

SMALL AND MEDIUM-SIZED CONFECTIONING COMPANIES OF THE STATE OF RIO DE JANEIRO: ANALYSIS OF THE IMPLEMENTATION OF THE LIFE CYCLE ASSESSMENT TOOL

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ABSTRACT

Purpose This paper analyzes the implementation of the Life Cycle Assessment tools in the Brazilian small and medium-sized confectioning companies, associated with the Federation of Industries of the State of Rio de Janeiro (Firjan).

Methods Considering that SMEs account for more than 60% of the economy of Rio de Janeiro's state, a multiple case study was carried out and the responses of a group of SMEs working in the state were analyzed in relation to their experience and knowledge on the subject.

Results and discussion Most of the investigated companies act on the environment only with palliative actions that do not eliminate the cause or avoid environmental problems, only minimally comply with the legislation.

Conclusions this research concludes that there is a great need to disseminate the concepts of environmental management and its tools, as well as the LCA theme among the industries, especially the SMEs, so that they have enough information to evaluate how they can insert the LCA as a tool of competitive strategy so that their products are recognized as sustainable, both in domestic market and abroad.

Keywords: Life Cycle Assessment; Environmental Management; Small and Medium Enterprises; Sustainability; Firjan.

1. INTRODUCTION

The diffusion of the concepts of sustainability, associated to the evolution of environmental awareness and the increasing competitiveness of the market, have led to the need to expand and improve the production processes, so that products are less harmful to the environment and with the best cost-benefit ratio. Based on this perception comes the concept of Life Cycle and Life Cycle Thinking (LCT).

The technical standard NBR ISO 14044 defines Life Cycle as being all the consecutive and linked stages of a product system, from the acquisition of the raw material or its generation from natural resources to the final disposal (ABNT, 2009). When considering the Life Cycle of a product, the objective is to know the potential that a product has of causing environmental impact. The Life Cycle Assessment (LCA), which, according to the Life Cycle Assessment Ontology (LCAO), is used to quantify the environmental burden of a product since the removal of basic raw materials from nature and their entry in the production system (cradle) until the disposal of the final product (grave) (IBICT, 2014).

Thus, the planning and design phase of a product is of increasing importance to industries (SEBRAE). In this line, the technical report ISO/TR 14062 shows how to integrate the main environmental aspects into the design and development of a product, based on the LCA. This integration is known as Ecodesign¹, defined as the “integration of environmental aspects into product design and development, aimed at reducing adverse environmental impacts throughout the entire product life cycle” (ABNT, 2004).

According to Coltro (2007), the design based on the concept of life cycle allows developing solutions of performance and quality of the product, such as reduction in the consumption of natural resources, efficiency in transportation, besides allowing the launching in the market of products that have longer useful life, recyclable products, among other facilities. For Gontijo and Dias (2014) ecodesign aims to design a project that can reduce the use of natural resources during the production stages and that minimize the environmental impact in all its phases. In addition, according to the Life Cycle Initiative (2017), the process of creating involved in ecodesign should consider:

- a) New concept of development.
- b) Selection of low impact materials.

- c) Reduction in material usage.
- d) Optimization of production techniques.
- e) Product structure level.
- f) Reduction of impact during use.
- g) Optimization of the initial lifetime.
- h) Optimization of the end-of-life system.

Ecodesign maximizes the eco-efficiency of a product (or service) throughout its life cycle (Bleischwitz; Kanda, 2004). Eco-efficiency is not restricted to a source or resource, and its concepts can be applied in any productive process, since it is a combination of environmental and economic bias, in the search for sustainability (Santos et al., 2016). In order to standardize the concept and methodologies that are used to measure the eco-efficiency of a process or company, ISO 14045 defines eco-efficiency as “an aspect of sustainability that relates the environmental performance of a product system to the value of the product” (2014).

The relation of life cycle, eco-efficiency and ecodesign is of extreme importance in the definition of the functionality of the products, allowing and stimulating innovation. For the World Business Council for Sustainable Development (WBCSD, 2018), “innovative companies see beyond changes in product design, they seek new ways to meet customer needs and enter new markets, idealizing more sustainable products” (2000). These Environmental Management tools are adopted by organizations aiming to minimize environmental problems and achieve sustainable development (Alves; Freitas, 2013), as well as customers and stakeholders’ satisfaction, higher quality of products, protection of the environment, and social aspects.

One of the environmental management tools used in Brazil is the environmental licensing, adopted in the country from Law 6.938 of August 31, 1981, which establishes the National Environmental Policy. Environmental licensing is compulsorily required as a prerequisite for business activities to be carried out when it refers to the construction, installation, expansion and operation of establishments and activities that use environmental resources, considered as effective and potentially polluting, as well as those capable of, in any form, cause environmental degradation (Brazil, 1981). The data generated in the environmental licensing process would configure a partial LCA (Coelho Filho et al., 2016) and could be used as a basis for a more complete evaluation.

Regarding corporate environmental management, the ISO 14000 family of technical standards is included. Among

1 According to ABNT NBR ISO 14006:2014, other terminologies used for ecodesign include Environmentally Conscious Design (ECD), Design for Environment (DfE), Green Project, and Environmentally Sustainable Project.

these, is ISO 14001 (ABNT, 2015), which specifies the requirements for an environmental management system (EMS) that an organization can use to increase performance. Within the defined scope of ISO 14001 EMS, the organization shall determine which environmental aspects of its activities, products and services it can control and those that can be influenced, considering a life cycle perspective. The organization may choose to certify its EMS based on ISO 14001, thus demonstrating compliance with EMS requirements. However, if the company is not willing to get certified, it can use the requirements of the standard that involve the concept of surveying and evaluating its environmental aspects and impacts, as a basic tool to start its management process in a simpler way.

