Consumer’s Perception Regarding Recycling of Mobile Phones: A Prospective Assessment in the State of São Paulo, Brazil

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Abstract—Consumption of mobile phones has become a consumer fever in Brazil with more than 190 million devices connected at the national market in 2010. This impressive figure leads to an important question: what is the final destination of these devices at the end of their lifecycle? The main purpose of this paper is to evaluate consumer’s behavior in terms of mobile phones discard and recycling in Brazil based on (i) a literature review of the main practices and programs involving reverse logistics of mobile phones currently in place nationwide; and (ii) a quantitative survey carried out in São Paulo state in order to seek the consumer’s perception concerning mobile phones recycling and other factors that also influence their behavior in this regard. The survey results showed that although 60% of the respondents know that a mobile phone can be recycled, only 7% have already recycled his/her old device. It was also possible to identify the main factors that could contribute to increase the mobile phones recycling and also the most convenient collecting points according to the respondents’ answers.

I. INTRODUCTION

The market expansion of electronics has been pushed by technological advances and economies of scale resulting in new features, improved performance and lower cost. The major negative externality of this has been the rapid obsolescence of equipment generating huge amounts of wastes.

A number of authors has studied e-waste latency with different approaches, including the efficiency assessment of recycling programs [1], improper disposal and the resulting problems [2], the inclusion of e-waste policies on solid waste management [3], major management challenges [4], and the introduction and management of reverse logistics systems [5]. While this has been an issue of concern in developed countries for years, in Brazil, the first regulation on the matter regarding specifically on batteries showed up only in 1999. The first regulations on the disposal of mobile phones, batteries and accessories are more recent dating from 2009.

The year 2010 was a milestone for the development of the mobile phone industry in Brazil. In October 2010 the Brazilian mobile phone market reached a density index of 100% indicating that there is at least one cell phone per inhabitant. It means that more than 190 million handsets were in use in the domestic market [6]. These numbers are impressive considering that in 2000 there were just over 20 million devices in operation.

One of the main factors that contributed to the expansion of the sector was the privatization of the mobile service in 1998. The privatization was followed by a period of consolidation of mobile operators countrywide. Presently, as a result of this process, there are only 4 major carriers in operation: VIVO, TIM, CLARO and OI.

Technological developments in the industry coupled with the consumption profile of the Brazilian are two fators that explain the rocketing in the mobile phone sales in Brazil. In 2001, 13 models of handsets were approved by the National Telecommunications Agency (ANATEL) against 147 approved in 2010. Technology innovation improved the quality of service, lowered prices of handsets and was responsible for the convergence of technology into a single device.

The migration from analog to digital technology and subsequently the launch of GSM technology contributed to a jump in the use of mobile phones as both brought a significant gain in quality service and cheapened their use. The devices also evolved significantly over the period via digital convergence. The devices began offering additional technology, such as sending both text and radio messages and, later on, digital camera coupled, GPS, music player. Smartphones, which allow accesses to the Internet and e-mail in real time, are among the most recent innovations.

According to Gartner [7], the category of mobile phones that grew the most in 2010 is the smartphones that allow the internet connection via 3G network. While the worldwide growth of mobile phone sales was 31.8%, that of smartphones grew up 72.1%, representing 19% of total industry sales.

The negative consequence of this rapid expansion and technological development is the high level of obsolescence of mobile phones leading the average consumer to change these devices every 18 months. The question that must be answered in this case is the following: where these obsolete devices are supposed to go? According to a research conducted by Nokia [8], with 6,500 respondents from 13 countries (including Brazil), only 3% of them claimed they had recycled their mobile phones.

Although the recycling rate in the industry of mobile phones is still very low, recycling is growing up in importance nowadays, especially in Brazil [9].

In parallel with the expansion of consumption in Brazil, the development of environmental laws that place responsibility on manufacturers for the environmentally sound disposal of appliances that are no longer in use has been underway at the federal level. Among them, the National Policy on Solid Waste and a resolution of the
National Council for the Environment (CONAMA) are the most important. CONAMA’s Resolution 401/2008 introduced the need of an environmentally sound management and disposal of batteries and laptop batteries, including the old mobile phone batteries based on Nickel and Cadmium. This resolution established that the manufacturer was responsible for the whole process of collection, reuse, recycling, environmentally sound treatment and/or disposal [10].

