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Dynamic capabilities for sustainable innovation: the case of a footwear company in Brazil

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Abstract

Paper aims: This paper aims to investigate which dynamic capabilities are responsible for sustainable innovation.

Originality: Based on the literature review, we propose a theoretical framework that relates dynamic capabilities to sustainable innovation (considering triple bottom line perspective), regarding product, process marketing, and organizational innovations typologies.

Research method: The framework was applied in this research through a case study method in two plants of a large footwear company that operates in the Northeastern region of Brazil. Data were collected by semi-structured interviews, observation, and company documents.

Main findings: The company developed sustainable innovation focusing on processes and products. The economic aspect of sustainability has a strong influence on these innovations, followed by the environmental aspect. The technological and resource integration are the most critical capabilities.

Implications for theory and practice: The paper contributes to understanding how DCs are deployed to boost sustainable innovation regarding the product, process, marketing, and organizational innovations typologies. Recognizing which DCs are necessary for sustainable innovation is a first step in being able to manage better and enhance sustainability considering the TBL perspective.

Keywords

Dynamic capabilities. Sustainable innovation. Triple bottom line.

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1. Introduction

Studies have shown that innovation positively affects firms by increasing competitiveness (De Clercq et al., 2018; Wu et al., 2015; Ketata et al., 2014; Mariadoss et al., 2011). Innovations can go beyond the concept of generating an idea, a method of execution, or technology. They can emerge in response to a specific problem or an original and unexpected idea (Rahman et al., 2015).

However, in the last few decades, scientists, practitioners, and governments are worried about “conserving the environment along with using resources efficiently (ecological concerns), improving the standard of human living (social challenges), and advancing long-term economic competitiveness (economic matters)” (Lopes et al., 2018, p. 250). In this context, companies have been looking for ways for sustainability or corporate sustainability (Engert, Rauter, & Baumgartner, 2016) in order to achieve the triple bottom line dimensions (economic, environmental and social) (Elkington, 1997). In this context, the role of innovation has attracted academics, managers, and policymakers (Organisation for Economic Co-operation and Development, 2005). Therefore, the concept of sustainability-oriented innovation (SOI) involves making intentional changes to an organization's



philosophy and values, as well as its products, processes or practices, to serve the specific purpose of creating and realizing social and environmental value, as well as economic returns (Adams et al., 2016).

Sustainability-oriented innovation has increasingly raised questions on how companies may improve environmental and/or social performance while at the same time finding competitive advantages (Kennedy et al., 2017). Thus, the development of sustainable innovation, actions, and programs has been expanding among organizations (Boscoianu et al., 2018).

In order to achieve a sustainable business by developing sustainability-oriented innovation, resources, and capabilities are required (Wu et al., 2015). In this sense, some authors have analyzed how capabilities influence sustainable innovation (Mousavi & Bossink, 2017; Wu et al., 2015; Ketata et al., 2014). For example, Ketata et al. (2014) considered that firms need to invest in internal absorptive capacities and draw both broadly and deeply from external sources to develop sustainable innovation. Mousavi & Bossink (2017) investigated what organizational and managerial capabilities are relevant for companies that wish to innovate for sustainability. Other authors have addressed how this dynamics between innovation and sustainability occurs (Boscoianu et al., 2018; De Clercq et al., 2018; Inigo et al., 2017).

The term capability can refer to those that encompass operations, administration, and governance of the company's activities to produce and sell its products. This capability can be called ordinary capability (Boscoianu et al., 2018; Teece, 2017; Teece et al., 1997). Capability can also be related to a set of strategic activities aiming to enable companies to integrate, build and reconfigure internal and external capabilities, competencies and resources, to address and possibly model rapidly changing business environments (Teece, 2017; Teece et al., 1997). Zollo & Winter (2002) and Eisenhardt & Martin (2000) complemented considering that dynamic capabilities (DC) are the antecedent organizational and strategic routines by which managers can generate new value creation strategies in order to achieve competitive advantage. This competitive advantage is possible since dynamic capabilities can drive the development of innovations allowing firms to challenge competitors that prioritize efficiency over innovation (Teece, 2017).

Although sustainability is one of the main drivers of innovation, the existing literature lacks a theoretically sound and empirically testable framework that provides specific insights on innovation from the perspective of dynamic capabilities (Dangelico et al., 2017). Amui et al. (2017) also consider that few works have used DC as the central theme in sustainability. Some studies have focused on innovation capabilities and resources (Lim et al., 2013), but they have not explored sustainability-oriented innovations. Other studies have addressed only product and process innovations and the impacts of such innovations on sustainability (Boscoianu et al., 2018; De Clercq et al., 2018; Moyano-Fuentes et al., 2018; Dangelico et al., 2017; Ketata et al., 2014; Lai et al., 2015). Thus, there is a gap in the literature examining the role of the DCs of firms in the adoption and their effects on different types of sustainable innovation (Zhou et al., 2018; Inigo et al., 2017).

To fulfill these gaps, this study assumes the perspective of dynamic capabilities to provide insights on companies' sustainable innovation activities, focusing on product, process, marketing, and organizational innovations (Organisation for Economic Co-operation and Development, 2005). Since we consider a broad concept of sustainability (environmental, social, and economic), we adopt the triple bottom line (TBL) perspective (Elkington, 1997). Thus, this paper aims to investigate which dynamic capabilities are responsible for sustainable innovation. Based on the literature review, we propose a theoretical framework that relates dynamic capabilities to sustainable innovation, considering the product, process marketing, and organizational innovations typologies. The framework was applied in this research through a case study method in two plants of a large footwear company that operates in the Northeastern region of Brazil.

