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USER BEHAVIOUR BEFORE MOBILE PHONE DISPOSAL AND RECYCLING IN THE STATE OF SÃO PAULO

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ABSTRACT

Given the privatization of the Telebras system in 1998 and the constant development of new technologies, mobile phone consumption picked up in the form of a craze in Brazil to the extent of in 2010 mile stoning 100% density, i.e., more than 190 million units were then in use within the domestic market. On the other hand, it seems appropriate to wonder what happens to this equipment once their lifecycle ends. Sheltered by this context, the prime purpose of this study is not only to evaluate user behaviour in the State of São Paulo in as much as mobile phone disposal and recycling is concerned, but also to contribute with the improvement of the current scenario. To this effect, some aspects of existing Brazilian mobile telephony market post-consumption reverse logistics practices were diagnosed. A quantitative exploratory survey centred on São Paulo State respondents was also conducted so as to pinpoint their behaviour in terms of mobile phone recycling and assess the factors that influence their disposal and recycling. Outcomes unveiled that although 60% of respondents are aware of the fact that mobile phones are recyclable, only

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7% have so done with their old phones. Finally, the study sought to contribute with suggested mobile phone market actions so as to increase post-consumption recycling.

KEY WORDS: User; behaviour; disposal; recycling; mobile phones.

COMPORTAMENTO DO USUÁRIO EM RELAÇÃO AO DESCARTE E À RECICLAGEM DE APARELHOS CELULARES NO ESTADO DE SÃO PAULO

RESUMO

Com a privatização do Sistema Telebras em 1998 e com o desenvolvimento constante de novas tecnologias, os aparelhos celulares tornaram-se uma febre de consumo no Brasil, atingindo a importante marca de 100% de densidade em 2010, ou seja, mais de 190 milhões de aparelhos em utilização no mercado nacional. Porém, cabe questionar qual o destino dado para esses aparelhos ao final de sua vida útil. Nesse contexto, o objetivo principal deste trabalho é não só avaliar o comportamento do usuário do estado de São Paulo em relação ao descarte e à reciclagem de aparelhos celulares, como também contribuir para a melhoria do cenário atual. Para isso, foi feito um diagnóstico sobre algumas das práticas de logística reversa pós-consumo já existentes no mercado de telefonia móvel no Brasil, além da realização de uma pesquisa exploratória quantitativa (*survey*) com foco nos respondentes do estado de São Paulo para identificar seu comportamento quanto à reciclagem de aparelhos celulares e para avaliar os fatores que influenciam no descarte e na reciclagem. Nos resultados da pesquisa, evidenciou-se que, apesar de 60% dos respondentes terem ciência de que um aparelho celular pode ser reciclado, apenas 7% já reciclaram seu celular antigo. Por fim, no trabalho, buscou-se contribuir com a sugestão de ações para o mercado de telefonia celular a fim de aumentar a reciclagem de aparelhos no pós-consumo.

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PALAVRAS-CHAVE: Usuário; comportamento; descarte; reciclagem; aparelhos celulares.

1 INTRODUCTION

The year 2010 was a positive milestone for the development of the mobile phone industry in Brazil. According to Teleco (Teleco, 2011), in October 2010, the Brazilian mobile phone market flag shipped a 100% density rate and thus there was at least one unit per inhabitant in the country, i.e., more than 190 million handsets were then in use. These are impressive numbers if one takes into account that in the year 2000 there were slightly more than 20 million active handsets.

One of the major contributing factors fostering the segment´s expansion occurred in 1998 during President Fernando Henrique Cardoso´s office: the privatization of the mobile phone service, till then a responsibility sheltered by the Telebras system, which in turn comprised regional and state-owned carriers such as Telesp, Telerj, Telebrasília and others in addition to Embratel, the long distance services provider (Folha de S.Paulo, 2008). This was the country´s largest privatization and ever since then, the number of lines expanded 26-fold.

Once privatized, local carriers faced continued consolidation to the extent that currently, there are only four large service providers in operation: Vivo, TIM, Claro and OI.

The boom in mobile phone sales in Brazil came about given both the industry´s technological evolution and the consumption profile of Brazilian users. This reflected on figures such as those of the National Telecommunications Agency (Anatel) whereby if one looks at 2001 for instance, this institution certified 13 mobile unit models and in contrast, in 2010 an astounding 147 models. Technology also ensured service quality improved, equipment prices reduced and enabled technology convergence into one single device.

The technological migration from analogue to digital platforms and the subsequent launch of GSM collaborated with major leaps in the use of mobile services since they imparted significant service quality gains and reduced the cost of using the same. During the period, equipment also developed in an outstanding manner thanks to digital convergence. Mobile phones came to offer

additional technologies such as text messaging and radio, then coupled digital cameras, GPS and music players and lately, offered intelligent devices known as smartphones that allow for real time web and email access.

According to the consulting firm known as Gartner (Gartner, 2011), in 2010 smartphones - intelligent mobile phones that allow one to connect with the web via the 3G network - comprised the category that most expanded. On a worldwide basis, whilst 31.8% of sales comprised mobile phones, that of smart phones expanded 72.1% and accounted for 19% of the segment´s total sales.

An additional factor that contributed with the increase in the number of phones made available to Brazil´s market was the advance in the number of illegal units. According to Wiziack and Fusco (2011, p. E1) "20% of the lines in the country use equipment that has not been certified by the National Telecommunication´s Agency (Anatel) that primarily comes from China".

The negative consequence of this rapid technological development and expansion is the high level of mobile telephony´s technological obsolescence whereby average consumers switch mobile units every 18 months. The query that calls for an answer is: what´s the destination of these obsolete phones? According to research conducted by the Finnish mobile phone manufacturer Nokia (Nokia, 2008) interwiewing 6.500 people across 13 countries amongst which Finland, Germany, Italy, Russia, England, United States, Nigeria, China, Indonesia and Brazil are worthy of special mention, only 3% of respondents claim to have recycled their mobile phones. Nokia´s survey indicates that:

a) 3% of interviewees have sent their mobile devices to be recycled;

b) 4% of interviewees dumped their phones in the garbage can;

c) 44% of interviewees keep their old phones in a drawer;

d) 75% of interviewees do not know that mobile phones can be recycled;

e) 72% of interviewees state that recycling makes an environmental difference.

In as much as the Brazilian scenario is concerned, the survey suggests consumers not only increased their mobile technology related consumption but also improved their perspective in as much as sustainability and the role companies play in the same, is concerned. Simultaneously, one notices increased governmental concern in coining public policies that address industrial waste disposal management, including those electro-electronic. The National Solid Waste Policy of 2010, known as *PNRS* (Law Nr. 12.305/2010) is but an example of this. Therefore, discussing means to extend reverse logistics programs that the country´s mobile phone industry engages in, proves to be a must.

