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Barriers and facilitators of technological eco-innovations: a multilevel analysis in a Brazilian cosmetics company

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Abstract

Purpose – This study analyzed the multilevel barriers and facilitators of technological eco-innovations.
Design/methodology/approach – The authors carried out an in-depth case study in a Brazilian cosmetics company, recognized for its eco-innovative initiatives, which has the technological eco-innovation of products as a central sustainability strategy.
Findings – The results contribute to the existing literature, showing that multilevel analysis is effective for minimizing barriers and increasing facilitators, especially through the company's adoption of an eco-innovation strategy and planning methodologies. The authors identified four groups of barriers: market, raw material, governmental and company's internal factors; and four groups of facilitators: legislation, market and technological innovation, communication and environmental management.
Originality/value – The original research results contribute both to the literature and to the companies that aim to implement eco-innovative measures. The results showed that the adoption of innovation strategies and planning methodologies by the company can minimize barriers and enhance facilitators. In addition the fact is that barriers and facilitators of implementing eco-innovations are dynamic factors that require continuous monitoring since they can be a barrier in one circumstance and a facilitator in another.

Keywords Eco-innovation, Green innovation, Technological innovation, Multilevel analysis, Cosmetics
Paper type Case study

1. Introduction

The unreasonable use of natural resources, pollution and population growth have compromised the planet's biocapacity (Lacy & Ruteqvist, 2016). Humanity already feels the damage through climate changes, extreme events, global warming, deforestation and extinction of species. This anthropogenic effect on Earth demands immediate action from society and companies. At the company level, it is necessary to innovate in production ways, with greater attention to the product cycle and services, besides changing organizational performance (De Jesus, Antunes, Santos, & Mendonça, 2019; Krajnc & Glavič, 2003; Secchi, Castellani, Collina, Mirabella, & Sala, 2016).

Not only do political and technological measures need to address environmental issues, but all innovations must have this concern (Leach *et al.*, 2012). Therefore, eco-innovation is an essential tool that enables sustainable business strategies and directly regards the dimensions of economic, social and environmental sustainability (de Jesus Pacheco *et al.*,

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2017). Kemp and Pearson (2007) confirm that by defining *eco-innovation* as a way of production, incorporation and use of the product, service or management style, seeking to decrease the negative impacts on the environment.

Firms have difficulty considering environmental impacts as consequences of their actions (Frone & Frone, 2017), especially the traditional ones, which need to adapt to developing less harmful products to the environment (Barbieri, 2004; Kemp, 2011). There are some potential explanations for this behavior, such as the innovation policy that does not address environmental aspects; the lack of standards for technological solutions or for measuring and assessing environmental performance (Andersen & Foxon, 2009; de Marchi, 2012); managers' doubts on the benefits of innovation with focus on the environment (Porter & Van der Linde, 1995); and finally, firms' economic concerns that lead them to ignore the environmental and social results of their actions (Peng & Liu, 2016).

Although eco-innovation is a potential solution to environmental difficulties, technological uncertainties and complexity are due to organizations' inexperience. However, there are also facilitators capable of stimulating eco-innovative practices, as they serve as a differential for the organization, providing visibility to consumers.

The literature on eco-innovations has been most commonly explored in the sectors of chemical engineering (Patel, Somani, Bajaj, & Jasra, 2006), civil engineering (Semeraro, Aretano, & Pomes, 2019), food engineering (Dammak, Neves, Isoda, Sayadi, & Nakajima, 2016), production engineering (Chen *et al.*, 2013) and electrical and electronics engineering (Cheng & Shiu, 2012; Wong, 2013; Tumelero, Sbragia, & Evans, 2019).

As Gunarathne (2019) observes, barriers and facilitators for implementing eco-innovations are highly significant since they help measure eco-innovative initiatives and also highlight the environmental and social benefits arising from the implementation of eco-innovation.

Marin, Marzucchi, and Zoboli (2015) mentioned that the topic of eco-innovation barriers in the literature is still at an early stage. From the environmental approach, eco-innovations have their own barriers, distinct from traditional innovations, and that needs more attention.

Andersen and Foxon (2009) observe that eco-innovations are affected by the organization's internal and external elements. Such elements operate at different levels, from State powers to internal influences (Gunarathne, 2019). Considering the arguments of Hazarika and Zhang (2019), the multilevel methodology is a tool for assessing the performance levels of eco-innovation's barriers and facilitators.

