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Survey on disposal behaviour and awareness of mobile phones in Chinese university students

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Abstract

Retired mobile phones represent the most valuable electrical and electronic equipment in the main waste stream because of such characteristics as large quantity, high reuse/recovery value and fast replacement frequency. An online survey was conducted in the university students in China to identify the disposal behaviour and awareness of mobile phones, which will promote sustainable management of retired mobile phones. The results show that about 22% of the respondents replace their mobile phones annually, while most respondents replace their phones in 2-3 years. The most common reason for mobile phones replacement is the physical broken. 64% of the respondents stockpile their most recently retired phones mainly due to lack of formal management system. The survey results on mobile phones consumers’ environmental awareness also can help improve the policy-making. Nearly 50% of the respondents believe the recycling cost of the retired phones should be shared by all the stakeholders. The incentives with cash or voucher will be the efficient take-back approach. Some suggestions for constructing efficient management system for retired mobile phones are given based on the results and discussions, in which the important effects of the monetary incentives and targeted publicity are emphasized.

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1. Introduction

The mobile phone has become the most ubiquitous electronic product. At the end of 2011, it was estimated that there were 5.9 billion mobile phone subscribers globally[1], of which 0.98 billion were in China[2]. Meanwhile, the rapid technology innovation with better functions and models impelled the customers to change mobile phones more and more frequently, which leads to the short lifetime of mobile
The retired mobile phone is a kind of typical WEEE with the characteristics such as large quantity, high reuse/recovery value and fast replacing frequency. Due to the relatively small sizes, mobile phones can be easily stored or thrown out with the municipal solid waste[3, 4]. At the same time, many mobile phones are not disposed in the proper way (through reuse or recycling) but stockpiled[5-7].

Research on consumers’ disposal behaviour can provide useful information for sustainable management of retired mobile phones. Focusing on the using behaviour of mobile phones among students in the US, Selian found that there is strong relationship between basic information (gender and age) and the various factors in the usage of mobile phones[8]. Darby and Obara analysed household recycling behaviour and attitudes in relation to the disposal of small WEEE (which including but not specifically addressing mobile phones) in the UK, and concluded that a one-size-fits-all approach is not appropriate for the WEEE recycling[3]. Nnorom et al. analysed consumer behaviour towards waste mobile phones, discussed their willingness to participate in waste mobile phones recycling and to pay for a more environmental friendly mobile phones[9].

It is estimated that more than 77 million mobile phones retired in 2008 in China, while only 4 million in 2000[10]. Only 1% of retired mobile phones are recycled in the formal channel, while the rest majority are stockpiled or even flow to the informal treatment sectors. The recycling rate in the formal sectors is far below the global average value (3%)[7]. Therefore, it is necessary to analyze the consumers’ disposal behaviour and awareness, to provide suggestions for sustainable management of retired mobile phones in China.

The university students belong to a typical group of youth. They are generally well educated and easy to accept the fangle, and have strong consumption ability [11]. Therefore, disposal behaviour and awareness of mobile phones in Chinese university students are assessed in this study. The results are demonstrated followed by the suggestions for sustainable management of the retired mobile phones in China.

2. Methods

2.1. Survey in university students

A questionnaire was designed for online survey to assess the students’ disposal behaviour and awareness of mobile phones. The survey was conducted between March and May 2012, which focused on the students in Chinese universities and independent institutes, mainly including postgraduates and undergraduates.

The content and type of the questions are shown in Table 1.