According to Bitar and Ortega (1998), the Environmental Impact Assessment (EIA) can be defined as a series of procedures aimed at characterizing and identifying potential impacts of an organization's productive activities, in order to predict the magnitude and importance of the impacts. This instrument serves as a basis for decision-making around measures to be implemented by the organization.

In addition to the EIA-related procedures, there are also footprint concepts (hydro, ecological and carbon) that are a set of indicators used to quantify the earth's capacity to absorb the environmental impacts produced by humanity (Galli et al., 2012). The ecological footprint, expressed in hectares, quantifies the use of productive areas by man and the water footprint, expressed in cubic meters per year, quantifies the use of fresh water (Silva et al., 2013). The carbon footprint quantifies the total greenhouse gases emitted by a process, activity or service during the life cycle of a product (Andrade, 2010). In this way, environmental management can be characterized by a series of procedures to be followed, application of techniques, and adoption of tools, systematically by the company, to ensure that its activities are in compliance with the legislation and with the intended objectives.

Martín-Tapia et al. (2010) point out to the reactive bias of SMEs regarding environmental management. According to the authors, descriptive studies on SMEs often highlight their low rate of environmental commitment, describing them as interested only in complying with environmental regulations, also emphasizing that often many of their owners have little knowledge of the natural environment and lack of experience in environmental management.

According to Daddi et al. (2016), an important barrier that SMEs face in relation to environmental issues is the lack of engagement between the owner and manager due to several factors, such as the belief that the environmental footprint of SMEs is insignificant; the lack of experience and understanding in combating environmental impacts; a

low level of compliance as a result of a lack of awareness of environmental regulations and a low level of acceptance of the environmental management system as a result of lack of time, money and technical knowledge. In addition to that, the authors also attribute this reactivity to the environmental management tools to the tools themselves, which are often not developed, considering SMEs' characteristics and their possible difficulties to implement them.

In 2011, the Polish Agency for Enterprise Development (PAED) funded a project on the implementation of life-cycle assessment tools in small and medium-sized Polish enterprises. The results of the project were published in a series of three articles in the International Journal of Life Cycle Assessment in 2014 (Kurzewski, 2014; Witczak et al., 2014; Selech et al., 2014). The central question that the project sought to answer was whether Polish small and medium-sized enterprises, often struggling with financial problems and the challenge of market survival, were ready to accept Life Cycle Thinking and take responsibility for environmental issues beyond their own organizations. This research has shown that small and medium-sized companies rarely know their environmental aspects, considering the different stages of the life cycle of their products. Most of them are limited to the aspects of their day-to-day operations and only attempt to meet the mandatory legal requirements in licenses and authorizations.

This work is based on the premise that SMEs, considered as sources of innovation and business entrepreneurship of the future (Lopes, 2010), should also include LCA in their management for the benefits derived from this practice, once it can be used as a strategic tool to increase their competitiveness. Therefore, in this work, the clothing confection SMEs, established in the State of Rio de Janeiro, associated to the Federation of Industries of the State of Rio de Janeiro (Firjan, Brazil), according to the strategy of Firjan's marketing business plan, will be studied, seeking to analyze the knowledge and the implementation of the Life Cycle Assessment tools in these companies, by identifying the variables that influence the implementation and obstacles faced by SMEs, as well as proposing strategies to overcome the identified obstacles.

2. METHODS

Considering the objectives to be achieved with this work, the research was planned and structured in the light of the work of Witczak et Al. (2014), as well as the materials and methods that were used to design the research project.

The methodology used is of a qualitative approach (Godoy, 1995), and it is intended to understand the perception of a certain group of medium and small companies, in

relation to the Life Cycle Assessment tools. This research can be classified according to its nature and based on its objectives. As for its nature, it is characterized as applied research (Gerhardt; Silveira, 2009), aiming to generate data capable of solving possible problems in the adoption of the Life Cycle Assessment tools by medium and small companies. Based on the objectives, the research is characterized as exploratory (Gil, 2002), since it seeks to provide SMEs with greater familiarity with the LCA tools, focusing on disseminating and incorporating the concept of life cycle and sustainability into the production methods.

The instrument used in this research for data collection was a questionnaire composed of 16 closed questions, organized in 5 sections, aimed at collecting data that allowed evaluating the environmental practices that demonstrate the knowledge and the implantation of the Life Cycle Assessment by SMEs of the of the State of Rio de Janeiro, as shown in Table 1.

Table 1. Thematic sections (S) of the questionnaire

| Section | | Objective |
|---------|---|--|
| S1 | Research Presentation | It is not composed of questions, but only by a presentation text of and definition of concepts that are intended to explain the objectives of the research. |
| S2 | Respondent Profile | It allows knowing the respondent according to their training and area of activity. |
| S3 | Company Features | It allows classifying the company according to its size and performance. |
| S4 | Characteristics of Environmental Management | It allows knowing the environmental profile of the company, according to the programs developed daily. |
| S5 | Life Cycle Assessment | This section allows understanding the familiarization of the company with the concept of LCA, which for this section is defined as: "Evaluation used to quantify the environmental burden of a product, since the nature of the raw materials entering the production system (cradle) are available to the final product (grave)" (IBICT, 2014). |
| S6 | Life Cycle Tools | It allows knowing which tools that contribute to the insertion of the thought of the life cycle are used by the company. |

Source: Authors.