Sheltered by this context, this study´s purpose is to assess the behaviour of São Paulo State users in as much as the disposal and recycling of mobile phones is concerned with views to ensuring the segment´s sustainable development. To this effect, this study poses to address the following research query: What is the behaviour of São Paulo State´s users in relation to the disposal and recycling of mobile phones?

2 THEORETICAL FRAMEWORK

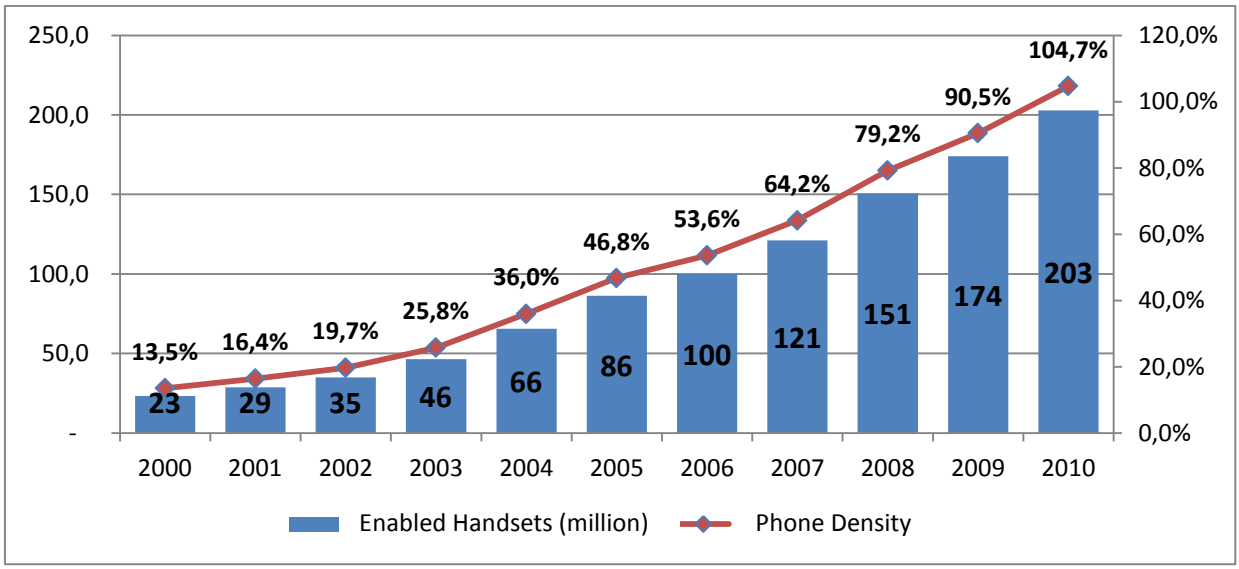
This section of the study discusses topics that pertain to Brazil´s mobile telephony market, electro-electronic waste and mobile phone recycling.

2.1 BRAZIL´S MOBILE TELEPHONY MARKET

Mobile telephony started up in the 1990´s but it´s true expansion occurred as of 1998 when auctions licensing the operation of what was then known as the B band, the opening allowing foreign companies to operate in the country and the privatization of the former Telebras system, took place.

Throughout the following decade, the market experienced rampant consolidation of mobile telephony carriers, the most recent of which took place in 2009 involving the OI and Brasil Telecom merge. In 2011, four mobile telephony carriers accounted for 99.7% of the local market, namely: Vivo, TIM, Claro and OI (Teleco, 2011).

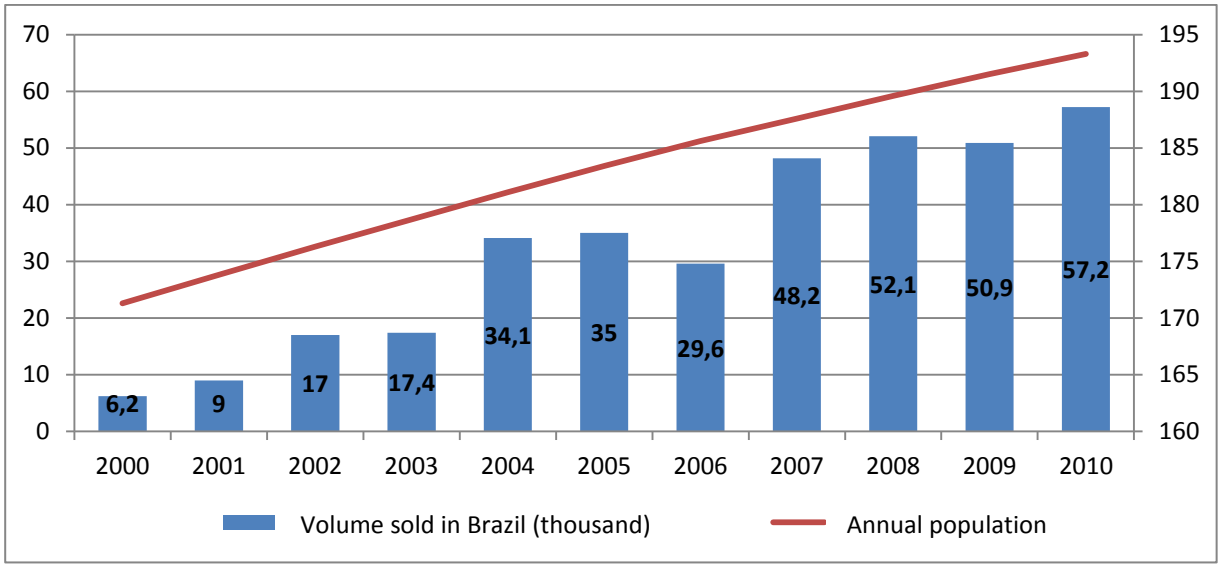
In 2010, Brazil´s mobile telephony market set a major milestone by attaining a 100% density rate, i.e., at least one phone per inhabitant. According to Teleco´s (Teleco, 2011) data, by the closing of 2010, there were approximately 203 million enabled handsets, i.e., 1.04 units per inhabitant. Graph 1 introduces Brazil´s volume of mobile phones and handset density between the years 2000 and 2010.