By analyzing DCs driving organizations to innovate with a focus on sustainability considering economic, environmental, and social aspects, this study contributes in same ways. First, the literature is still scarce regarding this approach. Second, some researchers have addressed specific DCs influencing sustainable innovation, even product/service, process, organizational or marketing) (De Clercq et al., 2018; He et al., 2018; Moyano-Fuentes et al., 2018; Dangelico et al., 2017; Kennedy et al., 2017; Nielsen et al., 2016; Rahman et al., 2015; Wu et al., 2015; Ketata et al., 2014). However, there was no analysis, including the dynamic capabilities listed in the literature that influenced innovation and focused on sustainability issues. Third, given that sustainable innovation has been a topic of interest to researchers and society, it is necessary to define what dynamic capabilities are paramount for a company to innovate with a focus on sustainability. Fourth, in terms of managerial implications, the paper contributes to understanding how DCs are deployed to boost sustainable innovation regarding the product, process, marketing, and organizational perspective of innovations. Finally, recognizing which DCs are necessary for sustainable innovation is a first step in being able to manage better and enhance sustainability considering the TBL perspective.

The study is structured as follows. Section 2 reviews the literature. Section 3 presents the research method and the theoretical framework. Section 4 contains an analysis of empirical data. Section 5 discusses the findings. Finally, section 6 presents conclusions, implications, limitations, and opportunities for future research.

2. Sustainable innovation

Modern and traditional paradigms of innovation stem from the work by Schumpeter (2002). The author defines innovation as new combinations of new or existing knowledge, resources, equipment, and other factors. It is related to new changes in product development, production processes, markets, resources, materials, and organizational forms (Chen et al., 2018). According to Rahman et al. (2015), innovations may emerge in response to a specific problem (incremental innovations) or a creative idea unexpectedly developed (radical innovations). Thus, innovation refers to converting an invention into a new or improved, useful, and marketable product or process (Rahman et al., 2015). The Organisation for Economic Co-operation and Development (2005) classifies innovation into four types (Table 1).

Table 1. Innovation typologies.

Innovation	Description	Source
Organizational	Organizational innovations refer to the way in which the company determines and uses the appropriate resources, introducing new management techniques, concepts, and work practices to maximize the company's performance. Implementing of a new organizational method in the company's business practices, in the organization of the workplace or in its external relations.	(Gabler et al., 2015), (Organisation for Economic Co-operation and Development, 2005)
Product	Product innovation can be defined as the initiation, development, and implementation of new or improved products. This includes significant improvements in technical specifications, components and materials, embedded software, ease of use or other functional features.	(Huang et al., 2016), (Organisation for Economic Co-operation and Development, 2005)
Process	The adoption of new technologies or relevant improvements, methods, equipment and / or skills used to perform the service. In addition, process innovation encompasses the prediction of new work strategies, innovative process design, and implementation of change in all its complex technological, human, organizational, and technological dimensions.	(Moyano-Fuentes et al., 2018), (Organisation for Economic Co-operation and Development, 2005)
Marketing	Is related to how marketers use to assume their responsibilities to guide innovations. It is the implementation of a new marketing method, involving significant changes in the product design or packaging, product placement, product promotion, or in the price.	(Kumar, 2015), (Organisation for Economic Co-operation and Development, 2005)

The growing search for innovations leads to greater concern over resource consumption, environmental degradation, and social inequality. This, in turn, leads to an ever-increasing search for a sustainable society and economy (Adams et al., 2016), and consequently, sustainable innovation. Thus, several companies invest in sustainability initiatives to reduce costs and risks and generate revenue (Dangelico et al., 2017).

"Sustainability is a complex and multi-dimensional concept that cannot be addressed by a single corporate action" (Mousavi & Bossink, 2017, p. 1264). Therefore, sustainability can be understood as the balance between an artifact and its supporting environment where they interact with each other without mutual detrimental effects (Tsai & Liao, 2017). In other words, sustainability is the balance or harmony between economic, social, and environmental aspects, requiring integration between them (Silvius, 2017).

Thus, the concept of sustainable development refers to meeting the needs of the present without compromising future generations' ability to meet their own needs (Adams et al., 2016). Elkington (1997) popularized sustainable development in terms of Triple Bottom Line (TBL). Thus, companies have been motivated to adopt a responsible approach and to treat equally environmental, social, and economic.

In order to achieve sustainable development, many companies have been looking for sustainable innovation taking into account the exploitation of resources and capabilities for this purpose (Zeng et al., 2017). Thus, innovation for sustainability seeks to achieve market differentiation and/or a relative improvement in environmental, economic, and social performance compared to the current situation (Kennedy et al., 2017). In this context, to develop sustainable innovation, companies need to coordinate and cooperate in the context of an innovation process (Mousavi & Bossink, 2017) and develop resources and capabilities responsible for such innovations.

2.1. Dynamic capabilities and sustainable innovation

To better understand the sustainable innovation process, this paper adopts the dynamic capabilities approach (Teece, 2017; Teece et al., 1997). This approach considers the resource-based view aiming to explain how firms develop and maintain their resources and capabilities to adapt to changes in their business environment in order to achieve sustainable competitive advantages.

Thus, strategies based on resources and capabilities offer a survival time in an environment of risk and success under conditions of normality (Boscoianu et al., 2018). Companies obtain advantages when they demonstrate, for example, timely responsiveness and fast, flexible product innovation, along with management capability to efficiently coordinate and redeploy internal and external competencies (Teece et al., 1997). In this sense, capabilities can be divided into ordinary capabilities or DCs

Ordinary (or common) capabilities are mostly operational. They make a company capable of producing and selling products using known technologies and generating financial returns (Teece, 2017). DCs are related to the company's ability to integrate, build, and reconfigure skills and resources to deal with rapidly changing environments (Teece, 2017; Teece et al., 1997). Thus, DCs exploit the momentum and dynamics of opportunities, reflecting the ability to support change and promote innovation in a context of better harmonization with the environment and the market (Boscoianu et al., 2018). Furthermore, these capabilities allow companies to shape the ecosystem around their business and develop new products or processes in response to the threats and opportunities in the marketplace (Mousavi & Bossink, 2017; Teece et al., 1997).

