

The producer's role in managing used mobile phones: the case of China

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Thesis for the fulfilment of the
Master of Science in Environmental Sciences, Policy & Management
Lund, Sweden, June 2009

MESPOM Programme:

Lund University – University of Manchester - University of the Aegean – Central European University



**Erasmus Mundus Masters Course in Environmental
Sciences, Policy and Management**

MESPOM



This thesis is submitted in fulfilment of the Master of Science degree awarded as a result of successful completion of the Erasmus Mundus Masters course in Environmental Sciences, Policy and Management (MESPOM) jointly operated by the University of the Aegean (Greece), Central European University (Hungary), Lund University (Sweden) and the University of Manchester (United Kingdom).

Supported by the European Commission's Erasmus Mundus Programme



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Published in 2009 by IIIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
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ISSN 1401-9191

Acknowledgements

First and foremost my sincere gratitude goes to Naoko Tojo and Panante Manomaivibool, my supervisors. Without their suggestions, comments, insights and patience, this thesis would not be presented here. I have learned a lot from them during the thesis process in terms of understanding EPR and the way and attitude of doing academic research. My appreciation is inexpressible in words.

I am also very grateful to Philip Peck for directing our ARPEA course and advising on my ARPEA paper, the preparation of this thesis. In addition, many thanks go to Faikham Harnnarong and Brian Carisma as well, for the precious comments on my ARPEA paper.

During the research period I met and interacted with seasoned interviewees working in the WEEE management area, such as Yun Lai, Min Chen, Junlin Ma and Helena Castren. I would like to thank you for taking time to share with me your story and for the follow up emails. I would also like to thank Tingcun Han and Jyri Rantanen for helping me contact interviewees. Without your help I would not be able to obtain so much valuable information for this thesis.

I also owe a debt of gratitude to everyone in MESPOM 07/09 and the MS 07/08 in the Department of Environmental Sciences and Policy in CEU. Thank you for the company and friendship. The time with you people brought me lots of fun and insights in diverse areas. Thank you Shan Zhou, my roommate in Budapest, for the patience and time talking and cooking together.

I would also like to thank all professors and staff in the Department of Environmental Sciences and Policy of CEU and IIIIEE, Lund University for your support. Thanks Lars Hansson for sharing with me your experience in China. Thanks Aleh Cherp for coordinating the MESPOM program. Thanks Håkan Rodhe for coordinating our study in IIIIEE. Thanks Irina Herczeg and Krisztina Szabados for your help in Budapest. Thanks Elna Andersson, Kristina Miolin, Gunilla Kittel and Fredrik Eriksson for your help in Lund.

Last but not the least, my gratitude goes to my Mom, brother and the extended family at large. Thank you for your always encouraging me. You are the most precious in my life.

Zhen Huang

Lund, May 2009

Abstract

This thesis explores China's policies on and practice of e-waste management, especially in the case of used mobile phones, by applying the concept of Extended Producer Responsibility (EPR). It aims to paint the picture of current policies and implementation pertaining to e-waste management in China, focusing particularly on producer responsibility and on a selected product group (mobile phones). It also aims to look at the possibilities and challenges to improve the system by applying EPR in China's e-waste management policy system. In order to achieve the objectives, the analytical framework used focuses on the three types of responsibility in EPR programs – physical, financial and informative. Two perspectives are relied on to review China's current situation – policy and practice. On the policy side, through literature review and policy review, current policies pertaining to e-waste management in China are summarized. From the practical perspective, an empirical case in managing used mobile phones is presented, mainly through interviewing.

With the help of the analytical framework, the picture of China's current policies on managing e-waste, particularly used mobile phones, is drawn. Based on it, the challenges and opportunities for China to involve producers in used mobile phone management are identified. In response to these, recommendations on improving China's EPR programs in managing WEEE, particularly used mobile phones, are given.

Key words: extended producer responsibility (EPR), e-waste management policy, used mobile phones, China

Executive Summary

Background and purpose

With a population of 1.33 billion, China witnesses growth in the volume of e-products consumption each year, particularly in the consumption of mobile phones, with more than 600 million subscribers at present (MIIT, 2009). The number of end-of-life mobile phones is large as well, at an average of 110 million per year. Dealing with the e-waste issue is and will continue to be a pressing challenge for the Chinese government.

In response to the challenge, the government has promulgated several policies, such as cleaner production policy, solid waste management policy, and, recently, a specific e-waste management policy.

Meanwhile, in the international arena, Extended Producer Responsibility (EPR) in e-waste management has been discussed since the early 1990s. However, this topic is relatively new for China, and the producer's role at the end-of-life of e-products management is rarely discussed in a systematic way in the country.

As such, the thesis has two objectives: (1) to paint a picture of current policies and implementation pertaining to e-waste management in China, focusing particularly on producer responsibility and on a selected product group (mobile phones), so that further improvement in the system may be identified; (2) to look at the possibilities and challenges to improve the system by applying the principle of EPR in China's e-waste management policy system.

Policies pertaining to e-waste management, particularly at the national level, are the main focus of this thesis. In addition, implementation of the policies will also be discussed, and an empirical case will be studied.

The work presented in this thesis is based on data and information collected through interviewing, literature review and policy review. The analysis is based on the concept of EPR and an existing framework applied by Tojo (2004).

WEEE management in China: policies and practice

Generally, there are two main levels in China's policy system: legislation and specific policy instruments. The former is the foundation of the latter, and the legislative system is foundational to the policy system.

In China, since e-waste is classified as solid waste, most policy instruments applied for managing solid waste are applicable for e-waste management. The particular legislation related to WEEE management in China mainly includes the Constitution of the People's Republic of China (PRC) (1982), the Environmental Protection Law of PRC (1989), the Law on Prevention and Control of Environmental Pollution by Solid Waste of PRC (2004) ("Solid Waste Pollution Prevention Law" for short), the Law on Promotion of Cleaner Production of PRC (2002) ("Cleaner Production Promotion Law" for short), the Administrative Measures on Prevention and Control of E-waste Pollution (2008) ("Administrative Measures" for short), and the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products (2009) ("China WEEE Ordinance" for short).

Various instruments related to WEEE management are applicable to EEE producers, and include (but are not limited to) environmentally friendly product design, adoption of proper technology, joining in the system of reporting and registration for industrial solid waste, toxic

and harmful raw materials control, recycling of certain products, and labeling of hazardous waste.

Specific WEEE management instruments are prescribed in the Administrative Measures and the China WEEE Ordinance, and include actors' qualification, treatment certification, information disclosure, special standards, material control, building recycling and disposal systems, a disposal fund, and proper product design.

Besides legal development as such, the Chinese government has launched four national pilot projects on WEEE management since 2004, to form a basis for informed policy making; however, there is not much detailed official data available for these projects. Nevertheless, one common thing among these projects is that a lot of effort is expended to develop professional treatment facilities and effective collection channels.

A voluntary take-back project for used mobile phones

Currently in China, there is a voluntary take-back project (the "Green Box Program"), initiated by some mobile phone producers and a telecommunications operator. This case may be the only one available to date in which the producers play an active role in dealing with e-wastes in the country. At present, there are eight mobile phone producers and one telecommunications operator taking part in the project, and they have applied various strategies to take back used mobile phones. For example, they set up dropping points for end users at their service centers, and also offer certain rewards as incentives for end users to drop the used products at the collection points. Generally, the program has increased the public's awareness on recycling used mobile phones. However, one issue of the program is that not many mobile phones were taken back, and most of the collected scraps were obsolete batteries.

Findings

Responsibility distribution in the policy

In the Administrative Measures and the China WEEE Ordinance, the three types of responsibility are touched upon in terms of collection and recovery of WEEE, and the duty of monitoring and enforcement is also specified.

Collection:

- *Physical responsibility* – In China, the responsibility of physical collection is placed mainly on the municipalities' shoulders instead of being the producers' onus.
- *Financial responsibility* – Financial responsibility ultimately rests with producers, and they are obliged to contribute to the disposal fund; however, the mechanism of the fund is not yet fixed.
- *Informative responsibility* – The producers are obliged to disclose the materials used in their products and put a recycling marking on the product or in the instructions. However, the provisions are not specific enough for implementation.

Recovery:

- *Physical management* – The treatment bodies play the main role in physically recovering WEEE on a commercial basis, without being mandated by the law.
- *Financial mechanism* – The producers bear the financial responsibility by placing a fee in the disposal fund.
- *Information management* – The producers must offer information about their products. The treatment bodies are required to provide information related to WEEE treatment to the authorities concerned, to establish a database on disposal of WEEE, and to report to local environmental protection agencies.

Monitoring & Enforcement:

In the management of WEEE, the governments at different levels play very important roles in monitoring and enforcement of the policy.

The responsibility arrangement in the Administrative Measures and in the China WEEE Ordinance is not totally consistent. For example, in the Administrative Measures, producers are responsible for building up a system to take back and dispose of their WEEE properly, or, alternatively, they can have their WEEE disposed of by the treatment bodies. However, under the China WEEE Ordinance, the producers are not required to do so, but just encouraged. In addition, when grouping the actors in WEEE management, both the Administrative Measures and the China WEEE Ordinance put the manufacturers and importers together as one type of actor – the producers – whereas in the Administration Measures, distributors are also included.

Lessons learned from the case study

In the voluntary collection scheme, the manufacturers and network provider involved undertake all of the three types of responsibility. However, there are not many used mobile phones taken back through the scheme. Furthermore, the scheme competes with the grey refurbished mobile phone market and the informal recycling sector for the used mobile phones.

In addition, some factors affect the outcome of the scheme, which include the driving force, the convenience of the take-back scheme for end users, awareness among end users, the incentives for end users, and the grey market for refurbished mobile-phones and the informal recycling sector.

Challenges and opportunities for involving producers in end-of-life mobile phone management

According to current policies and empirical experience in China, there are both challenges and opportunities for involving producers in end-of-life mobile phone management.

The challenges include unclear definition regarding producers in the policies, lack of awareness among end users for recycling of used mobile phones, the small amount of returned end-of-life products, the grey refurbished product market and the informal recycling sector, and the cost of collecting used mobile phones.

The opportunities are the new WEEE management policy, the potentially large amount of used mobile phones, a well established infrastructure, and the existing take-back schemes.

Recommendations

- Responsibility distribution in WEEE management:
 - ✓ Measures and provisions to increase direct involvement of the producers in the physical management of their products need to be included in the policies. In other words, producers shall be responsible for physically taking back their end-of-life products.
 - ✓ It should be clear whether producers shall bear the whole cost of dealing with WEEE and whether they shall undertake individual or collective financial responsibility in China's policies.
 - ✓ Specific instruments should be added into the policies on informative responsibility.
- In the case of mobile phones, the producers should include manufacturers, importers and refurbishers.

- Various kinds of incentives can be applied in policies to encourage producers and end users to participate in the take-back scheme.
- The government can adopt measures to increase public awareness on recycling used e-products.
- Since refurbished mobile phones have a market, it is better to legalize refurbishment in China, in order to place the activities under control.

Finally, in future the study can be expanded to other end-of-life e-products' management, such as air conditioners and TV sets, so that a more complete picture of China's e-waste management policies can be drawn.

Table of Contents

List of Figures

List of Tables

1	INTRODUCTION.....	1
1.1	BACKGROUND.....	1
1.2	RESEARCH OBJECTIVES AND QUESTIONS.....	2
1.3	RESEARCH SCOPE AND LIMITATION.....	2
1.4	RESEARCH METHODOLOGY.....	3
1.5	OUTLINE OF THE THESIS.....	4
2	THEORETICAL BACKGROUND AND INTERNATIONAL CONTEXT.....	6
2.1	ABOUT EXTENDED PRODUCER RESPONSIBILITY.....	6
2.2	ANALYTICAL FRAMEWORK.....	8
2.3	INTERNATIONAL CONTEXT FOR THE END-OF-LIFE MOBILE PHONE MANAGEMENT.....	8
2.3.1	<i>MPPI's Guideline on the Collection of Used Mobile Phones.....</i>	<i>9</i>
2.3.2	<i>Experience on used mobile phone management: international arena.....</i>	<i>9</i>
2.4	ADAPTED STEPS FOR ANALYSIS.....	11
3	WEEE MANAGEMENT IN CHINA: POLICIES AND PRACTICE.....	12
3.1	GENERAL POLICY SYSTEM IN CHINA.....	12
3.1.1	<i>General policy system in China.....</i>	<i>12</i>
3.1.2	<i>Legislative system in China.....</i>	<i>12</i>
3.2	POLICIES PERTAINING TO SOLID WASTE MANAGEMENT IN CHINA.....	14
3.3	CURRENT POLICIES PERTAINING TO CHINA'S WEEE MANAGEMENT.....	15
3.3.1	<i>Relevant legislation related to WEEE management.....</i>	<i>16</i>
3.3.2	<i>Policy instruments.....</i>	<i>19</i>
3.4	PILOT PROJECTS ON CHINA'S WEEE MANAGEMENT.....	20
3.4.1	<i>Tsingdao pilot project.....</i>	<i>20</i>
3.4.2	<i>Zhejiang pilot project.....</i>	<i>21</i>
3.4.3	<i>Tianjin pilot project.....</i>	<i>21</i>
3.4.4	<i>Beijing pilot project.....</i>	<i>21</i>
4	A CASE: A VOLUNTARY TAKE-BACK PROJECT FOR USED MOBILE PHONES.....	22
4.1	OVERVIEW OF THE MOBILE PHONE SECTOR IN CHINA.....	22
4.2	BACKGROUND OF THE PROJECT.....	22
4.3	DESIGN OF THE PROJECT.....	23
4.4	OUTCOMES OF THE PROJECT.....	24
5	ANALYSIS OF THE EXISTING POLICIES AND THE EMPIRICAL CASE.....	25
5.1	RESPONSIBILITY DISTRIBUTION IN THE POLICY.....	25
5.1.1	<i>Collection.....</i>	<i>25</i>
5.1.2	<i>Recovery.....</i>	<i>27</i>
5.1.3	<i>Monitoring & Enforcement.....</i>	<i>28</i>
5.1.4	<i>A supplementary issue.....</i>	<i>28</i>
5.2	LESSONS LEARNED FROM THE CASE.....	30
5.2.1	<i>Responsibility distribution.....</i>	<i>30</i>
5.2.2	<i>Evaluation and explanation.....</i>	<i>31</i>
5.2.3	<i>Factors affecting the project.....</i>	<i>33</i>
5.3	CHALLENGES AND OPPORTUNITIES FOR INVOLVING PRODUCERS IN USED MOBILE PHONE MANAGEMENT.....	34
5.3.1	<i>Challenges.....</i>	<i>34</i>
5.3.2	<i>Opportunities.....</i>	<i>35</i>

- 6 HOW TO IMPROVE EPR PROGRAMS IN CHINA’S E-WASTE MANAGEMENT SYSTEM: IN THE CASE OF USED MOBILE PHONES 36**
 - 6.1 RESPONSIBILITY DISTRIBUTION IN MANAGING USED MOBILE PHONES 36
 - 6.2 DEFINITION OF PRODUCER..... 37
 - 6.3 INCENTIVES..... 38
 - 6.4 PUBLIC AWARENESS 39
 - 6.5 MARKET FOR REFURBISHED MOBILE PHONES 39

- 7 CONCLUSIONS AND FUTURE RESEARCH OPPORTUNITIES 40**
 - 7.1 CONCLUSIONS..... 40
 - 7.2 FUTURE RESEARCH OPPORTUNITIES 41

- BIBLIOGRAPHY 42**

- ABBREVIATIONS 45**

List of Figures

Figure 2-1 Model for Extended Producer Responsibility	7
Figure 3-1 General policy system in China	1
Figure 3-2 Legislation system in China.....	1
Figure 3-3 Solid waste management system in China.....	1
Figure 4-1 The take-back box ©.....	1
Figure 5-1 Financial and material flows in collecting used mobile phones.....	32

List of Tables

Table 2-1 Elements of the activities in an EPR program.....	8
Table 3-1 Legislation pertaining to WEEE in China (Chronological)	17
Table 5-1 Responsibility distribution in WEEE management in China	29
Table 5-2 Responsibility allocation in the Administrative Measures and the China WEEE Ordinance.....	29
Table 5-3 Responsibility allocation in the empirical case	31

1 Introduction

1.1 Background

China has a large number of electrical and electronic equipment (EEE) producers, and they produce a large amount of the products each year. For example, between January and November 2008, around 42.5 million refrigerators, 37.8 million washing machines and 79 million air conditioners were produced (China Appliance, 2009, p.77). Furthermore, with a population of 1.33 billion (National Bureau of Statistics of China, 2009), China witnesses a growth in volume of e-product consumption each year. For instance, it is estimated that by 2010 there will be 178 million new computer users in China (Greenpeace China, n/d). Among the e-products, the consumption of mobile phones is eye-catching. Currently, there are more than 600 million mobile phone network subscribers (Ministry of Industry and Information Technology of China, 2009).