The questionnaire was validated through the statistical evaluation of its internal consistency, estimated using the Cronbach's alpha coefficient. The alpha value varies from 0 to 1, measuring the average correlation between questions and answers by analyzing the profile of the answers

given by the respondents (Matthiensen, 2011) with the same measurement scale, calculated from the variance of each item and from the total variance, of each evaluator (Hora et al., 2010). The formula presented for calculation is:

$$a = \frac{k}{k-1} \times \left(1 - \frac{\sum_{i=1}^k S_i^2}{S_T^2} \right) \quad (1)$$

Where: a = Cronbach's alpha coefficient; k = number of items in the questionnaire; S_i^2 = variance of each item; S_T^2 = total variance. Considering the structure of the validation instrument used and the return obtained from each respondent (T). In practice, Cronbach's alpha of at least 0.70 was suggested to indicate adequate internal consistency (Nunnally, 1978). A low value of Cronbach's alpha may be due to the weak interrelationship between items; thus, items with low correlation with the total questionnaire score should be discarded or revised (Tsang et al., 2017).

The methodology used to validate the survey questionnaire content is the development of a tool for recording the judgment of the selected respondents, in order to facilitate the analysis of the questions and the sections that comprise them, followed by an overall evaluation of the questionnaire. The attributes of the questionnaire to be analyzed by the respondents, in the validation stage, are shown in table 2.

Table 2. Judgment Criteria

| CRITERIA | DESCRIPTION |
|----------------------------------|--|
| Relevance | Degree of importance / need; |
| Scope | Degree of coverage of dimension; |
| Clarity | Quality of what is clear or intelligible; |
| Subjective decisions | Judgment by non-explicit criteria; |
| Possibility of generating biases | Deviations induced by the formulation of the question; |
| Redundancy | Degree of repetition of questions; |
| Core extension | Sufficient size; |
| Ambiguity | Possibility of generating doubts. |

Source: Authors.

For the validation (Haynes et al., 1995), the respondents indicated the degree of evaluation of the content, based on a Likert scale (table 3) and had space to comment on questions and items that judged the need for revision to identify opportunities and redundancy, suggest issues not contemplated or with partiality, and possible failures. According to Silva Junior and Costa (2014), this verification scale develops

a set of statements, based on a theoretical concept, from its definition, where respondents will numerically declare their degree of agreement.

Table 3. Scale for Evaluation of Questionnaire.

| Insufficient | Bad | Regular | Good | Excellent |
|--------------|-----|---------|------|-----------|
| 1 | 2 | 3 | 4 | 5 |

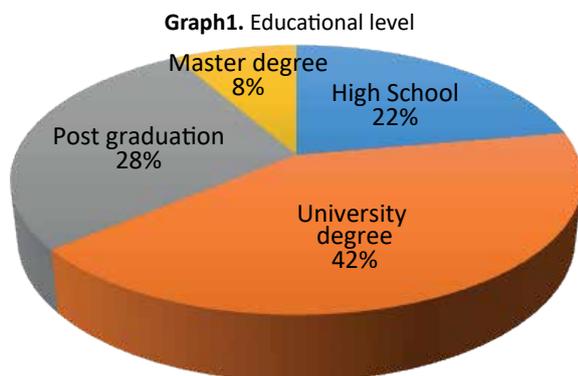
Source: Authors.

The questionnaire was sent to 30 respondents, selected by trial (non-probabilistic sampling), from which 18 validation instruments returned, accounting for 60% of the total sent for validation. The result of the validation step returned a value of 0.78 for Cronbach's alpha, thus considering the questionnaire as validated.

3. RESULTS

The questionnaire was applied to the companies of the clothing sector from July 20, 2018 to November 30, 2018, totaling 36 responses received. These responses were evaluated and grouped in order to organize views at similar levels. Subsequently, they were quantified and arranged graphically, thus allowing a conclusion about these data obtained.

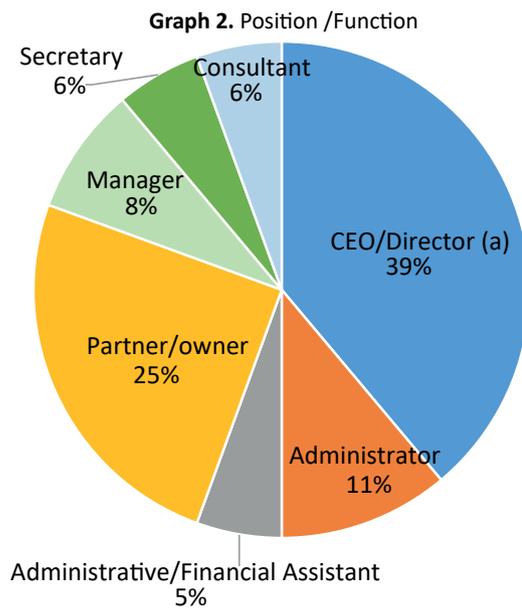
Graph 1 shows the results obtained on the educational level of respondents, with 78% of respondents with higher education.



Source: Authors.