Graph 1: Brazil´s mobile handset volumes and density
Source: Brazilian Telecommunications Association in partnership with Teleco (Telebrasil, 2011)

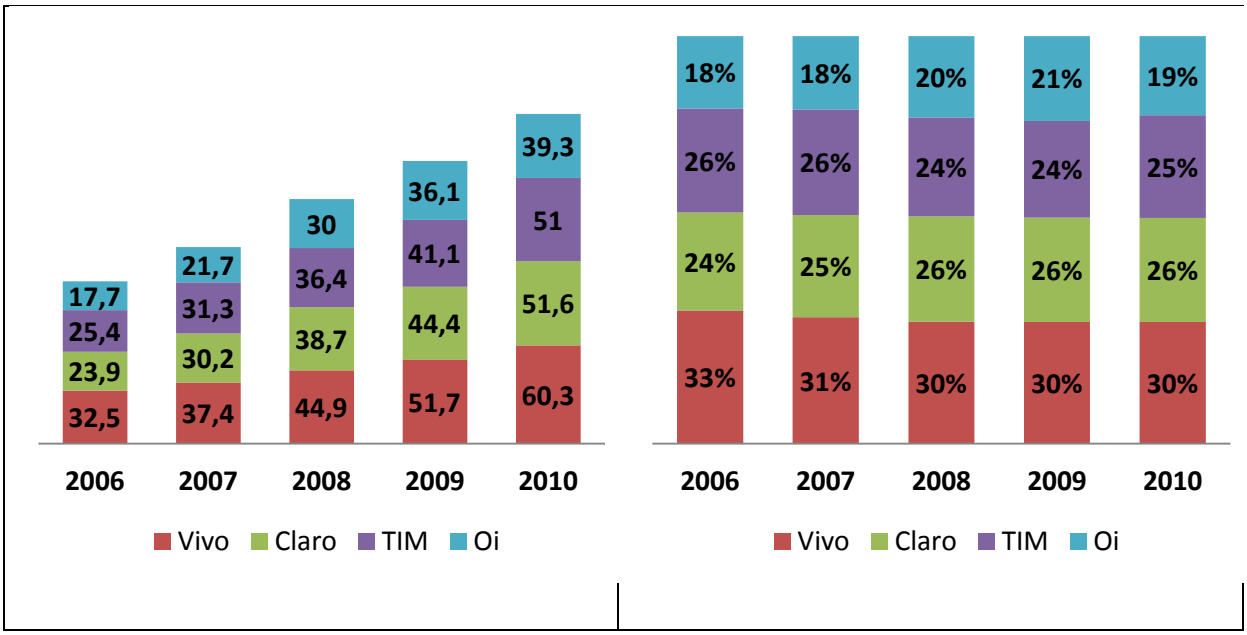
From one year to another, the volume of mobile phone sales also grows. According to Teleco´s (Teleco, 2011) estimates, in 2010, Brazil´s market sold approximately 57 million handsets. If one takes into account these same volumes as of the year 2000, totals almost sum 357 million mobile phones.

There is no official data on mobile phone manufacturer market shares in Brazil, just global surveys that institutes such as Gartner and IDC disseminate. According to Gartner Institute (Gartner, 2011) data, in 2010, 1.597 billion handsets were sold across the globe. Graph 2 presents the evolution of the volume of mobile phones sold in Brazil.



Graph 2: Evolution of the volume of handsets sold in Brazil
Source: Brazilian Telecommunications Association in partnership with Teleco (Telebrasil, 2011)

Graph 3 illustrates the mobile telephony carriers' market share in Brazil.



Graph 3: Mobile telephony carriers' market share in Brazil
Source: Teleco (2011)

2.2 ELECTRO-ELECTRONIC WASTE

With the advancement of technology, handsets increasingly incorporated more and more features such as digital cameras, GPS, music players, internet and e-mail access, etc., to such an extent that digital convergence is ever more embodied. New technologies have lately sought to include even more features in mobile phones such as payment modalities, personal identification, photo recognition of products and so forth.

Such marked advance in the form of new technologies largely derives from massive investments made by mobile phone companies such as Nokia, Samsung, Apple and RIM (Blackberry). According to an annual study that Booz & Co (2010) consulting conducts monitoring annual investments in research and development (R&D), the computer and electro-electronics industry was precisely the one that made the largest investments in 2010, 27% of the total invested sum being allocated to R&D. Part of the new technology investments companies make directly pertains to the use of materials that shall not harm the environment when equipment is used and most importantly, once its lifecycle comes to an end.

According to the European Parliament´s and WEEE (Waste Electrical and Electronic Equipment) Council´s (European Parliament and of the Council, 2003, p. 23) Directive 2002/96/EC, the WEEE concept, i.e., that of electro-electronic waste refers to "electric or electronic equipment that are waste (...) including all of their components, subcomponents and consumables that comprise the product at the time of disposal". Directive 75/442/EEC, Article 1(a) defines waste as "any substance or object that the holder discards or is obliged to dispose of according to local laws that are in force".

According to the Organization for Economic Co-operation and Development (OECD, 2001) electro-electronic waste is "any device that uses electric power that has come to the end of its lifecycle".

When it comes to mobile devices for instance and excluding the battery, 23% of the unit´s weight is made up of metals; the remainder is made of plastic and ceramic materials. According to the United Nations Environment Programme

(UNEP, 2009) for every ton of battery less mobile phones, there´s approximately:

a) 3,5 kg of silver;
b) 340 grams of gold;
c) 140 grams of palladium;
d) 130 kg of copper.

Although it seems not to be much if one takes into account that in 2010 the global production of mobile devices totalled 1.5 billion units, one can well imagine the impact this volume can cause. The metals employed in the manufacturing of electro-electronic equipment could come from recycled materials. Potentially, 40 million tons per annum of metals that derive from electro-electronic recycling processes are made available that could be put to this use. In 2010, Nokia launched its C6-01 model, the first mobile industry´s handset to employ in addition to bio-plastic materials, those recyclable.

According to the Finnish manufacturer´s estimates, if all nearly 4.8 billion world users returned at least one disused unit, there would be 380 tons of raw materials worth of savings plus a reduction in gas emissions that would have the same impact as that of removing four million cars from the world´s streets. A mobile phone is made up of 45% plastic; 35% metals; 10% glass and ceramic; 9% battery; 0.11% of precious metals and 0.9% of other metals. Recycling ensures power, chemical products and residue savings. As much as 65 to 80% of a handset´s material can be recycled but up to 100% can be recovered if transformed into other products and used to generate power (Nokia, 2010).

Using recycled metals is crucial to ensure their availability for the production of new products, whether electronic or not.

Electro-electronic products largely contain approximately 2.70% of toxic substances such as cadmium, mercury and lead. However, valuable metals such as gold, silver, platinum and copper are also present in this kind of equipment and account for some 60% of the total composition (Widmer, Oswald-Krapf, Sinha-Khetriwal, Schnellmann & Böni, 2005).

It is very important to employ materials that do not harm the environment since part of this electronic waste still finds its way to dump sites and sanitary landfills and impacts the environment via, for instance, contaminating the soil and water tables, in addition to releasing toxic substances. If incorrectly handled, the latter can seriously harm human beings.

As of 2008, the European Union implemented the RoHS Directive – Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment– which foresees restricted use of given toxic substances in electro-electronic equipment so as to mitigate the impact of their disposal at lifecycle end.

