

Waste Electronic & Electrotechnical Equipments Recycling Management System of China Based on the Stakeholder Theory

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Abstract. This paper analyzes Waste electronic & electrotechnical equipments (WEEE) recycling systems in Germany, the Netherlands and the United States (U.S.) from the perspective of stakeholders, which may be helpful for China to establish a study on rational WEEE recycling system. They all consider that how to recycle WEEE effectively is a burning question in the process of promoting the resource of waste and used household appliances (WUHA). In addition, according to the Mitchell score-based approach, the status, functions and responsibilities for all the stakeholders at recycling stages were defined. At last, a reference model on WEEE recycling management system conforming to the situation in China was put forward on the basis of the experience abroad.

Keywords: WUHA, recycling management system, stakeholder, responsibility

1. Introduction

According to the related survey data of Chinese bureau of statistics, there are about 5 million TV sets, 5 million washing machines and 4 million refrigerators per annum on average to scrap. Furthermore, with the improvement of people's living standard, the replacement cycle of household appliances is shorter and shorter. Therefore, China has to undertake heavy burden on recycling WEEE.

The characteristics of WEEE: on one hand it contains a lot of poisonous and harmful substances. For instance 700 chemical raw materials are essential to make a household computer, but 50% of them are harmful to humans. If the disposal methods are inappropriate, health of humans will be affected and human survival environment will be destructed seriously. On the other hand, WEEE possesses high value of recycling. Generally by means of suitable equipments and processing technologies, 286 pounds of copper, 1 pound of gold, 44 pounds of tin, 90 pounds iron and 65 pounds of lead can be isolated from a ton of circuit recycled. It is noteworthy that the value of just 1 pound gold is more than \$6,000. As the lack of natural resources is becoming serious day by day and environmental pressure increases gradually, WEEE, including WUHA, will become the main mineral resource.

On February 13, 2003, EU promulgated "the Restriction of the use of certain Hazardous substances in Electrical and Electronic Equipment" (RoHS) and "Waste Electrical and Electronic Equipment" (WEEE). WEEE and ROHS came into force on July 1, 2006. The 15 members of UN improved their laws and regulations on WEEE, gradually implemented standardization on WEEE management and formed their own modes of the WEEE management. This paper analyzes the WEEE recycling system in Germany, the Netherlands and the United States from stakeholders' viewpoint in order to offer reference for China to construct an effective and efficient WEEE recycling management system.

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2. The Stakeholder Theory

2.1 Concepts of stakeholder

In 1963, Stanford Research Institute first explicitly put forward the definition of stakeholders: "Stakeholders are such groups that, without their supports, the organizations can not survive." So far, stakeholders have not formed a unified definition. Among them, Freeman's point of view was the most representative. He proposed: "Stakeholders of an organization are groups or individuals that can affect organizational goals or be affected by them" in his book "Strategic Management: A stakeholder approach".^[1] The definition is classic, but not accurate measurement. Carroll put forward the most representative chivalrous concept of stakeholder. Carroll considered that stakeholder "refers to the individuals or groups who interact with enterprises and have interests or rights in the business."^[2] This concept is consistent with the reality of social practice activities, also easy to measure.

2.2 The definition method of stakeholders

The definition of stakeholders is the most important issue to the recycling management based on the stakeholder theory. Because different stakeholders to an enterprise, the influence degree is different. The influence of the enterprise to stakeholders, however, will adversely affect the enterprise itself eventually. That is the final management situation of business dependent on their interaction.^[3]

The western scholars did make plenty of studies on the definition of stakeholders and formed scientific research methods (table 1). This paper made a clear definition and evaluation of stakeholders in the WUHA recycling management system by using the method of Mitchell for reference.

3. Stakeholders and WUHA Recycling Management System

Stakeholders in WUHA recycling management system are organizations, groups and individuals that must effect recycling actions or be affected by them in the recycling process. Generally speaking, there are mainly seven parts: producers (manufacturer/importer), retailers, consumers, recyclers, the processing plants, government management departments and the third party organizations, etc.