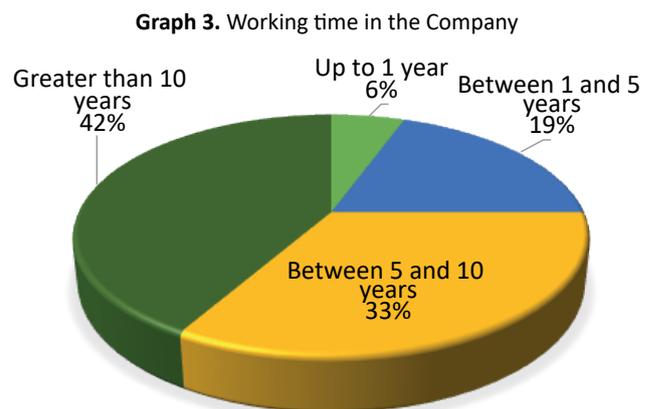
In analyzing this graph, a link can be made between the educational level and the position or function performed by the respondent in the company, which demonstrates the involvement of the highest hierarchical levels with the research, thus increasing the quality of the data obtained, considering that usually this same leadership is responsible for implementing, managing, financing and stimulating environmental programs within the organization, especially when related to small businesses with few employees.

In Graph 2 it is possible to know the performance of respondents in the company, according to the position or function they occupy, the majority of them being CEOs and/or Owners of the companies they represent.



Source: Authors.

The quality of the answers is reinforced when we observe that the great majority of the respondents have more than 10 years in the company, as shown in Graph 3. This shows a good level of maturity and organizational knowledge and consequently greater capacity to evaluate the practices, knowledge and vision of the company, as well as the barriers and challenges they face when it comes to environmental issues.

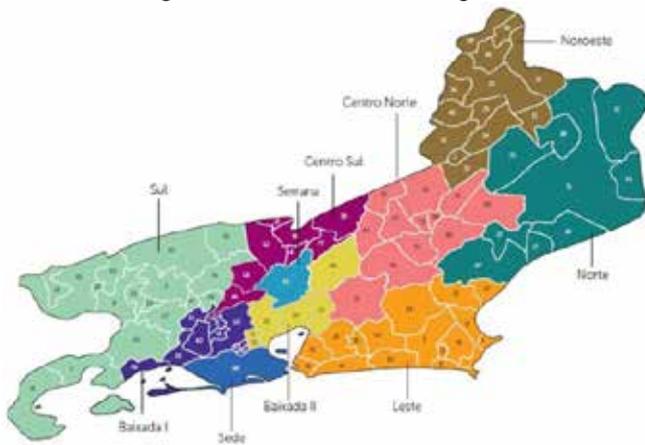


Source: Authors.

The size and profile of the company were identified based on the location, number of direct employees, and the profile of its clients, whether they are in the internal or external market. In the case of exporting companies, the questionnaire allowed the identification of the countries of the clients.

In order to evaluate the location data, the companies were divided and grouped according to the economic profile, drawn by Firjan and presented in Figure 1, for the State of Rio de Janeiro (Firjan, 2018).

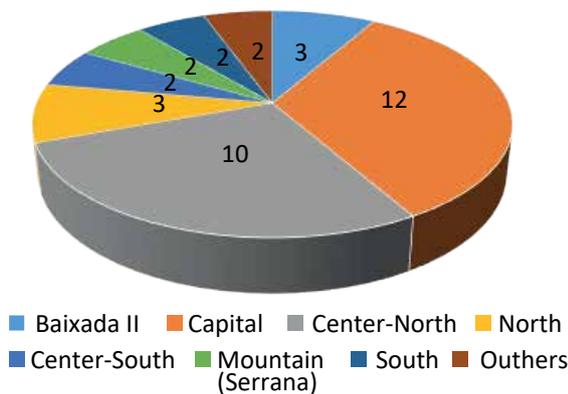
Figure 1. Rio de Janeiro State Regions.



Source: Retratos Regionais (Firjan, 2018).

There is a predominance of installation of respondent companies in the city of Rio de Janeiro (Capital or “Sede”), which has 33% of formal clothing establishments (Firjan, 2016) and in 2015, it accounts for 48.7% of the state’s total GDP (Firjan, 2018). The second largest number of information refers to companies located in the central-north region that owns 28% of the formal clothing establishments, as shown in Graph 4 (Firjan, 2016). Thus, the information extracted from the research can be considered representative of the sector in each region, portraying the vision regarding the environmental issues addressed in the research.

Graph 4. Location of Companies.

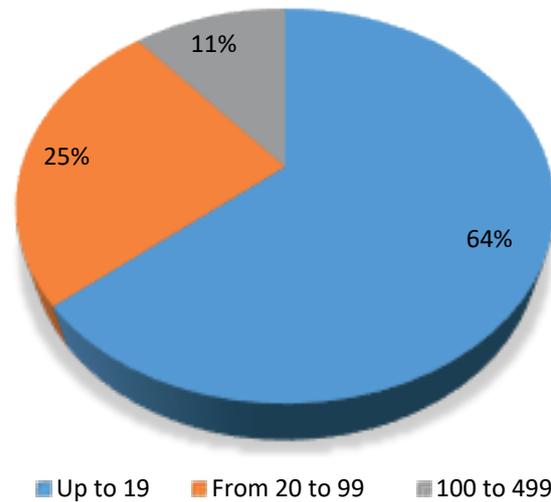


Source: Authors.