Via the RoHS Directive, the presence of the following substances in new electro-electronic equipment has been limited: mercury, lead, chrome, cadmium and a range of PBB (polybrominated biphenyls) and PBDE (polybrominated biphenyl ether) flame retardants. Furthermore, effort is being made to restrict the use of products that contain polyvinyl chloride plastic (PVC) and brominated (BFRs), chlorinated (CFRs) and antimony trioxide flame retardants.

The NGO known as Greenpeace every six months issues a ranking of electro-electronic equipment manufacturers whose environmental practices are evaluated in as much as the use of toxic materials, waste treatment and manufacturing process and handset lifecycle power consumption practices are concerned (Greenpeace, 2010). According to this organization, the ranking comprises companies that have partially or fully eliminated the use of such toxic substances whilst others continue to use the same and have not as yet introduced reduced utilization plans. The companies that have most positively captured the ranking´s spotlight are Nokia and Sony Ericsson.

The industry´s highest scoring company in as much as the use of toxic substances is concerned is Sony Ericsson which has, for instance, totally eliminated polyvinyl chloride (PVC) plastic and brominated flame retardants (BFRs) from its products.

In turn, the Finnish manufacturer Nokia was the first to fully eliminate in 2005 the use of PVC plastic in its handsets and to commit to eliminate from all of

its 2010 launches the use of BFR, CFR (chlorinated flame retardants) and antimony trioxide.

The inadequate and unbridled disposal of hazardous substances can cause severe environmental and human health impacts. Under this context, UNEP classifies the emission of hazardous substances into three distinct levels, (UNEP, 2009) namely:

a) primary emissions: hazardous substances within electro-electronic waste such as lead, mercury, arsenic, etc.;
b) secondary emissions: hazardous reactions that emerge from the inadequate treatment of electro-electronic waste, such as incineration, the casting of plastics that contain flame retarding substances, etc.;
c) tertiary emissions: hazardous or reacting substances employed during the recycling of electro-electronic components such as cyanide or other leaching agents such as mercury to separate gold.

It is important to emphasize that even the "greenest" products that comply with all the rulings set by the European RoHS Directive do not impair the use of inadequate methods that promote tertiary emission of hazardous waste.

A negative solid waste treatment practice is the export of the same to developing countries (primarily Africa) under the false pretext of contributing with the development of such countries by promoting low cost access to technology. What one perceives is the shipping of scrapped, unusable products that in the absence of local appropriate policies to receive and treat waste end up at open air dumps or worse, are incinerated together with regular garbage (Miguez, 2010).

To mitigate this practice, in 1992 the Basel Convention was instituted and rules inter-country hazardous substance trade. According to their report, 75% of computerized equipment exported to Africa is trash, i.e., reuse is not economically feasible (Miguez, 2010).

2.3 MOBILE PHONE RECYCLING IN BRAZIL

Handset, battery and accessory recycling programs are still to a certain extent limited and poorly disseminated to consumers in Brazil as one can verify by researching the electronic sites of carriers, manufacturers and retail networks and studies published in scientific literature (Idec, 2009; Moretti, Lima & Crnkovic, 2011).

Chart 1 presents a summary of existing information gathered from each mobile telephony manufacturer and carrier that operates in Brazil´s electronic site.

Company	What they say about disposal	Information on collection points
Nokia	Offers a worldwide program called *we:recycle*, that operates in 100 countries and counts on more than 5.000 collection points. Offers instructions on handset, batteries and acessory disposal via a user friendly portal.	Afterservicing stores. In Brazil they have also partnered with the Pão de Açúcar retail group (Extra and Pão de Açúcar stores offer recycling bins).
Sony Ericsson	In a generic manner informs readers of the importance of recycling.	None
Motorola	More detailed content is only offered in English and even so, on the company´s global page.	Informs the addresses of existing collection points within the afterservicing network.
Samsung	Only offers instructions on the disposal of batteries but the information is not easily located on the site by users. More detailed research has to be conducted to find instructions.	None
LG	Only offers instructions on the disposal of batteries but the information is not easily located on the site by users. More detailed research has to be conducted to find instructions.	None
Apple	Features clear instructions on handset disposal.	Allows users to forward handsets by mail for recycling purposes.
RIM Blackberry	Features no information on the subject matter.	None.

HTC	Features no information on the subject matter.	None.
Vivo	Offers readily visible information on the disposal of handsets, batteries and accessories.	3.400 collection points at Vivo´s stores and resellers.
TIM	Offers limited and hard for users to locate information on the site. More detailed research has to be conducted to find instructions.	Has a partnership with the Santander bank´s "Papa Pilhas" (battery disposal) program.
Claro	Offers limited and hard for users to locate information on the site. More detailed research has to be conducted to find instructions.	2.000 collection points at Claro´s stores and resellers.
OI	Offers limited and hard for users to locate information on the site. More detailed research has to be conducted to find instructions.	Collection points at OI´s stores and resellers.

Chart 1: Summary of information offered at manufacturers' and carriers' websites on the disposal of their handsets, batteries and accessories
Source: Adapted from Moretti, Lima and Crnkovic (2011); IDEC (2009); Analysed manufacturers' and carriers' websites

3 METHODOLOGY

3.1 RESEARCH OUTLINE

To conduct the research, a descriptive survey based quantitative investigation was conducted. According to Silva and Menezes (2001, p. 21), quantitative research "considers that everything is quantifiable, which means translating into numbers, opinions and information to classify and analyse it".

To this effect, as research tool a closed query questionnaire that was made available over the web to the general public yet primarily centred on the population of the State of São Paulo was employed.

The definition of a statistically representative of the State of São Paulo´s sample is relative, i.e., depends on the size of the population. There are several formulas to define samples according to the parameter under scrutiny. The most commonly employed are those based on the phenomena´s percentage.

To define the study´s sample size, i.e., a statistically representative sample of São Paulo´s State the level of reliability was set at 95%. The size of

the research sample was of 400 people, a figure that was established employing selected parameters.

3.2 DATA COLLECTION PROCEDURES

To conduct the data collection procedures a questionnaire was designed and made available over the web via the Questionpro research tool at http://reciclagem-celular.questionpro.com/. To organize the correct tabulation of data, 10 multiple choice questions, following a logical order were applied, organized as follows: three questions covered demographic information and seven sought to capture the respondent´s knowledge before the study´s subject matter, i.e., mobile phone recycling.

Some questions allowed respondents to include additional comments to their answers. These were analysed in a preliminary and non-exhaustive manner and some were included as part of the analysis of results to complementarily illustrate quantitative data analysis.

