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RESEARCH ARTICLE OPEN ACCESS

THE IMPORTANCE OF ENVIRONMENTAL MANAGEMENT AND CORPORATE SUSTAINABILITY IN RELATION TO ELECTRONIC WASTE

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ABSTRACT

In the last decades the relationship between economic development, environmental quality and social equity has been outlined within the concept of sustainability. The objective of this research was to investigate the importance of the reuse/treatment of technological waste for the environmental preservation and sustainability of a company. The research was carried out through an exploratory study, with a literature review on the subject through books, papers, theses, dissertations and a survey of information, in secondary sources from a company in the field of information technology. It was possible to verify that a company of any size can have its sustainable balance by caring for the environment through the adoption of practices based on the knowledge acquired. It was also evidenced that the environmental management intends to train for the practice of reuse and/or maintenance within a company, being able to generate revenues using a sustainable and controlled policy or even to generate a new business platform.

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INTRODUÇÃO

Economic growth in relation to the digital and technological era in Brazil is intertwined with consumption and environmental issues, as both business and civil society seek to acquire electronic products for their needs, higher quality in personal and informal activities, improvement of business processes. However, the post-consumption of these products has generated harmful impacts on the environment. Companies need to look at the environmental issue and for that the implementation of a corporate environmental management brings economic and strategic benefits to the company (Donaire & Oliveira, 2018). Dias (2017) shows that from an environmental point of view:

> The organization must be guided by the eco-efficiency of its production processes, adopt cleaner production, offer conditions for the development of an organizational environmental culture, adopt an attitude of environmental responsibility, seeking the non-contamination of any type of natural environment, and seek participation in all activities sponsored by governmental and regional authorities with regard to the natural environment. (p. 45)

Each organization, public or private, can deal with possible problems related to the environment, diagnosed and caused as a result of its main activities.

Administrative guidelines and activities are part of environmental management within organizations with the objective of reducing, eliminating or compensating for the environmental problems generated and preventing them from occurring again at any time (Barbieri, 2016). In this sense, Jabbour and Jabbour (2016) consider that

> (…) modern environmental management in organizations is defined as the adoption of management planning and organization practices, operational management (in product and process development) and communication aimed at improving the relationship between the organization and the environment, reducing environmental impacts and taking advantage of the benefits associated with environmental performance. (p. 7)

The adoption of management practices will meet the need to implement an environmental management policy, making it possible to show employees a new vision in relation to impacts on the environment. Jabbour and Jabbour (2016) highlight that environmental practices are relevant for establishing mechanisms, creating necessary conditions and motivating individuals within organizations so that the objectives of environmental performance advance (p. 41).

At the end of the 1980s, in Brazil, the need to have an Environmental Management System (EMS) reflected in voluntary norms and

agreements arose with the purpose of guiding public and private companies in creating their own systems with the understanding for a strategic dimension (Barbieri, 2016). In this context Tinoco and Kraemer (2011) define an EMS:

> As a set of procedures to manage or administer an organization, in order to obtain the best relationship with the environment. It essentially consists of the planning of its activities, aiming at the elimination or minimization of impacts on the environment, through preventive actions or mitigating measures. (p. 101)

Regarding the environmental issue today, some of the most used standards are the standards of the International Organization for Standardization (ISO), the standards of the ISO 14000 series that contemplate EMS issues. Seiffert (2014) highlights that

> (…) environmental analysis that results in a diagnosis of the organization's environmental performance, as well as environmental education, are basic assumptions for the implementation of any environmental management process. This generally involves a more systematic and complex methodology, which appears as an objective demand, when the organization presents a more proactive profile and seeks to manage its environmental risk through the implementation of an ISO 14001 EMS. (p. 190)

Companies that promote the introduction of ISO 14001 can achieve economic, social and environmental balance. According to Barbieri (2016), the objective of the standard is to provide organizations with a structure for the protection of the environment and to enable responses to changes in environmental conditions in a way that is balanced with socioeconomic needs (p. 129). ISO 14001 contains the requirements for an EMS and an informational annex with guidance for using the standard. Companies that implement and maintain good environmental management practices find that their customers and suppliers value their brands and products. In Brazil, there are laws for the environmental treatment of these products. In 2010, Law no. 12,305, of August 2, 2010, was enacted which established the National Solid Waste Policy (*Política Nacional de Resíduos Sólidos - PNRS*). To Bartholomeu, White and Caixeta-Filho (2011), the 2010 *PNRS* has established an adequate management for solid waste, outlining objectives, instruments, guidelines, goals and actions in which an order of priorities of non-generation, reduction, reuse, recycling and treatment is observed.