The view on DCs also recognizes that technology and know-how are not easy to obtain since they result from value creation activities, including learning processes, research, and development, and managed asset orchestration processes (Teece, 2017; Zollo & Winter, 2002). These DCs also emerge from a path-dependent process from a unique history of firms built along with the organizations' evolution (Eisenhardt & Martin, 2000; Ray et al., 2004).

From a sustainability point of view, Mariadoss et al. (2011) have argued that the company's dynamic capabilities may play a critical role in developing sustainability strategies based on innovation, regardless of the sector in which they operate, since markets are becoming increasingly dynamic. In this sense, it is fundamental that companies seek improvements in technology and innovation through DCs (Lai et al., 2015). Thus, sustainability-oriented DCs can be defined as the company's ability to integrate, build and reconfigure competencies and resources to incorporate environmental sustainability into the development of new products to respond to changes in the market (Dangelico et al., 2017). In this context, companies' sustainability aspects can no longer be ignored or delays in the development of a sustainable innovation strategy (Dangelico et al., 2017).

By analyzing the literature on DCs focusing on sustainable innovation, a large part of studies focused on product and process innovations and therefore used a wide range of capabilities (Table 2). Table 2 also shows studies (on a smaller scale compared to product/service and process innovations) focusing on marketing and organizational innovations.

Table 2. Literature review capabilities focusing on sustainable innovation

DYNAMIC CAPABILITIES	TYPE OF SUSTAINABLE INNOVATION			
	Product / Service	Process	Organizational	Marketing
Marketing	1	1	1	1
Partnership	3; 4; 7	4		
Technological	3; 5; 6; 12; 14	5; 6; 10		
Absorptive	2; 3; 7; 14	2		
R&D	5; 6; 12	5; 6		
Resource integration	5; 11	5		
Organizational	6; 8; 13	6; 8; 13	9	

Notes: (1) Mariadoss et al. (2011); (2) Ketata et al. (2014), (3) Wu et al. (2015), (4) De Clercq et al. (2018), (5) Rahman et al. (2015), (6) Lai et al. (2015), (7) Nielsen et al. (2016), (8) Mousavi & Bossink (2017), (9) Inigo et al. (2017), (10) Moyano-Fuentes et al. (2018), (11) Dangelico et al. (2017), (12) Kennedy et al. (2017), (13) Boscoianu et al. (2018), (14) He et al. (2018).

Thus, the authors presented in Table 2 demonstrated some evidence of how DCs are essential for developing sustainable innovations. For example, Mariadoss et al. (2011) considered that to influence consumers to adopt environmentally friendly products; firms need specialized marketing capabilities that can effectively relate this information. The authors also consider that marketing capability plays a critical role in the process, organizational, and marketing sustainable innovations strategies. Another example comes from De Clercq et al. (2018) that affirm for the development of sustainable products, firms need capabilities for the development of network relationships. Ketata et al. (2014), in their research, present the relevance of absorptive capability for sustainable innovations, such as product and process, especially those investments that are focused on investing in employees. Table 2 allowed developing a synthesis of DCs related to sustainable innovations considering the triple bottom line approach, and Table 3 shows a definition of each DC presented in Table 2.

Therefore, although the literature presents information regarding how DC are essential for the development of sustainable innovation, considering the product, process, marketing, and organizational perspective of

Table 3. Definition of capabilities

Capability	Definition	Authors
Marketing	It influences the development of sustainable strategies based on innovation through the use of specialized marketing resources: pricing, marketing communications, sales, product development, and distribution.	Mariadoss et al. (2011)
Partnership	It is essential for collecting and sharing knowledge, aiding in the production of innovation of the company, allowing an innovative collaboration.	Kleber et al. (2019), Wu et al. (2015), De Clercq et al. (2018)
Technological	It plays an important role in innovation. The readiness to update and integrate new technologies can enable innovation for the development of products and services, marketing, and even for management processes. New approaches for developing knowledge to perform management functions and new processes that produce changes in the organization's strategy, structure, administrative procedures, and systems.	Moyano-Fuentes et al. (2018), Wu et al. (2015), Lall (1992)
Absorptive	It is the company's ability to extract relevant knowledge from the market and integrate it into new products and services, as well as into the entire organization.	Wu et al. (2015), Ketata et al. (2014), Cohen & Levinthal (1990)
Research and Development (R&D)	The company shares knowledge with the R & D department to support the capacity for corporate innovation. It is related to the implementation of new technologies and processes.	Kennedy et al. (2017), Lai et al. (2015), Ketata et al. (2014)
Resource Interaction	Competitive advantage comes not only from the possession of such resources but also from the way they are used. Thus, it is related to how the organization integrates its resources in order to reduce consumption and, consequently, reduce damages to the environment and improve health and safety conditions.	Rahman et al. (2015), Ketata et al. (2014)
Organizational	A company's innovation for sustainability depends, to a large extent, on the effectiveness with which the company co-opts the complementary resources and skills around an innovation opportunity, individually and collectively. It is responsible for identifying the problem and constraints of the business (time, resources, and market).	Moyano-Fuentes et al. (2018), Mousavi & Bossink, (2017), Wu et al. (2015), Ketata et al. (2014)

innovations, the major part of studies focus on product innovation and process innovation, especially on green products or eco-innovations (Dangelico et al., 2017; Ketata et al., 2014). Besides, all companies are immersed in the same external environment, having the same regulations regarding environmental and social issues. Some of them choose to innovate, considering the sustainable perspective, while others not. The absence or presence of DC can explain this. Thus, this paper advances in identifying different DC to boost sustainable innovation considering these four innovations typologies. Therefore, the article brings some insights since it considers that DCs have positive effects on the organizational intention of adopting sustainable innovation, facilitating managers to interpret environmental innovations as an opportunity rather than a threat (Zhou et al., 2018).

3. Method

Given the objective of this study, the most appropriate methodological approach is the case study since this research intends to investigate an emergent phenomenon over which the researcher has no control (Yin, 2003). Therefore, since this study intends to analyze how different capabilities influence innovation strategy for the sustainability of a footwear company in Paraíba, a state located in the northeast of Brazil, this approach is the more appropriate one. Tables 2 and 3, presented in the literature review, allowed developing a theoretical framework representing the research analysis model, as Figure 1 shows. The framework represents a theoretical representation of the information presented in Tables 2 and 3.