The massive production and consumption hint at the generation of electronic waste (e-waste). Since 2003, it is estimated that around five million TV sets, four million refrigerators, six million washing machines and six million computers are out of use each year (Wang, 2008, p.17) and “in China e-waste is becoming an important waste stream in terms of both quantity and toxicity”(Liu *et al*, 2006, p.93). Meanwhile, the number of used mobile phones is much more than other used e-products. There are about 110 million mobile phones out of use each year (Xing and Lu, 2008, p.41). Besides this, each year a large amount of used products and e-waste is imported into China legally or illegally from other countries, e.g. the U.S. (see Basel Action Network and Silicon Valley Toxics Coalition, 2002, p.1-3). How to deal with the e-waste issue is and will continue to be a pressing challenge to the Chinese government.

In response to the challenge, the government has promulgated several policies, such as cleaner production policy, solid waste management policy, and recently the special e-waste management policy.

In addition, there is a number of research addressing various aspects of the problem. Some research is on the situation of the e-waste in China and its impact on the environment and human health, such as Wang (2008); others focus on the specific area of e-waste management, for example the recycling system, such as Hicks Dietmar and Eugster (2005).

However, only few have attempted to analyze multiple policies relating to e-waste management in China in a systematic manner, with few exceptions, e.g. Li (2006), Zhang, Chen and Zhong (2008). Most of the existing research regarding policies is either a general study or a cross-country comparison. For example, the research by Zhang *et al* (2008) briefly compared the e-waste management policies in China and in other countries in terms of policy system, administrative authorities, preparation time for implementation, responsibilities and penalty, and then gave suggestions on improving China's policies. Although these studies are invaluable, their scope does not allow an in-depth case study of policies in China.

Meanwhile, in the international arena producer responsibility in e-waste management has been discussed, such as in Japan and EU, since the early 1990s. The idea is to extend producer's responsibility to the post-consumer stage of a product's life cycle, instead of stopping at selling (Lindqvist, 2000; Organisation for Economic Co-operation and Development, 2001). The argument for this is that to extend producer responsibility may encourage producers to change the upstream activities in the product chain such as product design and the selection of materials, which will lessen the problem from end-of-life products.

However, this topic is relatively new in China. Until now the author only found two articles in Chinese which discussed extended producer responsibility (EPR) specifically (see Tong, 2003; Zhang and Liu, 2005). Tong's article introduced the theory of EPR and EPR in other countries' legislation, such as EU's WEEE Directive and Japan's legislation. Then she briefly analyzed how China could learn from the experience related to e-waste management in other countries in terms of introducing EPR in the waste management system. Zhang and Liu also discussed the theory of EPR, and the role of EPR in the development of circular economy. Yet, the producer's role at the end-of-life of e-products is rarely discussed in a systematic way in China. Thus this thesis aspires to fill in this gap.

1.2 Research objectives and questions

This thesis will focus on China's policies on e-waste management, especially on producer's role in them. As such, there are two objectives of the thesis: (1) to draw the picture of the current policies and implementation pertaining to e-waste management in China, especially focus on producer responsibility and on a selected product group (mobile phones), so that further improvement in the system may be identified; and (2) to look at the possibilities and challenges to improve the system by applying the principle of EPR in China's e-waste management policy system. The first objective is the foundation of the discussion, based on which the direction of the second objective may be found.

In order to achieve the objectives, the following research questions need to be answered:

- 1) How do the current Chinese policies related to WEEE look like?
- 2) How might the policies influence the e-waste management in China?
- 3) How can China's e-waste management system be improved by introducing EPR in the case of mobile phones?
 - ✓ What are the possibilities and challenges of introducing EPR into China's e-waste management policy system?
 - ✓ How can EPR be better integrated into China's e-waste management policy system?

1.3 Research scope and limitation

The policies pertaining to e-waste management are the main focus of this thesis. In addition, the implementation of the policies will be discussed as well, for example, in the case study. Nevertheless, it must be pointed out that the implementation cannot be fully captured in this thesis, because e-waste management policies are new in China and not many empirical data are available.

China's policy system is complicated and generally separated between national level and local level. The national policies are more important as they provide the foundation and guideline for local policies. Therefore, the policy review in this paper mainly focuses on those policies at the national level. Nevertheless, readers should be aware that local policies and implementation can deviate from the national prescriptions. Thus, some pilot projects at the local level will be introduced.

In the analysis of the effect of WEEE policy in China, EEE producers will be the focus group. The reason is that from the perspective of life-cycle thinking, product design is a crucial phase, as many environmental impacts of a product are determined at this stage (Dalhammar, 2007, p.235-318), and producers have the power to decide the design. In addition, the producers are important actors in the market and they have great influence on

the policy making as well. For example, during the process of making the latest China's ordinance on WEEE, the law-making body organized several meetings to listen to e-product producers' opinion (Anonymity, pers.comm.). Since producer responsibility is very important in e-waste management, as a principle, EPR has been introduced in almost all OECD countries' policy system (Lindhqvist, 2000, p.65-80). Now, the possibilities of introducing EPR in managing e-waste in non-OECD countries, such as India, are discussed (Manomaivibool, Lindhqvist & Tojo, 2007).

Among different electronic products (e-products) available on the market, even though the second-hand electronic products and the imported e-waste are big issues facing China (Wang, 2008), second-hand e-product sellers and e-waste importers are not included as producers of this thesis, because issues related to these producers are numerous and complicated and cannot be dealt with within this thesis. Similarly, the thesis does not discuss non-brand e-product assemblers.

When looking at the implementation side of the policies, this thesis will focus on ICT products, particularly mobile phones. The reasons for choosing this product group are two folded. First, the equipments in this sector contain substances such as potassium hydroxide and lithium, which even though very small amounts in individual products may cause significant negative impacts on human health and the environment with improperly end-of-life management (Mobile Phone Partnership Initiative, 2009.). Secondly, the sector has an empirical case and more concrete information is available. That is, the producers in this sector initiated a voluntary take-back program a few years ago, which enables the author to explore the challenges and possibilities of introducing EPR in the e-waste management system in China. Nevertheless, the reader must notice that different groups of products are quite various from each other in terms of product life span and technology for recycling and disposal. Thus, the measures suitable for used mobile phones may be distinct from other electrical and electronic equipments, such as TV sets and air-conditioners, and might not be directly applicable.

Moreover, this research mainly focuses on the policy side, especially the legislation, on the WEEE management in China. It cannot give the whole picture of China's WEEE management. However, other aspects, such as socio-economic perspective and the technology side, are also important and these aspects interact with each other. Some of these aspects will be touched in the thesis. For example, the public awareness on the issue of e-waste will be discussed during the analysis. Technology is also a consideration when it comes to policy making.

One big limitation of this thesis is the source of information. To understand the research topic in China's context, first-hand information is essential. Yet, even though various ways, such as interviewing and searching data from official website, are conducted to get the information, it is not easy to get official or empirical data and information in China, because in China it is not a tradition for government or officials to offer data and information to "non-official" researchers such as the author. Moreover, researching e-waste management in China is not easy. The topic is "sensitive" (the word was used by a Chinese officer who the author tried to interview but not successfully) so that the stakeholders' opinion is difficult to obtain directly, especially the decision-makers' viewpoint. What makes the research even more difficult is that there are no public official data on e-waste in China (Lai, pers.comm.).

1.4 Research methodology

To answer the first research question mentioned in Section 1.2, China's policy structure in

general and the WEEE management policies in particular will be explored, so that the whole picture of the system will be understood. Then, the effect of the present policies pertaining to e-waste management in China will be analyzed, so as to find out how the current policies work and what shall be done in the future in China. When doing this, the responsibility system in the relevant policies will be the main focus and special attention will be given to whether there are elements of producer responsibility in existing policies. After answering the first two questions, the improvement in terms of producer responsibility may be identified.

For the third research question, there are two sub-questions as shown in Section 1.2. For the former, the principle of EPR, China's situation and other countries' EPR programs will be considered so that the possibilities and challenges in China's context can be identified. For the latter, suggestions on improving China's e-waste management policy system from the perspective of EPR principle will be given.

The source of information is very limited, and getting access to people and documents requires connections and local knowledge. As such, the data and information are collected in two ways: from both primary and secondary sources. The primary information is mainly from personal communication – interviewing. The initial ambition of the author was to interview as many as possible stakeholders relevant to e-waste. But because of the aforementioned reason, it is hard to interview people in China. The author ended up with only four in-depth interviews in China: two informants from e-product producers, one officer in policy-making body and one person working for NGO. This is too limited to reflect various stakeholders' viewpoint. Thus, besides interviewing, there are still other primary sources such as official documents on which the policy system of e-waste is set up. The secondary data and information are usually written sources, from which stakeholders' opinion is sought and other countries' experience can be found.

To analyze the policies, Tojo's (2004, p.176) analytical framework is applied. The reasons for choosing this analytical framework are: (1) around the world the WEEE management policy mostly focuses on the allocation of responsibility, especially producer responsibility and EPR is a key principle to deal with WEEE; and (2) the administrative, economic and informative instruments are the main EPR policy instruments (Tojo, 2004, p.13-15). The detail of the framework together with theories related to EPR is given in Chapter 2.

Furthermore, comparative analysis is used to an extent to gain insight from other countries' experiences on WEEE management. Despite that China has its own context and others' experiences may not be directly applicable, in light of a very short history China has on e-waste management, the comparative analysis seems useful.

1.5 Outline of the thesis

This paper is structured as follows:

Chapter 1: The current chapter presents the background information on the topic, the research objectives and scope and the methodology of research.

Chapter 2: This chapter introduces existing knowledge on EPR by studying literature. Based on this, the analytical framework for the thesis is developed. To set benchmark for later discussion, the experience in Europe and Kenya on managing end-of-life mobile phones is described as well.

Chapter 3: This chapter presents China's policies and experience pertaining to e-waste management. First, it portrays the general picture of China's policy structure, which provides

the basis for the understanding of China's e-waste policy. Then, the current policies pertaining to e-waste management in China are reviewed. Following this, four pilot projects on e-waste management in China are briefly introduced.

Chapter 4: A case is summarized in this chapter. An empirical case from the mobile phone sector is introduced, which is a voluntary program initiated by some mobile phone producers and a telecommunication operator a few years ago. The background, design and outcomes of the program are described.

Chapter 5: This chapter summarizes the implications from the current policy and empirical case in managing e-waste, especially used mobile phones. Furthermore, the challenges and possibilities for involving producers in end-of-life mobile phone management are identified.

Chapter 6: This chapter focuses on recommendations on improving EPR programs in China, especially in the case of used mobile phones. The suggestions touch on the responsibility distribution in end-of-life product management, the definition of producer, the incentives, public awareness on e-waste issue and the refurbished mobile phone market.

Chapter 7: This chapter returns back to the research questions and draws conclusions on them. Then future research opportunities are suggested.

2 Theoretical background and international context

Before going to the details on China's current policy system on e-waste management, this chapter explores the concept of EPR and an exiting framework on analyzing EPR programs. Therefore, the theoretical background is presented for this thesis. Then, in order to set the benchmark for the selected product group, mobile phones, existing experience on managing used mobile phones in the international arena is introduced.

2.1 About extended producer responsibility

The term "extended producer responsibility" (EPR) was first used and defined by Lindhqvist in a report for the Swedish Ministry of the Environmental and Natural Resources in 1990 (Lindhqvist and Lidgren, 1990). Since then, it has been introduced into many countries' environmental policies (Lindhqvist, 2000; Tojo, 2004). Lindhqvist (2000, p.154) defines EPR as:

...a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the product's life cycle, and especially to the take-back, recovery and final disposal of the product.

OECD (2001, p.18) provides another definition of EPR as:

...an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle. There are two related features of EPR policy: (1) the shifting of responsibility (physically and/or economically; fully or partially) upstream to the producer and away from municipalities, and (2) to provide incentives to producers to incorporate environmental considerations in the design of their products.

These two are slightly different from each other and Van Rossem (2008, p.11-14) points out that Lindhqvist's definition addresses a broader scope in the life cycle stages than the OECD's. However, both of them emphasize the importance of extending producer responsibility to the post-consumer stage of a product's life cycle.

As a concept, EPR "implies that responsibilities, which were traditionally assigned to consumers and authorities responsible for waste management, are to be shifted to the producer of the products." (Lindhqvist 2000, p.29) As a principle, EPR does not only focus on improving the end-of-life management of products, but also tries to incorporate various policy instruments to improve products' environmental performance throughout their life cycle, especially emphasizing on promoting design change, so that EPR is a "founding principle to guide a shift towards a society based on sustainable production and consumption" (Tojo, 2004, p.i).

When it comes to environmental policy making, there are three distinctive features of EPR (Tojo, 2004, p.5-6). First, *prevention* is prioritized over end-of-pipe solutions. Second, the environmental impacts throughout products' *life cycle*, instead of the point sources such as production sites, are the focus. Third, through allocating extended *responsibility* to producers (including manufacturers, distributors and importers) and incorporating various policy instruments, *incentives* may be provided for changes at the design phase of a product's life.

Lindhqvist also developed a model (Figure 2-1) for characterizing different programs of implementing EPR, which categorized the types of responsibility as liability, economic

responsibility¹, physical responsibility, ownership and informative responsibility. Each responsibility is described as follows (Lindhqvist, 2000, p.38-39):

Liability refers to a responsibility for proven environmental damages caused by the product in question. The extent of the liability is determined by legislation and may embrace different parts of the life-cycle of the product, including usage and final disposal.

Economic responsibility means that the producer will cover all or part of the costs for e.g. the collection, recycling or final disposal of the products he is manufacturing. These costs could be paid for directly by the producer or by a special fee.

Physical responsibility is used to characterize the systems where the manufacturer is involved in the actual physical management of the products or of the effects of the products.