3.3 DATA ANALYSIS PROCEDURES

All gathered data was compiled by the Questionpro research tool itself. Subsequently, they were exported and analysed employing Microsoft´s Excel software. This enabled information crossing and the preparation of graphs that eased the interpretation of the survey´s outcomes. Each question´s results were individually analysed and replies between distinct queries were crossed so as to understand possible correlations.

3.4 RESEARCH LIMITATIONS

The survey was published and disseminated over the web which to some extent limits open access to all social classes since Brazil still does not have extensive access to the network rates. According to Teleco´s data (Teleco, 2011) in 2009 there were approximately 63 million web surfers and only 27.4% of homes in the country has a computer allowing for World Wide Web access.

Although answers were gathered from several states of the federation, research communication was limited to the State of São Paulo. According to Teleco´s August 2011 data (Teleco, 2011), there were approximately 55 million handsets in the State of São Paulo resulting in 131.92 units per 100 inhabitants.

4 RESULTS AND DISCUSSION

This section of the investigation seeks to analyse the outcomes of the quantitative survey that was applied to a sample of São Paulo´s State population in addition to analysing research findings before the theoretical framework so as to correlate the most relevant concepts.

4.1 DEMOGRAPHIC RESULTS

The survey gathered a total of 465 respondents, 410 of which were from the State of São Paulo (88% of the total), this study´s focal subject. Analysis was thus restricted to replies obtained from the State´s respondents.

In as much as respondent age distribution is concerned, 53% were women and 47% men. Almost all were over 18 years old, 54% ranging from 26 to 35 years.

As to the respondent´s current mobile phone brand, 41% owned a model manufactured by the Finnish supplier Nokia, followed by Samsung (15%) and Apple (14%).

4.2 HANDSET RECYCLING USER BEHAVIOUR

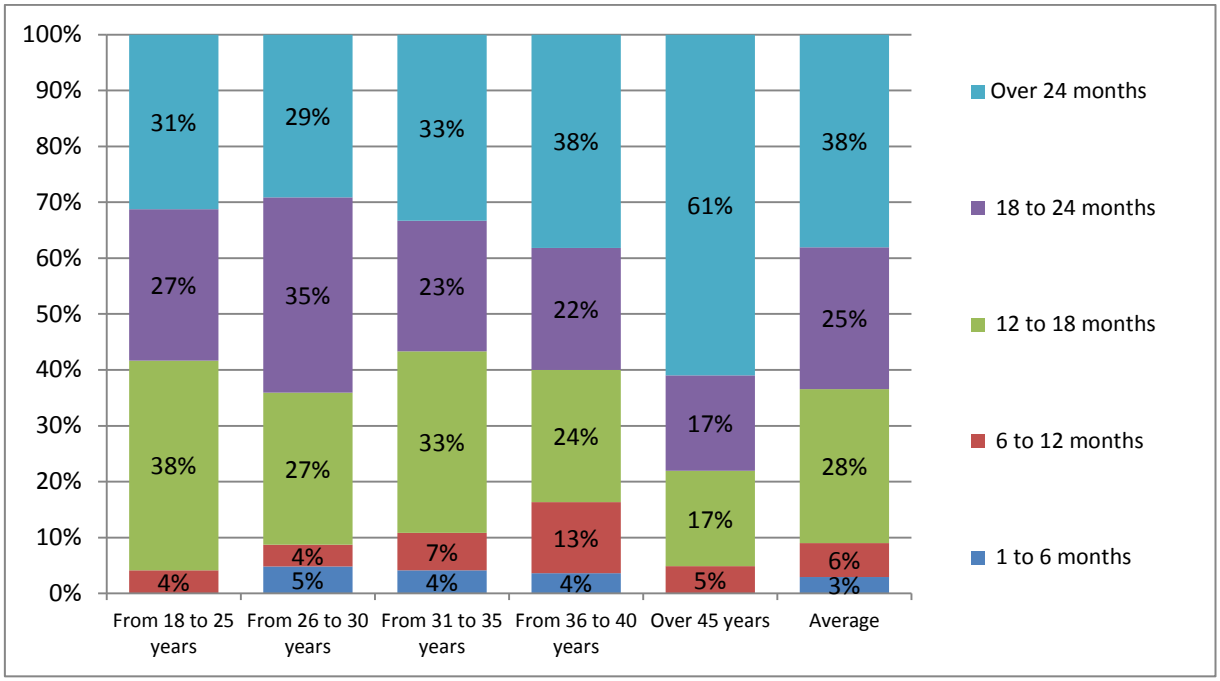
Amongst reasons for disposing handsets, 27% of respondents informed that the prime reason to do so was technological obsolesce, 25% discarded their phones due to breakdowns, 24% because they´d bought new models, 15% because the previous unit was too old and 6% because of robbery, theft or misplacement.

The qualitative analysis of replies revealed that some respondents commented they´d substituted their handsets motivated by promotions offered

by their carriers via loyalty (points) programmes and bonuses. Furthermore, the assortment of handset offerings featuring a range of functionalities and technological updates is massive. According to Teleco´s (Teleco, 2011) data, solely between January and August 2011, the National Telecommunications Agency (Anatel) certified 149 handsets, having by then already surpassed the total amount of 147 units certified during the entire previous year, 2010.

Mobile phone manufacturers make significant investments in the development of new technologies and this in turn results in rapid obsolesce rates of previous models. To this effect, the survey unveiled that 62% of respondents changed their handsets after up to 24 months of use and 38% after more than two years.

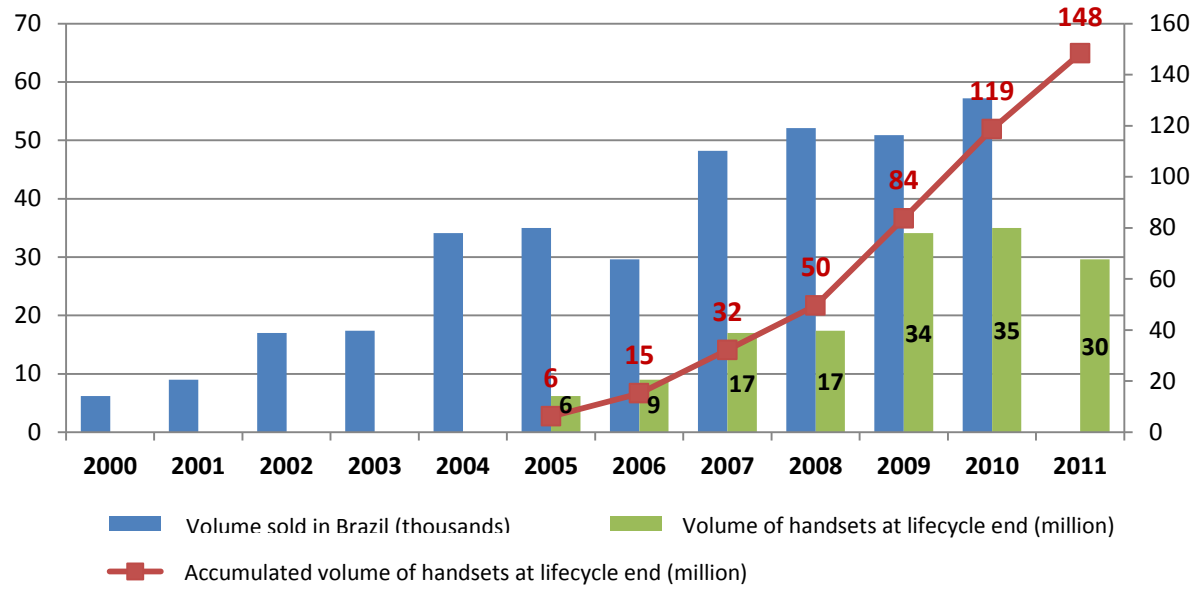
The average handset change time is influenced by the respondent´s age. Whilst 61% of respondents with more than 45 years of age informed to change their devices at more than 24 month intervals, only 31% of respondents aged between 18 and 25 years informed to do so within the same timeframe, as pictured in Graph 4.