In order to classify the size of the companies and to fit them into the group to be studied (small and medium); the number of formal employees was extracted from the

respondents, allowing a respondent company classified according to its size as a large company to be discarded. According to the data obtained (Graph 5), the largest number of respondents (64%) is registered as being small, which also allows us to understand whether there are different barriers for different company sizes.

Graph 5. Number of Employees.



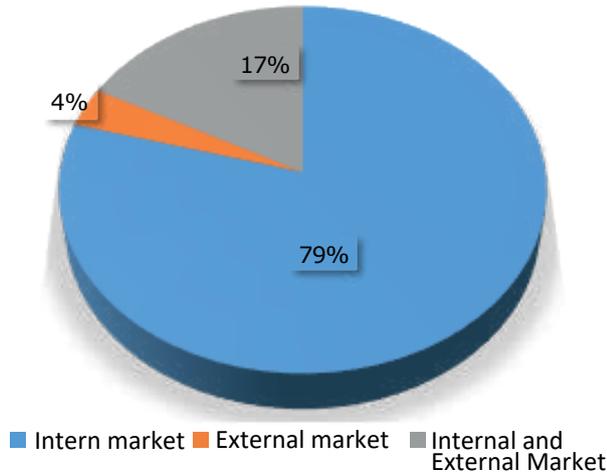
Source: Authors.

Regardless of the classification by number of employees, the type of customer of each company can portray the level of requirements and quality of the products offered; thus, it was sought to know which public each company attends and, in the case of an exporting one, to which countries it supplies. It is known that different countries, in different continents, represent different regulations and technical standards, as well as different product acceptance criteria, which may represent technical barriers, mainly to small businesses that do not always have a technical staff or assistance to meet these specifications.

Graph 6 shows that 11% of companies supply the domestic and foreign markets, thus needing to deal with different rules and technical barriers, which can modify their environmental vision of their products.

Companies with environmental licenses have also been identified, which demonstrates a minimum level of compliance with the state’s environmental legislation and, consequently, a certain level of adoption of environmental programs. It should be noted that some companies can be exempted from licensing. This assessment is made by the environmental agency, based on its classification, size, pollution potential, generation of waste and effluents, and consumption of natural resources.

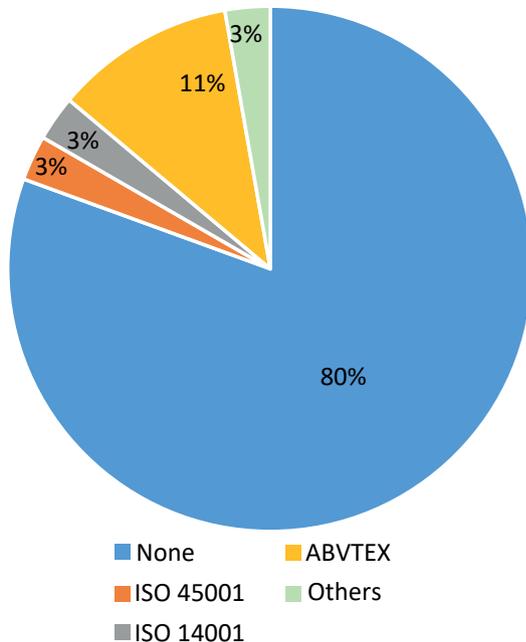
Graph 6. Customers.



Source: Authors.

Graph 7 shows that 47% of respondent companies do not have an environmental license, which can be considered a high number, depending on the volume of waste generated, which is a characteristic of this segment. It is also important to note that, of the 33% who consider that the license is not applicable, it cannot be guaranteed that this statement is extracted from the official form of the environmental agency of the state of Rio de Janeiro, or an opinion of the company itself. In this case, it is possible that environmental programs important to LCA do not gain importance or notoriety within the management of the company due to omission or ignorance.

Graph 7. Companies that have some type of Environmental License.



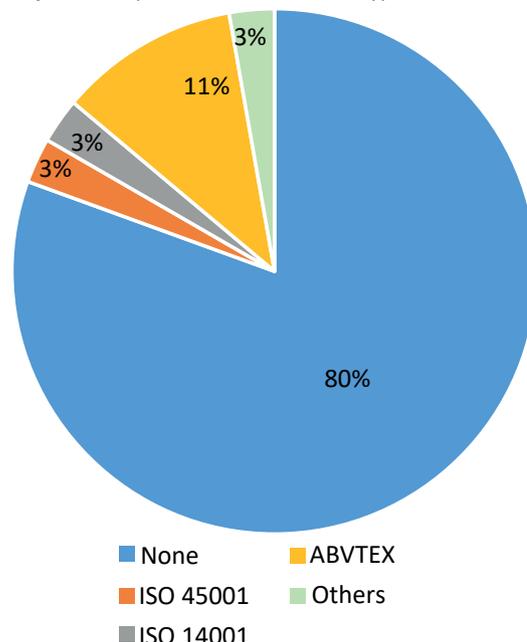
Source: Authors.

One way to stimulate the incorporation of life cycle management into the environmental management of companies is the adoption of Life Cycle Thinking (LCT), quoted and brought to the discussion by the latest version of ISO 14001 (ABNT, 2015), which established the need to consider this issue.

Considering the LCT and the management model of other certifiable systems, which are based on planning and risk vision, it can be considered that the adoption of these systems facilitates the implementation of new tools in the company. Therefore, we sought to identify which systems or certifications the respondent companies adopt in their daily activities. According to the data observed, the vast majority have no management model based on certifiable technical requirements and standards.

