

Social responsibility of consumers in the management of electrical and electronic waste in the metropolitan area of Barranquilla, Colombia

Responsabilidad social del consumidor en el manejo de los residuos eléctricos Y electrónicos en la zona metropolitana de Barranquilla, Colombia

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Abstract

The objective was to describe the social responsibility of consumers in the management of waste electrical and electronic equipment (WEEE) in the metropolitan area of Barranquilla (Colombia). A cross-sectional, quantitative study. A questionnaire in Likert scale was applied to consumers between 15 and 60 years old, a sample of 274 elements. A multivariate discriminant study was carried out in SPSS. The result was the description of WEEE management. As conclusion, it is necessary to minimize WEEE and optimize its use.

Key words: consumers' behavior, Waste Electrical and Electronic Equipment (WEEE), social responsibility.

Resumen

El objetivo fue describir la responsabilidad social de los consumidores en el manejo de residuos de aparatos eléctricos y electrónicos, (RAEE) en la zona metropolitana de Barranquilla (Colombia), estudio transversal, cuantitativo. Se aplicó un cuestionario en escala de Likert, a consumidores entre 15 y 60 años, la muestra fue de 274 elementos, se realizó un estudio multivariado discriminante en SPSS. El resultado fue la descripción en manejo de RAEE Se concluyó realizar acciones de minimización y aprovechamiento de los RAEE

Palabras clave: conducta del consumidor, residuos de equipos eléctricos y electrónicos, responsabilidad social.

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1. Introduction

Electronic waste derived from post-consumption, product of modern and hectic lifestyles, when people are anxious and time is urgent for the occupations of daily living, have caused a high consumption of small, medium and large electrical and electronic devices that directly or indirectly produce the deterioration of the environment and even of the people's health. The United Nations Organization (UN, 2010) when referring to the use of these devices stated that the increase in the statistics of WEEE has accelerated in recent years due to the use of technology, productivity, innovation, creativity and the competitiveness worldwide.

However, according to the (UN, 2017), the total of electronic garbage for 2016 was 44.7 million metric tons reflecting an 8% growth. It can be highlighted that only 20% of this garbage was recycled, 76% was deposited informally or stored in private homes. In relation to recycling, Europe managed to reuse 35%, America 17%, Asia 15% and Oceania 6%. In the particular case of Latin America, Brazil, Mexico and Argentina are among the largest producers of WEEE, taking into account the number of inhabitants.

Similarly, in the WEEE approach, it is of vital importance to take into account the formal information provided by statistical data, which shows the measurable and exponential increase of these devices, which constitutes a serious threat to the humanity. Moreover, when projected for 2030, the amount would be over 100 billion tons. This phenomenon according to sustainable future (2017) has been called "the plague of the 21st century".

According to Revertía (2011), China, specifically the Guiyu city, has been considered the main recipient of electronic waste, among the scenarios worldwide. 80% of this waste comes from North America, Japan and Korea. That is why this country is considered a holy field of WEEE. Likewise, according to studies carried out by the UN (2013), it is estimated that most of this garbage is exported to the underdeveloped countries. Also, a production of 7 kg of electronic garbage is calculated for each inhabitant of the planet, and an additional 33% is expected for 2017, according to the projections of the United Nations University (ONU). This dynamic of the WEEE, has led Europe, concerned about the treatment of technological waste, to promulgate the strategy of Extended Producer Responsibility (REP) in 2002, "related to the ecological design, with environmental education, collection of equipment in disuse, systematic treatment of hazardous components, reconditioning and recycling of usable components "(Unesco 2010, Granada representative of Mercosur, page 12).