3.1 WUHA recycling management systems in developed countries

1) *WUHA recycling management system in Germany*

At present the WUHA recycling management system in Germany has become the most representative one in UN. Whatever for the citizens or producers having recovery responsibilities, the recycling system is very perfect. According to the Extended Producer responsibility principle, the disposal expenses are offered by producers. Moreover, Germany also requires producers and importers to establish associations jointly and ask the state governments to set up registered centers. Things that some producer or the designated third party should collect how many WEEE and when to carry away the WEEE in designated location are determined by associations. The associations also proclaim producer list and the volumes of all recycled WEEE online. The producer list and the actual volumes are registered and reported to the associations by registered centers. But also registered centers are responsible for notifying designated objects to carry away the WEEE in designated location.

a) *Methods to dispose WUHA for consumers*

Mostly, municipal enterprises or Producers alliance are responsible for the recycling of WUHA in Germany. Recycling WUHA has formed an industry. For the convenience of residents, the authorities provide several methods to dispose WUHA in following:

Paid recycling. Residents contact actively with the municipal enterprises which are responsible to recycle WUHA. Then the enterprises would send some staff to take back WUHA. As in the capital Berlin, as long as people call the institutions designated, send a fax or email, then there will be specialized personnel provide on-site service. While the resident usually needed to pay 10 to 30 Euros as transport charges according to the size of the electrical appliance.

Free recycling. Residents who drive to the designated recycling centers to send the WUHA are out of charge. Nevertheless, the 16 recovery plants are all away from downtown at present. So it is difficult for Residents to adopt this measure.

Table 1 The definition of stakeholders

Presenter	Basis of definition	Types of stakeholders
Charkham	Transactional contract of related groups and enterprise	Contracted stakeholders, Public stakeholders
Clarkson	Tightness of stakeholder groups and enterprise	Primary stakeholders, Secondary stakeholders
Wheeler	Tightness of social dimension and enterprise	Primary social stakeholders, Secondary social stakeholders, Primary non-social stakeholders and Secondary non-social stakeholders
Mitchell	Legitimacy, Power and Urgency of stakeholders	Definite stakeholders, Expected stakeholders and Potential stakeholders

Fix-point collection. Residents discard WUHA to makeshift sites designated on the appointed time. Many cities stipulated that residents can discard WUHA to some designated sites in some one or several days every year or month. After that the departments concerned carry them away. As in Bonn, there are two days every year for collecting WUHA. On such two days residents in Bonn sort out the eliminated refrigerator, TV set, computer and so on and stack them together on the wayside. The municipal enterprises carry them away with big trucks.

In addition, flea markets all over Germany provide one way to handle with WEEE. Relevant Statistical data show that the sales of old electrical appliances on the flea markets account for 7% of total sales every year. ^[4]

b) *Dual recycling system and the “green dot” logo*

The function carrier of dual recycling system in Germany is a company named DSD. And the system coexists with the local processing system. DSD undertakes recycling obligations of each enterprise and enables them to concentrate on their core business. DSD charged to the enterprises that used “green dot” trade mark license. Operations of DSD relied upon it rather than government subsidies. If some enterprise does not agree with using “green dot” trademark license, he must fulfill his obligation to recycle, and come up with proof.

2) *WUHA recycling management system in the Netherlands*

Compared to other European countries, Netherlands began and performed earlier in terms of WEEE management legislation and practice. On the April 21st, 1998, the Netherlands promulgated "Brown, white goods and appliances Act" before the EU directives issued (February 2003). WUHA recycling management system was based on the principle of Extended Producer Responsibility (EPR) and mainly due to NVMP system.

NVMP system was established according to the 1998 "Brown, white goods and appliances Act" by the Dutch Association for the disposal of Metal and Electrical Products. ^[5] The operations of NVMP system are always in good condition. In the early 2001, the per capita collection rate was 4.13 Kilograms per year, which reached the EU Waste Electronic & Electrical Equipments (WEEE) Directive targets specified.

Now NVMP system executes visible charges. The disposal expenses were added to the new product prices. And for each type of products the charges were fixed. Those consumers must pay the visible disposal expenses at the time of purchase. The producer is in charge of recycling fees. After the retailers received the recycling fees, they would transfer accounts to the producers by regular payment. Producers hand in the corresponding processing fees to NVMP every two months according to the product type and quantity of sales. Stakeholders of this system were shown in fig. 1.