Observing the data obtained in figure 8, in addition to the certification of an EMS based on the ISO 14001 (ISO) standard, some companies are certified to ISO 45001 (2018), which establishes the requirements to implement an Occupational Health and Safety Management System. Although this standard does not have environmental applications, it has the same basis as other ISO standards, requiring leadership commitment, which facilitates the adoption of integrated management systems, increasing the chances of success and return of deployment and maintenance. The ABVTEX certification program aims to qualify suppliers so that retailers can develop, monitor and support compliance with aspects related to social responsibility, labor relations and business sustainability (ABIHPEC; Sebrae, 2019).

Graph 8. Companies that have some type of Certification.

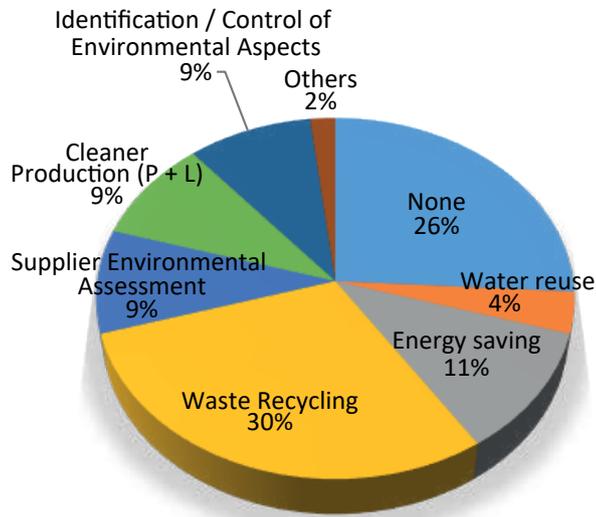


Source: Authors.

Regardless of the company’s performance model, some environmental programs may be developed, such as a natural resources control program. Considering the definition of LCA, it is assumed that any environmental program can be considered a premise of life-cycle-based thinking, or be used as part of a complete LCA study, as well as serve as a tool for collecting data for the implementation of LCA by these companies. Thus, the questionnaire sought to know the initiatives developed by the companies, in environmental terms.

Graph 9 shows that 30% of the companies are concerned with and at least develop actions to recycle their waste; however, a significant number of the organizations (26%) do not develop any environmental program. This number can represent a great opportunity of gain if the LCT can be inserted in the stages of development and production of these companies. It should be noted that the company may have more than one environmental program.

Graph 9. Environmental Programs developed by the company.



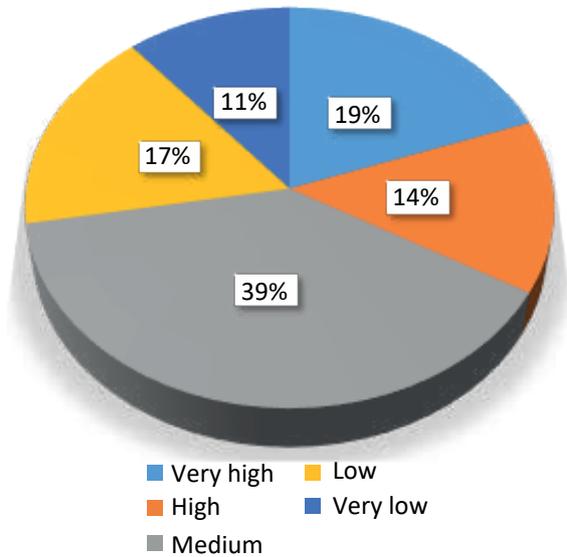
Source: Authors.

The LCA can be an important tool of innovation for the company because it allows knowing all the stages of the process, as well as its vulnerabilities and opportunities. A great opportunity is the exchange of raw materials for environmentally correct or less impactful ones. However, replacing the main raw material or some other part of the main product, despite aggregation, can be a great challenge. To know how challenging this change can be, we sought to know the maximum degree of difficulty, on a scale of 1 to 5, considering 5 the maximum difficulty level and 1 the minimum level that these companies see in replacing the raw material of their products.

As shown in Graph 10, most companies consider this substitution as a median, which may reflect the process view that these companies have and can demonstrate that at

least a part of them has already considered or evaluated the possibility of exchange, if necessary.

Graph 10. Degree of difficulty of substitution of main raw material.

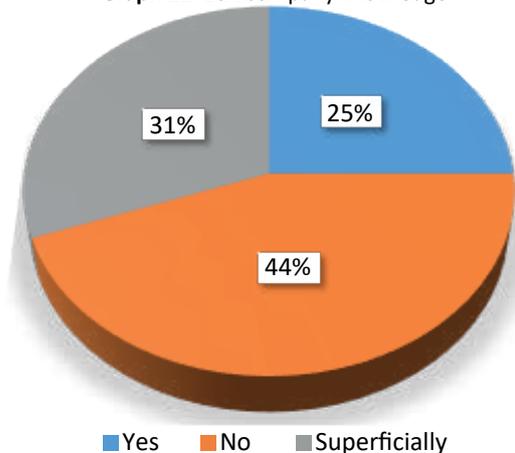


Source: Authors.

For an adequate analysis of the adoption of the LCA by the group of small and medium sized companies studied, it is of fundamental importance to be aware of the concept of life cycle assessment and life cycle tools that can be adopted for this evaluation.

