especially in the EU and its member countries) have placed substantial pressure on the electronic products export industry in China. Meanwhile, the amount of WEEE is approaching a peak Chinese domestic e-waste stockpile (Liu et al., 2006). There are three main government agencies regulating WEEE management in China (Yang et al., 2008): the Ministry of Environmental Protection (MEP), the National Development and Reform Commission (NDRC), and the Ministry of Industry and Information Technology (MIIT). In addition, the Ministry of Commerce (MOC), the Ministry of Public Security (MPS), the Ministry of Housing and Urban-Rural Development (MOHURD), and the State Administration for Industry & Commerce (SAIC) are also involved in the management of e-waste.

In response to the e-waste problem, China recently enacted a number of specific laws on WEEE. There are three basic laws on e-waste in China: the Cleaner Production Promotion Law, the Solid Waste Pollution Prevention Law (Amendment), and the Circular Economy Promotion Law. Based on those laws, the agencies

Table 1
Relevant laws and regulations of electronic wastes in China.

Laws and regulations	Major contents	Relationship of the regulations	Implementation time
Technology Policy of Hazardous Waste Pollution Control	Stipulate the activities technologies and facilities of collection, transport, storage, recycling and disposal of hazardous waste, including e-waste	Administrative rule	2001.12.17
Technology Policy of Waste Battery Pollution Prevention	Regulate the activities of production, collection, transport, storage, recycling and disposal of battery	Administrative rule	2003.10.09
Solid Waste Pollution Prevention Law (Amendment)	Blanket legislation on prevention and reduction of pollution caused by solid waste	Law	2005.04.01
Technology Policy of Discarded Household Appliances and Electronic Products Pollution Control	Establish the principles of "3R" and "polluter pays principle", encourage building multivariate recycling system of e-waste	Administrative rule	2006.04.27
Management Measures of Pollution Prevention for Electronic Information Products	Chinese RoHS	Administrative rule	2007.03 0.01
Management Measures of Renewable Resources Recycling	Stipulate rules of renewable resources recycling system	Administrative rule	2007.05 0.01
Regulations of Electronic Waste Pollution Prevention	Regulate the activities of production, disassembly, recycling, disposal and storage of e-waste	Administrative rule	2008.02.01
Circular Economy Promotion Law	Regulate the requirements for the disassembly and treatment of e-waste, excluding e-wastes collection	Law	2009.01.01
Technology Specifications of Pollution Control for Processing Waste Electrical and Electronic Equipment	Stipulate the process of collection, transportation, storage, dismantling, reuse and disposal of e-waste	Technical standard	2010.04.01
Management Ordinance of Recycling and Treatment of Waste Electrical and Electronic Products	Chinese WEEE directive	Decree	2011.01.01
Administrative Measures of Fund for Waste Electrical and Electronic Products	Establish special fund from producer and importer to finance e-waste recycling and disposal	Administrative rule	2012.05.21
Cleaner Production Promotion Law (Amendment)	Establish some principals about the design and production of EEE, and disposal of e-wastes	Law	2012.07.01