Table 1. The content and type of the questions in the survey.

| Question content | Question type |
|------------------|---------------|
| Awareness of the hazardous materials in the retired mobile phones | Multiple choices with single answer |
| Awareness of the precious metals in the retired mobile phones | Multiple choices with single answer |
| Awareness of mobile phones take-back services | Multiple choices with single answer |
| Awareness of the sharing mechanism of recycling cost | Multiple choices with single answer |
| Dispose options for the most recent retired mobile phones | Multiple choices with single answer including an open-ended alternative response |
| The effect of incentives on students’ willingness to use mobile phones take-back services | Multiple choices with multiple answers including an open-ended alternative response |
| The expected cash refund from the paid mobile phones take-back services | Multiple choices with single answers including an open-ended alternative response |
The questionnaire was firstly handout to a group of 100 students in Hebei University at Baoding to confirm its validation. The final questionnaire was put on the website (http://www.sojump.com/jq/1370980.aspx) and can be accessible to all the university students in China (including China mainland, Hong Kong, Macao and Taiwan).

3. Results and discussions

A total of 1011 complete questionnaires were responded. In the following sections, the samples sizes (1011) were depicted as N.

3.1. Disposal behaviour of mobile phones

The replacement frequency is summarized in Fig. 1. In all the respondents, about one fifth (21.86%) replace their mobile phones annually, most respondents (38%) replace their phones in two to three years. This result conforms with the previous researches[12, 13] and based on it we can estimate the average life time of the mobile phones used by the respondents is about 2 years.

![Fig. 1. Frequency of mobile phones replacement.](image)

The reasons for mobile phones replacement are summarized in Fig. 2. The most common reason is to take place of the broken phones. Combine this point of view with the result in Fig. 1, it can be deduced that many mobile phones used by students are broken in three years or little more. Although no detail information was collected in relation to how the phones broke or the extent of the damage, this phenomenon seems to be contradictory with the assertion that the technical life-span of a mobile phone is 10 years[14].

There are also many respondents replace their mobile phones because of poor function, stolen and old style. The replacement caused by the enthusiasm of new technology and the pursuit of fashion are seldom, only make up 7.42% and 5.04% respectively, which are different from the previous studies[14, 15]. This difference may due to the distinction of consumption structure between China and developed countries. The replacement taken by the network operators (contract with new mobile phone or network upgrade) are less than that in the developed countries, which is also due to the distinction of consumption structure.
The dispose options for the retired mobile phones are summarized in Fig. 3. More than half of the respondents (64%) stockpile their most recently retired phones, which concurs with previous research in China and some other countries[12, 13]. One fifth of the mobile phones are donated or gave to someone by the owners (20% and 36%), while 7% are sold to the second-hand market. As a result, the amount of mobile phones which are directly recycled are quite low (6%). A small portion of the retired phones (3%) are thrown in the municipal solid waste, which is lower than global study (4%)[7], but may still lay potential environmental risks to the human health and environment.

The reasons for stockpiling are summarized in Fig. 4. The most common reason is the respondents “don’t know how to deal with their retired mobile phones”, followed by the inconvenience of the take-back services. Stockpiling the retired mobile phones as spare for alternate, which is the most common reason among university students in the UK[12], seems to influence less students in China.
3.2. Awareness of mobile phones take-back services

Consumers’ attitudes and awareness are the key factors to the retired mobile phones management system and policy making. The awareness of take-back is basic information for sustainable management of the retired mobile phones.

Economic responsibility is chosen here instead of the environmental responsibility to analyze the consumers’ awareness of products life cycle environmental performance[13]. As compared with the responsibility of environmental protection, an abstract and macroscopic concept, the economic responsibility of retired mobile phones is definite and microscopic, which can be easily understood and accepted by the public. The recycling cost is chosen to represent the economic responsibility in this study. As showed in Fig. 5, most of the respondents believe the recycling cost of retired mobile phones should be shared by all the stakeholders (37%), or undertaken by the producers alone (34%). Less than one fifth of the respondents believe the government should undertake the recycling cost alone, while previous study in China showed that most of the respondents believe the government should take the main responsibility for environmental protection[16]. The low ratios on retailers, network operators and customers show the lack of life cycle thinking.

The respondents’ willingness to join the take-back services can be evoked by different policy and
economic tools, as Fig. 6 depicted. The most efficient incentives are those with cash or voucher, while the incentives with free or discount text message, prize draw, free or discount ringtones seem to be the bad choices for the organizers. From the important role of the incentives with cash or voucher, we can infer that the respondents want to get some financial return when recycle their retired mobile phones for the residual values. So, how to use the monetary incentive properly is crucial to the success of take-back services.