The manufacturing plants in which the empirical study was carried out is one of the multinational in the footwear sector. It has been operating for 111 years and is the owner of footwear brands consolidated in the national and international markets. It also holds the license for the national production and marketing of a large international brand. The research was carried out in two manufacturing plants in the Northeastern region of Brazil, as it is the place where R&D and manufacturing activities are located. The plants produce sports shoes, casual shoes, fashion shoes, and children's shoes.

Several motivations lead to the development and the adoption of sustainable innovation, including market demand, society's attention, and government concerning sustainability issues (Dangelico et al., 2017). Thus, the company under investigation is going through a process of changing its strategy, focusing on sustainability issues. Since it is a multinational, with a consolidated market, and with strategies that involve sustainable innovation, the company becomes an excellent laboratory to verify which innovations are subject to this focus and their necessary requests.

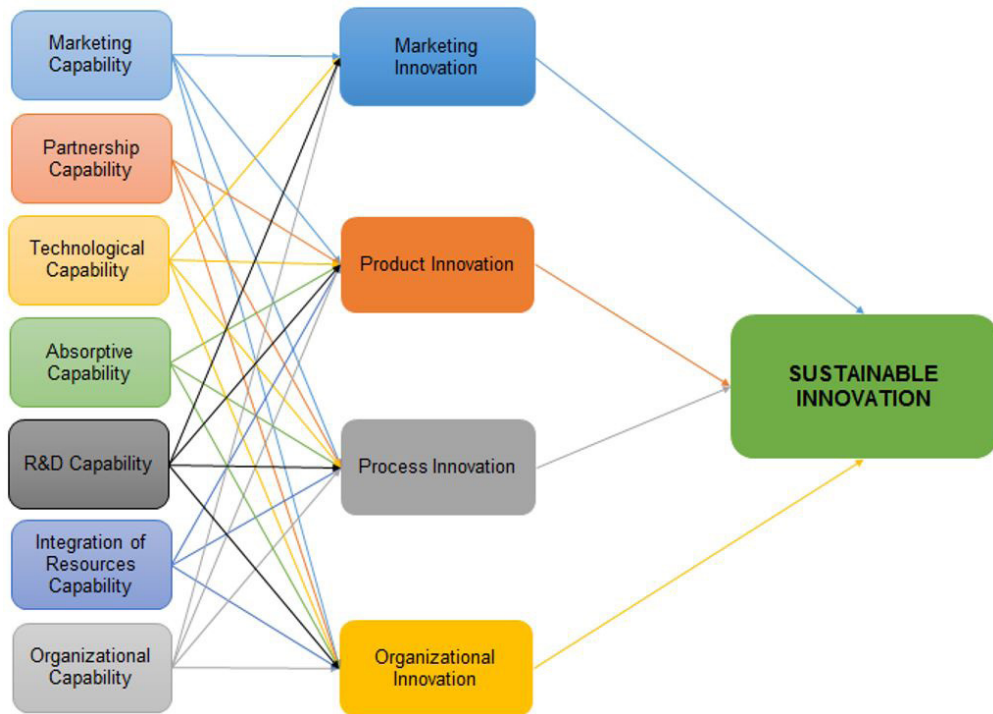


Figure 1. Theoretical framework.

Regarding the organizational structure, it is traditional (functional), and there are six hierarchical levels. The CEOs (Chief Executive Officers) are at the first level, and at the second, are the directors. The third level is divided into eleven corporate managers. In the fourth level are managers of the units' sectors. In the fifth, all supervisions are concentrated, and, finally, in the sixth are the analysts. The organizational structure is too complex and sometimes leads to excessive bureaucracy, resulting in slower decision-making, since some changes and decisions depend on several sectors.

As recommended by Yin (2003), the main instrument for data collection was an interview script (see Appendix A), with some questions that guided the interviews (a synthesis of the questions adopted in the script is also presented in Table 4 – research protocol). The questions were developed as well as conducted based on the theoretical framework represented in Figure 1. In the interview script, besides adopting questions regarding sustainable innovations and dynamic capabilities, we also included questions regarding the levels of influence of the dynamic capabilities in the development of sustainable innovation types, adopting a scale of 1 to 5 (where the higher the number, the greater the influence of capability of innovation).

Participant observation was also taken into account together the interviews to observe and analyze sustainable innovation adopted regarding product/service, process, marketing, and organizational. The participant observation conducted in this study was not a passive method of collecting data by an external observer. One of the researchers was involved actively partaking in the firm's operations, meetings, and process, as a 'participatory network builder, without a research protocol (Partanen & Möller, 2012).

The interviews were conducted between June and August 2018. They lasted on average 50 minutes each. Five people were interviewed. They are directly related to the company's innovation decisions and perform the following functions: sports articles R&D manager, sporting goods materials manager, sporting goods project analyst, fashion shoe manager, and supervisor of fashion shoe development. All interviews were recorded and transcribed (resulting in 41 A4 pages). Besides, some information was supplemented by notes made in a field diary containing information obtained through observations, as well as additional information provided by the interviewees during visits to the production process. Besides the interviews, the company's documents provided information about the sustainable innovations and dynamic capabilities, such as projects that describe processes; documents to identify waste used (given that waste from the production process is reused).