In the same way, Latin America is not exempt from the global problem. This is the reason why the different indicators have been detailed by country and the production of technological waste in recent years, taking into account the number of inhabitants. In accordance with this, the largest producers of these devices are Brazil and Mexico with 1412 and 958 kilo tonnes in 2014. Then Argentina with 292, and Colombia with 252 kilograms, occupying the third and fourth place, respectively. Ecuador (73), Bolivia (45) Paraguay (34), Uruguay (32) and Panama (31), are located below the 75 tonnes. According to the data taken from El Heraldo December 2 (2015), based on a study of the Association of Companies of the GSMA Mobile industry and the United Nations University, each country is independently taking measures to address the problem. The lowest indicator per inhabitant is Bolivia.

On the other hand, Colombia produces approximately 143,000 tons of WEEE related to these waste lines. The line of small white, brown and gray appliances produces the largest waste, approximately 252 kilo-ton according to Hurtado and Fonseca (2015).

Notwithstanding, the changes in the infrastructure of Barranquilla, the channeling of the streams of the 84th, and the 21th, with the 30th street; the construction of the river avenue and also the rapid increase of malls, communication and social networks, the presence of new universities, and the accelerated activities of digital

natives, have unleashed changes in consumers behavior that have involved an increase in the consumption of electrical and electronic devices, which in turn has meant an increase in Waste Electrical and Electronic Equipment, WEEE. Also, a recent study conducted by Peralta (2016), in Barranquilla, shows the following statistics (see Figure 1): the data was obtained through market research, with sample of 200 consumers, resident in Barranquilla, between 15 and 50 years old, who use electrical and electronic devices, through a positivist model, Kerlinger and Lee (2002), where a hypothesis of causality between variables is established.

Figure 1
Statistics of consumer perception

Analyzed Variables		
1	Use of electrical and electronic equipment	99.9%
2	Do not know the law of technological waste	98%
3	Do not know the final deposits of WEEE	90%
4	Do not know the dangerous substances that make up these WEEE	50%
5	Advertising communication related to WEEE campaigns	60%
6	Do not like to buy second-hand equipment	95%
7	Recycling WEEE	87%
8	Care about the environment	99%
9	Does not take initiative to participate in WEEE campaigns	90%
10	Growth of WEEE	80%

Source: Peralta (2016)

1.1. Theoretical Considerations

The product theory expounded by Kotler, and cited by Fernández-Villarán (2017), categorizes the types of products, such as generic, expected, increased, potential and adds the thin line of added value. In this order of ideas, the generic product is the focus point that satisfies the needs of consumers in terms of the reciprocity that the consumer wants to find, the expected product, whose response is the satisfaction of their needs. For that reason, it is complemented with the concept of product increased with brand, packaging, and quality. It was also extended to customer service, installation, maintenance, after-sales service, guarantees, deliveries, credits. All of these framed in the marketing strategy and strategic direction. In addition, the potential product is the future product that is always in research or prototype processes according to the reality and market trends. In this sense, electrical and electronic equipment (EEE), are constantly changing, and are categorized according to the integral management of waste electrical and electronic equipment established by the Ministry of the Environment (2017) in the following subgroups: White line (kitchen, washing, cooling and ventilation), brown line (communication, entertainment), gray line (ICT) and lines of small appliances.

Marketing strategies, referenced by Munera and Rodríguez (2012), focus on the generation of profitability for the organization. Igor Ansoff (1965) can be mentioned among them, who designed a double-entry matrix in which a row determines the expression of new (markets and products), and the current expression of (product diversification and market penetration), strategically seeking what to apply. In the same way, Kotler and Singh (1981) are found with the strategies: Challenger, Leader, Follower and Specialist. This was complemented by Mintzberg in (1988), with the strategy of differentiation based on image and design, through product research and development, and the quality of it, based on the reliability, duration and operation of the product in relation to the price. It is also worth highlighting Wissema et al (1980) with the strategies of Explosion, Expansion, Continuous growth, descent, consolidation and transcendental contraction in the market, and without doubt the great importance of the strategies postulated by Porter (1980), related to the low cost, differentiation and concentration, seeking the competitive advantage of companies with mass production and in large quantities, to minimize cost and maintain the price in the market. The Push and Pull strategy is usually applied in the treatment

of EEE, aimed at innovation and the design of new generations of prototypes. These are also complemented by a marketing strategy to seek positioning; such is the case of the competitiveness strategy proposed by Igor Ansoff, among others.