The manufacturer may also retain the **ownership** of his products throughout their life cycle, and consequently also be linked to the environmental problems of the product.

Informative responsibility signifies several different possibilities to extend responsibility for the products by requiring the producers to supply information on the environmental properties of the products he is manufacturing.

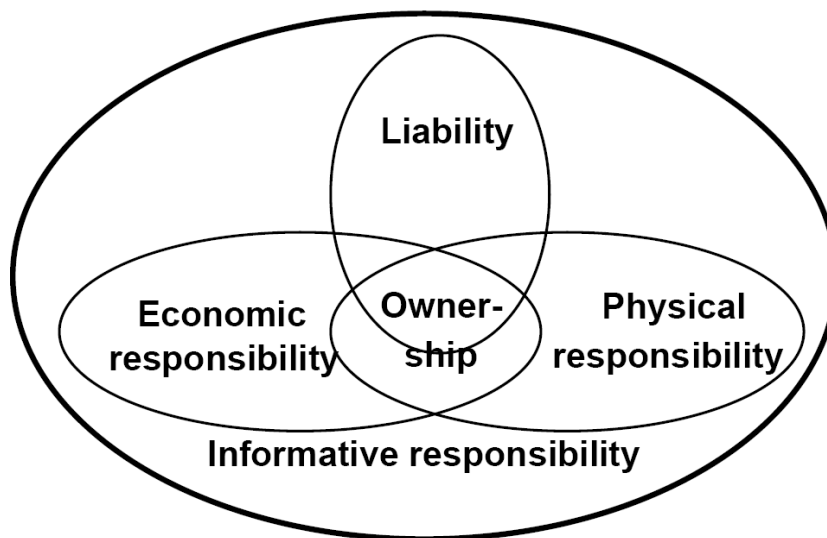


Figure 2-1 Model for Extended Producer Responsibility

Source: Lindhqvist, 2000, p.38

Liability is mainly related to environmental damages caused by the concerned products, and *ownership* is realized through a solution such as product service system developed by a manufacturer (Tojo, 2004, p.13). These are not in the scope of this thesis, and in the remainder of the thesis only the other three types of responsibility – physical, financial, and informative – are discussed.

Furthermore, Tojo (2004, p.265-278) clarifies the collective and individual responsibility in EPR programs. An *individual physical responsibility* for producers means that “the *distinction* of the products is made at minimum by brand” and the producers have the *control over the fate* of their end-of-life products with certain degree of participation in the organization of the downstream operation. And “[a] *collective physical responsibility* is taken when 1) products of similar kind are physically handled together regardless of the brand and 2) the handling is rest in the hands of a third party, such as PRO[producer responsibility organization]”(Tojo, 2004,

¹ In this thesis, the term of “financial responsibility” is used instead of “economic responsibility”.

p.273). Tojo also discloses that both types can be effective for dealing with WEEE so long as producers pay for the cost of end-of-life management of their own products. The factors affecting the selection between these two include end-value of the products, the feasibility and ambition of the producers to establish their own downstream infrastructure, the types of end-users, the existence of other producers that share the same level of ambition concerning the end-of-life management of their products and so on. When it comes to financial responsibility, the *individual financial responsibility* for producers means they initially pay for the end-of-life management of their own products. On the other hand, “[w]hen a group of producers pay for the end-of-life management of their products regardless of brands, their financial responsibility is collective” (p.271).

To implement EPR, OECD (2001, p.39-52) lists various policy instruments and measures which include (but not limited to) take-back requirements, economic instruments (such as fees, taxes and subsidies), standards, and other industry-based measures (such as leasing and servicing). Among these, “[t]he most active use of EPR, under both voluntary and mandatory schemes, is in product take-back”(p.40).

2.2 Analytical framework

As mentioned in the introduction, Tojo’s analytical framework to study the implementation of EPR programs² is applied for this thesis to analyze China’s policy. Following the three types of responsibility in EPR mentioned above, this framework covers three dimensions – the physical, the financial and the information responsibility. According to Tojo (2004, p.176), activities regarding the three types of responsibility of an EPR program are broken down into several elements which are illustrated in Table 2-1 below.

Table 2-1 Elements of the activities in an EPR program

Type of responsibility	Activities		
	Collection	Recovery	Monitoring & Enforcement
Physical management	Element 1	Element 4	Element 7
Financial mechanism	Element 2	Element 5	
Information management	Element 3	Element 6	

Source: Tojo, 2004, p.176

In each of these elements, actors that are responsible for fulfilling the activities and the effectiveness and potential outcome of their activities are studied, so that the possibilities and challenges for China to integrate EPR in its WEEE management policy can be identified.

2.3 International context for the end-of-life mobile phone management

In terms of the end-of-life mobile phone management, there already exist guidelines and experiences in the international arena. The Mobile Phone Partnership Initiative (MPPI) was launched by twelve mobile phone manufacturers to develop and promote the environmentally sound management of end-of-life mobile phones under the Basel Convention on Control of Trans-boundary Movement of Hazardous Wastes and their Disposal in 2002 (Basel

² According to Tojo (2004), an EPR programme is “made up of a number of public policy instruments”.

Convention, n/d). MPPI has delivered guidelines on addressing issues related to used mobile phone management, such as Guideline on the Refurbishment of Used Mobile Phones (MPPI Project 1.1), Guideline on the Collection of Used Mobile Phones (MPPI Project 2.1), and Guideline on Material Recovery and Recycling of End-of-Life Mobile Phones (MPPI Project 3.1). Besides these guidelines, some mobile phone makers have experiences in managing used mobile phones in many part of the world. In this part, MPPI's Guideline on the Collection of Used Mobile Phones (MPPI Project 2.1) and experiences from Nokia in Europe and Kenya in managing used mobile phone are briefly introduced as benchmark for later discussion on China's situation in this area.

2.3.1 MPPI's Guideline on the Collection of Used Mobile Phones

MPPI (2009) has launched its revised and approved version of Guideline on the Collection of Used Mobile Phones ("the Guideline" for short). The Guideline addresses the main issues related to the collection of used mobile phones, such as user of mobile phone and collection, and gives recommendations on how to deal with these issues.

Users³ of mobile phones are the starting point for collecting used mobile phones, so that the collection system must be "accessible to users". In the Guideline, there are some recommendations to the users on how to properly deal with the end-of-life mobile phones, such as, not throwing away used mobile phones, destroying personal data prior to passing the phone to other persons or collection points, and being informed the environmental issues caused by used mobile phones. The Guideline points out that "[t]he convenience of a mobile phone collection system is of paramount importance to a user" (MPPI, 2009, p.11).

When it comes to the collection point, the Guideline touches upon several issues related to collection, such as collection methods, how to manage used mobile phones at collection points, government regulation on collection, and financing of collection systems. Again, the convenience to users is mentioned as the primary factor in determining the success of a collection system. MPPI defines convenience as "[t]here must be a way, and probably several ways, in which users can deliver a mobile phone into a collection system with only a small effort..."(MPPI, 2009, p.13) Furthermore, eight collection methods are recommended in the Guideline, which are "collection at points of sale for mobile phones", "collection as part of other stores, businesses and institutions", "collection as part of general electronic scrap", "collection by charitable organizations", "collection by mail", "local informal door-to-door buyers of recyclable materials", "collection by local government at recycling 'bring site'", and "collection of scrap from informal sector".

The Guideline also says that all such collection systems "must be financed in some way" (MPPI, 2009, p.23). The Guideline points it out that there are different ways to finance the collection systems, such as contributions of users, businesses, sellers and manufacturers, the recovered value of the collected used mobile phones and a direct and transparent pre-paid recovery fee collected at the point of original sale. Moreover, government regulation on collection is considered important for successfully collecting used mobile phones.

2.3.2 Experience on used mobile phone management: international arena

2.3.2.1 Experience from Nokia in Europe

³ In the Guideline, "users" are defined as "all of the people who are now using mobile phones, and those who will use them in the future." (MPPI, 2009, p.8)

The information in this section is mainly from the author's personal communication with Ms. Helena Castren, Senior Environmental Manager in Nokia Finland. References are given to additional information sources.

In the mobile phone industry, Nokia is a leader in the world, holding about 1/3 of the sales in the world market (Remmen, Dirchinck-Holmfeld, Braun, Andersen & Kræmer, 2008, p.13), so Nokia can play a very important role in managing the used mobile phones. Around the world, Nokia has been involved in numerous voluntary take-back initiatives to address the end-of-life mobile phone issues (Herold, 2007, p. 219-229).

In Europe, according to Ms. Castren, Nokia was among the earliest actors to address the issue. In 1998, Nokia together with other mobile phone manufacturers (Alcatel, Eriksson, Motorola, Panasonic and Philips) started taking back used mobile phones in the UK, Spain and Sweden. When asked the reasons for this action, Ms. Castren mentioned two: the most important reason for such a take-back scheme rooted in the Nordic tradition of taking the environmental issues seriously. Before the mid-1990s, the issue of the waste mobile phones was not obvious because at that time the amount was not large. But since the late 1990s, the amount has grown very fast. With a long history in the Nordic society of focusing on environmental issues, the Nordic countries are very serious about the e-waste issues so that the mobile phone manufacturers began to consider the issue. The second reason is that the EU started discussing the legislation on e-waste issue in 1998. At the same time, the producers wanted to have experience in dealing with the issue which would enable them to offer opinions to the policy makers (*"teach the policy makers"*). Therefore, Nokia together with other manufacturers started pilot scheme in the aforementioned three European countries, in order to learn what they can do and what consumers think about this issue.

With the Directive 2002/96/EC of the European Parliament on Waste Electrical and Electronic Equipment (the 'WEEE Directive') came into force in 13 August 2005, Nokia joined national collection schemes in the EU Member States. For instance, Nokia participates in financing of e-waste, that is, Nokia needs to pay for its products sold out on the market according to the requirement of the Member States. Generally, national schemes are dealing with all sorts of WEEE, seldom with a specific product. At the same time, Nokia still has its own voluntary take-back scheme. For example, Nokia has collection boxes in all of its own service points. After collection, Nokia sends the used products to recyclers. In its own take-back scheme, Nokia pays for the collection bins, transportation for treatment, sorting, and treatment. However, Nokia gets money from the materials recovery from the recyclers. But to date the total balance is still the cost.

According to Nokia's experience in Europe, two factors affect the voluntary collection:

- Ease/convenience. This is very important for consumers. But what easy means differ among different consumers. Generally, the municipal collection system is the easiest way, and the drop-points at Nokia's service centers are also convenient for consumers to return their used mobile phones. Nokia also applied mailing, which is to distribute mail-back envelopes to consumers for their mailing back the used mobile phones, but the results from this method were not very good.
- Knowledge. If the consumers know they must recycle the product, they are more active to return their used mobile phones. To inform the consumers, Nokia put posters in shops to let consumers know. Also, the retailers communicate relevant information with consumers in their marketing materials, such as brochures.

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2.3.2.2 Experience from Nokia in Kenya

Kenya is a developing county and e-waste is a new issue as it is for China. The information in this section is based on a master thesis by Ms. Basiye Karen Khayanje (2008). References are shown for additional information sources.

With the fast expansion of mobile phone market in Kenya, used mobile phones are becoming an issue in Kenya. Under such a situation and based on its Middle East and Africa environmental strategy, Nokia is implementing a take-back scheme in Kenya. Nokia's customer care centers play a key role in organizing the collection scheme.

There are three methods applied in the collection, including business to business collection schemes, such as using the existing infrastructure set up by the network providers to put take-back boxes, designated collection facilities and customer care schemes.

According to Nokia's experience in Kenya, there are some challenges and opportunities for producers to establish effective take-back scheme. The challenges are: (1) inconvenience (due to very few collection points around the country); (2) lack of incentives to end users; (3) competition for material resources (between the repair shops and the take-back scheme); and (4) lack of awareness among the end users. On the other hand, the opportunities for future improvements include: (1) increasing quantities of mobile phone (so reasonable amount of obsolete mobile phones coming into the collection system); (2) no backyard dumping (addressing the problem before it gets out of hand); (3) existing infrastructure (well established care centers by the network providers all around the country); and (4) Nokia's competitive edge over other manufacturers due to early start.

2.4 Adapted steps for analysis

During analysis, the concept of EPR is the basis, and Tojo's framework is a tool for analyzing China's policy and implementation in managing used mobile phones. At the same time, international experience is the benchmark for analyzing China's situation. Therefore, the following steps are adapted by combining the theory, the framework, and the international experience in managing used mobile phones to analyze China's policies pertaining to used mobile phone management.

First, the three types of responsibility in collection and recovery of used mobile phones and monitoring and enforcement are summarized from the perspective of both sides of policy and implementation.

Second, challenges and opportunities for involving producers in used mobile phone management are identified by comparing the differences between China's situation and the EPR theory and international experience.

Finally, according to the purpose of China's polices on e-waste management recommendations on improve EPR programs are given. Furthermore, the focus of the improvement is the collection and financial responsibility, because according to MPPI (2009), the management must start with collection and the activities have to be financed.

3 WEEE management in China: policies and practice

This chapter looks at both the policy development and the practical implementation of the WEEE management in China. In terms of policy, even though the e-waste issue is quite new for China, there already have been some policies on it. But when it comes to practice, China does not have much experience. Nevertheless, there do exist some pilot projects on WEEE management implemented in China.

3.1 General policy system in China

Before discussing the policies pertaining to China's WEEE management, it is meaningful to get the whole picture of China's policy structure briefly, especially for those who are not familiar with China's policy system, because the WEEE management policy is part of the whole policy system and it follows the same structure and rule of the policy system. In this part, China's policy system as a whole will be introduced, and then the important part of it – the legislative system – will be described.

3.1.1 General policy system in China

In Chinese, the word “policy” can be interpreted in both a narrow sense and a broad sense. In the narrow sense, “policy” refers to the policy instruments which governments use to fulfill their functions authorized by legislation, such as the measures a government takes to strengthen financial stability. In the broad sense, “policy” includes both the foundation of “policy” in a narrow sense – the legislation – and the policy instruments adopted in the legislation. In this thesis the broad sense of “policy” will be used.

Figure 3-1 shows the structure of the general policy system in China. Generally, there are two big levels in the system: the legislation and specific policy instruments. The former is the foundation of the latter. Several sub-levels exist within each level. The sub-levels in the

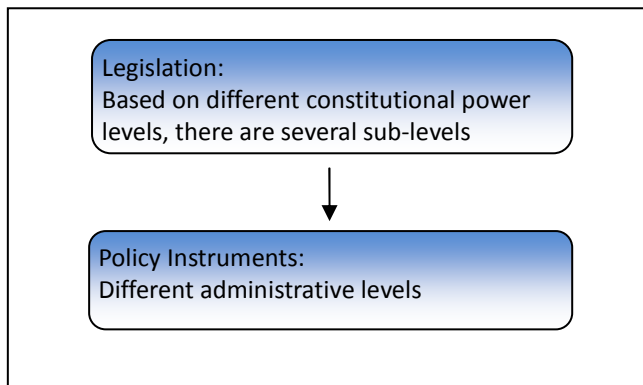


Figure 3-1 General policy system in China

Source: Developed by the author

legislation are based on the different levels of power given by the constitution to legislative bodies, which will be explained further in the following section (3.1.2). The sub-levels of the policy instruments are based on different administrative levels – central government level and various local government levels. Each local level can have its own mechanism suitable to its local situation but shall adhere to the basic principles of its upper level's policy. Principally, the legislation is always the foundation of

the policy instruments. Since the legislative system is foundational to the policy system, it is useful to look at it before going to the e-waste policy system.