In order to follow a strict methodological rigor, a research protocol was elaborated (Table 4). The information extracted from the case study regarding the variables and their relationships is presented in the theoretical

Table 4. Research protocol

	Description	Where
Objective	To investigate which dynamic capabilities are responsible for sustainable innovation	Section 1
Theoretical support and variables	- Innovation typologies (product, process, marketing and organizational) - DC: marketing, partnership, technological, absorptive, R&D, resource interaction, and organizational	- Section 2 (Table 1 – innovation definitions) - Section 2.1 (Table 3 – DC definitions)
unit of analysis	Two manufacturing plants in the Northeastern region of Brazil	Presented in section 3
Interviewees	(i) Sports articles R&D manager (ii) Sporting goods materials manager (iii) Sporting goods project analyst, (iv) Fashion shoe manager (v) Supervisor of fashion shoe development.	Presented in section 3
Data collection location	Manufacturing units	Presented in section 3
Period	June and August 2018	Presented in section 3
Synthesis of interview guidelines	(i) Knowing the company (4 questions); (ii) Knowing the interviewee (4 questions); (iii) Regarding environmental issues (4 questions); (iv) Concerning environmental issues (3 questions); (v) Knowing the company's innovations (4 questions); (vi) Recognizing the types of innovations and their relationship to aspects of sustainability (5 questions); (vii) Recognizing dynamic capabilities and their relationship with the development of sustainable innovations (1 question): capability for partnership (5 questions); R&D capability (5 questions); marketing capability (two questions); technological capability (4 questions); absorptive capability (3 questions); capability to integrate resources (4 questions); organizational capability (3 questions). (viii) Final remarks (5 questions regarding the challenges for the development of sustainable innovations)	

framework – Figure 1). The research protocol presented the main research objective, theoretical support topics, the definition of the unit of analysis, interviewees, period and place of data collecting, and synthesis of interview guidelines, as recommended by Voss et al. (2002). According to Voss et al. (2002), procedures and general rules should be used to collect data and evidence indicating who or where the information can be obtained.

The data analysis is the most challenging step, and one of the most important for case studies (Eisenhardt, 1989). This step was done based on the information from the interviews (that resulted in 41 A4 pages after we transcribed them) and documents (such as projects that describe processes, reports about the wastes reused), and participant observation. As suggested by Yin (2003) and Eisenhardt (1989) this information was triangulated. It employed systematic iterations between the literature review, case evidence, and researcher interpretation regarding DC that may influence sustainable innovation development. This process also enhances the research validity and reliability. Therefore, after obtaining the information, the categories of research were identified by analyzing the contents of the information. The content analysis technique is essential as it allows researchers to develop a set of techniques and approaches to analyze grouped texts under the broad term “textual analysis” (White & Marsh, 2006). Thus, the relations of DC and how they influence the development of sustainable innovations were verified.

In order to reduce subjectivity, we conducted tests to establish the quality of case studies (Yin, 2003; Voss et al., 2002). For example, as we adopted different data sources, we improved both the validity and reliability of our case study findings. The reliability was also improved since we developed a case study protocol as well as a database from the recorded interviews. The external validity was proved, since we developed a rigorous literature review, resulting in the theoretical framework. Finally, the internal validity occurred during the data analysis that was done considering the literature review, and the empirical results were compared with previous studies to provide an insight into the merits and limitations of the research results.

4. Results

4.1. Knowing the company's sustainable innovation

The company has a department focused on safety, health, and environment-related to work, but does not have any environment certification. This safety and environmental committee evaluate the innovation process. An idea can be vetoed depending on the economic and environmental impact it causes. Even though the company is on a changing process of its strategy since it desires to focus on sustainable issues, it has been observed that the economic sustainability tripod is the primary influence factor of the company's innovations. All innovations

are developed on the grounds of an economic appeal. According to one interviewee, “[...] *a project will hardly be created to be more sustainable in terms of the environment.*” The company’s focus is on investments that create new revenues, provided that they comply with the country’s legislation. Until this research, the environmental and social issues are still considered additional costs, as already stated for Klewitz & Hansen (2014). Environmental innovation may improve the efficiency of the company’s resources, but not necessarily its productivity (Rexhäuser & Rammer, 2014).

However, innovations also have an environmental appeal. Reducing the use of resources (raw materials, water, energy, etc.) will benefit the environmental issue. For example, some of the residues generated from the production process are reincorporated, such as EVA (ethylene-co-vinyl acetate), representing sustainable innovations regarding the process. The recycling of branches remaining after injection of the material is performed and then incorporated into the new formulations. Residues of rubbers generated by trimming of soles are also reused in new formulations. However, the company cannot use 100% of the waste generated, selling part of it to cement companies. The company also has a treatment of effluents and a program that monitors the amount of waste generated by peers.

The company also has a program encouraging sustainable innovation. Its main objectives are innovations that bring economic returns, but with impacts on environmental issues. The program is currently structured for product and process innovations, and the improvements are monitored. For example, annual brainstorming activities are conducted in order to survey the main demands. Later, the projects are launched to achieve financial objectives. This program is unique to the management area, where all managers and senior analysts are invited to contribute with new ideas.

Regarding product innovations, one of the company’s brands has switched all packaging activities to recyclable packaging produced using forest woods certified by the Forest Stewardship Council (FSC) and other controlled sources that guarantee the respect for environment and forestry workers. Although they have a great economic appeal, this type of innovation exerts environmental impacts since the company would not have changed the packaging if it were not the result of a demand for this type of product. In other words, the customer plays a key role in products’ environmental innovations as companies seek innovations to stay competitive in the market and serve their customers, as argued by Kammerer (2009). In addition, waste is used for the formulation of shoe soles. Moreover, some projects are under analysis related to the use of biodegradable raw materials and fabric and tarpaulin waste for the development of new products.

Concerning process innovations, according to Moyano-Fuentes et al. (2018), technological and process changes for cleaner production influence engagement in environmental behaviors. Therefore, the company has invested in equipment such as injectors with inverters and stoves with refractory to reduce energy consumption. In addition, other processes innovations can be mentioned. First, equipment for solvent recycling by the company itself and reincorporation into the production process. Second, paints and adhesives undergo revalidation processes to reduce waste and the amount of raw material discarded. Third, incorporating processes that use water-based inks and adhesives is less aggressive to the environment than solvent-based inks. There are projects at the implementation phase, such as replacing a primer UV with a primer without UV. With this change, there will no longer be any use of UV lamps. There will also be a decrease in greenhouse gases during the process since the new process will be carried out with the heat of the injection machine.

