Sustainability-Oriented Innovation Practices and the Business Model of Internationalized Industrial Companies

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Abstract
This study analyzed the differences regarding adopting sustainability-oriented innovation practices and the business model of industrial com-panies considering their degree of internationalization. Quantitative research was developed with a descriptive design using a survey, and the sample comprised 104 Brazilian industrial companies. Significant differences were observed concerning products, demonstrating the consumers' concerns regarding these aspects. As for the business model, differences were noted regarding a financial model responsible for the company's ecological and social impacts. This aspect shows that companies operating in foreign markets include sustainability's social, environmental, and economic dimensions in their business models. From a theoretical point of view, this study connects sustainability-oriented innovation practices and the business model by considering the degree of internationalization. As for originality, the present study relates the themes of sustainable innovation and internationalization while analyzing a developing country, whereas most articles have covered developed countries.

Keywords: sustainable innovation; business model; industries; internationalization
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Introduction

Organizations are increasingly inserting sustainability into their strategies and practices, especially those operating in the international market, considering they must comply with different legislations and regulations. Growing environmental awareness has led companies and governments to increase their efforts in adopting eco-innovation, making it an increasingly competitive factor in international supply chains (Galera-Quiles, Piedra-Muñoz, Galdeano-Gómez, & Carreño-Ortega, 2021). In this sense, proactive environmental strategies have been proven to improve environmental performance and competitive advantage in internationalization (Suarez-Perales, Garces-Ayerbe, Rivera-Torres, & Suarez-Galvez, 2017; Chen, Ong, & Hsu, 2016).

An organization's business model should adapt to the business environment and integrate sustainable innovation to achieve sustainable development (Gao & Li, 2020), which also makes it an interesting object of study to investigate the internationalization process of companies from a new and holistic view (Cavallo, Ghezzi, & Ruales Guzmán, 2020). From this perspective, companies should innovate their business model as they move into foreign environments (Gao & Li, 2020), given that adopting eco-innovations is increasingly evident for consumers and businesses alike (Hojnik, Ruzzier, & Manolova, 2018).

Despite international business and business models seemingly intertwining, there is little knowledge on how organizations use business model innovation to succeed in internationalization (Cavallo *et al.*, 2020). According to Hojnik *et al.* (2018), one cannot disregard environmental sustainability and eco-innovation in foreign markets.

Although researchers have described internationalization and eco-innovation as being entwined (Hojnik *et al.*, 2018; Šūmakaris, Ščeulovs, & Korsakienė, 2020), further research must be conducted on both topics (Chiarvesio, Marchi, & Maria, 2015). Cavallo, Ghezzi, & Ruales Guzmán (2020) stated that there are still research gaps between business model innovation and internationalization due to the emergent nature of the business model. Therefore, shedding more light on the role of business model innovation as a driver of the internationalization process is vital since, for many managers and entrepreneurs, internationalization is a 'mandatory' choice (Cavallo *et al.*, 2020). In fact, Agwu and Bessant (2021) described the need to transition into sustainable business models in the industrial sector.
Given this scenario, the study aimed to analyze the differences regarding adopting sustainability-oriented innovative practices and the business model of industrial companies when considering their degree of internationalization. After this introduction, the theoretical references of sustainability-oriented innovation, business models, and sustainable innovation practices in industrialized companies are presented, followed by the methodological approach, the results and discussions, and final considerations.

Theoretical framework

The references aim to provide necessary theoretical support, ground the study's construct, and give subsequent support to the discussion and data. Hence, the theoretical framework is intended to discuss aspects related to sustainability-oriented innovation practices, business models, and sustainable innovation practices in internationalized companies.

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Innovation-oriented innovation practices

Organizations have been increasingly inserting sustainability into their strategies and operations to comply with legislation, stakeholders, and the premises of the competitive environment. Hence, this context has also led to changes in the business environment, contributing to how companies create and capture value (Mattera, Gonzalez, Ruiz-Morales, & Gava, 2021). In these ever-changing and hypercompetitive environments, companies must promote innovation to survive (Leal-Rodríguez, Ariza-Montes, Morales-Fernández, & Albort-Morant, 2018). Transformations in society and the environment create demands and constraints for companies, making competitiveness increasingly hinged on adopting innovation management that includes sustainability (Kneipp, Gomes, Bichueti, Frizzo, & Perlin 2019).

In this context, there are different classifications for innovation. The Oslo Manual, published by the Organization for Economic Cooperation and Development in 2005 and verified in 2018, defined innovation as a new or improved product or process that significantly differs from previous products or processes and that has been made available to potential users (product) or put into use by the unit (process) (OECD, 2018, p. 20).