As already mentioned, there is a gap in eco-innovation sectorial studies, and Maçaneiro (2012) strengthened the need for studies that analyze the applications of eco-innovations adopted by companies in different sectors. The cosmetics sector has been present in society since the beginning of civilization, and the ancient Egyptians already used lip dyes and oils as perfume. Created for people's well-being, cosmetics are used for personal hygiene and increase self-esteem, an essential element in society's daily life. However, evidence leads to consider the cosmetic sector as one of the most toxic and polluting (Secchi *et al.*, 2016).

The current scenario has imposed on these companies the challenge of continuing to produce even with the shortage of natural resources (Sahota, 2013), especially during the COVID-19 pandemic, when the Brazilian Association of Personal Hygiene, Perfumery, and Cosmetics Industry (ABIHPEC, 2021) anticipated a sales drop due to the slowness of economic activities, unemployment, dollar appreciation and the suspension of commercial activities. Another relevant factor is that small and medium-sized companies are the drivers of innovation and creativity in the sector (Sahota, 2013).

Dugonski and Tumelero (2020) made an initial theoretical effort to classify the barriers and facilitators of eco-innovation. However, the literature is neither conclusive on which they are nor presents them empirically. Hence, there is an opportunity to investigate the macro,

meso and micro levels of barriers and facilitators of technological eco-innovations. The macro level refers to the natural environment, the operation that involves the internal and external environment; the meso level corresponds to actions that involve the economy of a region and its environment; and the micro level comprises a company's internal actions (Prieto-Sandoval, Jaca, & Ormazabal, 2018). Given the research opportunities identified, this study sought to answer the following question: *What are the barriers and facilitators in implementing technological eco-innovations in a cosmetics company?*

2. Theoretical background

2.1 Technological eco-innovations

Eco-innovation gained visibility with the research by Fussler and James (1996), entitled "Driving Eco-Innovation." The authors define it through three pillars they call "stability," which, in turn, relate to sustainability. *Ecological stability* regards environmental protection; *resource stability* aims to keep and use natural resources consciously to be accessible in the future; finally, *socioeconomic stability* deals with issues related to the quality and maintenance of life on Earth.

The Organization for Economic Cooperation and Development (OECD, 2009) conceptualized eco-innovation as an innovation that seeks to reduce the environment's adverse effects, intentional or not, even transforming social and institutional structures.

For eco-innovation to occur, it is necessary to recycle and reuse previous products, as well as to apply natural resources consciously to avoid waste. This production, based on the principle of reducing, reusing and recycling (3Rs), helps product development through efficient processes and clean technologies, generating savings and putting the company in the spotlight (Kiefer, Del Rio González, & Carrillo-Hermosilla, 2019; Porter & Van der Linde, 1995).

Fussler and James (1996) define eco-innovation as a process or product that, in addition to reducing environmental impact, adds value to end customers, whereas Rennings (2000) addresses it more thoroughly, showing that it groups actions of different social players, by which new behaviors, processes and products are developed, resulting in the reduction of environmental risks, pollution and use of resources. Andersen and Foxon (2009) see eco-innovation from an industrial dynamics perspective, considering it can attract the so-called "green" revenues into the market.

Freire (2018) extends the concept even more widely than other authors. Eco-innovations are sociotechnical changes that occur from the pressures of social and environmental elements and from the perception of control by decision-makers on requirements and opportunities, which serve as incentives for getting involved in it.

The definitions suggest that some concepts encompass more aspects than others. However, all definitions have in common the search for the efficient use of natural resources, thus achieving environmental development (García-Granero, Piedra-Muñoz, & Galdeano-Gómez, 2018).

The Eco-Innovation Observatory (EIO, 2013) defines six distinct types of eco-innovation: organizational, process, product, marketing, social and systems. We describe them in Table 1.

Hence, for management, eco-innovation covers all types. As something new to the environment where it operates, eco-innovation is affected by a series of barriers that limit its performance and facilitators that encourage its implementation, as we present in the following sections.