The National Policy on Solid Waste, enacted in 2010, establishes categories for goods covered by the legislation, especially electronic products and their components. This federal law introduced two important instruments of solid waste management: a shared management and reverse logistics. Under this law, reverse logistics is a set of actions, procedures and means to ease the collection and recovery of solid waste to the business sector, to reuse in its cycle or other production cycles, or other environmentally sound disposal. Shared responsibility is the set of assignments and individualized chained manufacturers, importers, distributors and traders, consumers and holders of public urban sanitation and solid waste management by minimizing the volume of solid waste generated and reducing impacts to human health and environmental quality via lifecycle analysis of the products.

It can be inferred that the increased consumption of mobile phone in Brazil is related to the recent improvement of the Brazilian quality of life. In this regard, it can be realized that there is a growing concern of the government in introducing public policies related to industrial waste management including electrical and electronic wastes. This way, it is necessary to deepen the resources to expand programs of reverse logistics for the mobile phone industry in the country.

Within this context, this paper aims to answer the following question: What is the perception of the user as it regards to the disposal or recycling of mobile phones in Brazil, aiming at the sustainable development of the sector?

A. OBJECTIVES
The main objective of this study is to assess the user perception as it regards to the disposal or recycling of mobile phones in Brazil as well as to contribute to improving the current scenario of recycling countrywide.

The specific objectives are:
1) To diagnose the practices of post-consumer reverse logistics already in place in the mobile market in Brazil;
2) To identify the user’s perception regarding the recycling of mobile handsets;
3) To evaluate the factors influencing the disposal and recycling of handsets from the user’s standpoint;
4) To contribute to the mobile phone market in order to increasing the recycling of post consumer appliances.

II. LITERATURE REVIEW
This section presents the results of the literature review of the following topics: mobile phone market in Brazil, electrical and electronic waste (including regulations pertaining to their management in Brazil and abroad), reverse logistics, and the main barriers to the expansion of mobile phone recycling initiatives and the related reverse logistics.

A. WIRELESS MARKET IN BRAZIL
The mobile phone market in Brazil achieved the density index of 100% in 2010 that means one device per capita countrywide. According to TELECO [6], at the end of that year, the country had about 203 million mobile phone enabled, representing 1.04 units per person. Figure 1 shows the number and density of mobile phones in Brazil in the period between 2000 and 2010.

![Figure 1: Amount of mobile phones and its density in Brazil](source: Based on TELEBRASIL [11]; TELECO [6])
Sales of handsets also grow every year. According to estimates from TELECO [6], around 57 million units were sold in 2010.

Figure 2 shows the evolution of the number of handsets sold in Brazil.

Figure 3 shows the market share of mobile operators in Brazil.

Figure 2: Evolution of both the amount of mobile phone sold per year and the annual population growth
Source: Based on TELEBRASIL [11]; TELECO [6]

Figure 3: Market share of companies operating in the mobile phone area in Brazil
Source: TELECO [6]
B. ELECTRICAL AND ELECTRONIC WASTES

As technology in the IT sector advanced, the mobile phones progressively incorporated features such as: digital cameras, GPS, music players, internet access and emails etc., characterizing the technological process named digital convergence. This breakthrough resulted from large investments made by Nokia, Samsung, Apple and RIM (Blackberry). It is important to highlight that part of these investments is directly related to the use of materials that reduces environmental impacts during use and after the end of their life cycles.

According to the classification of both the European Parliament and the Council on Waste of Electrical and Electronic Equipment [12] in Directive 2002/96/EC, the concept of the electrical and electronic waste encompasses residues of all its components, sub-components and consumable items that are part of the product upon disposal.

According to UNEP [8], the mobile phones have 23% of their weight (excluding batteries) composed of metals, with the remainder composed of plastics and ceramics. One ton of these handsets (without batteries) has about 3.5 Kg of silver, 340 grams of gold, 140 grams of palladium, and 130 kg of copper.

Considering that the global production of the mobile phones in 2010 was 1.5 billion, it could be anticipated that the environmental impact of these products in the end of their life cycle would be considerable. In this regard, it would be desirable that the manufacturing of electronic equipment could be done via recycled metals. The potential for use of metals from recycling of electronic products is 40 million tons per year [13].

According to NOKIA [14], if all of the estimated 4.8 billion mobile phone users worldwide would return at least one out of use appliance, around 380,000 tons of raw materials could be saved.

Widmer et al. [15] mention that electronic products in general have about 2.7% of toxic substances (e.g. cadmium, mercury and lead) and 60% of valuable metals (e.g. gold, silver, platinum and copper).