3.1.2 Legislative system in China

The base of China's legislative system is the Constitution of the People's Republic of China (1982) and the Legislation Law of the People's Republic of China (2000). According to these two legal documents, there are three sub-levels in the legislative system: laws (“法律”),

ordinances (“条例”)⁴, and local regulations (“地方法规”) (including autonomous regulations and separate regulations) and rules (“部门规章”)⁵. The following figure (Figure 3-2) provides an overview of the system.

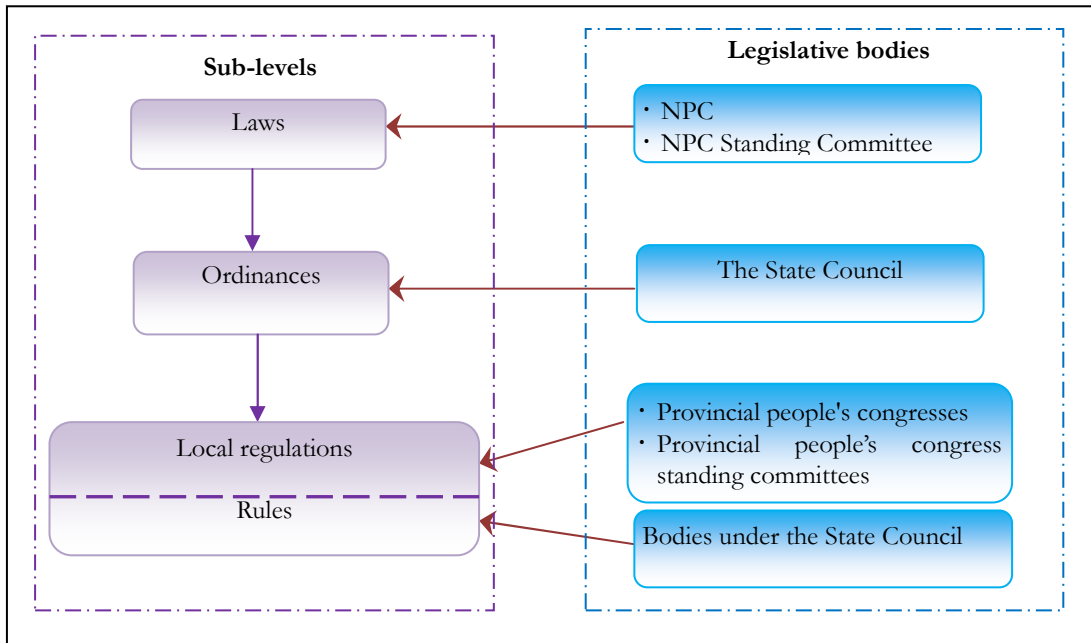


Figure 3-2 Legislation system in China

Source: Developed by the author

In China, “laws” are at the highest level of the legislative system. According to the Constitution of China and the Legislation Law of China, all important aspects related to society and citizens must be prescribed in laws, e.g. affairs concerning the sovereignty. The bodies who can make laws are the National People’s Congress (NPC) and the Standing Committee of the NPC. The basic laws regarding criminal offences, civil affairs, the State organizations and the like are enacted and amended by the NPC. The laws other than the ones to be enacted by the NPC are enacted and amended by the Standing Committee. Besides this, the Standing Committee also has the power to interpret laws made by both bodies.

“Ordinances” are made by the State Council and are based on the “laws”. The ordinances deal with matters required by the laws to fulfill the provisions or principles in laws or matters within the administrative functions and powers of the State Council as provided by the Constitution. Authorized by the NPC or its Standing Committee, the State Council can also make the ordinances regarding an affair on which the NPC or its Standing Committee is responsible to make a law but there is not much empirical experience on the issue in China. After gaining experience by practicing the ordinances, the NPC or its Standing Committee shall make a special law.

⁴ In Chinese, the laws introduced by administrative bodies are called “行政法规(Xing Zheng Fa Gui)” or the literal translation “administrative regulations”. However, the laws introduced by the next level of government use the term “local regulations”. In order to avoid confusion in this thesis the term “ordinance” is used for the laws introduced by the State Council, which shows that this level of legislation is just under the first level, the “laws”.

⁵ Sometimes this type of legislation will use another word, “measure”, in Chinese “办法”.

At the third level, there are two types of the legislation: local legislation⁶ and the rules. The **local regulations** are made by the provincial people's congresses or their standing committees adhering to the "laws" and "ordinances" and in light of the local conditions. In addition, the people's congresses or their standing committees of the comparatively larger cities⁷ can make their own local regulations by following the laws, the ordinances and the provincial regulations. These regulations are about implementing the laws or ordinances at the local level, or about specific local matters. The **rules** are made by the bodies under the State Council, including various ministries and commissions. The rules cover those matters whose principles have been prescribed in laws or ordinances, decisions and orders of the State Council while the operational procedure is not in the provisions.

In terms of the number, the laws are less than the ordinances which are less than the local regulations and rules. But in terms of jurisprudence, the laws are applied to the whole country and have the highest power next to the Constitution. The ordinances are also applied to the whole country but are at the lower level than the laws. The local regulations are only valid in the specific administrative regions, and are not discussed further in this thesis. The rules are valid to the whole country but usually mainly applied by the specific departments of the governmental system. For example, the rules made by the Ministry of Environmental Protection *per se* are applied by all environmental protection bureaus around the country, while other departments may not necessarily follow them. For the purpose of this thesis, Section 3.3 on reviewing the policy of China's WEEE management will mainly be on the relevant laws and ordinances and the rules made by the Ministry of Environmental Protection.

3.2 Policies pertaining to solid waste management in China

Before going to the details of WEEE management in China, it is necessary to look at the policies pertaining to solid waste management in general in China, because according to the Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Waste (2004), e-waste is part of the solid waste. In this context, most policy instruments applied for managing the solid waste are applicable for e-waste management.

China has a dual-system in solid waste management (Figure 3-3), which means that both environmental protection bureaus and environmental sanitation administrative departments under municipalities have the responsibility to take care of the solid waste. But they are not governed under the same administrative body at the national level. At the top of the environmental protection bureaus (EPB) is the Ministry of Environmental Protection (MEP). The environmental sanitation administrative departments (ESAD) at different levels belong to the construction bureaus, at the top of which is the Ministry of Housing and Urban-Rural Development (MOHURD). These two ministries have different authorities in terms of solid waste management. MEP has the power of "unified supervision and management of the prevention and control of environmental pollution by solid waste throughout the country" (Article 10), including establishing environmental standards for solid waste management.

⁶ This group includes local regulations ("地方法规"), autonomous regulations ("自治条例") and separate regulations ("单行条例"). All of these are pieces of local legislation, but according to the administrative status, the words used in Chinese are different. For example, "local regulations" are used in general indicating local legislation, but for some specific areas, such as autonomous minority areas, the local legislation regarding to general issues is called "autonomous regulations" and the local legislation on specific local issues is "separate regulations".

⁷ According to the Legislation Law of China (Article 63), a comparatively larger city "refers to a city where a provincial or autonomous regional people's government is located or where a special economic zone is located, or a city approved as such by the State Council". For example, Shenzhen City (in Guangdong Province) is the first special economic zone in China.

MOHURD is “responsible for supervision and management of the prevention and control of environmental pollution by solid waste within its respective functions and responsibilities” (Article 10). At the local level, the EPBs and ESADs are in the framework of local government, which means that EPBs and ESADs shall follow the requirements related to their professional duties from their national headquarters and at the same are administrated by the local government for their daily affairs.

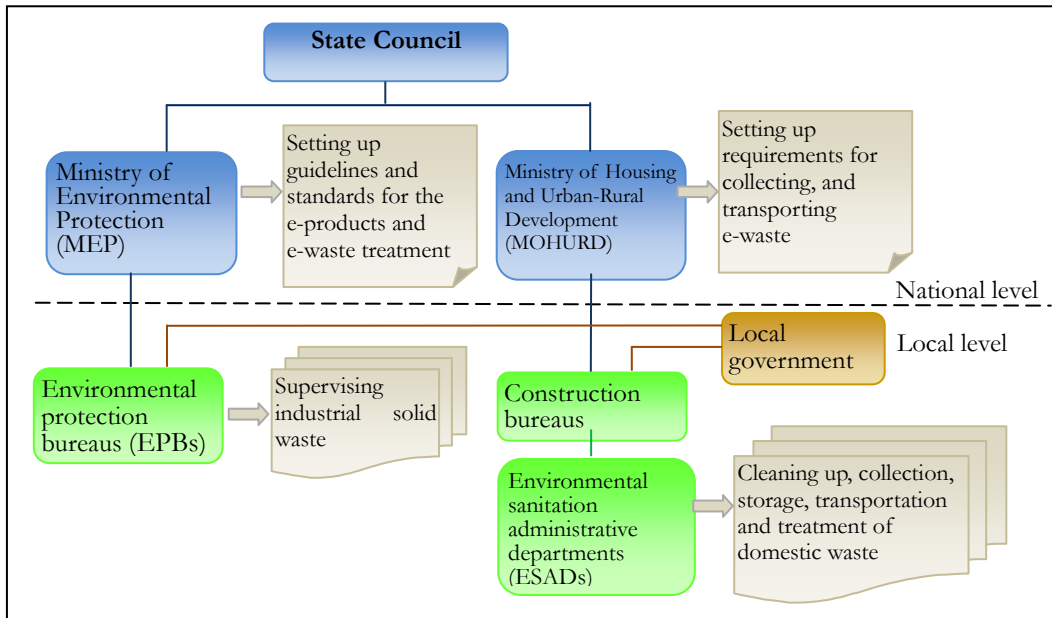


Figure 3-3 Solid waste management system in China

Sources: Developed by the Author

According to China’s solid waste law, there are three categories of solid waste: industrial waste, domestic waste, and hazardous waste (Article 88). Industrial waste comes from the process of industrial production; domestic waste is generated from everyday life (including households and businesses); hazardous waste means the solid waste possessing one or more hazardous properties such as corrosivity, toxicity, ignitability, reactivity or infectivity, which is included in the national catalogue of hazardous waste or defined as solid waste with hazardous properties according to authorized criteria and methods. Usually, hazardous waste is generated from industrial production or medical treatment, but not from domestic sources.

In terms of the job distribution, the environmental protection bureaus focus on supervising industrial solid waste (including hazardous waste) management (Article 27 and 51); and the environmental sanitation administrative departments under municipalities focus on cleaning up, collection, storage, transportation and treatment of domestic waste (Article 39). This arrangement is based on the sources of solid waste. However, due to the properties of e-waste, which is coming from both industrial and domestic sectors, and have hazardous components, both the MEP and MOHURD are responsible for the e-waste management. In practice, MEP mainly focuses on preventing the environmental impacts from the e-waste by establishing guidelines and standards for e-waste treatment; and MOHURD mainly works on setting up requirements for collection, and transportation of the e-waste properly. As such, MEP can be compared to a supervisor and MOHURD to an executor in the e-waste management system.

3.3 Current policies pertaining to China’s WEEE management

Current WEEE management policies in China follow the same structure as described in Figure 3-1 and 3-2. Here, the broad sense of “policy” will be applied to review the WEEE

management policy system, which is separated into two categories: the legislation and the policy instruments found in legislation.

3.3.1 Relevant legislation related to WEEE management

The legislation related to the WEEE⁸ management in China include the Constitution of the People's Republic of China (PRC) (1982), the Environmental Protection Law of PRC (1989), the Law on Prevention and Control of Environmental Pollution by Solid Waste of PRC (2004) ("Solid Waste Pollution Prevention Law" for short), the Law on Promotion of Cleaner Production of PRC (2002) ("Cleaner Production Promotion Law" for short), the Administrative Measures on Prevention and Control of E-waste Pollution⁹ (2008), and the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products (2009). Table 3-1 shows these main pieces of legislation on WEEE in China which are discussed in this thesis.

In addition, there is another rule relevant to WEEE, 《电子信息产品污染控制管理办法》 [the Administrative Measures on Control of Pollution Caused by Electronic Information Products], also known as China RoHS (restriction of hazardous substances). This rule can have significant contribution to WEEE management in China, especially in terms of the products from ICT sector (Ma, pers.comm.). However, this rule is not included here for discussion because the focus of this thesis is on policies directing at end-of-life management while the rule is on the production phase. Furthermore, there are some other laws which have policy instruments related to WEEE management. For example, the Law of the People's Republic of China on Evaluation of Environmental Effects (2002) expresses the sustainable development principle and the precautionary principle in China's environmental law system for the first time and prescribes the procedure to conduct the environmental impact assessment (EIA) at length. EIA is a common measure in the environmental protection in China, with no exception in the WEEE management system. But in this thesis the analysis mainly focuses on the legislation directly relevant to the WEEE management.

Article 26 of the Constitution is the root of the WEEE management policy as well as the root of the environmental protection in China. It confirms that environmental protection is one basic national policy.

Originated from this constitutional article, the basic law for environmental protection was enacted in 1989 – the Environmental Protection Law. In this law the basic principles on environmental protection are prescribed, including the principle of the integration of the environmental protection, the economic development and the social development (Article 4) and the principle of public participation (Article 6). Some principles are not expressed directly but implied by the contents. For instance, Chapter IV reflects the principle of prevention (Chapter IV), and Article 19 and 20 and Chapter IV reflect the principle of polluter's responsibility (or polluter pays principle). Besides the principles, some policy instruments are mentioned in the law. For example, the pollutant emission fee is described in Article 28. Since

⁸ Now there is not a consistent definition of "WEEE" in China's legislation. In the Administrative Measures on Prevention and Control of E-waste Pollution, in Article 25, it is said that "WEEE" means discarded electronic and electrical equipments, the scrap from the equipments and other items which the Ministry of Environmental Protection has put into the list under e-waste management. But in the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products, there is no specific definition of WEEE. Article 3 merely says that those waste electronic and electrical equipments in the National Catalog of WEEE Treatment are under the control of the Ordinance. But the catalog has not come out.

⁹ Even though in the title the word "rule" is not used, this is a rule made by the Ministry of Environmental Protection of PRC.

the Environmental Protection Law was issued twenty years ago, the principles are not elucidated as clearly as they are today. For example the principle of “the integration of the environmental protection, the economic development and the social development” in the law could be replaced by the sustainable development principle today. In addition, some important environmental management measures, such as environmental impact assessment (EIA), are not mentioned in the law.