2.2 Barriers of eco-innovation

As already mentioned, the implementation of eco-innovations is surrounded by barriers, mainly due to the need for organizational adjustments, from procedures in the production

Type	Description
Organizational eco-innovations	New management attitudes, which include training projects, eco-design programs and initiatives that aim at eco-innovative outcomes
Process eco-innovations	The goal is to optimize the use of natural resources and to recover productions in postuse state to reduce the environmental impacts caused by them
Product eco-innovations	Aims at product development, by thinking in the whole life cycle, so that they generate the least amount of waste possible, seeking greater durability, repair, reuse and recycling
Marketing eco-innovations	The goal is to use eco-design, through recyclable labels and packages. And to work with shapes that make the product more attractive to consumers
Social eco-innovations	Follows the changes, and encourages modifications in the ways of consumption, taking into account consumers' opinions for developing the products
System eco-innovations	Through a macro vision, it influences all previous eco-innovations, since the result affects all levels

Source(s): Adapted from EIO (2013)

Table 1. Types of eco-innovation

process to managerial styles. Moreover, it requires work and investment without a guaranteed return, thus being a great opportunity, but with risks and costs (Porter & Van der Linde, 1995; Wong, 2013), limiting the possibility of adopting "radical" eco-innovations (Hazarika & Zhang, 2019).

Literature mentions internal organizational environment barriers, such as technical skills, environmental management and available financial resources. In addition, there are external barriers linked to the ecosystem where the company operates, as the availability of suppliers and government support (Jabbour *et al.*, 2018; Kiefer *et al.*, 2019). According to Cai and Li (2018), external barriers comprise three types: *coercive pressure* (through policies and regulations), *normative pressure* (from the market) *and mimetic pressure* (from competitors).

Polzin, von Flotow, and Klerkx (2016) observe that financiers are a vital element for eco-innovation implementation since financial contribution enables developing and disclosing organization's initiatives. If sustainability is not a priority to management, in addition to infrastructure, marketing networks or support regulations, the lack of these elements will be a barrier to its implementation. Political measures are also a relevant factor, since their absence, through tax reduction, pollution licenses and subsidies for companies that reduce pollution emission, besides standardization rules, results in underutilization of eco-innovation (Marin *et al.*, 2015).

In summary, barriers can be in cost, knowledge or market. Based on the classifications, there are different barriers to face for implementing eco-innovations, and these operate at different levels, ranging from elements that involve support policies, forms of consumption and qualified labor (Marin *et al.*, 2015; Pinget, Bocquet, & Mothe, 2015).

According to Cai and Li (2018), companies with more extensive internal and external knowledge networks have greater chances of success in their innovations with a sustainable focus because they can find new and better ways to develop their products and adapt their production. However, depending on how they face the barriers, it can become a style for implementing eco-innovations (Pinget *et al.*, 2015). The following section presents eco-innovation facilitators.

2.3 Facilitators of eco-innovation

Eco-innovations also have a series of facilitators, encouraging organizations to implement them (Kammerer, 2009). We chose Horbach, Rammer, & Rennings (2012) and Rennings's (2000) studies on the theme as primary references in the present study due to their relevance.

Rennings's (2000) model separates these facilitators into two categories, technological development (*technology push*) and *regulatory push*. The former focuses on research and development (R&D) for a diversified and quality production, while environmental policies and technical standards represent the latter. Such facilitators are drivers for implementing eco-innovations, resulting in a market pull, new consumption demands, preference for ecological products, market actions and a company image differentiated through its actions and elements of market attraction.

Horbach *et al.* (2012) model classifies the facilitators in four categories:

(1) Technology: This factor regards new technical solutions and new applications for existing technologies (Stosic, Milutinovic, Zakic, & Zivkovic, 2016). Other important aspects of technological facilitators are the availability of qualified labor, venture capital and suppliers that assist in the efficiency of eco-innovation and complement the technological production base (de Marchi, 2012), relevant factors for technology development.

(2) Market: Consumers' demands, opinions and preferences are significant for introducing eco-innovations (Marzucchi & Montresor, 2017). Carrillo-Hermosilla, Del Río, and Könnölä (2010) highlight the need for a marketing professional focused only on capturing users' needs in the early stages of product or service development. Another important feature of the market is the innovation chain, formed through the collaboration between the company, universities, intrasectorial and intersectorial organizations, technology transfer and dissemination of research results (Wong, 2013). In addition to cooperation among competitors, the innovation chain is an essential element in shaping patterns and guiding the company's development.