The RoHS Directive (Restriction on the Use of Certain Harzardous Substances) has been implemented in Europe since 2008. It sets up restrictive limits for the use of certain toxic substances (mercury, lead, chromium, cadmium, polybrominated biphenyls, and polybrominated diphenyl ether) in electrical and electronic equipment in order to minimizing the impact of these devices during their useful life. The WEEE Directive (Waste on Electrical and Electronic Equipment) has also been implemented in Europe and its tolerance limits for hazardous substances are more concerned with the environmental impacts of these products in the end of their life cycle.

According to UNEP [13], the uncontrolled and inappropriate disposal of hazardous substances can cause severe impacts to the environment and human health.

Greenpeace issues a half-yearly ranking of electronic products’ manufacturers that evaluates their environmental practices as it regards to management of the use of toxic materials, waste treatment, and energy consumption in manufacturing and also during the useful lifetime of the appliance [16]. Nokia and Sony - Ericsson are the companies in the mobile phone industry that hold outstanding positions regarding partial or total elimination of the use of these toxic substances.

Over 25 nations have some sort of EPR – Extended Producer Responsibility – programs [17]. Particularly in the United Kingdom, it is estimated that 18 million mobile phones are replaced every year and between 50 and 90 million units are laying aside at home. In this country, there are at least 102 online take-back and recycling / reuse programs that are operated by charities (27%), manufacturers (4%), retailers (8%), network operators (8%), and mobile phone recycling companies which provide actually the majority of these programs (53%) [18]. In Japan, the law requires manufacturers and importers to take back e-waste for recycling, while consumers must pay an end-of-life (EoL) fee – a pre-disposal fee (PDF) – that covers part of the recycling and transportation costs. The mobile phone recycling rates in Japan achieved approximately 20% of all sold devices in 2009. This model adopted in Japan is very likable because consumers, who are a crucial stakeholder of this problem, are also part of the solution working as a co-responsible agent [17].

C. ENVIRONMENTAL LEGISLATION IN BRAZIL

Presently Brazil seems to be in the beginning of an adaptation of its legislation to worldwide environmental standards as it concerns to waste treatment [19].

Used batteries were one of the first regulated electronic waste that deserved specific regulations as it regards to after consumption disposal and its components, especially the limitation of heavy metals, such as: cadmium, lead and mercury. The CONAMA’s Resolution n. 401, from November 4, 2008, legislates on the management of environmentally sound disposal of portable batteries, lead acid batteries, automotive and industrial batteries and electrochemical systems of nickel-cadmium and mercury oxide regarding the collection, reuse, recycling, treatment or disposal [10].

The National Policy on Solid Waste sets up the shared responsibility of the recall and the remaining after use waste, as well as its subsequent environmentally sound disposal, in the case of many products subject of reverse logistics system, including batteries and electronic products and components, among others [20].

In the state of São Paulo, Law number 13.576/2009, details the procedure to be adopted for the management of technological waste including: (i) components and computer peripherals, (ii) monitors and televisions (iii) energy accumulators (batteries), and (iv) magnetized products. This state law introduced a joint liability for the disposal of these wastes involving companies that produce, sell or import products and electronic components. It also requires that these products and components sold in the state of São Paulo
must indicate on the packaging or label information on disposal (e.g. collections places, address and phone numbers), and a warning about the presence of heavy metals or toxic substances in the componentes of the product [21].

**D. REVERSE LOGISTICS**

The CSCMP [22] defines Supply Chain Management (SCM) as the planning and management of all activities involved in the purchase, conversion and logistics management. Furthermore, the activities also include coordination and collaboration with business partners, which can be suppliers, intermediaries, third-party logistics providers and customers. In essence, SCM connects supply with demand through business.

According to the referred Council, recycling is the reverse channel revaluation, in which the material composition of discarded products are extracted industrially, turning back into raw materials that can be reincorporated into the manufacturing of new products. The Council also defines disposal as the last place to which products, materials and waste in general are sent without revaluation.

**E. MOBILE PHONE RECYCLING IN BRAZIL**

Presently there is a small number of recycling programs for mobile phones, batteries and accessories in Brazil and consumers in general are still not familiar with all the existing ones [23].

Box 1 presents a summary of the existing information on websites of manufacturers and mobile operators in Brazil.

It worths mentioning the recycling of electronics (including mobile phones) of two companies: C&A and Descarte Certo (Grupo Ambipar). C&A began a campaign of collecting cell phones and accessories in 2009 and this company had prospects for expanding it to all stores of the group in the following years [25]. This initiative was born with the opening of the C&A’s Eco store in Porto Alegre, Southern Brazil.