Table 3-1 Legislation pertaining to WEEE in China (Chronological)

Legislation (Chinese)	Legislation (English)	Brief Description	Issuer	Issue Time	Effective Time
中华人民共和国宪法	Constitution of PRC	Article 26 is the root of the environmental protection in China	The National People's Congress	December 4, 1982	December 4, 1982
中华人民共和国环境保护法	Environmental Protection Law of PRC	The basic law for environmental protection in China	The Standing Committee of the National People's Congress	December 26, 1989	December 26, 1989
中华人民共和国固体废物污染环境防治法	Law on Prevention and Control of Environmental Pollution by Solid Waste of PRC	First law in China to control and manage the solid waste pollution	The Standing Committee of the National People's Congress	October 30, 1995 (First version) December 29, 2004 (Revised)	April 1, 1996 (First version) April 1, 2005 (Revised)
中华人民共和国清洁生产促进法	Law on Promotion of Cleaner Production of PRC	First law in China to promote cleaner production	The Standing Committee of the National People's Congress	June 29, 2002	January 1, 2003
电子废物污染防治管理办法	Administrative Measures on Prevention and Control of E-waste Pollution	First legislation on e-waste management in China	The Ministry of Environmental Protection of PRC	September 7, 2007	February 1, 2008
废弃电器电子产品回收处理管理条例	Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products	First ordinance on WEEE in China	The State Council	February 25, 2009	January 1, 2011

Source: Combined by the Author

Moreover, the basic environmental protection law is not specific enough for WEEE

management. Some new laws have been enacted since 1989 to complement the basic law in a way, including the Solid Waste Pollution Prevention Law and the Cleaner Production Promotion Law. The **Solid Waste Pollution Prevention Law** covers industrial solid waste, domestic solid waste (including urban-rural household waste and construction refuse) and hazardous waste (Article 2 and 88). As such, the WEEE is included in it. According to this law, the principles for the WEEE management as well as for all solid waste management include the principle of reduction, reuse and recycle (3Rs principle) (Article 3), and the polluter (including the producers, sellers, importers and users of products) pays principle (Article 5). In addition, this law prescribes specific policy instruments to manage waste which will be explained in Section 3.2.2.

The **Cleaner Production Promotion Law** is a special legislation to implement the principle of prevention and the principle of 3Rs during the production phase. The purpose of this law is to reduce the generation and discharge of pollutants in the course of production, services and use of products by adopting measures to continuously improve design, use cleaner energy and raw materials, introduce advanced techniques and equipment, improve management and make comprehensive use of resources as well as other measures (Article 2). This law mentions a series of policy instruments to implement cleaner production measures, and Section 3.3.2 will review those related to the WEEE management.

From Table 3-1, it may be noticed that before 2009 there were no ordinances regarding China's WEEE management, but only one rule in this area which is the Administrative Measures on Prevention and Control of E-waste Pollution enacted by the Ministry of Environmental Protection (MEP) in 2008. The reason is because the WEEE management is a very new topic in China's environmental policy system. Under such condition, the State Council usually assigns one or more of governmental agencies to conduct pilot study to obtain empirical information on a certain issue and later a policy can be made. Sometimes special rules are made by ministries or commissions under the State Council in to order to see how certain policy works around the country. Based on the experience the State Council may make ordinances, or even submit a bill to the National People's Congress or its Standing Committee to enact a law.

The Administrative Measures on Prevention and Control of E-waste Pollution is made through the authorization of the Solid Waste Pollution Prevention Law and its purpose is to prevent e-waste pollution through properly managing e-waste (Article 1). The rule regulates the activities related to disassembly, utilization and disposal as well as the generation and storage of e-wastes but excludes the activities concerning the electronic hazardous wastes which are subject to provision on hazardous waste management of the Solid Waste Pollution Prevention Law (Article 2). Since it is a rule, most of its contents are measures to implement the WEEE management, which is discussed in Section 3.3.2 below.

In practice, this rule is not enough as for producers this rule is just the "guideline". The rule does not have much impact on their production behavior, because it is mainly about the end-of-life stage of the products, not like the "China RoHS" which directly affects whether a product can come into the market and when it can (Ma, pers.comm.; Lai, pers.comm.). This situation may change in 2011, because the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products, also known as "China WEEE Ordinance" (Ma, pers.comm.; Chen, pers.comm.; Lai, pers.comm.), will come into force in the year. The process of developing this ordinance was long as the State Council started the legislative process in 2001 (Anonymity, pers.comm.). The ordinance is authorized by both of the Cleaner Production Promotion Law and the Solid Waste Pollution Prevention Law. The purpose of the ordinance is to promote the effective use of resources and the development

of circular economy in China by regulating the activities of recovering and disposing WEEE in China (Article 1). This ordinance describes the responsibility of various actors, such as the manufacturers, the importers, the recyclers and the treatment bodies of e-products/e-waste. The details of the policy instruments are in the next section (3.3.2).

3.3.2 Policy instruments

This section mainly summarized the policy instruments related to WEEE management found in the contents of the Solid Waste Pollution Prevention Law, the Cleaner Production Promotion Law, the Administrative Measures on Prevention and Control of E-waste Pollution (“Administrative Measures” for short), and the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products (“China WEEE Ordinance” for short).

The Solid Waste Pollution Prevention Law regulates all sorts of solid waste by managing the production, distribution, consumption, and disposal of products. The instruments related to the WEEE management include public awareness building (Article 2), monitoring environmental pollution from solid wastes and publishing information concerned (Article 12), conducting environmental impact assessment on any projects which may generate or dispose solid waste (Article 13), strict control of the transportation and import of solid wastes (Article 23-25), special industrial solid waste management measures (Article 27-37), such as a system of report and registration for industrial solid waste, and the special measures on hazardous wastes (Chapter IV), such as labeling hazardous waste and strict control of transfer and transportation of hazardous waste. Among these, the instruments related to EEE producers include proper design and recycling of certain products (Article 18), adoption of proper technology (Article 28), joining in the system of reporting and registration for industrial solid waste (Article 32), and labeling on hazardous waste (Article 52).

As a “promotion” law, most policy instruments in the Cleaner Production Promotion Law are incentive or instructional. For example, the reduction of tax is applied to the project promoting cleaner production. The policy instruments applicable to EEE producers are toxic and harmful raw materials control (Article 19), environmentally friendly design (Article 20), reporting (Article 21), recycling of certain products (Article 27), and monitoring of waste during production and auditing hazardous materials used in products (Article 28).

The instruments in both of the laws are not specific enough for the implementation of WEEE management. The more adoptable policy instruments are described in the Administrative Measures and the China WEEE Ordinance. The instruments in the Administrative Measures can be categorized into two groups: one deals with activities of treatment (disassembling, utilizing and disposing) of WEEE, and the other deals with the activities of producing, importing and distributing the electrical and electronic equipment (EEE). In the former group there are instruments such as: (1) **actors’ qualification**: only qualified bodies can disassemble, utilize and dispose WEEE; (2) **treatment certificate**: the authorized bodies must have the certificate of environmental impact assessment before they conduct any of WEEE project; (3) **information disclosure**: the authorized bodies must report to the relevant authorities about their e-waste management activities; (4) **special standards**: the authorized bodies must follow the technology and environmental requirements on WEEE management. The instruments in the latter group include: (1) **material control**: the EEE producers must follow the legal restrictions on the use of toxic materials in their products; (2) **information disclosure**: the EEE producers, importers and distributors must disclose the information on materials used in their products; and (3) **mandate to develop recycling and disposal system**: based on legal requirements, the EEE producers, importers

and distributors shall build up certain system to recycle and dispose their WEEE.

In the China WEEE Ordinance, there are some policy instruments which have been applied in the Administrative Measures already, such as the **treatment certificate** for the authorized treatment bodies, and **information disclosure** of the treatment bodies and the producers. The ordinance introduces some special instruments: (1) **qualifying treatment bodies**: when disposing the WEEE, only the authorized bodies can conduct the activity; and (2) establishing a **disposal fund**: the fund is set up by the government and is used to subsidize the recycling and disposal of WEEE. The money in the fund mainly comes from the producers. In addition, the producers shall follow the requirements on material used to change their **product design** so that their products are easy to deal with at the recycling and disposal phase. Besides policy instruments, The Ordinance explicitly indicates that the fundamental approach of managing e-waste which is **multi-way recycling and centralized disposal**, that is, when recycling the WEEE there can be different ways, such as professional recyclers, producer's take-back program, and collecting yards.

3.4 Pilot projects on China's WEEE management

As the WEEE management is quite a new issue facing China, before the specific legislation, the Chinese government has launched four national pilot projects on WEEE management since 2004 (China Resources Comprehensive Utilization, 2005, p.2-3; Streicher-Porte and Yang, 2007, p. 43), so that information on WEEE management in the light of China's conditions can be obtained for policy making.

The four projects are located in Tsingdao (in Shandong Province), Zhenjiang Province, Tianjin and Beijing respectively. These projects are on different administrative levels. The project in Tsingdao is on city level. The project in Zhejiang Province is at provincial level. The projects in Tianjin and Beijing are committed to two treatment companies as demonstration for recycling and disposing WEEE (China Resources Comprehensive Utilization, 2005, p.2-3; Streicher-Porte and Yang, 2007, p.43).

3.4.1 Tsingdao pilot project

The reason for choosing Tsingdao as a pilot city is because some big and well-known Chinese domestic electrical appliance manufacturers have their headquarters in Tsingdao, such as Haier and Hisense, and they have a comprehensive distribution and service network in the city, based on which the collection network for WEEE in the city may be set up effectively (Anonymity, pers.comm.).

This pilot project focuses on building a disposal system with a capacity of disposing 600,000 sets of domestic appliances per year, and at the same time setting up a complete collection system (China Resources Comprehensive Utilization, 2007, p.1-2). As far as the financial responsibility of collecting used appliances is concerned, manufacturers would undertake part of it and the rest will be subsidized by the government. The project started in 2005. So far there is no official report disclosing the progress of the project, but according to Streicher-Porte and Yang (2007, p.43), the collection cost is a key obstacle for setting up the collection network. They discover that in 2004, there were 250,000 TV set, 100,000 refrigerators, 100,000 washing machines and 150,000 PCs are discarded in the city, while the recycling center of the project, with the capacity of 200,000, only collected less than 1,000 equipments. The reason for this is that the informal recycling sector is more efficient than the formal recyclers in the project, as the former pays less both for transporting WEEE and for the payment to product owners than the latter.

3.4.2 Zhejiang pilot project

Zhejiang has been chosen as a pilot province for WEEE management because it has a relatively mature waste collection network around the province (Anonymity, pers.comm.). The tasks of the project include: (1) to set up a province-wide collection network for WEEE; and (2) to build up a treatment base for WEEE (China Resources Comprehensive Utilization, 2005, p.2-3).

So far, the project has been running smoothly (China Resources Comprehensive Utilization, 2006, p.41). A treatment body, Dadi Company, has build up a disposing system with a capacity of disposing 7,000 tons of WEEE per year. Four types of collection ways have been formed in Huangzhou, the Capital of Zhejiang Province: first, the exchange model, in which retailers take back the end-of-life products when consumers come to buy a new product and take back the old one; second, curbside collection in communities and by the local government; third, collection at some institutional consumers, such as governmental institutions and schools; fourth, collecting of e-waste during production of domestic appliance manufacturers. Through these four paths, totally thirty-six collection points were built in Huangzhou between 2005 and 2006 and around 133 tons of e-waste (1325 sets of waste equipments) were taken back through these collection points.

3.4.3 Tianjin pilot project

Tianjin is one of the four municipalities directly under the central government in China¹⁰ and also home of some big mobile phone producers and mobile phone components manufacturers so that it has been chosen as for a pilot project location (Anonymity, pers.comm.). But the pilot project in Tianjin is still under planning (Streicher-Porte and Yang, 2007, p.43), so that there is no further information on it.

3.4.4 Beijing pilot project

Beijing, the capital of China, with its fast economic development has a very high number of urban households possessing electrical appliances, such as TV sets, air-conditioners and washing machines, which was the reason why it has been chosen as one of the pilot project city (Anonymity, pers.comm.).

The project in Beijing has been committed to a company, Huaxin Environmental Protection Company, and the company is trying to set up proper WEEE collection network and to construct a treatment base of WEEE (China Resources Comprehensive Utilization, 2005, p.2-3). However, this project is still in the process of planning, and there is not much official data on its results.

¹⁰ The other three are Beijing (the capital of China), Shanghai and Chongqing.

4 A case: A voluntary take-back project for used mobile phones

As it has been mentioned in Chapter 1, the focus product group of this thesis is the ICT products, specifically mobile phones and their accessories. In this chapter, an empirical case (the “Green Box Program”) is introduced, which is a voluntary program initiated by some mobile phone producers and a telecommunication operator a few years ago in China. This case may be the only one available to date in which the producers play an active role in dealing with e-wastes in the country. The background, design and outcomes of the program are described below. The information in this chapter is based on the interviews with two major actors in the program and from the website¹¹ of the program. The two interviewees are Mr. Junlin Ma from EMS of Motorola China and Ms. Min Chen from Environmental Affairs in Nokia China. References are given for additional information sources.

4.1 Overview of the mobile phone sector in China

Mobile phone’s market has expanded very fast in China since late 1990s. By the end of January 2009, there are around 649 million Mobile phone network subscribers in China (MIIT, 2009). According to Nokia’s study, the use phase of mobile phones is less than two years on average (Remmen *et al*, 2008, p.14). Therefore, even if when it is assumed that every subscriber only has one mobile phone in China (actually the real situation most likely is that some subscribers own more than one), each year the number of out of use mobile phones increases at an incredible rate, on average 110 million per year (see Section 1.1).

When it comes to mobile phone manufacturers, there are two kinds of them: one is the multinational companies (MNCs); the other is local companies. The MNCs hold a leading position in the market sales, the top four are Nokia (about 40% market share), Samsung Mobile (about 10%), Motorola (about 8%), and Sony Ericsson (about 7-8%). The total market share of local companies is quite small, about 10% (Chen, perso.comm.). Other MNCs, such as LG Mobile and Siemens, hold the other 25% market share.

In terms of mobile communication network providers, there are three in China: China Mobile Communications Corporation (CMCC or “China Mobile” for short), China Unicom, and China Telecom. The market share of them is 70%, 22% and 8% respectively (Cheng and Tang, 2008, p.27). CMCC holds an absolute leading position. CMCC has around 1500 service centers in large and medium cities¹². In terms of economic development, usually large and medium cities are more advanced than the small ones. Thus, the rate of mobile communication subscribers in the former group of cities is higher. With such a big service center network in large and medium cities CMCC has very good infrastructure for collecting used mobile phones.

4.2 Background of the project

Among producers, Nokia China and Motorola China have already launched their own take-back schemes for collecting their own end-of-life products. Nokia launched its take-back

¹¹ The website of the program is <http://www.monternet.com/moneditor/cs/subject/lxz/>.

¹² In China, there are about 667 cities, 45 per cent of which are large and medium cities, and the rest are small cities (Wang and Wang, 2002). This categorization is mainly based on the population size. A small city has a population less than 200,000, the population of a medium city is between 200,000 and 500,000, and that of a large city is above 500,000.

scheme in 2002 in China. In addition, it is also trying to cooperate with service providers to take back end-of-life products. Motorola initiated “ECOMOTO Takeback” program in Asia Pacific area before the program in China. In December 2005, China Mobile together with Nokia China and Motorola China initiated the “Green Box Program”.

The purposes of the program are: (1) to prevent the hazardous substances in mobile phones and accessories from spreading into society; (2) to increase public environmental awareness on recycling used mobile phones; (3) to build up company's environmental image; (4) to set up a good take-back model for the industry. The companies are motivated to join the program as part of their corporate social responsibility (CSR), which means that a public action such as the “Green Box Program” can show that the companies do not just pursue profits but also care about social issues, for example environmental issues.