4.2. Dynamic capabilities and sustainable innovation

In terms of dynamic capabilities, the company needs to develop them in order to achieve sustainable innovation, since the focus is still on product and process SOIs, as explained as follows.

Concerning partnership capabilities, suppliers are essential partners. They can present new materials and sustainable alternative components, as well as knowledge, skills and, resources that arise from the development of environmental innovation, as already pointed out by Dangelico et al. (2017) and Cainelli et al. (2015). Currently, the company has partnerships with its suppliers and few partners (two multinational companies). A justification for this was organizational barriers and a lack of resources needed to establish new partnerships. However, the company recognizes the importance of partnerships for sustainable innovation. Nevertheless, because it is not located near footwear poles, it has been observed that such relationships are not exploited as they should be.

Besides, such partnerships have influenced sustainable innovation regarding the generation of new products. However, they focused on the performance of the shoe having the customer in mind. Despite being closely related to economic aspects, there is environmental bias in these innovations since the company seeks to reduce resources and improve processes. According to Nielsen et al. (2016), end-customers, combined with other innovation actors, may play a key role in sustainable-focused innovation processes. Concerning to the

innovation of sustainable processes, the capability of partnership has a medium influence. Because of the growing sustainable appeal on the world market, some suppliers are looking for sustainable innovation to increase their market share. Partnerships achieve such innovations with the company (solvent recycling process, a process for the use of primers without UV, processes that use water-based inks and adhesives). The interviewees considered partnership as an essential capability for sustainable innovation. However, compared with the company's current situation, this dynamic capability has no influence on product innovations yet. On the other hand, in relation to process innovations, this capability has an average influence.

The company's R&D capability was considered relevant to the organization as a whole. However, the current scenario is not favorable. One of the justifications is the fact that R&D is related to the industrial area and product engineering. Another factor is the distance between shoe poles and supply poles. The company has also been reducing investments in this sector. The focus falls greatly on development rather than on research. However, respondents considered the influence of R&D capability on new sustainable products as average because product development is carried out by the R&D sector. Concerning to process innovations, the respondents reported a low influence because such innovations now occur due to partnerships and, mainly, to the technological capabilities and integration of resources. Regardless of the innovations, one of the interviews considered that for the development of this capability, investment in people is essential, in order to promote radical sustainable innovations and not just incremental innovations.

Technological capability and resource integration influence the most sustainable products and process innovations. This can be justified by the fact that, by adopting new technologies aiming to improve internal processes, organizations could achieve better environmental results. Reductions in resource consumption might influence environmentally relevant and economically efficient practices, as mentioned by Moyano-Fuentes et al. (2018).

Thus, technological capability is one of the most important capabilities influencing the company's sustainable innovation. It has a more economical and efficient appeal and, at the same time, improves the environmental aspect. It is composed of presses, injectors, greenhouses, solvent recycling, and automatic sewing machines. All technologies implemented in the organization are evaluated in terms of the amount of energy, water, and raw material that will be used. These technologies aim to minimize consumption and bring economic returns to the company. In the background, it is hoped to contribute to environmental (as it will use fewer resources) and social issues (machines should not make too much noise and should be ergonomic to adapt to the operator). This capability was considered highly influential to innovations in the company's sustainable products and processes, especially regarding the economic aspect.

Regarding resource integration, the organization's new products and processes are developed, taking into account existing resources. However, such an ability to integrate resources has an economic focus. By using the same resources for a mix of products, the probability of raw materials, machines, and other resources becoming obsolete are lower, and the value invested in new resources will also be lower. According to one interviewee, "the focus is financial; if there is any process that improves environmental impacts, it is not measured," although the company has control of waste through indicators related to energy, waste, and water. Regarding the importance of the capability to integrate resources for sustainable innovation, one interviewee reported that it has a strong economic influence because there is a decrease in investments and the possibility of outdated raw materials. Therefore, the company needs to develop this dynamic capability since the focus is usually only on one tripod of sustainable innovation.

Although the company learns with suppliers and other partners, there is no mechanism for absorptive capability development. Absorptive capability is based on the analysis of information and knowledge accumulation and their flow within organizations. In this study, for sustainable innovation development, the difficulties regarding the knowledge absorption are explained by the absence of organizational capability; and knowledge and learning have been widely acknowledged in the literature as the main ingredients in creating organizational capabilities (Grant, 1996). The learning process from the external environment and the ease of adapting to changes is more time-consuming because of the company's organizational structure (more bureaucratic steps, resulting in slower decision-making and depending on several sectors). Thus, although all interviewees considered absorptive capability a significant capability for sustainable innovation, this capability has a low influence on sustainable innovation. The interviewees also argued that the company does not have initiatives for improving its DCs, especially those related to absorbing information and knowledge.

Finally, marketing capability has been influencing product innovations. One of the company's brands has switched all packaging activities to recyclable packaging produced using forest woods certified by the Forest Stewardship Council (FSC) and other controlled sources that guarantee the respect for environment and forestry workers.

5. Discussion

The company is in the process of changing its strategy in order to focus on sustainability issues. However, this process is not easy, being necessary to change its culture, requiring an extended period. On the other hand, process and product innovations are focusing on sustainable issues. For example, the adoption of forest woods certified by the Forest Stewardship Council (FSC) for the development of packaging represents an important product environmental innovation, as well as the adoption of the waste for the formulation of shoe soles. The innovation process is also representative and takes into account sustainable aspects (such as injectors with inverters and stoves with refractory to reduce energy consumption, paints and adhesives that undergo revalidation processes in order to reduce waste, incorporation of water-based inks and adhesives less aggressive to the environment, among others). Although these innovations are directed related to environmental issues, they are less aggressive for the workers (the social aspect of sustainability). However, as stated by the interviews, such innovations are strictly related to TBL's economic aspect. Figure 2 shows these innovations.