Graph 4: Average handset change time per age range

This rapid obsolescence and handset change rate reinforces the relevance of communicating to consumers what must be done as to the correct destination of their previous, used device at the end of its lifecycle.

By analysing mobile phone sales ever since the year 2000 and considering that a device´s lifecycle is five years, estimates suggested that by 2011, there would be approximately 148 million units that would be nearing the end of their lifecycle. Graph 5 provides details of this analysis whereby for instance, handsets sold in 2000 end their lifecycle in 2005. It´s worth noting that the analysis was not conducted in an exhaustive manner and does not take the volume of mobile phones that were effectively discarded during the defined time frame, into account.



Graph 5: Mobile device lifecycle end analysis

Source: Prepared by the author based on sales figures (Teleco, 2011).

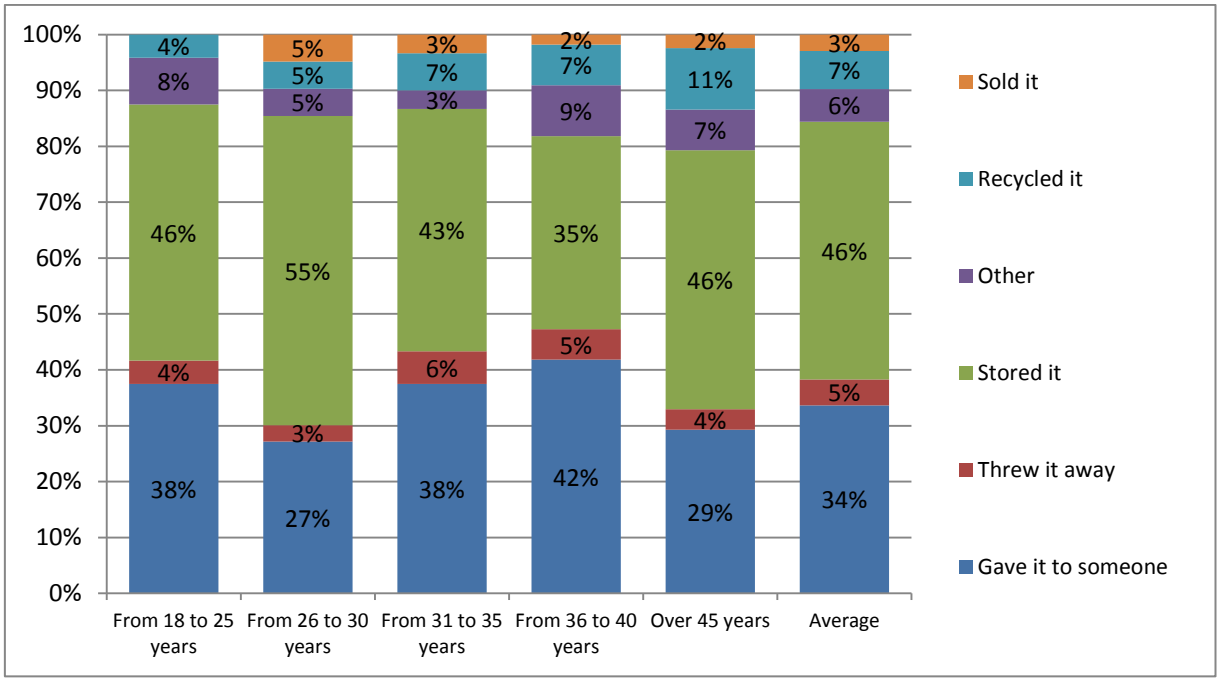
As to consumers that changed their old phones, 46% of respondents informed that they stored the old device, 34% gave them to someone, 7% claimed to have recycled their unit, 5% threw it away and 3% sold it.

Amongst men and women, behaviours were quite similar: 48% of men replied they´d kept the old mobile phone versus 44% of women. On the other hand, 35% of women claimed to have given their units to someone whilst only 32% of men had done so.

Similar behaviour was revealed by a global survey the manufacturer Nokia conducted in 2008 whereby 44% of interviewees claimed to keep their old mobile phones and only 3% stated to have sent their previous handsets to be recycled.

The question that covered the destination of the previous unit also presented behaviours according to the respondent´s age range. The options that presented the greatest variations were "Stored it" and "Gave it to someone". Emphasis must be placed on the fact that the share of respondents that claimed