In 2006, another six mobile-phone producers joined the program. Besides the first three actors, now there are also Amoi, Bird, Lenovo Mobile, LG Mobile, Panasonic and NEC working in the program. The eight mobile phone manufacturers together have about 50% market share in the mobile phone market.

4.3 Design of the project

Until now the project has been running through three phases: (1) Phase One – from 6 December 2005 to 28 February 2006, in which the main actors were the first three initiators; (2) Phase Two – from 1 March 2006 to 31 December 2006, in which six more mobile phone manufacturers joined the program and the coverage of project cities was expanded; (3) Phase Three – from May 2007 to present, in which no more actors join but some new incentives are adopted to improve the take-back of waste mobile phones and accessories.

In the program, various strategies have been applied to promote the progress of the program. The first strategy is to disseminate the information about the take-back program and the problems caused by used mobile phones through the mass media, such as newspaper, the TV news, and the posters at retailers, so that the public awareness can be increased.

The second is to set up convenient dropping points for end users, for example putting take-back boxes (Figure 4-1 is the picture of one box) in CMCC's service centers and the service centers of Nokia China or Motorola China. For example, around 500 Nokia Care Points started to take back used mobile phones and accessories from end users on 24 May 2007 so that it is more convenient for consumers to give back the used products.



Figure 4-1 The take-back box ©

Source: The project website

Third, certain rewards are offered as incentives for end users to drop the used products at the collection points. For instance, CMCC started to give prepaid card (a 10-Yuan-card (about 1 Euro) for one returned mobile phone) to consumers for their telecommunication credits on 17 May 2007 as an incentive. The total cost of the cards given as rewards was about 1,000,000 RMB. But this strategy was only applied once ending at when all of the prepaid cards were distributed. Another example is that in December 2008 Nokia China gave cotton shopping bags for returned end-of-life products¹³ and totally around 2,000,000 bags were distributed.

¹³ The background of this incentive is that since June 2008, in China shopping bags have not been given for free in supermarkets or stores and consumers must pay for them.

Fourth, in the end, the used products are transported to qualified treatment bodies. Two treatment bodies are committed by Nokia China and Motorola China: one is Fortune Group (China), a subsidiary company of Fortune Group USA; the other is TES-AMM Corporation (China) Ltd, a subsidiary company of TES Envirocorp (Holding) Pte Ltd whose headquarter is in Singapore. Nokia China pays for transportation of the collected used products to its storage base in Guangzhou (Guangdong Province) and sorting of these products there. The treatment bodies bear the cost of transportation and disposal of the sorted stuff. At the same time, the benefits from recovery materials, such as copper, gold and silver, belong to the treatment bodies.

4.4 Outcomes of the project

In the first phase, forty big cities¹⁴ joined in the program. By the end of February 2006, 1500 recycling bins were placed in the service centers of CMCC, which are located in large and medium cities around the country. About 32,000 pieces¹⁵ of end-of-life products, including mobile phones, batteries, chargers and other accessories, were collected and sent to specific treatment bodies, but most of them were obsolete batteries.

In the second phase, Nokia China expanded the coverage of recycling bins to its three or four tier cities¹⁶. Within ten months around 90,000 pieces (about 6 tons) of end-of-life products were collected and sent to the treatment bodies. But still most of the scraps were obsolete batteries.

Even though in phase three there are no more new actors joining in the program, because of the incentives adopted by the actors, the amount of the take-back products was significant. In 2007, totally 100 tons of scraps were collected. In 2008, 43 tons were collected. However, most of the scraps were still obsolete batteries.

Generally, the program has increased the public's awareness on recycling the used products. But one issue of the program is that not many mobile phones were taken back, and most of the collected scraps were batteries. Compared with the consumption of mobile phones in China, the amount of returned products is quite small. Each year 110 million mobile phones are out of use in China (Xing and Lu, 2008, p.41), but in the best year only two million pieces of scraps of used products were returned, in which obsolete batteries hold the largest part. As a result, the cost of transporting, storing, sorting and treating the returned equipments is higher than the benefit from the recovery materials. Moreover, the program does not run evenly in all project cities. The amount of take-back scraps from the big cities, such as the capital city of a province, especially from the cities located along the south-east coastal line of China, is much more than from other cities.

¹⁴ These include thirty capital cities of the provinces and four municipalities directly under the central government— Beijing, Tianjin, Shanghai and Chongqing, and plus several big cities.

¹⁵ When counted, a “piece” means a mobile phone or a separate accessory, such as a battery or an ear-phone.

¹⁶ This categorization is mainly according to the size of the cities. One tier cities are those municipalities directly under the central government and capital cities of each province. Two tier cities are other large cities. Three and four tier cities are medium and small cities.

5 Analysis of the existing policies and the empirical case

Based on previous chapters, this chapter analyzes the policies and case in China pertaining to WEEE management, especially on the used mobile phone management by using the analytical framework. Then, the challenges and possibilities for involving producers in end-of-life mobile phone management are identified.

5.1 Responsibility distribution in the policy

When the responsibility distribution is considered, the actors involved are essential. There are several actors in China's WEEE management system. This section just looks at the Administrative Measures and the China WEEE Ordinance, because these two pieces of legislation are specifically addressing WEEE management to date in China and the Solid Waste Pollution Prevention Law and the Cleaner Production Promotion Law are too abstract to implement.

As mentioned before, two groups of instruments are prescribed in the Administrative Measures. They are separated based on the actors: the WEEE treatment bodies (“拆解利用处置单位”) and the producers of the EEE. Moreover, in the China WEEE Ordinance, there is one more type of actors, the recyclers (“回收经营者”)¹⁷. In addition to these three types of actors, the governments are also important. Therefore, these actors more or less play a role in dealing with WEEE.

5.1.1 Collection

Physical responsibility

When it comes to physical collection of WEEE, several actors are involved. According to the Administrative Measures, the EEE producers undertake two categories of the responsibility in the WEEE management: one is during their production; the other is at the end-of-life management of their products (Article 14). The former covers the responsibility to follow the legal restrictions on the use of toxic materials in their products and to provide the information on materials used in their products. The latter is to build up certain system to take back or recycle the WEEE. The producers are responsible to build up a system to take back and dispose their WEEE properly, or they can have their WEEE disposed by the treatment bodies (Article 15). However, under the China WEEE Ordinance, the producers are not required to take back or recycle their products at the end-of-life phase, but just encouraged to do so (Article 11).

The responsibility for the producers is not consistent between the Administrative Measures and the China WEEE Ordinance. Logically, the Ordinance has higher power than the Administrative Measures as it is explained in 3.1.2. Generally, when there are two pieces of legislation and they are well connected, it is in fact often the lower level of legislation that stipulates specific mandates to different actors, while the upper level of the legislation sets forth direction or distributes power among the government bodies, and the like. In that sense, lower level of legislation (i.e. Administrative Measures) could still give specific requirement to, in this case, producers even though it is not specified in the upper level of legislation (i.e. Ordinance). However, this is not the case in the current two regulations, because the upper

¹⁷ The term “recyclers” in China's legislation does not have the same meaning as in other countries' or regions' legislation. In China's legislative context, “recyclers” just mean those bodies that only collect but not treat WEEE, so that in China treatment bodies and recyclers are different types of actors in WEEE management.

does not authorize the lower to specify mandates of relevant actors. Moreover, since the Administrative Measures was enacted by one body under the State Council, when there is discrepancy on responsibility arrangement between the upper level legislation and the lower one, usually the provision in the upper will be followed. As such, the producers do not have the compulsory physical responsibility to take back and dispose WEEE.

Because the local governments/municipalities, especially the environmental protection bureaus and the environmental sanitation administrative departments in the local governments, are in charge of managing the solid waste, when there are WEEE not taken back by anybody, the municipalities shall take the responsibility to take back them and transport them to the authorized treatment bodies. Thus, the physical responsibility of collecting WEEE is mandatory to municipalities.

In the China WEEE Ordinance, the recyclers can conduct the collection. If they just collect the WEEE, there are no special requirements but that they should take the ways which are convenient for WEEE consumers to return the used products. After collection, they shall transport the WEEE to the qualified treatment bodies. The recyclers are for-profit organizations and they do not undertake the mandatory responsibility of collecting WEEE.

In sum, the physical collection responsibility is put mainly on the shoulder of municipalities in China's context instead of on producers, as provided in the Solid Waste Pollution Prevention Law. The argument for this arrangement roots in the belief that the main role of producers is to make products and the waste issue is a separate issue (Anonymity, pers.comm.; Chen, pers.comm.), which is traditionally taken care by municipalities, and they have built up infrastructure to collect wastes.

However, as it is mentioned in Chapter 2, to shift the responsibility from consumers and authorities to producers for the waste management is in order to promote products environmental performance throughout their life cycle, not just to improve the end-of-life management (Lindhqvist, 2000; Tojo, 2004). This is also consistent with the idea of sustainable production and consumption.

Financial responsibility

In terms of financial responsibility there is nothing about who shall finance the collection of WEEE in the Administrative Measures. In the China WEEE Ordinance, however, a disposal fund will be set up to subsidize the disposal of WEEE and producers shall put fees into this fund (Article 7). Therefore, we can assume that financial responsibilities are with producers (and other actors who would be obliged to contribute to the fund in a major way). The details on how to set up the fund have not been described in the Ordinance, and a further regulation on the fund will be set in the future. One thing for sure is that there will be no fee on products put on the market before the Ordinance comes into effect, i.e. no retroaction (Anonymity, pers.comm.).

Despite that the financial mechanism is not sure yet, some implications can be envisioned from the policies. Since producers do not necessarily have a control over the collection, the payment for their end-of-life product management is ultimately put on the shoulder of consumers through the price of the products. As a result, via the disposal fund the government creates a new source of revenues for e-waste management, instead of promoting products environmental performance throughout their life cycle. Moreover, if the fee rates could not reflect the distinction of products in terms of their end-of-life environmental impacts, producers will not take effort to change their product design for better end-of-life management. Or if the financial mechanism would not encourage producers have their own

take-back scheme, they might not take charge for the physical management as well.

Informative responsibility

In terms of the information management, it is required in the Administrative Measures that the producers shall keep records on how their products are disposed of at the end of the life and provide the information to relevant authorities. According to the Ordinance, the producers shall disclose the materials used in their products and a recycling marking on the product or in the instruction. But unlike in Europe, there is not an official recycling sign for e-products in China. Furthermore, if producers do not obey the requirement, they will be fined.

5.1.2 Recovery

Physical responsibility

As mentioned in the former part, producers do not have the compulsory physical responsibility to dispose WEEE. The treatment bodies play the main role in physically recovering WEEE. According to the Administrative Measures, the WEEE treatment bodies are for-profit organizations (Article 13) so that their primary goal is to make money. Thus, even though they are important in treating WEEE, they do not undertake compulsory responsibility. The physical management by them includes disassembly, utilization and disposal of WEEE. When conducting these activities, they must fulfill some requirements. Firstly, they shall conduct environmental impact assessment (EIA) before they implement any treatment projects. Secondly, their treatment activities must follow various environmental standards and technical standards. Thirdly, they shall monitor their activities regularly, and keep records. However, there are not specific mechanisms in the policies to ensure that the e-waste collected is taken to the treatment bodies that are operating in accordance with the standards. This should be addressed in the informative mechanism (see Section 6.1 “Informative responsibility”).

In the China WEEE Ordinance, the recyclers can conduct both collection and treatment of WEEE. If they also dispose the WEEE, they should follow the requirements mentioned above for the treatment bodies. After collection, they shall treat the WEEE themselves.

According to the four national pilot projects and the China WEEE Ordinance, lots of efforts are or will be taken to develop treatment bodies and professional recyclers, in other words, to build up a complete recycling system. The reason for this is that the professional e-waste recycling system is immature in China (Anonymity, pers.comm.). Even though China has the informal waste collection sector for a long time, it is not specific for e-waste. Thus, the policy makers believe that establishing such a mature recycling system is a key for addressing e-waste issue in China. In such a system, they believe, treatment bodies play an essential role and at the beginning of their development financial support is necessary. As such, a fund will be established and subsidy will be offered to treatment bodies.

Financial responsibility

In terms of financial responsibility there is nothing about who shall finance the collection, treatment, recovery and environmentally sound disposal of WEEE in the Administrative Measures. According to the China WEEE Ordinance, however, a special fund will be set up to finance the disposal of WEEE, the producers are asked to put money into this fund (Article 7). Therefore, the same as in financing collection of WEEE, producers undertake mandatory responsibility for financing recovery.

Informative responsibility

For the sake of recycle and disposal, according to both of the Administrative Measures and the China WEEE Ordinance, the producers shall offer information about their products, such as the material used and how to recycle or dispose the used product. Furthermore, if producers do not obey the requirement, they will be fined.

In both pieces of legislation, treatment bodies are required to provide information related to WEEE treatment to the authorities concerned. Treatment bodies shall establish database on disposal of WEEE, and report to local environmental protection agencies. Otherwise, they will be fined.

5.1.3 Monitoring & Enforcement

In the WEEE management, the governments at different levels play a very important role in monitoring and enforcement of the policy. Since the Administrative Measures is made by a specific body in the State Council, it only regulates the activities of environmental protection bureaus. They are in charge of monitoring the pollution from WEEE and approving projects related to WEEE management which may have environmental impacts, such as setting up an e-waste treatment body. On the other hand, the China WEEE Ordinance is issued by the State Council, and several ministries undertake different tasks in managing the e-waste at the national level. The National Development and Reform Commission, the Ministry of Environmental Protection and the Ministry of Industry and Information Technology shall work together to development policy instruments on recycling and disposing WEEE; the Ministry of Environmental Protection is responsible to implement the policy instruments; and the Ministry of Commerce is responsible to regulate the recycling of WEEE and recycler's activities.

At the local level, the Ordinance does not say anything about how to implement the policy. But in the draft of the Ordinance, it was said that the local governments took the main role of dealing with WEEE. In the interview, this idea was also echoed by an official who took part in the development of the legislation (Anonymity, pers.comm.). The reason for this is that China is a big country and the situation at the local level is diverse, so that it is better to accredit power to the local governments to implement the policy in light of the local conditions. However, the final version of the Ordinance commissions the Ministry of Environmental Protection with the power to implement the policy. Accordingly, at the local level it is the environmental protection bureaus, part of the local government system, who implement the policy. The results from this arrangement are uncertain. One result could be that the policy would be implemented efficiently because the environmental protection is becoming more and more important for local governments so that they will totally support the environmental protection bureaus to implement the policy. The other could be that the policy would be compromised for local economic development because local governments prioritize economic development over environmental protection and they may not always support the environmental protection bureaus to implement the policy.

5.1.4 A supplementary issue

In China's legislation, there is no special definition on "producers" in the WEEE management. However, when grouping the actors in the WEEE management, both the Administrative Measures (in Article 14) and the China WEEE Ordinance (in Article 10) put the manufacturers and importers together in one article as one type of actors — the producers. Moreover, in the Administration Measures, producers also involve distributors, but in the China WEEE management distributors are not mentioned as a type of actors at all. This

difference may cause confusion in implementation, because distributors directly face end users and if they are included in the scope of producers, they can disseminate information related to e-waste management to consumers and they will also participate in take-back programs. As such, there might be more used products taken back.

To summarize the responsibility distribution in China's policies pertaining to e-waste management, the Table 5-1 is formed. From it, the actors bear various responsibility in the management system can be noticed.