1.1.1. Obsolescence Market Strategy

Electronic and electrical products, whose functionality is immersed in the lifestyles of consumers, have transformed their daily tasks seeking effectiveness and reducing time and cost in activities. However, this is contradictory with the intrinsic characteristics of the devices, which contain dangerous substances such as PCB (Bephenyl Polycarbonate), TBBA Tetrabromo. Biphenol APBB, Arsenic Barium, Beryllium, cadmium, lead, lithium, mercury, nickel, selenium, zinc sulphide, toner powder, among others, taken from the source RAEE'S.org.co, cited by Martínez (2015) p.50. These substances have become a source of contamination for people and the environment at the end of the product useful life.

The tendencies in the lifestyle of consumers have caused obsolescence to be a strategy that affects the life cycle of the product in the market, generating defined objectives for each of the different stages of the life cycle. For example, in the introductory stage, the information on the characteristics of the product and the knowledge and image of it; in the growth stage, the persuasion, the predisposition and the action; and in the maturity stage the recall of the use, and the reiteration (Dvoskin, 2004), These stages in turn promote the positioning and profitability of the product in the market and in a particular case, that the product reaches the decline, this becomes a crucial stage in which a repositioning is sought and there is a struggle for the product survival.

On the other hand, the theory of planned obsolescence, which can be physical or material, refers to the quality, durability and price, which can be replaced by other similar competitors. Another type of obsolescence is the technological. This is related to the new generations of products in functionality advances. The obsolescence in spare parts as well. In this one, the manufacturer calculates the useful life of each piece or spare parts, which are exhausted or are declared discontinuous, such a situation merits changing the product for a new one. And finally the obsolescence of style or psychological concerning the alterations of the characteristics of the time, which add updates or values to the product that the consumer is willing to pay for.

According to the above, modifications of aggregated values can be applied in the products. According to the rotation in the market, it can be decided to remove them from it or to replace them by new products. For this last case, the Push or Pull strategy can be applied.

In general, according to the different strategies mentioned, electrical and electronic devices useful life is reduced every day. That is the case of a television, its useful life was approximately 10 years in the 70s, 80s and 90s, and yet, after ten years, its existence could be prolonged up to 10 more years. It was also easy to get spare parts for the models in reference. Currently, in the XXI century, the useful life of an artifact may probably reach two years, due to the speed new technologies are developed at, in order to maintain the competitive advantage in the market.

1.1.2. Product life cycle

In relation to the product life cycle, Peralta, Cervantes, Oliveros and Salazar, (2014), distinguish five phases, among them: Product gestation, market entry, product launch, market adaptation, fullness and degradation. In this sense, each of these phases fulfills a specific role within the marketing strategy in the competitive market, either for the positioning in the fulfillment of the organizational goals or to enhance the characteristics of the product. Of the above, it can be deduced that the useful life of the products is planned from their manufacture to their degradation in the market. From this perspective, other initiatives of new generations of products based on business interests are born.

1.1.3. Social Responsibility (SR)

Since the 1990s, the concept of Social Responsibility has evolved rapidly, to such an extent that new actors have been actively added to its actions, including the business sector. From this line of study, the Colombian Center for Corporate Responsibility (CCRE - 2006), defines social responsibility, as "the response capacity of a company or entity against the effects and implications of its actions on different interest groups" (P, 1). Taking into account the previous definition of corporate social responsibility, it is an organizational decision, which benefits an interest group, for instance: neighbors, collaborators, suppliers, customers, environments among others. In this way, companies respond to social requirements, contributing to the development of these groups, benefiting them with resources, economic materials, and in-kind.