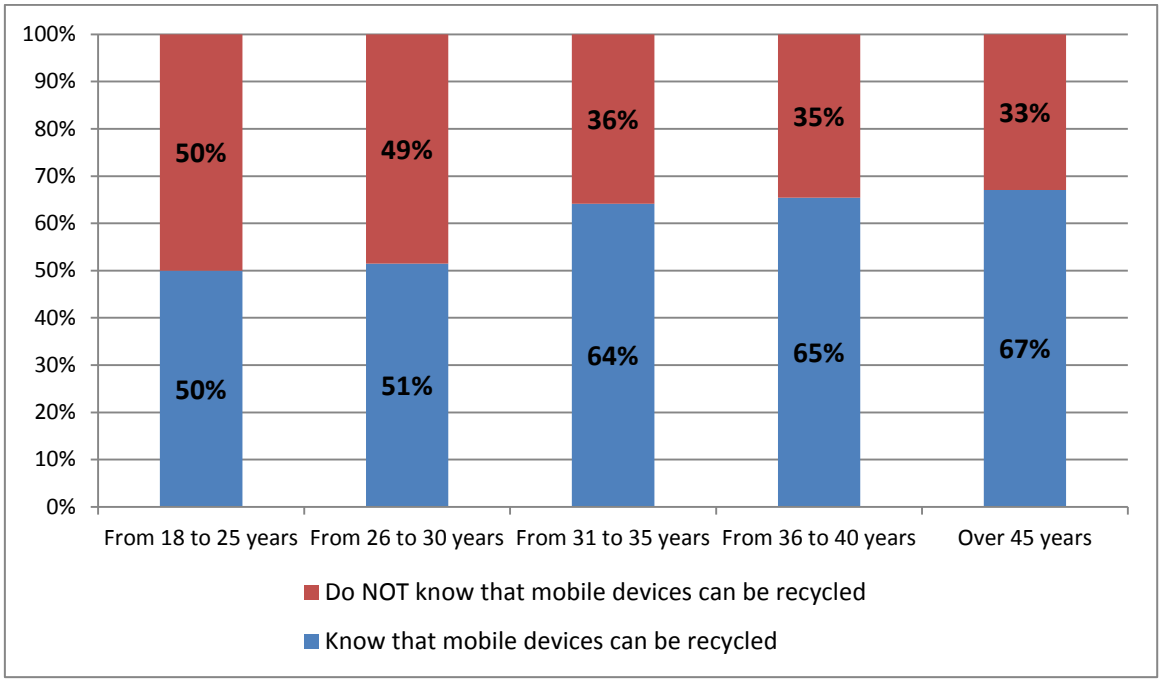
to have recycled their previous handsets increases the older the respondent is. Details on this analysis are pictured in Graph 6.



Graph 6: Previous handset destination per age range

When asked about their awareness that mobile phones can be recycled, 60% of respondents stated that they knew this was possible. The level of knowledge on the recyclability of mobile devices varies according to the respondent´s age range to the extent that, the older the respondent, proportionately more respondents claimed to be aware of the fact that handsets could be recycled, as pictured by Graph 7.

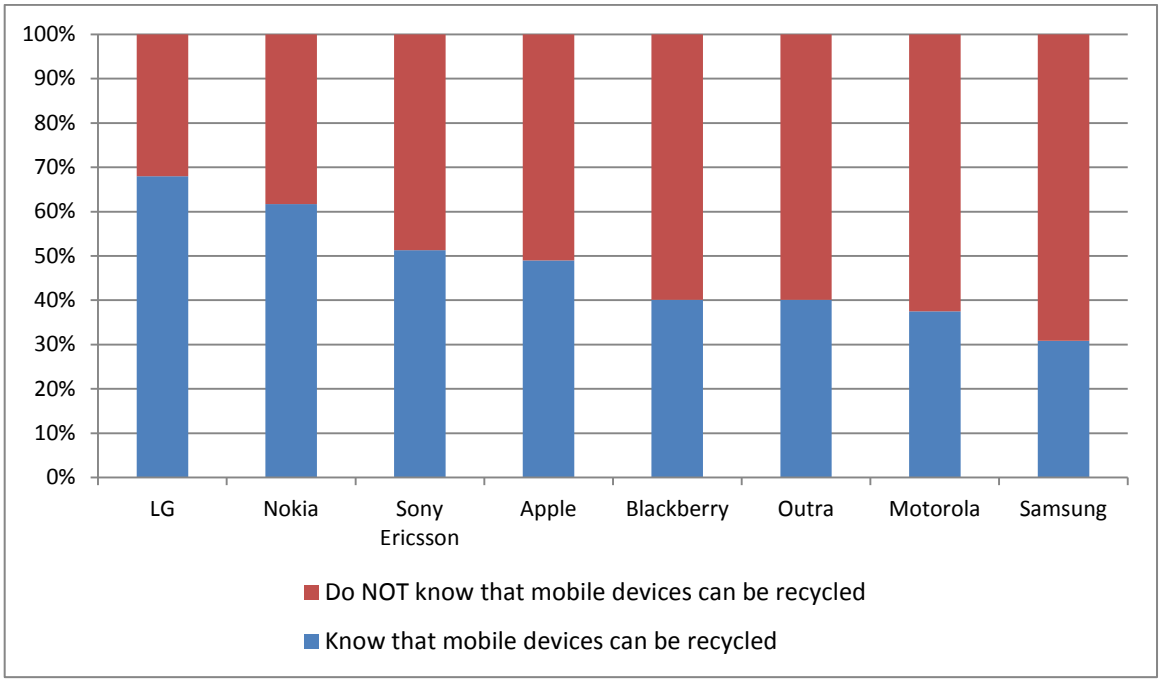
This fact might indicate that although younger generations are extensively involved in sustainability related matters, this does not necessarily reflect in direct actions such as the recycling of mobile phones. Another point of relevance lies in the fact that since youngsters change their handsets at shorter intervals, these devices are given away to other people or end up being kept as a back-up unit because they are still relatively new.



Graph 7: Mobile phone recycling knowledge per survey respondent age range

When asked about their level of knowledge on mobile device recycling, only 24% of respondents claimed to fully understand the subject matter and 39% informed they had doubts as to the process. This illustrates that although recycling is an extensively discussed theme, when it comes to recycling handsets there is still plenty of room to improve awareness.

Once knowledge on mobile phone recycling is confronted with the brand name of the respondent´s current device, the highest outcomes involve users of LG, followed by Nokia and Sony Ericsson as pictured in Graph 8 that follows.



Graph 8: Mobile phone recycling knowledge per survey respondent´s device brand name

Amongst those companies that operate in the field of technology, Nokia and Sony Ericsson top Greenpeace´s ranking for having the best environmental practices. It´s worth noting that Nokia has the largest voluntary (take back) mobile phone collection for recycling purposes program in the world. Even so, from the survey´s results one notices that companies must place further effort in improving both communication and consumer awareness of the process.

Subsequently, 20% of survey respondents claimed to have sent a mobile phone to be recycled and the proportion of men and women was exactly the same. Amongst respondents who had already practiced recycling, 36% informed they´d done so at their carrier´s store, 21% at the manufacturer´s after-servicing network and 8% at a reseller.

When asked about their opinions on the underlying reasons for mobile phone recycling being so low in Brazil, 49% of respondents believed that the prime reason was the lack of knowledge as to the very possibility of recycling; 19% believed it was due to the absence of knowledge as to the product´s final destination and 10% understood it was due to poor convenience.

5 CONCLUSIONS

This study´s prime objective was not to only assess user behaviour before mobile phone disposal and recycling in the State of São Paulo but also contribute with the improvement of the first encountered scenario.

Research outcomes enabled identifying that the mobile phone market in Brazil has rampantly increased particularly as of 1998, given the privatization of the old Telebras system until it peaked in 2010 the 100% density rate with on average, at least one handset per inhabitant in the country.