Law no. 12,305/2010 defines solid waste as:

> material, substance, object or discarded goods resulting from human activities in society, the final destination of which proceeds, proposes to proceed or is obliged to proceed, in solid or semi-solid states, as well as gases contained in containers and liquids whose particularities make its release into the public sewerage system or into water bodies unfeasible, or require solutions that are technically or economically unviable in view of the best available technology.

Solid wastes have different classifications and, in all waste categories, *PNRS* defines treatment and regulatory aspects.

ELECTRONIC WASTE: DEFINING A SUSTAINABLE PATH

With regard to the physical cycle, considering the stages of production and commercialization of a good or service, Barbieri (2016) highlights that

> (…) from the origin of productive resources in the environment to final disposal, after use or consumption, through intermediate stages, such as processing, transport, storage and others, including reuse in the form of reuse, recycling, revaluation energy. This cycle is also known as cradle to grave or cradle to cradle. In the first expression, the environment is the source of the resources used in the product (cradle) and the final deposit of its unusable remains (grave). In the second stage, it is expected that the remains, besides being minimal, will not damage the environment and can be fully assimilated. (p. 199)

The Life-cycle Assessment (LCA) of a product or service was discussed during Rio+20 and with that it was inserted as a metric for business commercial relations. A term was signed by more than 200 Brazilian companies towards a commitment to work in their production chains in order to inform customers about the importance of their choices (Luz & Teixeira, 2017). In the general context of the life cycle, it is important to understand the list of impacts and where the damage occurs, which require actions to be taken to reduce the environmental burden caused by the lack of knowledge or inappropriate actions by companies without proper government inspections. One of the points causing pollution to the environment, over the years, is the generation of solid waste from the private, public and business spheres (industry, commerce and services). Thus, the implementation of strategies for classification and destination comes from the need of people and companies to understand that after the use or consumption of technological products they must have a correct destination. The companies employ internal environmental management for the correct destination of the waste generated and also the internal awareness of their employees. Therefore, it is necessary to understand the responsibility of suppliers and the company itself when making a product. In organizational development the companies need to be concerned with their products throughout their life cycle so that they do not impact the environment. It is important to highlight that the supply chain is also related.

The companies employ internal environmental management for the correct destination of the waste generated and also the internal awareness of their employees. It is necessary to understand the responsibility of suppliers and the company itself when manufacturing a product and the involvement of suppliers with companies in order to minimize the use of natural resources for the development of waste reduction and ecologically sustainable products/services (Pereira et al., 2012). Electronic waste can be generated in personal life and/or in any type of company. Thus, it is important to highlight concepts and characteristics, international and national guidelines on how to treat them. In this context, environmental management can contribute with people and companies distinguishing them from the dominant interests. Santos (2012) highlights that with remanufacturing and reuse, equipment can have its life cycle extended, avoiding early disposal and being reinserted for use in different socioeconomic contexts (p. 33). The electronic equipment industry can track and discover specific information about the material composition of its products, according to legal and market requirements. The industry needs to collect information about the composition of products and subparts that are purchased from suppliers to incorporate them into their final products. This affects the entire global supply chain (Miguez, 2010). According to Carvalho and Xavier (2014), the life cycle of Electrical and Electronic Equipment (EEE) begins with the extraction of ores for the production of equipment, which are distributed, sold, consumed and, when they reach the end of their life, have a destination and can be reused, recycled or disposed of in landfills (p. 10).