The colors in Figure 2 represent the levels of influence that each DC has regarding the innovations in the company. The color green means a strong influence, yellow, medium influence, and red a low influence. The interviewees themselves assigned these levels. For this, a scale of 1 to 5 was adopted, where the higher the number, the greater the influence of the capability on the innovation.

Thus, in terms of DC, technological and resource integration strongly influenced the innovations of sustainable products and processes. The technological capability is described in the company as presses, injectors, greenhouses, solvent recycling, and automatic sewing machines, among others. They are evaluated in terms of the amount of energy, water, and raw material that will be used. Technological capabilities are important to innovation and may lead to economic success and sustainable business (Wu et al., 2015). Resource integration is relevant for product and process sustainable innovations; this capability allows for both manufacturing plants to decrease investments and the possibility of outdated raw materials.

Furthermore, they allow companies to pool resources and skills around a sustainability opportunity regarding such innovations, as already stated Mousavi & Bossink (2017). In addition, the returns of such DCs are easily measured (sales revenue, cost savings). Dangelico et al. (2017) also considered that resource integration shows a positive effect on green innovations, being our results consistent with previous studies.

R&D capabilities are significantly related to the likelihood of developing new products or processes that reduce environmental impacts (Cainelli et al., 2015). This statement can be complemented by the fact that, through investment in R&D, there is a reduction in consumption and cost of materials if products are designed considering sustainability aspects (Kusi-Sarpong et al., 2018). However, in the company, R&D capabilities exert a medium influence on product innovations and a low influence on process innovations. Even if the organization

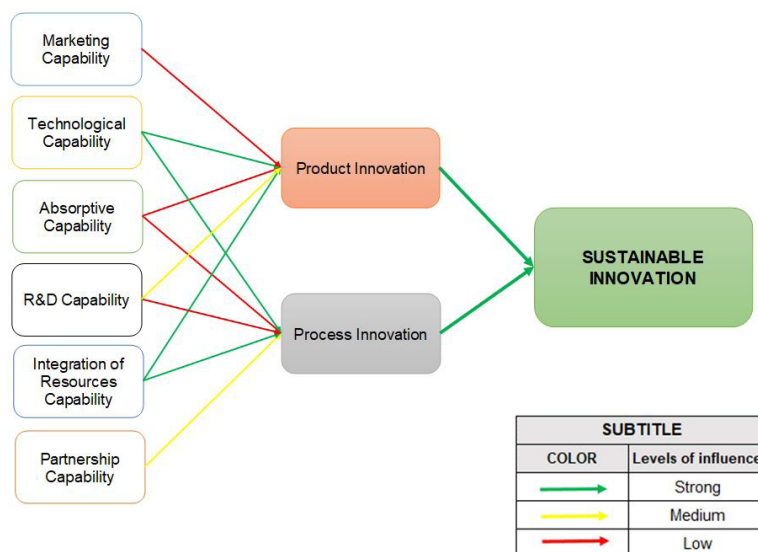


Figure 2. Framework after empirical research.

having a specific R&D department, there is a reduction of resources used and a location far away from footwear and supply poles.

Partnership capability has a medium influence on process innovations, and; absorptive and marketing capabilities have a low influence on both innovations. This is because in the company, the measurement of gains by these DC is subjective. Regarding organizational capability, it does not influence any of the sustainable innovation identified in empirical research. Thus, it is not represented in the tested framework (Figure 2).

In the studied manufacturing plants, marketing capability is changing shoe packaging based on customer demand. However, despite the interviewees having considered this capability with a low influence, analyzing the other sources of information, we verified that there is a consumer appeal for sustainable products, mainly in the international market. This has influenced the development of products with a focus on environmental sustainability.

The company has some difficulties that hinder the development of sustainable innovation, making it difficult to develop the capability for partnerships. This capability is important for collecting and sharing knowledge, aiding in the production of innovation (Wu et al., 2015; De Clercq et al., 2018). The organizational culture and the lack of proximity to factories with the same business idea also hinder the development of sustainable innovations.

Although it is a multinational company, there is still a great need for improvement in the development of innovations focusing on sustainability, mainly focusing on marketing and organizational innovations (besides the development of DC for boosting such innovations), although the changing process that the company is on. Furthermore, the company has an organizational structure that can lead to a more bureaucratic process. This may difficult the development of absorptive capability, one of the most critical capabilities, since it can influence the knowledge accumulation and flow within the company. This difficulty also exerts a significant influence on the partnership capability, affecting negatively in the absorption of knowledge from their partners. The focus of that company is still on DC that generates innovations almost exclusively with an economic impact. Thus, identifying the DCs that influence sustainable innovation, according to the TBL perspective, may guide managers who wish to prioritize DC that exert a more considerable influence on such innovations.

6. Conclusions, limitations, and directions for future research

This study aimed to investigate which DCs are responsible for sustainable innovation. Based on the literature review, we propose a theoretical framework that relates dynamic capabilities to sustainable innovation, considering the product, process marketing, and organizational innovations typologies. The framework was applied through a case study in two plants of a large footwear company that operates in the Northeastern region of Brazil. Through the research, it was possible to verify that the company developed innovations regarding processes and products focusing on sustainability, as already found in the literature review. These innovations focused mainly on the economic aspect, which is intermediate to the environmental and social appeal.

Among the DC described in the proposed framework after empirical research (Figure 2), R&D, technological, resource integration, partnerships, marketing and, absorptive capabilities are related to sustainable innovations in the company under investigation. However, the integration of resources and technology are dynamic capabilities that exert the most considerable influence on product and process sustainable innovations.

The proposed theoretical framework represents a theoretical implication of this study since most studies relate DC with sustainable innovations, such as eco (or green, environmental) innovation (Chen & Hung, 2014) or environmental or green (new) product development (Dangelico et al. (2017)). On the other hand, this research sought to relate DCs to the different types of innovations proposed by the OECD (Organisation for Economic Co-operation and Development, 2005), but focusing on sustainability and taking the TBL perspective into account.