![Fig. 6. The effect of the incentives.](image)

The expected cash refund from the paid mobile phones take-back services is summarized in Fig. 7. When participating the paid mobile phones take-back services with a mobile phone which was manufactured in five years ago or broken, the expectant amount of the monetary incentive concentrates on RMB 20-100 yuan, which is chosen by 72% of all the respondents. However, it is far beyond the exchange price and the internal value[6], this may partly explain the high stockpiled rate: the big gaps between owners and market prevent the deals and make the retired mobile phones stockpiled. So how to use the pricing mechanism to determine the rational exchange price of retired phones and make the owners accept it is the key element for a successful take-back service.

Environmental and charitable incentives are also efficient due to the concern of respondents. But compared to financial needs, they seem to be less important. Incentives with free or discount text message, prize draw, free or discount ringtones maybe not attractive to the respondents, when the incentives with free or discount airtime is more attractive. The reason may be that, there are many pricing packages which include a complimentary number of free text message and ringtones in China to attract the customers. The number of free text message and ringtones in these pricing packages can usually meet the customers’ demand, so they don’t need any more, even for free. But the airtime is more expensive relatively and not enough in the pricing packages, so the incentives with free or discount airtime are still attractive in China, which is different with the previous study in the UK[17]. The demand of ringtones can be satisfied easily, so the incentives with free or discount ringtones would possibly not appeal to the majority of respondents and maybe the bad choices for the take-back services.
The recycling cost share that the customers willing to undertake is showed in Table 2, more than half of the respondents will afford less than 5% of the recycling cost of the retired mobile phones. The willingness to pay (WTP) decreases sharply with the increase of percentage of the recycling cost. This phenomenon concurs with the results of the awareness of sharing mechanism of recycling cost (Fig. 5) and the previous research[16], which shows the customers trend to minimize the recycling cost they need to undertake.

Table 2. The recycling cost share that the customers willing to undertake.

|          | 18-24 Male | 18-24 Female | 25-30 Male | 25-30 Female | Total |
|----------|------------|--------------|------------|---------------|-------|
| 0-5%     | 207        | 144          | 166        | 69            | 586   |
| 6-10%    | 128        | 71           | 59         | 20            | 278   |
| 11-15%   | 38         | 21           | 25         | 2             | 86    |
| 16-20%   | 17         | 8            | 9          | 1             | 35    |
| 21%+     | 14         | 5            | 5          | 2             | 26    |
| Total    | 404        | 249          | 264        | 94            | 1011  |

4. Conclusions and suggestions

The results of behaviour and awareness survey can provide important information to construct the sustainable management system of the retired mobile phones. About 22% of the respondents replace their mobile phones annually, while 38% respondents replace their phones in 2-3 years. The most common reason for mobile phones replacement is to take the place of the physically broken phones. Another important behaviour of university mobile phone users is stockpiling, the result shows 64% of the respondents stockpile their most recently retired phones and the most common reason is that there is no proper take-back service. Most of the respondents believe that the recycling cost of retired mobile phones should be shared by all the stakeholders (37%), or undertaken by the producers alone (34%). Specifically, the economic incentives with cash or voucher, which is chosen by 81.21% of the respondents, will be efficient for the tack-back services.

Based on the results, there are several experiences applicable to the management of retired mobile phones can be learnt. Primarily, retired mobile phones are small in size and light in weight, which make stockpiling possible and set obstacles for the take-back services. It is important to stimulate the owners to
participate in the take-back services. The monetary incentives are realization processes for the residual value of retired phones which can drive the owners to participate in the take-back services. An efficient formal take-back services network is needed, in which the third party take-back enterprises may emerge as the core. Secondly, the targeted publicity can be used to promote the awareness of the mobile phones owners.

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