3) *WUHA recycling management system in the United States*

So far the U.S. has passed no nationwide legislation. While California passed the act— “The Electronic Waste Recycling Act of 2003”. WEEE management in U.S. was carried out by electronic industrial circle, state governments, state environmental protection administration and non-profit organizations jointly. Among

them, the U.S. electronic industrial circle played an important role in the process of boosting the resource of WEEE.

a) Deposit system

Deposit system is widely used in recycling system and stakeholders have been brought into recycling system. [6]

b) The spontaneous market adjustment mechanism

When the electronic products end of life, the products will be directly sent to the recycling and reuse of decomposing bodies. And these recycling institutions are solely driven by profit, follow the rules of market economy and rationally utilize renewable resources in exchange for proper rewards. [6]

c) Effective incentive mechanism of classification recycling

An American garbage collection company named Recycle Bank created a new garbage collection mode. Users, who classified the recyclable waste, threw into special bins and sent WUHA to the designated collection points could obtain scores from Recycle Bank per month, but also spend the scores in specified trade companies. This made a huge success, greatly mobilized the enthusiasm of users and benefited communities, businesses, local government and the environment. [7]

According to the above analysis about recycling mode, the recycling management systems of different countries have different characteristics. See table 2. The government plays an important role on WUHA recycling management. The cooperation between stakeholders is guaranteed to promote renewable resources industrial of WUHA and to protect the healthy development of the industry. The economy is the driving factor to ensure all stakeholders' active participation in recycling activities. Compared with developed countries, the Participant is single and the main one involved in the distribution of related responsibilities is not clear in Chinese WUHA recycling management.

3.2 Analysis stakeholders of WUHA recycling management system in China

1) The importance of evaluation stakeholders of WUHA recycling management system

Mitchell score method was proposed in 1997 by Mitchell and Wood. It combined the definition and classification of stakeholders. First of all, the enterprise stakeholders must have at least one of the three properties: legitimacy, power and urgency. Legitimacy is used to reflect whether a group has a legal and moral or in specific circumstances of the claim on the enterprise. Power reflects that whether a group has the position, ability and means to affect enterprise decision making. Urgency can inform whether the needs and aspirations of a group can get the immediate attention and support from corporate management or not. According to the three attributes, we can score on the likely stakeholders. According to the scores, stakeholders could be divided into three types: a) Definite stakeholders, this type of stakeholders have legality, urgency and power at the same time. They are the first and foremost objects for business to pay close attention to. b) Expected stakeholders, with any two of the three properties. c) Potential stakeholders, only has one of the properties.

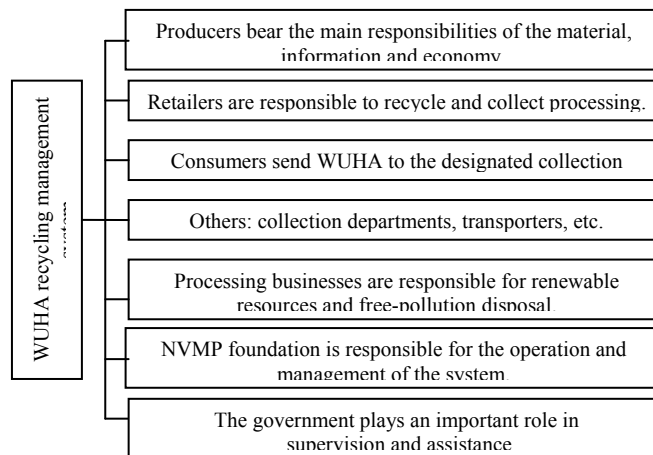


Fig.1 Stakeholders of WUHA recycling management system in Netherlands

According to Mitchell's three properties about definition of stakeholders, this study suggests that professional recyclers, second-hand market, consumers and producers are determinacy stakeholders. While processors, semi-fixed recyclers, retailers, government and industry associations are expected stakeholders. Scientific research institutions, financial services and logistics center are potential stakeholders. Detailed in table 3.

2) *The status, roles and responsibilities of stakeholders in WUHA recycling management system*

It is necessary that we should identify stakeholders' status and effect in the whole system, concern about their wishes and requirements and try to meet them. The purpose is to arouse their enthusiasm and to make it fulfill corresponding responsibilities and obligations.

a) *Producers*

Producers (manufacturer/importer) should assume primary responsibilities in physical, economic and information.