More recently, researchers have scrutinized the integration of innovation and sustainability, leading to new terms such as "green innovation," "sustainable innovation," "eco-innovation," and "cleaner technologies" (Ghassim, 2018). Companies that use sustainability-oriented innovation are recognized as "responsible companies" from the stakeholders' perspective (Neutzling, Land, Seuring, & do Nascimento, 2018).

Organizational survival and competitive advantage rely on adopting sustainability practices, and organizations must reinvent their products and services to remain competitive (Khattak, Cavaliere, & Imran, 2021). In this regard, Adams, Jeanrenaud, Bessant, Denyer, and Overy (2016) reported that sustainability-driven innovation goes beyond achieving higher economic growth and involves changing the company's organizational philosophy, values, products, processes, and practices to create social and environmental value. Innovation in products, organizational structures, and business methods can be crucial to achieving environmental, economic, and social outcomes (Neutzling *et al*., 2018). Companies can integrate sustainability into their idea generation systems from research and development (R&D) and commercialization, applying this concept to products, services, technologies, new businesses, and organizational models (Charter & Clark, 2007).

Hence, adopting innovation practices for sustainability improves economic performance and (in)directly influences it through non-financial outcomes, including innovation and improved environmental and social performance (Leal-Rodríguez *et al*., 2018; Maletič, Gomišček, & Maletič, 2021). Klewitz and Hansen (2014) surveyed articles published in 84 journals from 1987 to 2010 and identified sustainability-oriented innovation practices at the product, process, and organizational levels (Table 1).

Table 1. Levels of sustainability-oriented innovation practices

Innovation level	Definition	Practices
Organizational	This level involves reorganizing the company's routines and structures and new forms of management.	- Certifications that guide its activities toward sustainability. - Policies that promote environmental preservation. - Environmental accounting instruments (i.e., records and controls that help evaluate the environmental impact of business activities). - New processes that bring greater efficiency and contribute to sustainable practices. - Practices that seek to incorporate environmentally sound and socially just issues into the supply chain. - Facilities and local procurement that decrease the emission of pollutants from transportation. - Use of local labor. - Involvement of several stakeholders such as employees, suppliers, and the community in sustainable actions. - Departments, teams, units, and/or cross-functional committees responsible for sustainability. - Vision of sustainability based on owner-manager values. - Development and training for employees to perform sustainability-related activities. - Norms that guide employee behavior toward sustainable practices in the organization. - The involvement of employees in actions aimed at promoting sustainability. - Concern for the health and safety of employees and stakeholders.
Product	This level concerns improving or developing new products and services, including using organic and recycled materials, searching for greater durability, and decreasing energy consumption.	- Products that have the least aggressive design to the environment and reduce the use of raw materials. - Labeling products to explicitly show the adoption of sustainable actions, practices, and/or certifications. - Ways to measure resource consumption, environmental impacts, and waste release throughout a product's life cycle (i.e., from the extraction of raw materials to the final disposal). - Innovations aimed at reducing the number of materials or replace them with sustainable ones. - Using reduced packaging or reusable packaging.
Process	This level is related to producing goods and services and is generally focused on increasing eco-efficiency or metabolic consistency.	- Productive processes that reduce environmental impacts. - Correct elimination of unnecessary materials in production processes, reduction of wastewater discharges, and sewage control. - Practices aimed at reducing the consumption of energy, water, and materials/resources and replacing inefficient processes. - Forms of transportation that contribute to reducing environmental impact.

Source: Elaborated based on Klewitz and Hansen (2014).

Eco-organizational innovations contribute to a favorable environment regarding developing eco-products and eco-processes (Cheng, Yang, & Sheu, 2014). Indeed, these authors also believed that eco-organizational and eco-process innovations enable companies to improve their business performance, and another study found that product and process innovations to make the company's activity 'greener' can substantially benefit its reputation and performance (Leal-Rodríguez *et al*., 2018). Each type of eco-innovation (product, process, or organizational) affects the different dimensions (environmental, social, and economic) of sustainable business performance (Ch'ng, Cheah, & Amran, 2021). Moreover, eco-innovation depends on the sustainable business model adopted and production processes with effective investment opportunities in sustainable innovations (Barbieri & Santos, 2020). In this sense, the following section addresses the literature on the business model.