Table 5-1 Responsibility distribution in WEEE management in China

Type of responsibility	Activities			
		Collection	Recovery	Monitoring & Enforcement
Physical management	Municipalities; Recyclers *	Treatment bodies*	Ministry of Environmental Protection (national), and environmental protection bureaus (local)	
Financial mechanism	Producers	Producers		
Information management	Producers	Producers; Treatment bodies		

* These actors do not undertake mandatory responsibility, but play a role in conducting these activities as for their business.

Source: Combined by the author

Considering the discrepancies between the Administrative Measures and the China WEEE Ordinance on the responsibility arrangement, the Table 5-2 provides the details of the activities of collection and recovery of WEEE in the two regulations.

Table 5-2 Responsibility allocation in the Administrative Measures and the China WEEE Ordinance

Activities	Types of responsibility	Actors	Policies	
			Administrative Measures	China WEEE Ordinance
Collection	Physical	Producers	Establishing certain system to take back or recycle WEEE (M)*	Being encouraged to do take back or recycle WEEE
		Others	Not mentioned	Recyclers can conduct the collection.
	Financial	Producers	Not mentioned	Putting fees into a disposal fund (M)
		Others	Not mentioned	Not mentioned
	Informative	Producers	<ul style="list-style-type: none"> • Keeping records on how their products are disposed • Provide the information to relevant authorities (M)	<ul style="list-style-type: none"> • Disclose the materials used in their products • Putting recycling sign on the product or in the instruction (M)
		Others	Not mentioned	No mentioned

(Continued on the next page)

Table 5-2 (continued)

Activities	Types of responsibility	Actors	Policies		
			Administrative Measures	China WEEE Ordinance	
Recovery	Physical	Producers	Not mentioned	No mentioned	
		Others	Treatment body: disassembly, utilization and disposal of WEEE	<ul style="list-style-type: none"> • Treatment facility: disassembly, utilization and disposal of WEEE • Recyclers can conduct both collection and treatment of WEEE. 	
	Financial	Producers	Not mentioned	Putting fees into a disposal fund (M)	
		Others	Not mentioned	Not mentioned	
	Information	Producers	Disclosing information about the products (M)	Disclosing information about the products (M)	
		Others	<ul style="list-style-type: none"> • Treatment body : establishing database on disposal of WEEE • Treatment body: reporting to local environmental protection agencies (M) 	<ul style="list-style-type: none"> • Treatment body: establishing database on disposal of WEEE • Treatment body: reporting to local environmental protection agencies (M) 	
	* “M” means mandatory responsibility.				

Source: Combined by the author

5.2 Lessons learned from the case

Since the voluntary take-back project in the mobile phone sector is the first case which the producers initiated in China, it can give some insight on how producers can work in addressing issues from their products at the post-consumer stage. The project merely focuses on collection and is conducted voluntarily instead of required by law. Nevertheless, the analytical framework is still applied to discuss the responsibility distribution of the project. Then, the project is evaluated in light of its purposes. Finally, the factors affects the project are summarized.

5.2.1 Responsibility distribution

Physical responsibility

The manufacturers and the network provider involved in the project are responsible for collecting used mobile phones by putting collection bins in their care centers or service centers. To fulfill this responsibility, they cooperate together, for all collection bins take back used mobile phones regardless of the brand.

Financial responsibility

The manufacturers involved pay for the collection bins put at their own service centers, the transportation of the used products collected to its storage base, and the sorting of these products. The treatment bodies bear the cost of transportation and disposal of the sorted stuff. At the same time, the benefits from recovered materials, such as copper, gold and silver, belong to the treatment bodies.

Informative responsibility

The producers disclose the information of the collection on the project's website and their own website.

In sum, in this voluntary collection scheme, the manufacturers and network provider involved undertake all of the three types of responsibility. The physical responsibility is collective. The financial responsibility is kind of a mixed individual and collective responsibility, as the manufacturers bear the cost of collection and transportation and storage of the stuff they get in their collection bins regardless of the brand (collective responsibility), and at the same time they solely undertake the cost of the strategies they initiated by themselves (individual responsibility). For example, Nokia China pays for making and distributing the cotton shopping bags. The following table shows the responsibility allocation among the actors.

Table 5-3 Responsibility allocation in the empirical case

Types of responsibility	Collection	Note
Physical	Manufacturers, network provider	Collective responsibility
Financial	Manufacturers, network provider	Individual and collective responsibility
Informative	Manufacturers, network provider	Individual responsibility

Source: Combined by the author

5.2.2 Evaluation and explanation

The project is evaluated in light of its purposes. The first purpose of the project is to prevent the hazardous materials in mobile phones and accessories from spreading into society. Since the actors in the project do not set indicators for this purpose, here only the amount of returned products is considered. Each year 110 million mobile phones are out of use in China (Xing and Lu, 2008, p.41), but in the best year only two million pieces of scraps of mobile phones and accessories were returned, in which batteries hold the largest part (Chen, pers.comm.). Thus, the result of taking back is not good in terms of collecting used mobile phones. But this cannot be explained as that after two years' use all mobile phones have been thrown away, because two years are in terms of fashion and technological oscillation (that means people stop using them for they think the products are out of fashion), whereas their function as mobile phones may still be good (Remmen et al., 2008, p.14). And most people in China will keep their unused mobile phones at home or give them to friends or relatives or sell (Chen, pers.comm.). However, in terms of collecting used accessories, especially used batteries, it can be concluded that the project somehow achieved part of the purpose, because the batteries contain hazardous materials, and in the project they were collected and stored in a proper place.

The second and third purposes, which are to increase public environmental awareness on recycling used mobile phones and to build up company's environmental image respectively, are hard to evaluate, since there are no indicators set up for them in the project, and there is no evaluation from the third party such as environmental NGOs either¹⁸.

¹⁸ At the global level, Greenpeace has a "Green Electronic Guide" to rank leading mobile and PC manufacturers on their global policies and practice on eliminating harmful chemicals and on taking responsibility for their products once they are discarded by consumers (see

The fourth purpose is to set up a good take-back model for the industry. It is hard to make a conclusion on this purpose as well. On the one hand, in terms of market share, the mobile phone manufacturers participating in the project together hold about 50% in mobile-phone market, and the network provider in the project has 70% in mobile communication market. Therefore, they will more or less influence the industrial behavior. On the other hand, there are still other important mobile phone manufacturers such as Samsung and Sony Ericsson not in the project. For example, according to the information disclosed on its website, so far Sony Ericsson does not have its own individual take-back scheme in China, but it has joint collection and recycling systems in other place such as in Europe (Sony Ericsson-Global, n/d). Moreover, as mentioned in Section 2.3, convenience of a collection system is essential. MPPI (2009) points out that a convenient system may involve various methods for end users to deliver their used mobile phones with “only a small effort” and eight methods are identified (see Section 2.3.1). But this project chiefly applies one method – collection points at manufacturers’ and network operator’s service centers. Despite that CMCC has drop-off boxes in its 1500 service centers and Nokia China have the collection bins in its 500 service centers, compared with the large number of mobile phone users and their widely spreading, these are not enough. Probably, diverse collection methods should be introduced in the take-back scheme. For example, Nokia in Europe also applied the method of collection by mail.

In terms of the responsibility allocation, even though it is a voluntary action, the free-rider issue is a problem, because the actors pay not only for their own products but also for others’. At the same time, they will not get the benefit from the recovered materials. As such, the sustainability of the project is problematic.

In addition, the financial and material flows in collecting used mobile phone can give some insight to explain the results of the project as well, particularly on why not many used mobile phones were collected. According to Streicher-Porte and Yang’s (2007, p.43) research on China’s national pilot projects (see Section 3.4), the collection cost is the key for an efficient collection system. The situation in China is that the informal recycling sector (such as small peddlers) is more efficient than the formal collection system in the national projects, as the former pays less both for transporting WEEE and for the payment to end users than the latter. In the case of the voluntary take-back scheme, it is similar. Figure 5-1 shows the financial and material flows in the scheme.

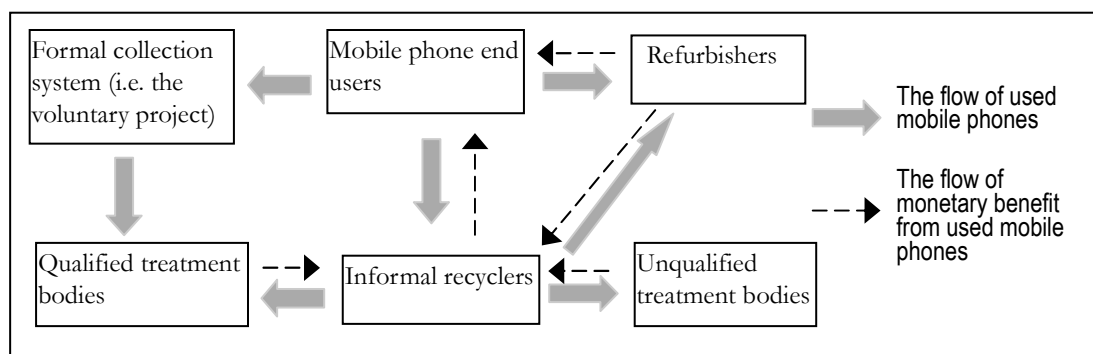


Figure 5-1 Financial and material flows in collecting used mobile phones

Source: Developed by the author

<http://www.greenpeace.org/china/en/campaigns/toxics/e-waste/how-the-companies-line-up>). But in China, there is no such a scheme.

According to the above figure, there are three ways for end users to get off their used mobile phones, which are dropping off their used mobile phones in the formal collection system (i.e. the voluntary project), selling them to informal recyclers or refurbishers. In China refurbishing mobile-phone is illegal due to product safety reasons (Herold, 2007, p.226). Thus, there are no standards for refurbished mobile phones. Corporations like Nokia and Motorola must follow all the requirements so that they are not involved in refurbishment in China. But there are some small companies refurbishing used mobile phones illegally and there is a grey market for the refurbished mobile phones since they are cheaper than the new ones. If they can sell their used mobile phones for some money, most end users will not return them free of charge. When it comes to the informal recyclers, they are more accessible to the end users than the formal collection system, since they are usually door-to-door collecting the items and pay for them as well. After they get the used products, they can sell them to refurbishers or treatment bodies (qualified or unqualified) and gain benefits.

When the formal collection is considered, the producers or network provider have collection bins in their service centers and they do not pay the end users for the returned items even though sometimes they offer rewards to the returned products. As such, end users are more likely to sell their used mobile phones than drop them off for free. In terms of the qualified treatment bodies, they get the used mobile phones from the project for free, but the volume is small. If they get them from the informal sector, they need to pay, usually more than what the informal sector pay to the end users.

5.2.3 Factors affecting the project

Driving force

The main driving force for the project is CSR or company's public image. Another driving force is MNCs' mother company's policy. Even before the joint project, Nokia and Motorola already had their own voluntary take-back schemes. The reason that Nokia started its voluntary take-back scheme in China in 2002 is that according to its experience in Europe Nokia has realized that e-waste issue would be an issue in China and Nokia has consistent environmental policy in all of its companies around the world (Castren, pers.comm.).

The third driving force, which is implied from one of the project purposes – to set up a good take-back model for the industry, is that the actors want to influence industrial behavior of collection of used mobile phones. This is different from its counterpart in Europe. From Nokia in Europe's experience, the take-back scheme there undertook a mission to “teach the policy maker” which means the producers in Europe wanted to influence the policy making.

Convenience

Because the actors put collection bins in network provider's service centers and manufacturers' care points and the coverage of these points is broad, there is higher likelihood for the end users to drop off their end-of-life products at the points if they want. At least in the case of mobile phone accessories (batteries) this is the case. But the collection system is still not as accessible as the informal recycling sector.

Awareness

If people do not realize that they shall return their used mobile phones, they will not recycle their end-of-life products. According to Nokia's survey on recycling mobile phones (Chen, pers.comm.), globally only 3% of people recycled their unused mobile phones, while many are simply unaware that they can recycle these old and unused mobiles or how they can do this. The percentage of people recycling used mobile phones in China is even lower than the global

average.

Incentives for end users

Incentives for mobile phone end users turned out to be very important. The project has witnessed that when there were certain rewards, the amount of returned products were increased. Between March and December 2006, the amount of the returned products was 6 tons, while in 2007 it was 100 tons as in this year CMCC offered prepaid card to consumers as for their telecommunication credits to encourage them to return their used products. Moreover, the effect differs from various incentives. In 2008 the amount of take-back products was 43 tons, a big drop compared with 100 tons in the previous year, even though Nokia applied the strategy of distributing cotton shopping bags.

Grey market for refurbished mobile-phones and informal recycling sector

The existence of the grey market reduces the possibility of returning the used products. And the same as the informal recycling sector does. Both of them pay for the used mobile phones, which is an attraction to end users.

5.3 Challenges and opportunities for involving producers in used mobile phone management

According to current policy and empirical experience in China, there are both challenges and opportunities for involving producers in end-of-life mobile phone management.

5.3.1 Challenges

Unclear definition on producers in the policies

The scope of the producers in China's WEEE management policies is inconsistent. However, according to OECD (2001, p.54), if EPR is introduced in a policy, it is necessary to allocate clear responsibility for implementing the policy instrument. As such, "[a] principal consideration is deciding who is responsible and for what?" Therefore, if the definition of producer is not clear in the policy, the implementation of the policy may be compromised.

Lack of awareness among end users

To a large extent, awareness affects whether end users will return their used mobile phones. Without end users' participation, producer's take-back scheme is not possible to work well.

Small amount of returned end-of-life products

The amount of products taken back is small now in the take-back scheme, and among the used products taken back, end-of-life mobile phones only hold a very small part. This means that the amount of recovered materials, which may discourage producer or treatment facilities to treat the used products.

Grey refurbished product market and informal recycling sector

This market attracts end users to sell their used mobile phones, which competes with producers on materials to recover. What makes the situation more challenging is that there are no data on how large this market is.

Cost of collecting used mobile phones

With the competition from gray refurbished product market and the informal recycling sector,

the cost of the current voluntary take-back scheme is higher than the former two in terms of getting back used mobile phones. The actors in the project bear the cost of transportation, storing and sorting of the used products as well and the treatment facilities pay for the transportation of end-of-life products to their factory. However, the benefits from the recovered materials belong to the treatment bodies, rather than sharing benefits between manufacturers and the treatment facilities, like the case in Europe (Castren, pers.comm.). The reason for this situation is that the amount of collected used mobile phones is quite small (because the most are obsolete batteries), and the cost for transportation and treatment is very high compared with the benefits.

Moreover, with the enforcement of the China WEEE Ordinance in 2011, producers will pay fees into a disposal fund, which might reduce their enthusiasm of having a voluntary take-back scheme.

5.3.2 Opportunities

Policy

Now China has policy addressing e-waste issues which puts responsibility on producers' shoulder. Therefore, producers have to play an active role in managing end-of-life products. But the result is uncertain, because the details of the disposal fund and the product scope are not sure.

Large amount of used mobile phones

There is a potential large amount of used mobile phones, which are a rich source of raw materials, such as gold, copper, and silver, which can bring large benefits both economic and environment.

Well established infrastructure

Since both the manufacturers and the network service providers have a large coverage of service centers around the country, and collection bins are put at these points, it is very convenient for consumers to drop their used products.