Descarte Certo was established in 2009 and offers services on collection, waste management and recycling for old or unusable electronic products. According to this company, any person or company can get rid of its appliances and be sure that they are going to be properly disposed of [26].

**III. RESEARCH METHODOLOGY**

For the definition of a statistically significant sample of respondents a method to calculate Sample Size for Infinite Populations (over than 100,000 elements) was used. According to this method, the sample depends on:

- Extension of the universe;
- Level of confidence;
- Error Maximum allowed;

The percentage with which the phenomenon occurs. Equation (1) for calculating the sample size.

\[
N = \frac{\sigma^2(pq)}{e^2}  \tag{1}
\]

**Company** | **What does it say about the disposal?** | **Information about the collection points**
---|---|---
NOKIA | It has a global program called we: recycle in 100 countries with more than 5,000 collection points | Instructions provided by technical assistance; in Brazil it has a partnership with retailer Grupo Pao de Acucar (collecting places in stores of Extra and Pão de Açúcar)

Sony Ericsson | It reports the importance of recycling in a generic way | Not available

Motorola | I has a detailed content in English on the global company page | It informs the addresses of collection points available in technical support network

Samsung | It has instructions only for battery disposal, but it is difficult to find them; detailed content on this issue available only in English in the global page of the company | Not available

LG | It has instructions only for battery disposal demanding a careful search to find detailed information on this issue | Not available

Apple | It has clear instructions on disposal of equipment | It allows the handset user to send his / her device to be recycled by mail

RIM Blackberry | No information is available about this issue | Not available

HTC | No information is available about this issue | Not available

VIVO | It has easy to find information about the disposal of mobile phones, batteries and accessories | 3,400 collection points in VIVO’s stores and resellers

TIM | It has little instructions on the electronic waste disposal and they are not easily accessible | It has a partnership with Papa Pilhas program of Santander

CLARO | It has little instructions on the electronic waste disposal and they are not easily accessible | 2,000 collection points in CLARO’s stores and resellers

OI | It has little instructions on the electronic waste disposal and they are not easily accessible | Collection points in OI’s stores and resellers

Box 1: Summary of information about disposal of mobile phones, batteries and accessories from manufacturers and operators in the Internet.

Source: Adapted from [23]; [24]
To determine the sample size statistically representative for the population of the state of São Paulo, Brazil, the following parameters were established:

a) Maximum error: 5%
   If the maximum error is 5%, \( e^2 = 25 \).

b) \( p = 50 \)
   Whenever it is not possible to estimate a proportion of the phenomenon, \( p = 50 \) should always be used.

c) Confidence level of 95% (2 standard deviations).

By Equation (1) and the parameters used, the sample size for the survey is 400 people.

To perform the procedure of data gathering, a questionnaire was designed and made available on the internet via the search tool QuestionPro - \text{http://reciclagem-celular.questionpro.com/}.

In order to organizing the correct tabulation of the data, there were 15 multiple choice questions following a logical order, as follows: (i) three questions on the respondent’s characteristics; (ii) six questions designed to understand the respondent's knowledge regarding recycling of mobile phone, and; (iii) six questions designed to understand the “levers” of the respondent for recycling mobile phones.

Some questions were open end allowing the respondents to comment their answers. Part of these comments were included in the analysis of the results to complement the quantitative data analysis.

IV. RESULTS AND DISCUSSION

The respondents of the survey amounted 465 people being 410 (88% of total) from the State of São Paulo that was previously defined as the primary focus of the study. All data analyzes performed in this paper were restricted to replies given by respondents from this state because the amount of responses for it was statistically representative with a confidence level of 95%.

As regards to the age distribution of respondents, 53% are female and 47% male, almost all being above 18 years old, with 54% aged between 26 and 35 years, as can be seen in Figure 4.

A. KNOWLEDGE OF RESPONDENTS ON MOBILE PHONE RECYCLING

The purpose of this item is to understand the level of the respondent’s knowledge regarding the process of recycling mobile phones, through questions that reflect their behavior in situations prior to the study.

Regarding the respondent’s reasons for the disposal of the mobile phone prior to the one he / she is currently using, as can be seen in Figure 5, 27% of them reported that the main reason was obsolescence, 25% due to breaking, 24% due to purchase of a new handset, 15% due to the fact that it is too old, and above 6% due to its theft or loss.