Despite efforts to respond to the problem of waste in Barranquilla through different strategies, the lack of formal and adequate processes for their treatment persists. This is due to the increase in production, marketing and consumption, which have grown exponentially in the recent decades. One of the formal strategies applied is related to the Extended Social Responsibility to the consumer. Its application has not reached the expected impact in many cases; since disinformation of the harmful effects that these residues cause persists on consumers, a situation that contributes to the increase of the statistics in the post consumed of EEE.

Hence the need expressed by Drucker cited by Carneiro (2013), that socially responsible companies should focus their objectives on the social, contributing to stability, strength, harmony and the solution of social problems. Complementary to the above, the Organization for Economic Development OECD (2000), also cited by Carneiro (2013), believes that companies should promote social development and the promotion of the fundamental rights of workers, on a voluntary basis. The same author, when citing Strandberg (2010), emphasizes how CSR should focus on coherent and orderly measurable actions in corporate social performance, being reflected in the processes, policies, strategies and plans, in accordance with the principles enshrined in the Global Compact.

From a political standpoint, in a contemporary sense, the Spanish Accounting Association, (2003), quoted by Duque, Cardona, and Rendón (2013), considers SR as a voluntary commitment to the development and preservation of the environment, people and social groups that interact in this complex world, full of vicissitudes and pollution that directly and indirectly cause environmental degradation. For this reason, all organizations, not only those of electrical and electronic products, must act to face this silent reality that overwhelms humanity, in order to provide future generations with a decent space to be inhabited with quality.

2. Materials and Methods

This was a cross-sectional study, Hernández, Fernández and Baptista (2014) framed in a quantitative paradigm, which allows to examine data from a scientific process and through statistical tools, under a structuralist analysis model (Hurtado 2016). The information was collected by means of a Likert-scale survey. Its reliability was estimated by the Cronbach's alpha coefficient, obtaining a score of 0.95, indicating a high level of internal consistency of the items analyzed. At the same time, the instrument was validated by expert judgment. The survey was applied to residents in the metropolitan area of Barranquilla, between 15 and 60 years old, who had small, medium and large electrical appliances in their homes. The sampling was by cluster, where each cluster was constituted by the inhabitants of each population. Later, the sample size was calculated, a result of 274 was obtained. A discriminant statistical analysis was conducted, which shows differences appreciated in several groups under study. A classification of its characteristics does not solve the problem, but the number of variables that affected the problem is reduced, allowing to visualize possible solutions, Vallejo Seco (1992).

3. Results

According to the multivariate discriminant analysis processed by the SPSS, in the metropolitan area of Barranquilla with 274 observations, all of them were considered included in the data processing, as shown in Figure 2: Box Test on the equality of covariance matrices. A multivariate discriminant analysis among the groups under study was applied. In this case the populations or localities located in the metropolitan area of Barranquilla, as well as the linear relationships between continuous variables discriminated in the target groups, as shown in the Figure 3: Summary of proceedings for the case analysis. With a systematic classification in relation to the independent social responsibility in the management of waste electrical and electronic equipment (WEEE), in the Colombian Caribbean coast, in ranges and natural logarithms of the printed determinants, those of the covariance matrices of the groups: a. less than or equal to 1.7. b. very few cases to be non-singular, c. Range less than six, d. Singular.

Figure 2
Box test on the equality of covariance matrices

Municipio	Rango	Logaritmo del determinante
Barranquilla	46	-16,779
Malambo	.	.
Puerto C	.	.
Soledad	45	.
Intra-grupos combinada	46	-8,404