According to Miguez (2010), promoting extra life to products means less waste and, when post-consumption waste is dangerous, as is the case with electronic products, there will be less dangerous substances generated (p. 24). In this context, the reuse channel can be important. As Pereira et al. (2012) highlight,

> (...) it is necessary that post-consumption goods have the conditions and the chain is structured for collection, selection and revaluation, thus, it will be forwarded to the second-hand goods market. The secondary market for used or remanufactured goods corresponds to a market share not only in Brazil, but also in most countries. (p. 37)

Electronic waste can have in its treatment the return of raw materials to their respective production chains as well as the reuse of them, thus

without any environmental contamination generated. The objective of the research was to investigate the importance of the reuse/treatment of technological waste for the environmental preservation and sustainability of a company.

MATERIAL AND METHOD

A. Research Typification and Procedures: This research was developed by means of a qualitative approach, with a bibliographic review on the theme through books, papers, theses, dissertations, and a survey of information, in secondary sources, from a company in the field of information technology to illustrate the theory. To establish the context, a bibliographic research was carried out as, according to Gil (2002), a bibliographic research is developed based on material already prepared, consisting mainly of books and scientific papers (p. 44). The records available in documents such as books, papers, dissertations made by other researchers are sources for a bibliographic research where the researcher can work through the study of these authors (Severino, 2007). Furthermore, a research was carried out with exploratory purposes to gather information for an understanding on how the studied company initiated change in its business through environmental education and started to establish new parameters of sustainability and a critical thinking about environmental issues in its area of electronics' operations. Simka and Silva (2018) point out that research classified as exploratory aims to provide greater familiarity on the subject/theme researched (p. 45). Thus, the bibliographic research together with the information collected and analyzed on the topic made it possible to propose actions for correct disposal and reduction of electronic waste.

B. Company location, activities and organization: The research was carried out in a company located in the city of São Paulo, on the east side of the city, in the state of São Paulo, Brazil. The company has an entrance through which employees and customers can enter as well as gates for access to larger volume cargo entrances/exits. It occupies an area of approximately 800m². The company is constituted in its main activity as commerce, rental and services in the area of computer science. The main customers are banking and commercial automation companies, parts resellers, retail and wholesale segment and end users. It has a staff of 11 employees in Consolidation of Labor Laws regimen. In the organization of internal activities, it has a reception area for equipment/inputs from customers, suppliers, auctions and donations. A laboratory for analysis, repair and identification of the functional characteristics of computer/electronic products. Two storage areas, the first for products not yet tested and the second for qualified products. Two exit areas, one for products qualified for commercialization or services provided and the second for products for environmental disposal. Rooms for the commercial, purchasing, financial, tax and administrative departments.

RESULTS AND DISCUSSION

The result of the research with analysis of a company that established a new business management, after acquiring knowledge on environmental and organizational issues can establish practices of preservation of the environment, sustainable environmental management, in accordance with the conditions established in the 2010 *PNRS* and pertinent legislation. The company started its activities in 2015, its initial business strategy was to establish commercial sales relationships/services for computer products/ electronics for companies in various business segments. Tachizawa (2015) presents a vision of business management:

> The management of companies in the era of the digital economy and environmental management and social responsibility must face an organization with its enlarged frontiers as absolutely normal. In fact, a new type of relationship is emerging between the organization and its suppliers, customers and other institutions in its operating environment. These relationships should enable organizations to develop comprehensive approaches to their markets, respond quickly to new opportunities, have interorganizational access to common customers, create new markets, share information, act together, expand geographically in joint ventures, among other possibilities. The enlargement of the organization's borders starts to occur due to: (a) environmental and social issues; (b) strategic partnerships and alliances between organizations; and (c) information technologies. (p. 50)

In 2016, there was a change in strategy, highlighting three factors that motivated the company to resize its objectives. The first was a lecture given at the Federation of Industries of the State of São Paulo (FIESP) on environmental disposal and equipment reuse and countless opportunities in Brazil for the type of business on the reuse of Electrical and Electronic Equipment (EEE). The second important factor was the relationship with customers. They requested consultancy to deal with the deactivation computer equipment, as they were concerned with their incorrect disposal and, in some cases, would like to have a value for their assets. The third factor was the IT market consultant, who highlighted the need for customers to purchase computer equipment and parts that are no longer manufactured and inform about the problems of incorrect environmental disposal and the possible damage to people and to the environment. In a process of reflection and business opportunity, the company started to seek out knowledge about the qualification and classification processes of used computer products, so that they could be offered to customers who were looking for spare parts. The items of which the company started to manage vary from a simple mouse, complete computers and their parts, monitors, printers, nobreaks and bank automation equipment.