(3) Regulation: serves as a form of pressure for companies to seek cleaner production methods that cause less environmental impact. Horbach (2008) observes that the stricter the standards, the greater the tendency of organizations to implement such innovations.

(4) Firm-specific factors: implementation of eco-innovations also depends on company's internal elements, such as proactive management, with managerial concerns and an environmental focus (Hazarika & Zhang, 2019; Horbach, 2008), in addition to ethical values (Savaget & Carvalho, 2016), improvement in processes for reducing production costs (Carrillo-Hermosilla *et al.*, 2010) and quality management (Sánchez-Medina, Corbett, & Toledo-López, 2011).

In a nutshell, facilitators are elements that interrelate to carry out and disseminate eco-innovations (Dugonski & Tumelero, 2020; Savaget & Carvalho, 2016). Hazarika and Zhang (2019) observe that the motivation that leads to the implementation of eco-innovations, in addition to creating a positive relationship between environmental regulation and corporate social responsibility, encourages collaboration among competitors and helps to resist common market risks.

Figure 1 shows the barriers and facilitators of eco-innovation, according to the literature review.

3. Methodology

Our methodological strategy followed Maçaneiro (2012), who states that the qualitative approach allows greater proximity between the researcher and the object of study when applied to the eco-innovation topic. As to the method, we chose the case study, which, according to Carrillo-Hermosilla *et al.* (2010), is one of the best methods to collect details on eco-innovation that may go unnoticed through quantitative methods.

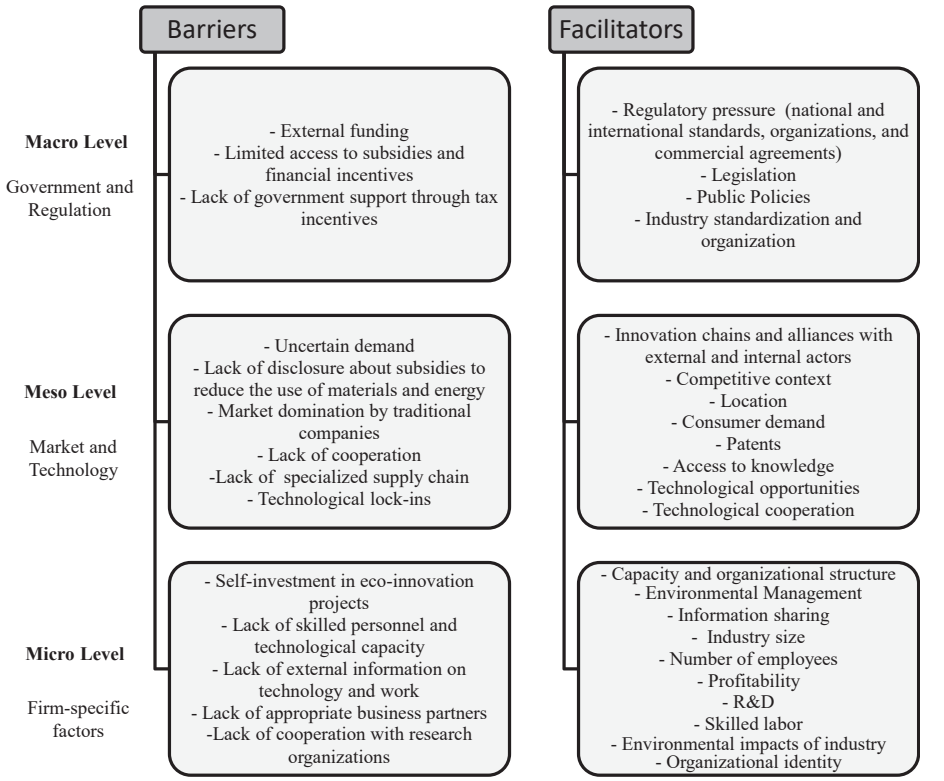

Figure 1.
Barriers and facilitators of eco-innovation (literature data)

The analysis unit was a medium-sized company in the cosmetics sector. We assessed the firm's uniqueness as the object of study to test a specific theory, as suggested by Yin (2001). We defined a set of criteria for choosing the unit of analysis, such as (1) to have at least three indicators of product eco-innovation and three indicators of process eco-innovation, in order to be considered eco-innovative; (2) to carry out Green R&D; (3) to develop actions toward the Sustainable Development Goals (SDGs); and finally (4) to be a reference company in sustainable practices in its sector. The chosen firm was the first Brazilian store of traceable organic products, opened in 2008 in the capital city of Curitiba, aiming to sell products free of substances that cause damage to health or the environment. The company was one of the pioneers in the cosmetics sector with sustainability as its principle and a reference in natural and organic cosmetics, which has gained market space in Brazil and abroad.