Source: SPSS Processing

Likewise, Figure 3: Summary of processing for the analysis of cases related to the Lambda Wilks statistic, used to measure the discriminant power of a set of variables, evidenced that the questions of each of the dangerous substances, such as hydroxides, manganese, lead, has an average of 4.65% and 4.99%, the closest to 5%. This indicates that consumers are unaware of this type of substances and their involvement in the personal and environmental field, in this sense the final deposits are not adequate, but the usual ones. In addition, regarding the change of appliances, these are given due to damage in the appliances or exhaustion of the useful life of the appliance, even some take advantage of the possibility of negotiating them. In relation to the social responsibility of the consumer, which is between a range from 4.41% to 4.66%, with an approximation of 5% of lambda Wilks, do not know the law 1672, and do not participate in actions of responsibility, such as the collection, recycling and reuse of these devices. Likewise, it's not receive accurate information to the appropriate final deposits at the time of acquisition of the Electrical and Electronic Equipment (EEE), which causes the decision to place the WEEE, in usual final deposits not appropriate for this type of waste.

Figure 3
Processing summary for case analysis

Unweighted cases		N	Percentage
Valid		274	100,0
Excluded	Group codes for lost or out of range	0	,0
	At least one discriminant variable lost	0	,0
	Lost or out of range both, the group code and at least one of the discriminant variables.	0	,0
	Total, excluded	0	,0
Total cases		274	100,0

Source: SPSS Processing

The discriminant analysis in this study was based on a set of explanatory variables with a classification variable, this case social responsibility, in each of the populations of the metropolitan area of Barranquilla, which are detailed in the following matrix: see Figure 4.

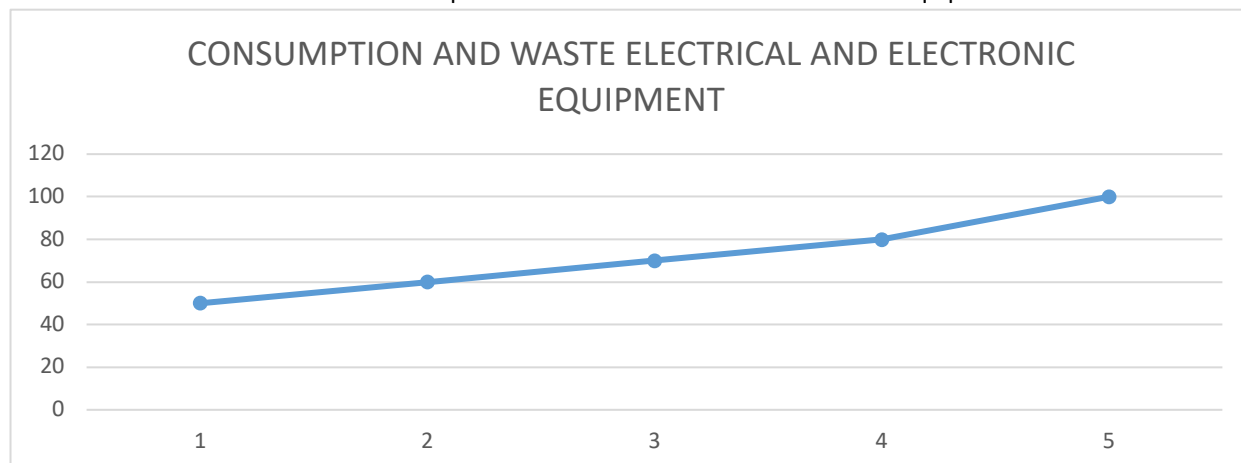
Figure 4
Behavior of the variables for category of Social Responsibility

Ítem	Variables	Barranquilla	Malambo	Soledad	Pto C/mbia
1	Unawareness of hazardous substances	X			
2	Consequences of hazardous substances	X			
3	Management of electrical and electronic devices	X			
4	Do not identify the final WEEE deposits		X		
5	Vehicle accidents due to the use of AEE		X		
6	EEE Replacement		X		
7	Do not practice WEEE consumer's social responsibility			X	
8	Suppliers do not provide final deposits			X	
9	Do not participate in WEEE collection campaigns			X	
10	Children are exposed to EEE risks				X
11	Environment pollution				X
12	Do not identify WEEE advertisements				X