![Figure 5: Reasons for discarding the previous mobile phone](image)

Some respondents commented that they replaced their previous mobile phone due to promotions offered by the carriers, via programs and bonus points. Another factor that motivated the change is the great supply of devices with different features and the continuous technological upgrading.

This behavior can be seen in Figure 6 where 62% of respondents changed their handsets with up to 24 months of use and 38% with over 2 years of use.

![Figure 6: Average time to exchange mobile phone](image)

Both the rapid obsolescence and replacement of these appliances reinforce the importance of communicating to consumers what actions should be taken regarding the proper disposal of their previous device.

By analysing data from handset’s sale since 2000 (Figure 7) and considering that the lifetime of a mobile phone is around 5 years, it could be said that approximately 148
Figure 7: Comparison of the quantity of mobile phones sold in Brazil with the quantity of device in the end of their lifecycle

Source: Analysis made by the authors based on sale’s data [6]

Million devices would be reaching the end of their life cycle in 2011. Figure 7 also shows that handsets sold in 2000 would be reaching the end of their useful life in 2005.

For those consumers that have changed their old mobile phone (Figure 8), 46% of respondents kept the old appliance saved, 34% gave it to someone else, 7% recycled it, 5% threw it out, and 3% sold it.

The destination given by the respondents to their previous mobile phone showed similar level of answers for "I kept it saved" and "I gave it to someone else".

When asked about the knowledge that a mobile phone can be recycled, 60% claimed to know that the device can be recycled. The level of knowledge about the recyclability of these devices varies according to the age of the respondents as it can be seen in Figure 9. I shows that the older the respondents, the more informed they are.

This information may sign that while younger generations are more involved with the theme of sustainability than the older ones, this is not reflected in their actions as it regards to recycling cell phones. Another point to be emphasized is that as the younger change phones more frequently, their old devices may end up being given to someone else or being kept saved as a reserve unit. It means that even for the younger generations there is still much room for awareness.
As concerns to 20% of the survey’s respondents that claimed they had sent a mobile phone to be recycled, 36% reported that they did that in the store operator, 21% in the technical assistance of the manufacturer, and 8% in a retailer (Figure 10).

Figure 9: Knowledge about recycling mobile phones by survey respondents classified by age

B. LEVERS TO IMPROVE RECYCLING

In this section it was made an attempt to identify the levers that could increase the number of mobile phones collected for recycling via the understanding of the respondents on the shortcomings of the current process of recycling and opportunities for its improvement.

When asked about the reasons for the low rate of recycled cell phones in Brazil, 49% of respondents believe that the main reason is lack of knowledge about the possibility of recycling, 19% by lack of knowledge about the destination, and 10% by the low convenience of the disposal site (Figure 11).

Figure 10: Destination of the mobile phone to be recycled

Figure 11: Respondents’ opinion on the reasons for low rate of recycling of mobile phones in Brazil

Another point evaluated in this research are the factors that motivate the respondents to recycle their old mobile phone. Figure 12 shows that the factor that most motivate the respondents to recycle is to "have a convenient place to dispose it of," followed by "have the personal satisfaction that fulfill my role as a citizen" and "know that my phone is properly recycled".
When evaluating the convenience of the collection points for receiving the cell phones to be recycled (Figure 13), respondents claimed that the most convenient place is the supermarket / hypermarket, followed by stores in the mall and the carrier. The post offices, gas stations and pharmacies, despite showing a good amount of points, did not show the same level of convenience as supermarkets and shopping malls. This can be explained by the fact that supermarket or hypermarkets stores are visited weekly or monthly and malls have become major areas for shopping, entertainment and services.

The post offices, gas stations and pharmacies, despite showing a good amount of points, did not show the same level of convenience that supermarkets and shopping malls demonstrating that the level of identification with sustainability and recycling programs should also influence the decision consumer convenience in the question.
According to ABRASCE [27], today there are 416 malls in Brazil, with more than 74,000 stores representing 18.3% of the national retail. Considering that according to most respondents supermarkets and hypermarkets are the most convenient places for mobile phone disposal, new recycling initiatives must be incentivated in these places.

According to Figure 14, the main attributes that respondents consider when purchasing a new mobile phone are the brand (implying good quality), affordability and ease of use. It is interesting that a brand concerned with the environment was not seen as one of the most important attributes by respondents when purchasing a new appliance.

It is interesting that crossing the data of that answer to the age of the respondents, one can observe a significant difference in the level of importance of each of the attributes studied. Particularly for the attribute "brand concerned about the environment," for respondents aged over 45 years, on average this was considered the fourth attribute for purchase decision, while for respondents aged 31 to 35 years that was the least important attribute.