For the research development, we gathered primary and secondary data. We used the semistructured interview for primary data collection by applying a script with closed and open questions. Additional questions were inserted according to the progress of the interview. This allowed interviewees to discuss the topic, which helped data collection since they found themselves in a situation they did not have total control over (Yin, 2001).

To create the interview script, we followed these steps: theoretical review and identification of existing scripts in the literature, and elaboration of a research mooring matrix; academic validation by members of a research group in the area of Innovation and Entrepreneurship at a Brazilian university; validation by market professionals; and pretest. The interview script was built considering the constructs of technological eco-innovations

and barriers and facilitators of the implementation of technological eco-innovation. A total of seven interviews were conducted with employees from the commercial, marketing, production and financial sectors and with the directors. The interviews resulted in a time of 7 hours and 12 minutes.

We compared data collected in the interviews with the basic theoretical materials through content analysis to directly handle the communication content and its data (Bardin, 1977, 2004).

We collected secondary data from other sources (Godoy, 1995). The company provided the documents, such as reports on prohibited inputs for the company and environmental impact – *Eureciclo* – and news from websites and public documents, for data triangulation. We used content analysis for examining primary and secondary data and tabulated the textual *corpus* consisting of data collected from websites and reports, according to their relevance to the study (Bardin, 1977, 2004).

The Atlas.TI software was applied to support the data analysis. The collected data were analyzed through networks connections. The barrier network was composed of four codes with a total of 102 citations, and the facilitator network was composed of five codes with a total of 160 citations. These results were later compared with the results in the literature.

4. Result analysis

As specified in the Oslo Manual (OECD, 2018), innovation occurs through its implementation. However, the implementation of eco-innovations, which aim at sustainable development, has specific barriers and facilitators, which we investigated in this study.

Based on data collected in the interviews, we perceived the relationship between the different types of barriers, which directly interfere in implementing eco-innovations at different levels. They may involve external agents or just the organization itself. We found four groups of barriers: market, raw material, government and firm's internal factors.

At the macro level, we observed that the barrier that stands out is the *government and regulation*, as it discourages the company and occurs mainly in developing countries such as Brazil, due to the absence of *legislation* on 100% organic cosmetics. Although the firm seeks organic inputs and certifications that prove the quality of its products, it still cannot label them as *organic*. These barriers are in line with what has already been highlighted by Cai and Li (2018) as external barriers, more specifically, political and regulatory pressures. As stated by Polzin *et al.* (2016), that a relevant element for the implementation of eco-innovations is financing, we identified in the studied company the barrier of limited access to *subsidies and financing* for the creation and implementation of eco-innovations. This element affects the company and its input suppliers, who are farmers and have difficulties investing in plantations. As a cause, they mentioned the lack of government interest in innovations with a sustainable approach, as mentioned by interviewee 7:

> Thus, I think that the government, it is limited to other sectors of the economy; it does not care for the vegan, the organic, well-being, and health. It really aims at profit, technology, fast development, that's what the government wants. [. . .] I think there is still a long way to go for the government to support such an original idea and so ahead of its time as organic products (Interviewee 7).

Observing the meso level, we identified *market and technology* barriers in the company. Although the literature has already highlighted the market barrier, where companies with more extensive knowledge networks tend to have a higher success rate by implementing eco-innovations (Cai & Li, 2018), during the interviews, we noticed something new, that eco-innovations had gained space in the market due to consumer demand. However, there are still market barriers, such as *competition* of traditional companies, that is, market tradition makes consumers choose products from companies that have been in business longer. Another issue

is the size of the batches, since big companies produce larger amounts, thus getting lower costs for inputs, which directly affects the final product's value.

This traditional companies' domination ends up affecting production. Traditional companies are also taking a stance in defense of the environment and offering products to the market with less environmental impact. Therefore, as these firms adopt more sustainable initiatives, the researched company loses its *suppliers*, thus making its production impractical.