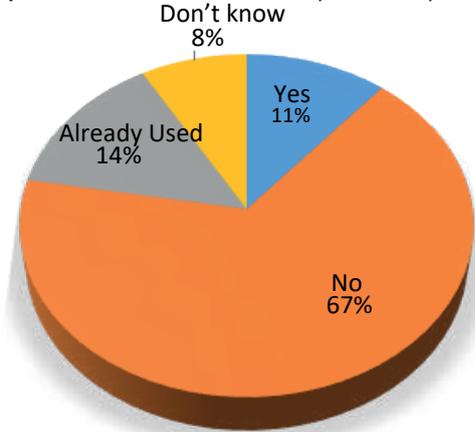
Graph 11 shows that 44% of the companies do not know the concept and a representative number know it superficially, which explains the graph 12, which shows that 66% of these companies do not use the life cycle tools, that is, they do not perform the LCA.

Graph 11. LCA company knowledge.



Source: Authors.

Graph 12. Use of one or more life cycle tools by the company.

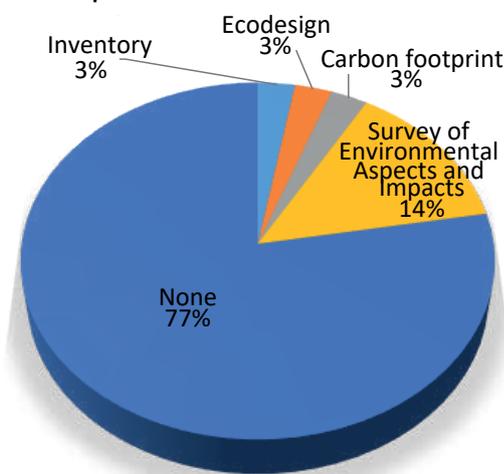


Source: Authors.

The most common environmental tools for building a LCA can be used for other purposes and are not always associated exclusively to LCA by companies. Knowing these tools, we can analyze the possibility of using them to build a robust LCA study and to use this study for company development, innovation, opening new markets, and other management strategies.

However, as displayed in Graph 13, 78% of the companies studied do not adopt any of the most common environmental tools used for LCA, which shows a certain environmental fragility of the sector and indicates a great opportunity for development as well.

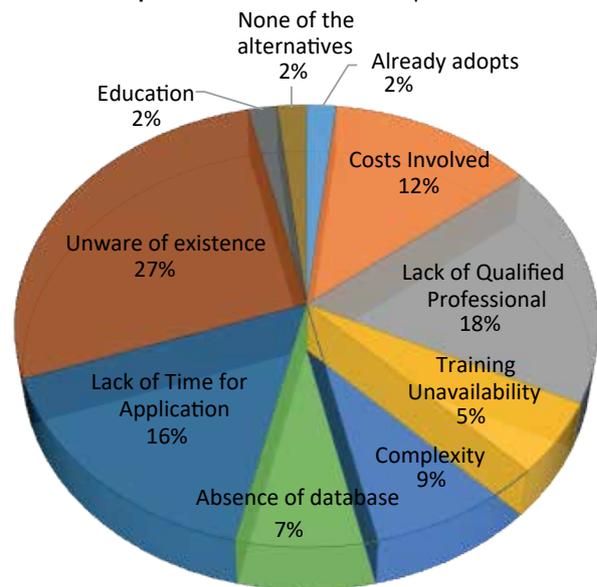
Graph 13. Environmental tools used for LCA.



Source: Authors.

Based on the existing literature and the practical experiences in daily activities with small and medium-sized companies, it was considered the hypothesis of some of these not adopting the environmental tools. Thus, we sought to identify the main reasons for non-adoption. A total of 27% of the respondents stated that lack of knowledge of LCA was the main reason, followed by lack of qualified professionals within these companies (18%) and lack of time to implement these programs (16%).

Graph 14. Reasons for Non-Adoption of LCA.



Source: Authors.

Likewise, it was sought to know the reasons that would lead the company to adopt the LCA, as a way to identify the opportunities and promote new sustainability practices within a business model that, until then, does not understand environmental issues as a model of strategic action.

Graph 15 demonstrates that the reasons are varied, 22% would adopt it to have a competitive advantage over their competitors in the market, another 19% to improve the image of their products, while 17% would adopt LCA to plan new products, and 10% signaled that if they had the support of a subsidized consultancy, they would adopt the LCA as a management tool.

Graph 15. Reasons for Adoption of LCA.



Source: Authors.

4. DISCUSSION

Based on the analysis of the data obtained from the research, it can be seen that the small and medium-sized clothing confection industries that export their products or provide to large retailers understand more easily the importance of implementing an environmental management and are able to see LCA as a good tool to control their environmental aspects, with a view to eliminating or minimizing impacts related to their products. In addition, the survey demonstrates that companies with an environmental license or some certification have a more in-depth knowledge of environmental issues, whether acquired in practice or in the daily practice of their activities, or due to the requirements that are specified in the licenses, legal requirements, and even contractual requirements imposed by their purchasers.

However, unlike the previous ones, these are the majority of respondent companies, as can be seen in the results shown in the graphs. Although most of these companies are located in the capital, which gives them greater visibility, as well as greater proximity to the community and regulatory agencies, they do not have a license or some kind of management of environmental issues and, even though they

have a stable market position, with more than 10 years of activity and a good level of education of its managers, environmental issues are still limited to waste recycling, and are the most effective tools for the economic growth of the company, outside of managerial and strategic discussions. Whether by popularity, economic return or because it is one of the major environmental aspects of this sector, waste management, control and recycling have been the only actions of the companies, which can be critical, considering the complexity of the interaction between company and environment in all phases of the process, from raw material acquisition to disposal. Although bulky, the majority of garment waste is not classified as hazardous and, even though it is expensive to dispose of, it would be more efficient to minimize the generation of waste, whether due to changes or improvement in the production process or in product design, for example.