It is also worth mentioning that the partnership between Nokia and Pão de Açúcar supermarket in the "Alô Recicla" (Hello Recycle) program is expected to come up with good results because these companies are recognized by their actions on recycling and are also providing collecting polls in the most convenient places to dispose of handsets as considered by the respondents of this survey.

V. FINAL REMARKS

It was found that the mobile phone market has grown considerably in Brazil, especially after 1998 when the privatization of the former Telebras took place. In 2010 the density index of 100% was reached with at least one cellular phone per capita on average countrywide.

Furthermore, the National Solid Waste Policy was passed in 2010, which defines the responsibilities of the various stakeholders of the production chain (including the consumer and government) in the process of solid waste management. This policy encourages the private sector, state and society to take actions aligned with sustainable development. In this regard, in January 3, 2013, the federal government issued a notice calling manufacturers, importers, distributors and retailers of electronics and their components to elaborate a sectoral agreement proposal aiming at the implementation of a reverse logistics system nationwide for these products. Since the major challenge to elaborate these proposals has been to make agreements among different segments of the electronics sector, in most of the states this process has been headed by the Brazilian Association of Electrical and Electronics Industry – ABINEE.

In addition, public initiatives are also emerging within municipal government throughout the country to submit integrated plans on solid waste management in order to apply for federal funds for investments in public cleaning services. Taking a very optimistic scenario into perspective for the coming years, the incorporation of coordinated actions of the electronics industry on reverse logistics by these integrated public plans would be a good strategy at least for the partial implementation of our National Policy on Solid Waste.

During this research it was possible to raise important and pioneering initiatives in the process of recycling mobile phones in Brazil, such as programs undertaken by VIVO, Nokia, C&A, and Descarte Certo.
It was identified that 62% of respondents exchanged their mobile phones up to 24 months of use. However, among the respondents aged between 18 and 25 years, 69% changed their handsets in a time period less than 24 months. According to the respondents, the main factors that lead them to change their mobile device are technology obsolescence (27%) and breaking (25%).

The survey revealed that after making the switch from mobile phone, 46% of respondents keep the old device, 34% give it to someone else and only 7% recycle it. When asked for the reasons of the low rate of recycled mobile phones in Brazil, 49% of the respondents believe it is related to lack of knowledge about recycling, 19% by lack of knowledge of the final destination given to these handsets, and 10% by the low convenience of the discarding places. Among the youngsters, 60% believe that the main reason is related to lack of knowledge about recycling.

These figures are somewhat related to the number of respondents who claimed to know that the mobile phone can be recycled. Around 60% reported knowing that a mobile phone can be recycled, 24% mentioned having a full knowledge on the subject, and 20% indicated having recycled a cell phone before.

For those respondents that had previously recycled a mobile phone, 36% did it in operator’s stores and 21% in the technical assistance of the manufacturer. When asked about the appropriateness of the collection points, stores in supermarkets / hypermarkets followed by stores in malls and operator’s stores were pointed out as the most convenient ones.

In order to increase the amount of equipment to be recycled, respondents reported that the factors of greatest incentive would be: (i) to have an easily accessible location to dispose it of; (ii) to have the good feeling of playing his / her role a citizen; and (iii) to believe that the disposed appliance would be properly recycled. It is noteworthy that financial incentives didn’t encourage respondents as much as other options available.

An analysis of these responses indicates that there is a great opportunity for improving the current initiatives for collecting mobile phones, batteries and accessories from the infrastructure standpoint (e.g. extending the reach of the collection points) and also from the communication standpoint via information dissemination about the existing recycling programs, the environmentally friendly disposal options available.

It could be realized that the existing recycling programs show evidences of significant expansion via partnerships between industry and retailers. This is the case of the program "Alô Recicle" that resulted from a partnership between Nokia and Grupo Pão de Açucar. Since the respondents indicated that retail stores are the ones with the greater convenience for installation of collection points, such a strategy might be expanded in the future.

Another action that might be taken is an expansion of coordinated collection programs via partnerships between different manufacturers in the same industry. Other than providing a gain of scale, this action would encourage a sharing of best practices and a cost sharing program among companies in the same industrial sector.

It was possible to identify that there are cultural aspects that impact directly on the action taken on the mobile phone at the end of their life cycle, such as: keeping the device at home even knowing that they are obsolete or broken; attachment to the device, and; lack of initiative on recycling.

REFERENCES