Disclose product information. Product manuals must include information about environmental performance of products. It is the function to guide consumers purchasing more environmentally friendly products and to inform them the correct way of processing waste products.

In strict accordance with the EPR, producers undertake processing fee of recycling WUHA on their own initiative. At the same time, establish recycling system through their own sales outlets and maintenance points.

In order to facilitate the government supervision of recycling WUHA, producers should provide informations like product sales and the quantity of WUHA recycled and reused from social networks and their recycling system.

Table 2 Characteristics of different national management systems

countries	Relevant laws and promulgated time	The main bearers of responsibility	Source of expenses
Germany	"Electrical and Electronic Act" promulgated on March 16th, 2005	Government, Producers	Producers
Netherlands	April 21, 1998 promulgated "Brown, white goods and appliances Act", July 6, 2004 and July 19 passed "WEEE Management Decree" And "WEEE Management Regulations	Producers, Retailers, Consumers and so on	Consumers
the U.S	National legislation is not uniform, some states own legislation alone	Industry plays a main role, state government and national environmental protection agency	Government, Producers

b) *Retailers*

Retailers are bridges which can connect producers and consumers. Under the condition of incomplete recycling management system, Retailers can assume the main responsibilities of recycling through their own sales network.

In sales transfer the information of products related to environment and recycling channels to consumers.

Accept the entrustment and assist producers in recycling WUHA. Simultaneously, the retailer must spare no efforts to establish clear recycling channels for recovery of waste.

c) *Consumers*

Consumers provide WUHA and play an important role in the recycling management system.

The government agencies, schools and other units who bought the electrical appliances with the financial provision should participate in activities of compulsory recycling. And regularly report the scrap amount and disposition of their wastes to the competent government department.

Table 3 Mitchell score WEEE Management System

Types of Stakeholders	Stakeholders	Urgency	Power	Legality
Definite stakeholders	Professional recyclers	√	√	√
	Second-hand markets	√	√	√
	Consumers Producers			
Expected stakeholders	Processing plants	√		√
	Scavengers		√	√
	Semi-fixed recyclers		√	√
	Retailers		√	√
	Government Industry associations	√	√	
Potential stakeholders	Scientific research institutions	√		
	Financial services	√		
	Logistics center			

For the Banks, enterprises and Internet cafes with non-financial provisions, the generated waste electrical appliances should be centralized and sent to the recycle bins with or without compensations. It is necessary to build recovery files of each unit.

Residents and other general consumers should promptly send their WUHA to the recycling established by the government departments or retailers, or contact with the recyclers who provide door-to-door recovery service.

d) Recyclers

In China there are few regular municipal recycling. Most are individual companies without standardized management and itinerant recycling scavengers. Several pilot recycling enterprises are unable to compete with the itinerant scavengers for the very high recycling cost.

Recyclers should establish recycle bins in electrical equipment sales agency and communities. And retrieve the waste electrical equipments from enterprises and residents paid or not in accordance with the pricing of waste electrical recycling rate.

Recyclers should keep the recycling electronics safely and prohibit collectors from disassembling unauthorized or selling. One thing is certain that recyclers are responsible for transports and deliver to the accreditation processors of waste electrical appliance to carry through the science and sound processing.

e) Processing plants

Waste electrical processors require obtaining the relevant qualifications issued by the State. In addition, they should actively support scientific research institutes' research and development; learn home and abroad advanced processing technology. The profits of processing enterprises are directly affected by the holders of WUHA and recyclers' act.

f) Government

The government has an irreplaceable function in guiding the development of the industry and rectifying the market order. We should take advantage of the influence of franchise, demonstration project and the preferential tax policies to ensure the smooth development of WUHA recycling industry^[8].

Relevant government departments should quickly rectify the waste electrical secondary trading market and regulate the incorporated collectors gradually into the regular recovery for unified management. Economic factors should be converted into effective incentive mechanism, and the cooperation between stakeholders should be strengthened.