Business model

Technological advancement, globalization, and regulations have challenged companies to promote changes in their business models (Trierveiler, Sell, & dos Santos Pacheco, 2015). Globalization has shaped companies to direct their activities to satisfy the needs of different consumers in an internationalized manner (Guercini & Milanesi, 2017). Regarding the term "business model," a single concept has yet to be agreed upon (Peric, Durkin, & Vitezic, 2017), although some consensus has been reached. The business model depicts how organizations capture and promote value in the organizational structure (Brehmer, Podoynitsyna, & Langerak, 2018); it has four main elements: value proposition, supply chain, customer interface, and financial model (Man & Strandhagem, 2017).

Given the emphasis on sustainable issues, companies use sustainability-focused business strategies and goals as a new way of doing business and generating a competitive advantage (Kruglianskas & Pinsky, 2014). Sustainable business models incorporate a triple-line approach, considering the environment and society as stakeholders (Silva, de Oliveira, Tonelli, & Sugano, 2019). Thus, business relationships with natural livelihoods must change business models towards more sustainable ones (Geissdoerfer, Vladimirova, & Evans, 2018).

The industrial sector is a critical player in building a better future through more sustainable models; however, it has struggled with integrating the three spheres of sustainability into its business model, which is due to only a handful of companies having adopted sustainability-oriented business models (Neri, Cagno, Di Sebastiano, & Trianni, 2018). The 2030 Agenda explicitly acknowledges the need for changes involving industrialization standards and innovation in structures (United Nations, 2015). In general, the Brazilian industry has been carrying out sporadic and planned actions toward achieving the Sustainable Development Goals, albeit there is still much room for improvement (Martins *et al*., 2020).

Pontes and Giordano (2015) investigated a company that sought to reduce energy consumption and efficiently replace waste accumulation and disposal processes. The authors found that the company's integration with customers and society increased, resulting in positive social and environmental impacts. Efficient waste disposal is another form of monetary capture, thereby increasing profitability, as demonstrated by Munaretto, Aguiar, and Vieira (2017) and Pontes and Giordano (2015).

Business model innovation enables companies to invest in sustainability while also profiting (Kiron, Kruschwitz, Reeves, & Goh, 2013). Boons and Lüdeke-Freund (2013) investigated the relationship between business models and sustainable innovation and pointed to the need to integrate the four elements of a business model that are necessary for sustainable innovation: value proposition, supply chain, consumer relationship, and financial model. These elements must meet normative requirements for successful sustainable innovation (Boons & Lüdeke-Freund, 2013). Given the understanding of the sustainability-oriented business model, the following section discusses adopting sustainable innovation practices in internationalized companies.

Adopting sustainable innovation practices in internationalized companies

Behavior toward export market orientation indirectly influences profit performance and sales growth (Cadogan, Cui & Li, 2003), and political, economic, regulatory, and sociocultural factors make the international environment differ from the domestic one (Diamantopoulos & Cadogan, 1996). Companies with a strong market orientation perform better in exports considering the institutional differences between the national and international environment using hierarchical export channels (He, Brouthers, & Filatotchev, 2018).

Competition in global markets warrants companies to frequently rethink their business operating models since innovation based solely on new products and targeting local markets is no longer enough to sustain competitiveness and survival (Taran, Boer, & Lindgren, 2015). In order to internationalize satisfactorily, it is necessary to innovate and modify various business model components that lead to internationalization and meet customer needs (Cavallo *et al*., 2020). Hojnik *et al*. (2018) highlighted the need for companies to adopt major product, organizational, and technological innovations to operate environmentally sustainably and respond to growing consumer demand for green products and services. In addition, internationalization is positively associated with corporate sustainability, improving the company's economic performance (Bojnec & Tomšič, 2020).

In Brazilian industrial companies, Kneipp, Gomes, Frizzo, Rossato, and Centenaro (2019) demonstrated that internationalized companies have a greater tendency to adopt a proactive stance toward sustainable innovation. In internationalized agribusiness firms, Costa, Macedo-Soares, Carneiro, De Beule, and Goldszmidt (2021) found a positive association between environmentally sustainable strategies and export market performance, including markets with lower and higher environmental awareness. Internationalization is a crucial driver of eco-innovation and drives companies to learn and implement eco-innovation through two channels of influence: i) increasing demand for cleaner and environmentally sustainable production technologies, products, and services; and ii) foreign regulation (Hojnik *et al*., 2018).