The analysis of the variables that affect the Social Responsibility of the consumer in the waste management of Electrical and Electronic Devices (WEEE), in the metropolitan area of the city of Barranquilla, where four groups were categorized, named as follows: Barranquilla, Malambo, Soledad and Puerto Colombia, is described in Figure 4. It was found that one of the variables with the highest incidence was the lack of knowledge of hazardous substances, taking into account that 89% of consumers are unaware of these components as well as the symptoms that these substances produce: lithium which is hydroxide, it produces depression and respiratory failure; Manganese, which affects breathing and sexual alterations; Lead, pollutes the air, food, and consequently produces damage to the nervous system; Zinc that produces intoxication by inhalation; Cadmium, impacts the kidneys, and last the beryllium, categorized as a carcinogenic substance. Likewise lithium, mercury, arsenic which are found in electrical and electronic devices that people are exposed to.

In this order of ideas, another variable that affects the city of Barranquilla, in the social responsibility in the handling of WEEE, is the excessive Consumption of electrical and electronic devices, product of excessive publicity and commercial communication, which has prompted the Purchasing decisions by the consumer, to acquire electrical and electronic equipment (EEE) of last generation, in order to be fashionable, regardless of the useful life the devices they own still have because they are considered as second-hand equipment, bringing this, serious consequences such as the production of Waste Electrical and Electronic equipment. See Figure 5. Increase in Consumption and Waste Electrical and Electronic Equipment.

Figure 5
Increase in Consumption and Waste electrical and electronic equipment



Design: Authors (2017)

The above graph shows a directly proportional reason in relation between the increase in the consumption of electrical and electronic devices and the increase of waste WEEE. The above derives from aggressive advertising campaigns as stated in the previous paragraph. These campaigns encourage consumers to buy the latest generations of appliances, promoting the unbridled increase in the demand for these technological wastes, causing in turn the stacking of large tons of electronic waste, which are causing pollution and degradation in the environment.

In the particular case of Malambo, three variable affected the Social Responsibility: one of them was the identification of the final deposits of WEEE, the second vehicle accidents by use of EEE and the last one was related to the replacement of Electrical and Electronic Equipment. Regarding the identification of deposits, suppliers provide marketing and advisory services for large, medium and small electrical and electronic products sales. That means that they should also strengthen the information regarding what the consumer should do when the equipment fulfills its useful life, its obsolescence; question that is not clearly defined yet. Therefore, they leave it where they presume it is its final deposit. In relation to the replacement of EEE, the most frequent reason is due to bad handling, theft, and in the last case due to exhaustion of the useful life of the devices, what they popularly call "scrap". Although recycling is a favorable option for the final treatment of EEE, this technique is little considered by consumers in this locality.

However, in the municipality of Soledad, the variables affecting Social Responsibility focused on the social responsibility of consumers, providers, and the non-participation in WEEE collection campaigns. Therefore, the consumers of products of Electrical and Electronic devices, recognize that the WEEE, constitute a great social problem, due to the increase of the consumption and the lack of personal responsibility of consumers in handling them. The above is derived from the limited information from suppliers and distributors that promote the EEE, plus the lack of consumer's cooperation in reading manuals and other commercial information that accompanies the equipment in its packaging. In addition, the consumer has little interest in participating in collection campaigns in local, regional, national or international order.

Finally, in the Municipality of Puerto Colombia, the variables that affect Social Responsibility are the lack of knowledge of the WEEE Law 1672, the exposure of children to the risk of EEE, concern for environmental pollution, and the lack of advertising for the treatment of WEEE. In this sense the population's ignorance about the Law 1672 of 2013, related to the Electrical and Electronic Residues, mediates by the presentation of public policies to improve the problem. The concern for the deterioration of the environment, and the exposure of children to the use of EEE (battery and electric toys) are among the relevant contributions obtained in the

municipality. This last variable stands out due to the boom that this line of toys has taken, which attract in an addictive way to the consumers, in these cases children's parents, to the excessive purchase of the same ones. This behavior causes the increase of the demand in a geometric form, with some sub variables like technology, innovation, productivity, competitiveness, etc. And finally, the variable environment, with all the implications for WEEE: pollution, climate change among others.