4. WUHA Recycling Management System Reference Model in Line with China's National Conditions

In the process of establishing WUHA recycling management system in line with China's national conditions, deposit-refund systems should also be considered. That is, on selling electronic products, producers pay deposits and taxes to the government, and the deposits are added to the price. The undertakers of deposits are producers, dealers (wholesalers/retailers) and consumers in order. In this model, on returning the WUHA, consumers can receive the refunds. Surely, the government should take the lead in establishing WUHA recycling management system, and be sure to set up WUHA management institutions. Fig. 2 illustrates this situation. The WUHA management institutions' tasks are described as follows: to fetch and register the information about the recycling amounts and types of WUHA by recycling points and the trading volume in the secondary market, distribute deposits and taxes to recycling points, taxes to processing plants.

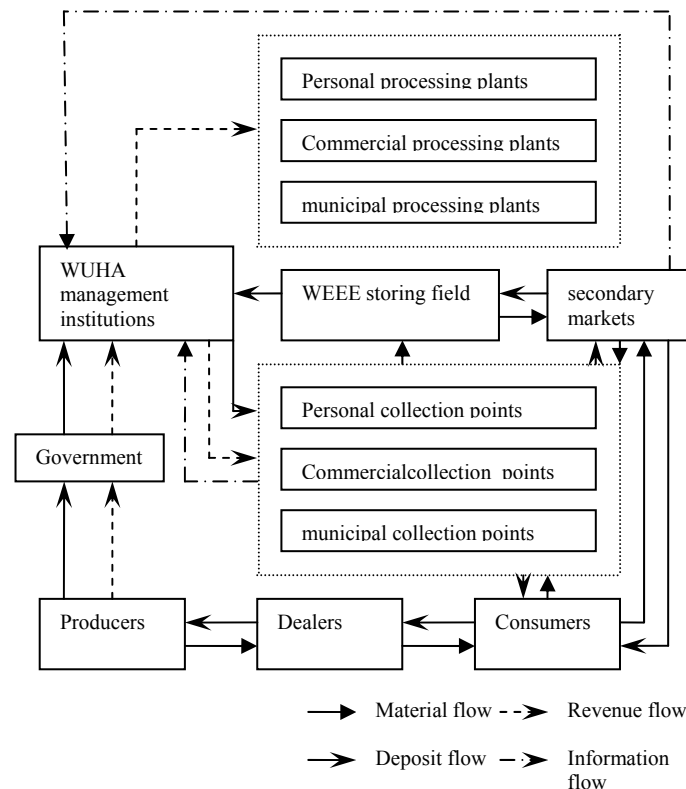


Fig. 2 WUHA recycling management system reference model in line with China's national conditions

The government should establish municipal recycling systems referring to the public service departments or enterprise service departments such as banks, post offices and so on. Because the factors needed to consider are the same or similar. Personal collection points and individual processing plants are always set up with private funding, while commercial collection points and processing plants are established by producers and retailers respectively or jointly. It is necessary for the government to allocate land free of charge for WEEE storing field. In the process of planning and construction, the WEEE storage and various WEEE processing plants should be built in the same park. People engage in the scientific sorting and testing at the storing field. After tested and simple maintenance, the old appliances which can still use a long time should send to the second-hand market. The WUHA which are determined to be scrapped must be stored for treatment.

Taxes are partly used for the establishment and operation of the WUHA recycling management system, and the other part as the processing fee. Revenue comes from two parts: one part of producers to bear and the other part included in the electric price which is undertaken by consumers.

If there is the guidance of government policy, the implementation feasibility of the above reference model of WUHA recycling management system will be larger. Above all, it clears the main undertakers of responsibility and fee sources. So the issues that it is difficult to recycle WUHA in China and the disordered recycling situation can be resolved or partially resolved.

5. Conclusion

In summary, the case that the appliance recycling of waste has been in disorder and lack the guidance of theory in recycling process, lead to the low efficiency and inefficient in recycling WUHA. Therefore when learn the management experience from developed countries; we need to combine in China's national conditions. For one thing, the reasonable definition of all stakeholders in the WUHA recycling management system, conforming their status and roles and clearing their respective responsibilities by the relevant laws and policies are of vital importance to the establishment of the sustainable recycling management system. For another, the government should play a good role in guiding the development of WUHA recycling industry, and strengthen the cooperation between stakeholders. Thus it will be soon to achieve the synergy of stakeholders and to establish a stable efficient recycling management system.

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