In this context of acquiring knowledge about reuse and disposal, the company sought to deepen the legal issues within the *PNRS* based on Law no. 12,305/2010 and environmental management criteria, since the electronic products that no longer have operating conditions have to be discarded correctly. Environmental management has processes that determine a workflow in organizations within a company, establishing new quality criteria. The processes that the company used also underwent changes, such as the reception, storage and testing standards for the products that would be reused. In order to improve processes for customers, who needed a valuation of their discontinued products, the company created all the conditions for inventory and movement of the customer's products to their base, which would have to leave with the write-off of tax assets, but also with fair economic value and that the products, if not reused, would be disposed of correctly.

To create technical conditions and management capacity, there was training with information on how the substances contained in electronics and in the manufacturing and maintenance processes are harmful to health. This knowledge is highlighted both in the *PNRS* and in the ISO 14000 standards. Gouveia, Ferron and Kuno (2014) mention that:

> In general, during the usual production and maintenance process, we seek to propose mechanisms to avoid the occurrence of electric shocks during material handling, as well as the inhalation of lead oxides during welding operations and even printing toner dust. (p. 115)

The knowledge acquired by the qualification company was standardized and socialized to contributors in the format of training, using strategies for testing and evaluation, as customers of discontinued parts needed qualified parts. In each training, employees were asked about what is harmful to the environment, if the materials are sent incorrectly and also about the use of protective equipment.

Figure 1 represents the way of testing the internal computer items, right after they are available for future sale.

Figure 1. Memory, processor and charger testing

The verified testing processes that the company performs in the electronic products generate products to be stored and identified to meet the needs of each customer. Reis et al. (2009 as cited in Bartholomeu, 2011) believe that an economic system based on the rational use of renewable resources, on the recycling of materials and on the fair distribution of natural resources offered a solution of balance between society and nature (p. 98). This entire route managed from entry to exit of products, with the identified standards and parameters, constitutes the EMS. Barbieri (2016) highlights that environmental management comprises the guidelines and administrative activities carried out in an organization to achieve positive effects on the environment, that is, to reduce, eliminate or compensate for the environmental problems arising from its performance and avoid others to occur in the future (p. 18). In this way, Tachizawa (2015) presents:

> The concern with environmental and social responsibility issues means that the organization of the new era chooses suppliers that meet its ethical requirements and that attest that the contracted productive inputs meet its environmental requirements, predefined in its corporate policy. In other words, the management of an organization advances to the internal scope of the companies that contracts as suppliers, thus going beyond the traditional organizational boundaries. (p. 50)

The strategies implemented in the company showed important results, because the information on sustainable practices of reuse and proper disposal make the client aware of the destination and the assigned economic value and at the same time serves as a source of resources for its corporate sustainability. In business management, Barbieri (2016) establishes that the company that anticipates meeting new environmental demands through legitimate and true actions ends up creating an important strategic differential (p. 93). It can be observed that all knowledge acquired through Environmental Management has enabled the company to establish itself in the market as a sustainable company and environmentally concerned.

CONCLUSION

Brazilian society, over the past decades, has been increasingly consuming products and, among them, those with electronic technology in their composition, starting this way to realize the need for more sustainable consumption, with an ecological sensitivity that was not considered before, which occurred through the new legislations and knowledge acquired. The companies in turn started to look at the market differently in relation to their products and services with regard to the environmental issue. With the implementation and training of new sustainable environmental practices, concepts about environmental business management processes are changing. From the information obtained through the research carried out and analysis of a company in the field of information technology, it can be concluded the importance of environmental management in business management, as we learn to listen carefully and understand the concepts and best practices for disposal or reuse of electrical and electronic products, which can generate revenue for the company and motivate the people involved. The possibility of carrying out studies for the implantation of an electronics' recycling plant can be suggested because the products at the end of their life cycle, when they no longer have the possibility of reuse, can be treated in a factory where the raw materials generated can return to their industrial cycle.

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