4. Discussion

The competitive advantage led by Porter, who states that production in large quantities, contributes to maintain competitive prices in the market, naturally taking into account the factors of competitiveness representative of the modern era, such as productivity, innovation, technology, internationalization, exports and imports, the same education and the qualification of human resources, and financial resources, have promoted the application of this postulate in social practice, which would serve as an explanation for the production of EEE, and therefore the amount of electronic waste generated on the planet. The above is observed as a dilemma regarding the contribution of innovation in improving the quality of life to current and future generations, which is not entirely true when we see the other side of the coin, since in turn, the use of resources continues in evident deterioration and scarce, reflected in the degradation of the planet and its environmental ecosystem.

In the same way, marketing strategies according to Munera and Rodríguez (2012) are decisive in the profitability of the organization and it is the strategic direction of marketing, which focuses on the positioning of electrical and electronic products in an aggressive manner, capable of influencing the consumer's behavior purchase decision by showing the new generations of product and high technology, which leads to the consumption of these EEE, and therefore to the increase of WEEE. The above goes against the principles of the consumer's Social Responsibility in relation to the information of the final treatment of these wastes, which are being placed in the ordinary garbage, causing contamination, due to the lack of good practices in the handling of this type of waste.

In the conceptualization of the life cycle represented in five (5) nodes, Peralta, et al. (2014), complement the life cycle by adding or extending two nodes related to obsolescence, in which the activities of the 5Rs to be executed are specified as: Recovery, Reuse, Recycling, Spare parts, Final waste with social responsibility extended to the producer and consumer in handling WEEE. It is expected that the consumer's knowledge of the life cycle proposed by the authors allows a better procedure of these residues. In this way, the pollution produced by these devices at an environmental and health level is reduced.

Likewise, corporate social responsibility of producing and distributing organizations should be more aggressive in relation to the commitment actions with the stakeholders. This would indirectly contribute to the purpose of minimizing WEEE, which is affecting the planet. Along with this, it is important that collection campaigns developed are supported by public policies, in order to guarantee the rights and duties of all the actors involved. However, the scope of the problem, which is growing progressively, as a result of the new trends in the market, has facilitated the acquisition of this waste, but at the same time, the interest in strengthening the instructions for its management has increased in order to optimize it and, as a consequence, diminishes its affectation.

5. Conclusions

Taking into account the dimension of Social Responsibility in the management of Waste Electrical and Electronic Equipment (WEEE) in the localities of the metropolitan area of the city of Barranquilla, made up of four municipalities, each of them with differential characteristics, it can be inferred that the variables studied are represented proportionally in all the locations provided in this paper, observing a marked difference in the applicability of some variables that directly affect social responsibility between one locality and another.

These differential characteristics found among the localities show the needs of specific plans to counteract the social problems generated by the WEEE in each municipality. There must also be a transversal plan for the metropolitan area which is fed by the specific plans and allows to obtain effective results that compensate for the overall impact on the region.

In the same way, the transversal plans must be supported by formal public policies that are disclosed and mandatory, making them a reference of social responsibility for the organizations involved in the treatment of this waste in the metropolitan area.

At the same time, it is imperative for the solution of the problem in question, to involve all the actors, whether at the personal level (consumers- society in general), at the organizational level (producers, suppliers, marketers) or at the governmental level (entities of control), since by involving them they can neutralize the differences between the localities as well as strengthen the practices of social responsibility that society requires. Socially responsible actions will promote good practices in each of the localities under study, as well as it will mitigate the reduction of pollutants in order to improve the quality of life and the environment of the only planet we have.

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