Existing take-back schemes

The existing take-back schemes in China, joint or individual, give producers experience on managing their products at the post-consumer stage. With these, they can continue and improve their work in this area.

6 How to improve EPR programs in China's e-waste management system: in the case of used mobile phones

Since China has introduced the concept of EPR in its e-waste management policy, theories on EPR do give insights on improving the policy. Here, some recommendations are given to improve EPR programs in China. These suggestions are based on the previous discussion, that is, in the case of end-of-life mobile phone management. Meanwhile, mobile phones have distinctive characteristics from other e-products. For example, the size of mobile phones is much smaller than other e-products, such as refrigerators and TV sets. Also, mobile phones have a shorter use phase. As such, the ways to manage end-of-life mobile phones can be very different from those to other e-waste. Nevertheless, some suggestions are still applicable to manage other e-wastes, for instance the model of producer responsibility.

Generally, in China's policies, qualified treatment bodies and professional recyclers are given noticeable emphasis in addressing the e-waste issue. In the short term this is reasonable, because they are too young in China, and they need to grow up rapidly. Treatment bodies and professional recyclers are actors on the market, and they need to grow up in the market. This is also good for the whole treatment or recycling industry, for their competency on disposal of WEEE will be improved through competition on the market. Of course, at the beginning there could be some incentives for their development, such as tax reduction. But in a long term policy, they are not the key to address the e-waste issue. If the focus of the policy keeps on the development of treatment facility, in the long term the purpose of the policy, which is to reduce the material use and to protect the environmental, may not be achieved.

Instead, the product itself shall be given more attention, which means to meet its purpose the policy should pay more attention to the upstream change. Otherwise, the policies may turn out to be a way of creating a new source of revenues for waste management (Tojo, 2004, p.i). Thus, the design of the responsibility distribution in the policies shall be careful.

6.1 Responsibility distribution in managing used mobile phones

As mentioned in Chapter 2, three types of responsibility – physical, financial, and informative – are essential to implement EPR. Now in the China WEEE Ordinance, financial and informative responsibilities are designated to producers, and the physical responsibility is mainly put on municipalities' shoulder.

Physical responsibility

When it comes to physical responsibility, only the municipalities undertake the mandatory responsibility to collect e-waste in China, which is based on their responsibility of disposing solid waste. However, the study from both Tojo (2004) and van Rossem *et al* (2006) shows that e-product producers undertaking physical responsibility of taking back their own brand products are inclined to design cleaner and more resource efficient products. Even though Article 10 of the China WEEE Ordinance says that the EEE producers shall adopt proper product design so that the products are easy to be recycled or disposed at the end of life, there is no specific mechanism in the legislation to inspire producers to do so. If China wants to fulfill its WEEE management policy purpose, measures and provisions to increase the direct involvement of the producers in physical management of their products are important.

China needs to think about what kind of physical responsibility for producers it wants to have in the WEEE management system as well. Is it collective, individual or mixed? As mentioned

In Section 2.1, the factors affecting the selection between collective physical responsibility and individual physical responsibility include end-value of the products, the feasibility and ambition of the producers to establish their own downstream infrastructure, the types of end-users, the existence of other producers that share the same level of ambition concerning the end-of-life management of their products and so on.

In the case of China's used mobile phone management, the policy can have both of the individual and collective physical responsibility. The first reason for this is that used mobile phones contain valuable materials such as gold and copper, and producers may be interested in taking back used mobile phones regardless of the brand (collective responsibility). Second, now some producers already have their own take-back infrastructures and they can do it individually (individual responsibility). Third, because the end users are spreading, collective collection of the products may be effective (collective responsibility).

Financial responsibility

Since the mechanism of the disposal fund is not available yet, the details about the financial responsibility are not certain. The China WEEE Ordinance only mentions that producers shall put fees into the disposal fund which will be used to subsidize the disposal of WEEE.

As mentioned in Chapter 2, the financial responsibility means that the producer will cover all or part of the cost for managing their end-of-life products. According to this, in the future, when setting up the fee rates for producers in China, some questions need to be answered. First, will the producers bear the whole cost or just part cost of dealing WEEE? Second, will the responsibility be individual or collective? Now there are no answers to them, and it needs further research. However, existing research may help China to find the direction. Tojo's (2004) empirical study shows that when the producers pay for the actual cost of recycling of their products instead of a common fee regardless of the brand (individual financial responsibility), it provides incentive on upstream change, such as design change and materials used. Therefore, when designing the mechanism of the disposal fund, China shall consider individual financial responsibility for producers. For example, producers put fees in the fund according to their products' market share, or the number of their products sold on the market. If producers keep clear records of their product sale, this mechanism is feasible. Moreover, when setting rates, the whole cost of the recycling should be taken into account.

Informative responsibility

Even though China's present policies have provisions on informative responsibility, they are too general, and not easy to implement. Specific instruments should be added into the policies. First, since it is said producers should put recycling marking on their product, an official sign shall be designed so that all of the producers can follow it. Second, details on what kind of information and how producers shall deliver to the authorities and treatment bodies should be written down in the policies. Third, according to other countries' experience (Tojo, 2004), for effectively disseminating information, producers should co-operate, through a third party, say a producer responsibility organization (PRO) or an industry association, in providing information regarding the operation of an EPR program, location of collection points, the results of the program and the like. In addition, since there is no specific mechanism in the policies to ensure that the e-waste collected are taken to the treatment bodies who are operating in accordance with the standards, via informative mechanism, relevant actors should keep the records of to where they transport the collected items.

6.2 Definition of producer

As mentioned in the above chapter, the definition of producer shall be clear. How to define

producer? OECD (2001, p.54) gives a guideline regarding the definition of producer based on the characteristics of products:

*Producers are, therefore, in the best position to make changes to their products to meet the objectives of the EPR programme and to stimulate product innovation and redesign, promote less wasteful products (i.e. products where less waste enters the waste stream for final disposal), or produce products that are easier to re-use or recycle. As such, an EPR scheme is most effective if the **producer** is designated as the entity with the greatest control over the decisions relating to materials selection and product design.*

*With longer-life products, the **producer** is considered to be the firm whose brand name appears on the product itself or the importer. However, in the case of packaging, the **filler** of the packaging, rather than the firm that makes the product container or wrapping, would be considered the producer. In instances where the **brand owner** can not be clearly identified, the **manufacturer** would be considered as the **producer**.*

In the case of mobile phones, the producer shall include manufacturers, importers and refurbishers. The manufacturers are the most important part of the producers, because they are in the best position to make change to their products to meet the purpose of the policies. In China, there are two types of manufacturers. One is the multinational companies (MNCs). They hold the largest part of market share (see Section 4.1). The other is the domestic companies.

The importers should still be included in the scope of producer. They are in charge of deciding what kind of products they buy from other countries and at the same they know the requirements of their home country. If they are responsible for the end-of-life products management, they will consider the impacts from the products they import and they can ask the producers in the exporting countries to follow the requirements as well. However, in the case of mobile phones the importers are not the key actors in China, because China now is the largest country of mobile phone production and the importation only has a very small market share (Wang, 2009, p.32). Nevertheless, for the imported mobile phones, the importers should be involved in the end-of-life management.

The refurbishers rebuild the returned mobile phones and then sell them. In China this is illegal. But in some countries, such as in the United States, refurbishment is allowed as a replacement of recycling (Kahhat *et al.*, 2008, p.960). Since they change the product in a way, sell the products to consumers, and have certain control over the decisions relating to materials selection, they should be included in the scope of producers.

However, one issue for the refurbishers is how to identify them in the market. If there are no specific requirements for them, they may just rebuild the returned mobile phones and then sell them with the original brand. Nevertheless, it is still possible to do so. Some measures can be applied. First, the refurbishers shall be registered and get a business license. Thus, they will be under supervision. Second, certain technical and environmental standards should be established for guiding the refurbishment. Third, refurbishers shall put their commercial logo and a refurbishment sign on the products, so that people can tell the refurbishers and the refurbished mobile phones.

6.3 Incentives

There are two kinds of incentives in the case of used mobile phone management. One is for the end users. The other is for the producers. According to the voluntary take-back project, it is quite clear that incentives are effective to encourage end users to return their unused

products. There are different kinds of incentives, as applied in the project. It relies on the producers to decide which one to use.

For the producers, there are also various incentives to encourage them improve the end-of-life management of their products. From the viewpoint of upstream change, incentives, such as subsidizing design for the environment, technology support, can be added into the policies. From the perspective of end-of-life management, incentives, such as tax reduction or subsidizing of take-back infrastructures, can be applied to encourage producers. In light of the potential benefit from the materials contained in used mobile phones, certain instruments shall be adopted to properly distribute the benefit among different actors in order to encourage them to take part in dealing with used mobile phones.

6.4 Public awareness

Even though producers have taken some actions to disseminate information on used mobile phone recycling, the government can adopt measures to increase public awareness on this issue. Especially, now in China's school education the environmental protection is a topic, and e-waste issue and recycling can be included in this topic as well. Similarly, the e-waste issue can be discussed in the mass media and public education.

6.5 Market for refurbished mobile phones

This is an obvious issue in the mobile phone case. Since the refurbished mobile phones have their market, even though refurbishing used mobile phones is illegal in China, it is better to legalize refurbishment, so that standards and requirements on how to do it can be set up. In this way, the activities are under control and the refurbishing companies can be included into the EPR program.

7 Conclusions and future research opportunities

This last chapter revisits the research questions and the research objectives and then comes out with some recommendations on future research.

7.1 Conclusions

The research focuses on the producer's role in managing used mobile phones in China, by applying the concept of EPR. The following research questions work as guidelines for the study:

- 1) How do the current Chinese policies related to WEEE look like?
- 2) How might the policies influence the e-waste management in China?
- 3) How can China's e-waste management system be improved by introducing EPR in the case of mobile phones?
 - ✓ What are the possibilities and challenges of introducing EPR into China's e-waste management policy system?
 - ✓ How can EPR be better integrated into China's e-waste management policy system?

The first research question explores *policies in China pertaining to the e-waste issue*. This question is mainly addressed in Chapter 3. Currently in China, WEEE management is in the realm of solid waste management and related to cleaner production as well. As such, WEEE management generally follows the principles of solid waste management. Furthermore, since the WEEE is a particular kind of waste, there is a special rule and an ordinance on WEEE management now, even though they are not as strong as a law in terms of jurisprudence. In these two pieces of legislation, China has introduced the concept of extended producer responsibility (EPR). For the first time, the Administrative Measures touches producer responsibility on managing e-waste. Then, the China WEEE Ordinance echoes this idea. Furthermore, in the policy system, there are also policy instruments for promoting the producer's role in managing e-waste. In addition, before the specific legislation on WEEE management, the Chinese government has launched four national pilot projects on WEEE management since 2004 and information on this issue in the light of China's conditions can be obtained for policy making.

The second research question probes *the influence of the current policies* on the e-waste management in China, especially in the case of used mobile phones. Thus, EPR in China's e-waste management policy has been looked at. Chapter 4, Section 5.1 and 5.2 works on answering this question. In Chapter 4, an empirical case in the mobile phone sector is described, which is a voluntary take-back project initiated by the producers. In both of the policies and the empirical case, the responsibility allocation is analyzed. On the policy side, the physical collection responsibility of WEEE is designated mainly to the municipalities instead of the producers. When it comes to the recovery of WEEE, producers do not take responsibility either. Instead, it is commissioned to professional treatment bodies, which recover and treat WEEE on commercial basis, without being mandated by the law. In terms of financial responsibility, it is producers who are responsible for financing the collection and recovery of WEEE, by putting certain fees in a disposal fund which is still under building. In terms of informative responsibility, producers, recyclers (if they also dispose WEEE as treatment bodies do), and treatment bodies are required to disclose information, but the provisions in the policy are too general, and specific mechanism is still needed. In addition, some differences in the responsibility arrangement are seen between the Administrative Measures and the China WEEE Ordinance, which may cause confusion in the

implementation. The scope of producers is not the same in these two regulations either. The empirical case also shows the responsibility allocation in the collection of used mobile phones, in which the manufacturers and network provider undertake all of the three types of responsibility. Furthermore, it displays the factors that affecting a voluntary take-back scheme. Those factors include driving forces for producers, convenience and incentives for end users, awareness among end users, and the grey market for refurbished mobile phones.

The third research question is about *how to improve China's e-waste management system* by applying the concept of EPR in the case of used mobile phones. Section 5.3, based on the former two questions, identifies the challenges and opportunities for involving producers in end-of-life mobile phone management. Then in Chapter 6 recommendations are given. Currently, the challenges for involving producers in the used mobile phone management are unclear definition on producers, lack of awareness among end users, cost and benefits distribution on the recovered materials, small amount of take-back products, and the grey refurbished product market. The opportunities for improving the EPR implementation in managing used mobile phones are the existing policies, the potential large amount of used mobile phones, well established infrastructure and the existing take-back schemes. The recommendations are regarding to the responsibility distribution, the definition of producer, incentives, public awareness, and the market for refurbished mobile phones. The main focus is to clarify the three types of responsibility – physical, financial and informative – based on the concept of EPR. In China's policies, professional treatment bodies and recyclers are given noticeable emphasis in collecting and disposing e-waste. The producers chiefly bear the financial responsibility (putting fees in a disposal fund). The physical responsibility of managing e-waste is mainly put on municipalities' shoulder. In the long term this arrangement may not be able to fulfill the purpose of the policy which is to reduce the material use and to protect the environmental. Instead, the policy should pay more attention to the upstream change. In terms of the physical responsibility, besides the municipalities, the producers shall take the responsibility to management their end-of-life products either in an individual or a collective way or both. In terms of the financial responsibility, China should consider individual financial responsibility for producers. In terms of the informative responsibility, specific instruments should be added into the policies, such as an official recycling sign for e-products in the country.

7.2 Future research opportunities

E-waste management is a relatively new topic for China, and the same as the concept of EPR. China does not have much experience in the area. This thesis only touches a small part of the whole issue. The following areas can be explored further:

The general flows and quantities of e-waste in China should be studied, so that the data for policy making and implementation are available. As such, the four national pilot projects, mentioned in Section 3.4, can be studied further, and the data and results from them may give lights in developing the policy further.

Further efforts are needed to study the management mechanism for other end-of-life e-products. After all, mobile phones are different from other e-products. They are smaller and the use phase is shorter. In addition, they contain valuable materials. All this characteristics distinguish them from products such as air conditioners and TV sets. Thus, the mechanism for managing used mobile phones may be quite distinctive, for example the recovery.

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Abbreviations

BAN	Basel Action Network
CMCC	China Mobile Communications Corporation
CSR	corporate social responsibility
EEE	electrical and electronic equipment
EIA	environmental impact assessment
EPB	environmental protection bureau
EPR	extended producer responsibility
ESAD	environmental sanitation administrative departments
MEP	Ministry of Environmental Protection
MIIT	Ministry of Industry and Information Technology
MNC	multinational company
MOHURD	Ministry of Housing and Urban-Rural Development
MPPI	Mobile Phone Partnership Initiative
NGO	non-governmental organization
NPC	National People's Congress
OECD	Organisation for Economic Co-operation and Development
PRC	People's Republic of China
PRO	producer responsibility organization
RMB	Ren Min Bi (Chinese currency)
RoHS	restriction of hazardous substances
SVTC	Silicon Valley Toxics Coalition
WEEE	waste wlectrical and wlectronic equipment