Another barrier related to suppliers concerns the seasonality of production. Thus, the input provided to the company is either missing or has an inconstant stock, directly affecting the availability of the product in the market. We also found that some suppliers, seeking a quick profit, offered the company adulterated *raw materials*, thus demanding more attention to this input.

Since natural and organic inputs are perishable, they cannot be stored for long periods. Companies need small batches with a quick sale to avoid waste of raw material and storage costs. Thus, in search of specific properties of the inputs that result from their planting site, it is necessary *to import* inputs to achieve the desired chemotypes. However, import requires the purchase of a minimum amount of inputs per operation, especially transportation, to be feasible for the supplier, thus affecting the company's acquisition of raw materials. In addition, the pandemic made import more difficult, as expressed below:

> [. . .] currently there are some missing products, because one of the inputs, one of the actives inside the product is imported, and is not entering Brazil. This situation has been going on since January, February, because of the pandemic [. . .] (Interviewee 6).

Through the collected data, we observed some *company's specific factors* as barriers at the micro level. An internal barrier is *self-financing*, which affects company's strategies, as, for example, in corporate marketing. Due to its economic-financial limitation, the firm is unable to make much publicity through mass communication, which hinders reaching the market on a large scale.

The low budget for eco-innovation projects determines the formation of small teams, leading to an overload of activities to develop eco-innovations and define the production machinery and inputs. This may limit potential improvements in production.

We also identified a *technical qualification* barrier, observed in the difficulty of finding professionals who have experience developing natural and organic products. Although there are qualified professionals with extensive training, it is not easy to find those interested in organics (green chemistry) or experienced in the area.

In addition, we observed the lack of *technological cooperation* as barriers to implementing eco-innovation in the company. For example, plastic replacement in packaging could be solved through technological collaboration with universities, science and technology institutes or value chain partners.

A potential solution to the lack of technological knowledge, or even for the development of production technologies, would be to work together with research organizations. However, as interviewees mentioned, this cooperation does not exist since few public bodies show interest in developing research with the company.

We also detected a barrier in *costs and certifications* related to the company's internal factors because high investments are necessary to get the certifications of its products and have a differential before its competitors. In addition, the method of certification charging is also a barrier since the higher the annual income, the higher the base price for the certification. Our findings are in line with Polzin *et al.*'s (2016), which deem as a barrier the lack of resources for implementation and problems with infrastructure and marketing networks.

On the other hand, facilitators, unlike barriers, are elements that encourage and facilitate companies to implement eco-innovations. Based on the collected data, we observed

something new related to the literature, that one of the means used to prove the company's objectives and principles is *certifications*. They are a form of registration showing the quality of the natural and organic product, serving as a quality seal. Certifications emerge from *regulation*, which, in turn, monitors the organization's actions and standardizes the sector.

As defined by the Instituto Biodinâmico Certification Association (IBD, 2014), in order to get a certification, the company must meet a series of criteria:

(1) Comply with the current national legislation;

(2) Employ natural and organic inputs, keeping as much as possible the natural characteristics of the raw material;

(3) Avoid damage to the environment, both in the production stage and in the final disposal;

(4) Do not test products on animals;

(5) Do not harm human beings; and

(6) Have a clear label.

Rennings (2000) elucidated that technological development and the regulatory factor serve as drivers for the implementation of eco-innovations, which results in market demand (market pull), new consumption demands, preferences for ecological products, market actions, image of the company distinguished by its actions and market attraction elements. At the meso level, we found the *market* facilitator. We noticed the *market pressure*, where consumers demand that companies use less plastic, less packaging and make less harmful products. There is a more conscious and demanding consumer who seeks to understand what he/she is consuming, in addition to well-being. Even during the global pandemic, the company sensed consumers' concerns with health and personal care, looking for products of natural or organic origin. As interviewee 2 said:

> [. . .] now, when the pandemic came, we wanted an antiseptic toilet soap; then we reformulated an existing soap, from "copaíba", and added several other elements that enhanced its antiviral and antiseptic capacity; this was driven by a market demand (Interviewee 2).

However, pressure does not come only from consumers; there is pressure from suppliers and competitors as well. In this scenario, even traditional companies have adapted to meet the new demands, as they envision that these new requirements will call for more attention from companies that consider themselves eco-innovators. In fact, because of their positioning, these firms have gained market prominence, having received proposals from potential partners and investors.