Company internationalization and environmental management are positively related (Gómez-Bolaños, Hurtado-Torres, & Delgado-Márquez, 2019), and Hojnik *et al*. (2018) identified that internationalized companies are more likely to adopt product, process, and/or organizational eco-innovations. Some companies introduce organizational eco-innovation practices to address environmental concerns and opt for certifications with recognized international standards (García-Quevedo, Kesidou, & Martínez-Ros, 2020). Organizational innovation strengthens the positive impact of internationalization on product innovation (Nguyen-Van & Chang, 2020). Indeed, García-Quevedo *et al*. (2020) showed that companies exposed to international competition are likelier to adopt environmental management systems to indicate environmental credentials in foreign markets. The higher the degree of internationalization, the likelier the company is to adopt green certifications (Luan, Tien, & Chen, 2016).

Regarding environmental proactivity, Chiarvesio, Marchi, & Maria (2015) compared three structural variables concerning eco-innovation: (a) the presence of environmental certification, (b) size, and (c) the propensity to innovate within a collaborative network, especially concerning product innovation. The variety of products and services offered by environmentally proactive companies contributes to company differentiation advantages in the international market (Chen *et al*., 2016). Moreover, R&D activities are related to eco-product strategies, and cost reduction is the primary driver of eco-processing (Biscione, Felice, Gallucci, & Lagioia, 2021).

Calazans and Silva (2016) analyzed internationalized and innovative companies and identified the common presence of sustainable practices in their production processes, such as reducing greenhouse gas emissions, saving water throughout the production chain, and using renewable resources. Alves (2019) noted that companies achieved international recognition and expansion by directing their production processes to sustainable products and processes. A study on Baltic companies showed that cooperation is an essential factor for the eco-process, as it helps reduce the use of inputs and increases efficiency (Biscione *et al*., 2021). The authors also stated that increased efficiency through cost savings is the leading motivator of the eco-process. In addition, Cavallo *et al.* (2020) studied a company in northwestern Colombia and reported that the overall business model innovation process had a clear impact on the internationalization scale, corroborating the understanding that a new cost structure can benefit the viability of business models in international markets (Abrahamsson, Boter, & Vanyushyn, 2019).

Companies that operate in foreign markets and implement eco-innovations (product, process, and organization) perform even better (Hojnik *et al*., 2018). Furthermore, internationalization leads multinational companies in emerging markets to grow substantially in sustainability and increase sustain/ability concerns at the global market level (Park, 2018). The following section describes the method adopted to conduct this study.

Method

This study sought to analyze the differences between adopting sustainability-oriented innovation and the business model of industrial companies considering their degree of internationalization. To this end, a quantitative approach with a descriptive nature was employed using a survey. The variables analyzed were grouped into two key dimensions: sustainable innovation practices and the business model. The sustainable innovation practices were evaluated based on Klewitz and Hansen (2014) through the dimensions of sustainability-oriented innovation at the product, process, and organization levels. Regarding the business model, the studies of Boons and Lüdeke-Freund (2013), Kiron, Kruschwitz, Reeves, and Goh (2013), and Taran, Boer, & Lindgren, (2015) were used as a basis while seeking to analyze the business model from the dimensions of value proposition, supply chain, customer relationship, financial model, and degree of business model innovation.

The research universe consisted of companies that benefited from the so-called "*Lei do Bem*" (Law No. 11.196/2005), which provides tax incentives to legal entities that carry out R&D of technological innovation. According to data from the Brazilian Ministry of Science, Technology, and Innovation (MCTI, 2013), seven hundred and eighty-seven (787) companies were eligible to benefit from the incentives provided by the "*Lei do Bem*" in 2012, representing the target population of the study.

Industrial companies that benefited from this legislation were chosen because they receive incentives for R&D and technological innovation activities; in addition, this study included companies in the international market. This decision was made because internationalization is a driver for pursuing sustainability initiatives and is associated with the need to follow sustainability goals, which raised particular concern in companies with traditional business models to seek appropriate solutions (Nosratabadi *et al*., 2019; Gomez-Trujillo & Gonzalez-Perez, 2020). Thus, this study contributes to the literature by integrating the themes of internationalization, sustainability, and business model.

Questionnaires were sent via an online platform to the companies with an invitation letter explaining the study's objectives, and a total of 104 questionnaires were returned (13.20% of the surveyed population). The data were collected utilizing a structured questionnaire from the conceptual model and composed of closed questions and an interval scale. Data were collected from July 2018 to May 2019 and were tabulated and analyzed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) software using univariate and bivariate analysis. Chapter 4 presents the results of this investigation and analyses based on existing studies in the literature.

Analysis and discussion of the results

The differences in adopting sustainability-oriented innovation and the business model of industrial companies were analyzed considering their degrees of internationalization. The sampled companies were classified into low, medium, and high degrees of internationalization (Table 2).