Furthermore, in 2010, Brazil´s congress approved the National Solid Waste Policy (*PNRS*) which defines the responsibilities of the productive chain´s many links - including consumers and government - in the solid waste management process. The *PNRS* is an important environmental process milestone to motivate the private sector, State and society to take sustainable development aligned actions.

Results outcomes also revealed that 62% of respondents changed their handsets once having used them for up to 24 months. However, amongst youngsters, change timeframes are even shorter: for those between 18 and 25 years old, 69% changed their mobile phones before completing 24 months of use. The prime reasons driving handset switches are technological obsolescence (27%) and breakage (25%).

Findings also unveiled that once having changed their handsets, 46% of respondents stored their old units; 34% gave it to someone; and only 7% claimed to have recycled their mobile phones. It´s interesting to note that when asked about what might explain why mobile device recycling rates are low in Brazil, 49% of respondents believed that this was primarily due to the lack of knowledge as to the very possibility of recycling; 19%, the absence of knowledge as to their final destination; and 10% poor convenience. However, amongst younger respondents, 60% believed that the prime reason involved the lack of knowledge as to recycling being an option.

Indicators of the kind directly influence the volume of respondents that claim to know that mobile phones can be recycled. A total of 60% of respondents reported to know that handsets could be recycled but only 24% claimed to have a comprehensive understanding of the subject matter and 20% had in the past already effectively recycled a mobile unit.

The direct analysis of replies suggested that there is a tremendous opportunity for the improvement of the current mobile phone, battery and accessory collection processes from both the infrastructure, i.e., collection points capillarity extension and program communication, unit post-disposal recycling process, environmentally correct destination and overall process benefits standpoints.

By intensifying this communication primarily amongst youngsters, collection volume results shall certainly increase in the same proportion. Communication must directly relate to factors that flagship consumer compliance with their roles as citizens, allying environmental benefits with taking this kind of attitude whilst also clearly informing the final destination, i.e., what happens to the material that is collected.

This study revealed that there are cultural aspects which directly impact the decision making process involving mobile phones when they come to the end of their lifecycle such as storing the unit although it´s technologically obsolete or broken, remaining attached to the handset and even the absence of consumer initiative when it comes to recycling.

BIBLIOGRAPHY

Associação Brasileira de Telecomunicações -Telebrasil. (2010). *O desempenho do setor de telecomunicações no Brasil* (Séries Temporais). Rio de Janeiro: TeleBrasil.

Apple. Apple e o meio ambiente. (2011). Recovered in August 30, 2011 from http://www.apple.com/br/environment/.

Booz & Company. (2010). The global innovation 1000: How the top innovators keep winning. *Strategy+Business*, (61).

Claro. (2010). Claro Recicla. Recovered in August 30, 2011 from http://www.claro.com.br/portal/artigo.do?method=showArtigo&channelId=6b89603541203110VgnVCM1000000a08150aRCRD&origem=Conheça a Claro&item=Claro Recicla.

European Parliament and of the Council. (2003, February 13). Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). *Official Journal of the European Union*, 27, 1.

Folha de S.Paulo. (2008, 29 de julho). Saiba como foi a privatização da Telebras em 1998. Mercado. Recovered in August 30, 2011 from http://www1.folha.uol.com.br/folha/dinheiro/ult91u427127.shtml.

Gartner. (2011). Recovered in September 2, 2011 from http://www.gartner.com/it/page.jsp?id=1543014.

Greenpeace. (2010). *Guide to greener electronics*. Stockholm: Greenpeace.

Instituto Brasileiro de Defesa do Consumidor (Idec). (2009, 4 de abril). Tecnologia que vira lixo. *Revista do Idec*, 26-30.

Lei n. 12.305, de 2 de agosto de 2010 (2010). Institui a Política Nacional de Resíduos Sólidos; altera a Lei n. 9.605, de 12 de fevereiro de 1998; e dá outras providências. *Diário Oficial da União*, seção 1.

Miguez, E. C. (2010). *Logística reversa como solução para o problema do lixo eletrônico: benefícios ambientais e financeiros*. Rio de Janeiro: Qualitymark.

Moretti, S. L. A., Lima, M. C, & Crnkovic, L. H. (2011). Gestão de resíduos pós-consumo: Avaliação do comportamento do consumidor e dos canais reversos do setor de telefonia móvel. *Revista de Gestão Social e Ambiental (RGSA), 5*(1), 3-14.

Motorola. (2011). *How to recycle Motorola products*. USA: Motorola Mobility. Recovered in October 30, 2011 from

http://responsibility.motorola.com/index.php/environment/products/recycling/htrmp/.

Nokia. (2008, July 8). Nokia connecting people, Nokia press releases. Recovered in February 20, 2011 from http://press.nokia.com/2008/07/08/global-consumer-survey-reveals-that-majority-of-old-mobile-phones-are-lying-in-drawers-at-home-and-not-being-recycled/.

Nokia. (2010). *Nokia sustainability report*. Recovered in October 20, 2014 from http://company.nokia.com/sites/default/files/download/nokia-sustainability-report-2010-pdf.pdf

Nokia. (2011). Blog Nokia sem limites. Recovered in September 10, 2011 from http://www.semlimites.blog.br/acessorios/o-valor-da-coleta-e-reuso-dos-materiais/.

Organization for Economic Co-Operation and Development - OECD. (2001). *Extended producer responsibility: a guidance manual for governments*. Paris: OECD.

Samsung. (2011). Meio ambiente - cidadania - sobre a Samsung. Recovered in August 30, 2011 from http://www.samsung.com/br/aboutsamsung/citizenship/environment.html.

Silva, E. L., & Menezes, E. M. (2001). *Metodologia da pesquisa e elaboração de dissertação*. Florianópolis: Laboratório de Ensino a Distância da UFSC.

Sony Ericsson. (2011). Sony Ericsson sustentabilidade - company press. Recovered in August 30, 2011 from http://www.sonyericsson.com/cws/company-press-and-jobs/sustainability/recycling?cc=br&lc=pt.

Teleco. (2011). *Teleco: inteligência em telecomunicações*. Recovered in March 15, 2011 from http://www.teleco.com.br.

TIM. (2011). Sistema de coleta de baterias e celulares - ambiental – sustentabilidade. Recovered in August 30, 2011 from http://www.tim.com.br.

United Nations Environment Program - UNEP. (2009). Recycling – from e-waste to resources. New York: UNEP

Vivo. (2011). Recicle o seu celular. Recovered in August 30, 2011 from http://www.vivo.com.br/portal/a-vivo-sustentabilidade-recicle-seu-celular.php.

Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M, & Böni, H. (2005). *Global perspectives on e-waste*. Berne, Switzerland: Elsevier.

Wiziack, J., & Fusco, C. (2011). Celulares clandestinos já são 20% do total. *Folha de S.Paulo*, Caderno Economia, p. 1.