Figure 2 shows the tested framework, which represents a company's diagnosis concerning its DC as well as its influence on the company's sustainable innovations (product and process). It cannot be generalized. However, since the company is on a process of changing its strategy to achieve sustainable issues, the results presented in Figure 2 highlight for managers and decision-makers what they need to do regarding their DCs in order to achieve its goals regarding sustainable innovations. As the empirical research was developed in two units of multinational companies located in Brazil, this also represents a relevant contribution, since several studies have focused on developed economies.

This study has some limitations that can be transformed into opportunities for further research. For example, since we applied a case study, we cannot generalize the findings. Therefore, further research could apply the same framework to different companies through multiple case studies in order to compare the findings of this research. To perform a survey considering the same variables adopted in this paper could also increase the degree of generalization. The adoption of multicriteria tools may help managers and decision-makers in the

company in order to prioritize investments for the most important capabilities for the development of sustainable innovation. We suggest AHP (*Analytic Hierarchy Process*) or ANP (*Analytic Network Process*) as multicriteria tools that could be adopted. Exploratory research could also be developed in both companies in order to explore why marketing and organizational innovations are not the focus of the studied manufacturing plants. Finally, future studies could further the analysis of the main difficulties hindering the development of sustainable innovation in the manufacturing plants under investigation or identify factors that facilitate the development of DCs for sustainable innovation.

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Appendix A. Interview script.

(i) Knowing the company (4 questions);

- 1) Does the company have any environmental certification?
- 2) Does the company have a department focused on the environment?
- 3) Does the company have a corporate program focusing on the environment?
- 4) Does the company carry out any activity in order to reduce the impacts caused on the environment? Which are?

(ii) Knowing the interviewee (4 questions);

- 1) What is your background?
- 2) What is your position in the company?
- 3) Can you explain your role?
- 4) Do you participate in the company's innovation decisions?

(iii) Regarding environmental issues (4 questions);

- 1) What does the company do with the waste? Does the company have any project to reduce or reuse waste?
- 2) Does the company have a reverse logistics program?
- 3) Does the company have any practice related to the environment concerning the resources used?
- 4) Is there a program to guide energy consumption? Does the company use solar energy? How?

(iv) Concerning environmental issues (3 questions);

- 1) Does the company invest in educational and social projects, mainly for low-income people? Which are?
- 2) Does the company invest in programs aimed at social inclusion, especially for people with special needs? In what way?
- 3) Is there a program aimed at the professional qualification of young people and adults (free foreign language courses, information technology, among others)? Who are the beneficiaries?

(v) Knowing the company's innovations (4 questions);

1. Does the company have a program that encourages employees to innovate?
2. Is there any training program that enables employees to develop innovative attitudes?
3. Is there any incentive, support from the government on sustainability issues? If so, what incentives would these be?
4. Do sustainability issues affect the company's innovation decisions? If so, how?

(vi) Recognizing the types of innovations and their relationship to aspects of sustainability (5 questions);

1. What types of innovations has the company made regarding:
 - I. Product
 - II. Process
 - III. Organizational
 - IV. Marketing
2. On a scale of 1 to 5 (where 5 is very important, and 1 is unimportant) to what degree do these innovations relate to sustainability aspects considering the TBL perspective?
3. Have these innovations generated (or have they related) any economic impact? In what way?
4. Have these innovations generated a social impact? In what way?
5. Have these innovations generated an environmental impact? In what way?

(vii) Recognizing dynamic capabilities and their relationship with the development of sustainable innovation (1 question);

1. In your opinion, what are the primary resources and capabilities responsible for the development of sustainable innovations?

Capability for partnership (5 questions);

1. Does the company have partnerships (with universities or other organizations)? If so, how does knowledge/information exchange take place?
 2. If so, do these partnerships influence the innovations generated by new products or processes?
 3. If not, does the company seek external knowledge (whether through fairs, workshops, or some other)? There is periodicity?
 4. On a scale of 1 to 5, what is the importance of partnerships?
 5. What types of innovations do these partnerships generate? (Processes, products, marketing, or organizational)
- R&D capability (5 questions);**
- 1) What is the importance of the R&D sector in the organization? Why?
 - 2) Does the company have patents?
 - 3) If not, is the company planning to achieve this goal?
 - 4) Do investments in R&D influence innovations generated from new products or processes? In what way?
 - 5) On a scale of 1 to 5, what is the importance of investments in R&D? Why?

Marketing capability (two questions);

- 1) Does the company invest in innovations related to marketing? How?
- 2) On a scale of 1 to 5, what is the importance of marketing innovations? Why?

Technological capability (4 questions);

- 1) Does the company invest in new technologies? Which ones?
- 2) Is there a corporate program to develop new clean technologies?
- 3) Does the company have a specific project to invest in new technologies?
- 4) On a scale of 1 to 5, what is the importance of technological capacity? Why?

Absorptive capability (3 questions);

- 1) How is knowledge managed, which favors innovation within the company?
- 2) How does the company adapt to new changes in the market? Are there procedures adopted that favor this adaptation?
- 3) On a scale of 1 to 5, what is the importance of absorptive capacity? Why?

Capability to integrate resources (4 questions);

- 1) Does the company have any strategy to integrate its resources in order to reduce its consumption? In what way?
- 2) Does the company have a project to control the waste of resources?
- 3) When designing a new project, does the company take pre-existing resources into account to follow the standard production process? In what way?
- 4) On a scale of 1 to 5, what is the importance of integrating resources? Why?

Organizational capability (3 questions);

- 1) Does the company invest in employee training? Does the company have a training control program? How does it work?
- 2) How does the company encourage its employees to innovate, considering sustainable issues?
- 3) On a scale of 1 to 5, what is the importance of organizational capacity? Why?

(viii) Final remarks (5 questions regarding the challenges for the development of sustainable innovation)

- 1) What are (or were) the main challenges for the development of sustainable innovations?
- 2) How can these challenges be overcome?
- 3) Who are the main facilitators?
- 4) How would you summarize the effect of the corporate sustainability strategy on the innovation process?
- 5) Is there anything else you would like to discuss?