Such a consumer demand, together with suppliers' and competitors', helps form the *innovation network*. In the case of the company in Curitiba, because it is a symbol of pioneering green cosmetics and innovation, it created an ecosystem of green innovation through innovation networks. The company director, who was born and worked in the country Northern region, has several partners to develop the products. This network of partners amplifies through cooperation in developing parallel projects, such as Fiocruz's *Fito Project*.

The company is attentive to sustainable demands and seeks to position itself according to them to keep its *image*. Therefore, consumer demand is also linked to the company's image. Furthermore, due to its environmental focus, it seeks to achieve a good image in the market, offering products that value the environment and society's well-being.

Another facilitator that has not been explored yet in the literature is *export*. Brazil is recognized abroad for its natural resources, mainly due to the Amazon rainforest; hence, there

is a high demand for natural and organic products, and Europe is already an established market. As ABIHPEC (2020) mentions, the export factor gained more notoriety during the pandemic, when this research was carried out, due to interest rate reduction and dollar appreciation, which facilitated export.

However, as the literature has already pointed out in studies such as Rennings's (2000) and Horbach *et al.* (2012), for the development of these eco-innovations, the *technological innovation* facilitator is a must, both in process and in product innovation. We noticed a great interest of the company in *materials' efficiency*. The more efficient the material, the higher the economy of scale production; therefore, carbon emission to the environment will be lower, and there will be a reduction in water consumption, thus optimizing production.

Support technologies are another vital element for the development of innovations with an environmental focus, which reduce waste or allow reusing materials after they were discarded, facilitate the implementation of eco-innovations and encourage the company to invest in eco-innovative projects, by anticipating a potential long-term financial return.

At the micro level, we identified the *communication* the company seeks to improve, both in the external environment, with its consumers, and in the internal one, among its employees. The company analyzed is constantly communicating with its consumers to collect their opinions; for example, after each purchase, the customer receives a questionnaire covering delivery, service and product quality. Through these answers, the firm seeks to improve the aspects that customers highlight.

Communication is also a facilitator for internal processes. The researched company has four main sectors – financial, commercial, marketing and production – its strategy being to work with all of them connected. For example, all sectors are asked to present their suggestions for project development continuously.

Finally, we highlight the importance of the *environmental management* facilitator, which has sustainability as a purpose, even when the financial return will occur only in the long term. Environmental management encourages employees to have focus and seek to innovate sustainably, since these concerns are part of their daily tasks. Frondel, Horbach, & Rennings (2007) had already identified the importance of the environmental management and its effect on the employees' motivation. One can even see a connection to communication here, as the company's concerns are reinforced through it.

Thus, based on data collected at the small/medium-sized cosmetics company, the model with the barriers and facilitators of eco-innovation is depicted in Figure 2.

Comparing the model based on our empirical data (Figure 2) to the one derived from the literature review (Figure 1), there is an opportunity to complement Rennings's analysis (2000). This author brings visibility to essential factors, such as the *fostering relationship between factors*, that is, through initial impulses, we can implement eco-innovation, which generates new market demands. However, in his model, the author does not address some internal attributes of the company. We also considered, as a complement, Horbach *et al.* model (2012), which classifies eco-innovation facilitators in four categories: technology, market, regulation and firm-specific factors. However, the author does not refer to factors mentioned by the company, such as the import barrier and the export facilitator, elements that received greater prominence during the COVID-19 pandemic.

5. Conclusion

To answer the following research question: *What are the barriers and facilitators in implementing technological eco-innovations in a cosmetics company?,* we carried out an in-depth case study at a company from Curitiba, Brazil, recognized for its eco-innovative initiatives and which has sustainability as the main strategy for developing its products. It is noteworthy that new barriers and facilitators emerged because of the COVID-19 pandemic, during which we conducted the study.