Such superficiality in environmental management allows us to infer that most companies act on the environment only with palliative actions that do not eliminate the cause or avoid environmental problems; they only comply minimally with the legislation. This culture needs to be re-evaluated and the management tools combined to address the environmental problems of the companies at source, reducing and eliminating waste and consequently correction costs, as well as damage to the company or product image. To do this, it is necessary to economically see the effects of investing time and money in environmental management, that is, with the certainty of the return demonstrated in numerical terms, 87% of respondents stated the possibility of changes in their performance and even in the substitution of the main raw material of their products, improving their production process, making them cleaner companies and even severely altering the design of their products. This bias reinforces Knorr's (2011) theory that stimulates the association between environment and business.

Besides the economic character, it can be observed that culturally, external factors contribute to accelerate the process of environmental awareness within companies and insert management directly into the business strategy. Such factors include the pressure from consumers, the media and even the external market, regarding the consumption of environmentally less harmful products and their requirement to know and understand why the product can be considered "green" or sustainable, and under which rating criteria. According to 10% of respondents, customer requirements can stimulate the diffusion of life-cycle thinking and the adoption of LCA at all stages, "from cradle to grave", which leads us to draw the same conclusion of Witczak (2014) in his case study, demonstrating that in the sense of strategic environmental management, there is no difference between a Polish and a Brazilian SME.

Based on these evaluations, we can conclude that there are still other ways to stimulate LCA adoption, through the propagation of the concepts that surround it and the diffusion of the experiences obtained by different types of company, in different places of the world, when they decide to adopt it over there. Considering the SMEs, most of which are not aware of LCA, it is well known that discussions and disclosures need to go beyond academic boundaries and enter business reality. Cooperative agreements and agreements between researchers, federations, industries and institutes specializing in LCA are important instruments to be used for this purpose, as they put the developers and users of the environmental tools and technical requirements for LCA implementation in contact, allowing them to consider the reality and difficulty of SMEs, generating solutions so that these management tools are intrinsic to the business, not being a managerial obstacle in any aspect. The preparation and dissemination of booklets and group training for the managers of these companies help further demystify the LCA applied to the daily routine of companies. In addition, support from international institutions for conducting studies, training and dissemination in journals, as well as supporting projects that finance not only the training of companies, but also the adoption of innovative practices with a view to improve the environmental footprint and sustainable development, eliminates the barriers to this incorporation.

In addition to the already mentioned, we can include in the barrier concept the lack of knowledge of the LCA and the environmental management tools associated with it, further distancing SMEs from the theme. Generally, when a subject is not dominated, the company is faced with the need to invest in skilled labor, training and consulting to only then be able to operationalize it. Thus, we can see that it becomes a vicious cycle where the obstacles are not overcome by not seeing economic benefits, only the high financial investments required, depending on the company's billing. Not only that, the dispensation of time and labor, often already scarce in SMEs, also represent a relevant obstacle in relating billing, cost, profit and maintenance of a formal employee.

Aiming to overcome all the obstacles observed in the research, a good strategy to be adopted is the LCA implementation in a group, through the creation of a program structured by the SENAI Institute of Environmental Technology, with the support of Firjan, whose objective is to develop sustainably small and medium-sized businesses. Ideally, this program can be applied by segment and by region of action, eliminating some consulting, hosting and displacement costs. It should be noted that the program can count on important and strategic partnerships of other governmental institutions interested in the diffusion of LCA. In addition, some development agencies, including international agencies, directly encourage subsidizing projects in this way,

which would require the company to bear only the costs of a small percentage of this consultancy for its participation.

There is also the method of implementing a "performance" project in parts, whose objective is solely to insert in the company an environmental management tool related to LCA that best fits in its current condition and allows greater gain. Thus, the payment of the program is only made if the SME obtains an increase in its productivity.

5. CONCLUSIONS

In general, the objectives proposed by this work were identified and achieved, and it is possible to list the main variables that influence the implementation of the LCA: the existence of an environmental license, the adoption of certifiable management programs and the knowledge in terms of return (real gains) obtained with the adoption of the LCA.

In addition, it was possible to conclude the main obstacles faced by SMEs in the implementation of LCA in their management, which are the lack of practical and theoretical knowledge; the absence of qualified professionals in the companies' functional body, and the costs involved.

The gathered observations allow us to affirm that the SMEs in the clothing sector, located in the state of Rio de Janeiro, respondents to the research, have doubts and difficulties in the adoption of concepts and tools involved with the LCA, similar to the SMEs of developed countries, as is the case of the Polish companies referenced in this study.

In view of this, the increase in the number of SMEs covered and immersed in the knowledge about LCA is of extreme importance for environmental issues to find space in strategic business management. To this end, support from the government, private companies, development agencies, universities, among others, is of the utmost importance. Therefore, it is recommended that SMEs be stimulated through projects and specialized technical consultancy for the environmental adequacy of their basic activities, especially those related to compliance with legislation and seeking an environmental permit, so that they are mature and able to implement LCA tools with clarity and defined objectives.

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