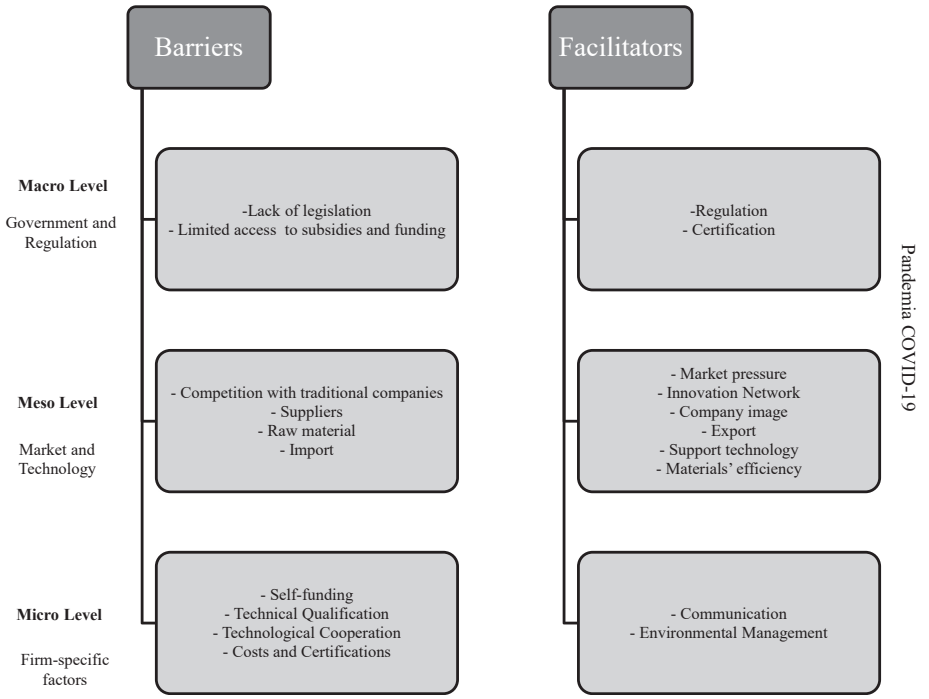

Figure 2.
Barriers and facilitators of eco-innovation (research data)

At the macro level, we conclude that the main barrier is governmental, since the absence of a specific legislation for eco-innovative products discourages companies from implementing such measures. In the researched company, we did not identify government support, financing or subsidies, confirming Marin *et al.* (2015). Therefore, there is evidence that the company has limited access to financial resources for implementing eco-innovation.

At the meso level, the company has difficulty keeping the input supply, because of the natural seasonality of raw materials; in addition, there is a shortage of suppliers for meeting the demand, a situation worsened when large companies monopolize the purchase of inputs for product eco-innovations. Due to their large size and resources, traditional companies buy inputs in large batches and, consequently, for lower prices, negatively affecting the studied company in terms of market competitiveness. Another relevant factor is import, as the COVID-19 pandemic increased dollar appreciation and the batches became even more extensive so that transportation became feasible for the supplier, which ended up hampering access to the raw material.

At the micro level, by choosing self-investment, the company has a limitation for developing innovations with an environmental focus, as these investments are high. On the other hand, the lack of technological cooperation brings a potential opportunity for the company to work together with universities, research institutes and other technological partners to develop eco-innovations, mainly focused on packaging and technologies that do not generate polluting waste and reduce costs.

The main facilitator for implementing eco-innovations in the company is market pressure, which is at the meso level. Consumers participate actively in developing the company's products, providing constant feedback and communicating through social networks. We conclude that such engagement works as a proposal for the company's value creation, thus

stressing the importance of communication, a factor classified at the micro level. We also concluded that COVID-19 pandemic changed consumption habits, as it was the moment when consumers showed greater concern with personal care and hygiene.

The company's sustainable image is relevant for implementing eco-innovations and is a differential before the competition. The company continuously seeks to strengthen its image, objectives and mission, as observed in its news and social networks. Thus, there is a relationship between image and certification (macro level) as it works as a seal of quality for the company's products and reinforces its values. However, little is mentioned in the literature about the importance of certification for eco-innovative products, especially its importance to starting companies.

Barriers and facilitators for implementing eco-innovations are dynamic factors that require continuous monitoring since they can be a barrier in one circumstance and a facilitator in another. The adoption of innovation strategies and planning methodologies by the company can minimize barriers and enhance facilitators.

The main limitations of the research are analytical, as there are other possible interpretations of the different levels. Based on this, we suggest that future studies assess facilitators and barriers in other sectors and ecosystems, for comparison, besides evaluating how each barrier and facilitator of eco-innovation act individually, in order to complement this research. Since we have identified market pressure as the main facilitator and raw material as the main barrier, there is an opportunity for studies that measure such elements in the implementation of eco-innovation.

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