Table 2: The different levels of internationalization

Answer	Degree
Null (does not operate in the foreign market)	
Very low (very little activity in the foreign market)	1
Low (little activity in the foreign market)	
Medium (regular activity in the foreign market)	2
High (high activity in the foreign market)	
Very high (very high activity in the foreign market)	3

Source: Prepared by the authors.

The characteristics of the sample are listed in Table 3. The respondents' average experience in the company and industry are similar (11.44 and 10.73, respectively). Despite the high variability in the answers, this average time denotes the respondents' experience. Nonetheless, the surveyed companies have an average of 50 years of founding; the youngest company is 3 years old, and the oldest is 182 years old, thus evidencing the diversity of perceptions between traditional and modern companies. As for the number of employees, most of the companies surveyed have between 100 and 499 employees (44.2%), thereby being considered medium-sized companies, and those with over 499 employees (38.5%) were considered large. In addition, these companies entered the innovation market in the last five years mainly through process and product innovation (68.3%). Lastly, the companies mostly belong to the machinery, equipment, technology, automotive, and chemical sectors. In addition, innovation and/or sustainability investments are of fundamental importance to these sectors due to their productive nature.

Table 3: Sample characteristics

	Mean	Standard deviation	Coefficient of variation	Minimum time	Maximum time
Time in the company	11.44 years	9.22 years	80.59%	1 month	46 years
Time in the sector	10.73 years	8.72 years	81.27%	3 months	46 years
Founding time	50.30 years	30.99 years	61.61%	3 years	182 years
Number of employees	<19 employees (microenterprise)	20 to 99 employees (small enterprise)	100 to 499 employees (medium enterprise)	Above 499 employees (large enterprise)	
	3.80%	13.50%	44.20%	38.50%	
Introduction into the innovation market in the last five years	Product innovation	Process innovation	Product and process innovation	Not applicable	
	21.20%	4.80%	68.30%	5.80%	
Area of operation					
Machinery and equipment		24.00%	Engineering		2.90%
Technological		10.60%	Paper production		2.90%
Automotive		8.70%	Health and education		2.90%
Chemical		8.70%	Rubber		1.00%
Food		4.80%	Energy		1.00%
Agricultural/agroindustrial		3.80%	Mining		1.00%
Pharmaceutical		3.80%	Oil and gas		1.00%
Furniture		4.80%	Recycling		1.00%
Industrial automation		2.90%	Other		15.40%

Source: Prepared by the authors.

The variables corresponding to sustainability-oriented innovation practices and the business model according to the degree of internationalization of the industrial companies surveyed are listed in Table 4.

Table 4: Descriptive analysis of adopting sustainability management practices

Dimension	Variables	N	Chi-square	Significance
Process innovation	Production processes that reduce environmental impacts	102	1.937	0.38
	Correct elimination of unnecessary materials in production processes, reduction of wastewater discharge, and sewage control	103	0.222	0.895
	Practices aimed at reducing the consumption of energy, water, and materials/resources and replacing inefficient processes	104	5.195	0.074*
	Forms of transportation that contribute to reducing environmental impact	95	0.962	0.618
	Certifications aimed at sustainability-oriented activities	96	0.772	0.68
	Policies that promote environmental preservation	102	6.508	0.039**
	Environmental accounting instruments (i.e., records and controls that help evaluate the environmental impact of business activities)	95	2.29	0.318
Organizational innovation	New processes that increase efficiency and contribute to sustainable practices	102	5.646	0.059*
	Practices that seek to incorporate environmentally sound and socially just issues into the supply chain	102	0.638	0.727
	Facilities and local procurement that reduce the emission of pollutants from transportation	93	2.009	0.366
	The use of local labor	101	0.116	0.944
	Involvement of stakeholders, such as employees, suppliers, and the community, in sustainable actions	104	0.839	0.657
	Departments, teams, units, and/or cross-functional committees responsible for sustainability	103	1.496	0.473
	The vision of sustainability based on owner-manager values	99	0.432	0.806
	Development and training for employees to perform sustainability-related activities	102	2.971	0.226
	Norms that lead to sustainability-oriented employee behavior in the organization	103	0.872	0.647
	The involvement of employees in actions aimed at promoting sustainability	102	1.049	0.592
	Concern for the health and safety of employees and stakeholders	104	0.058	0.971
Product innovation	Products that have a less aggressive design to the environment and that reduce the use of raw materials	92	5.686	0.058*
	Labeling that explains the adoption of sustainable actions, practices, and/or certifications	80	0.500	0.779
	Forms of measuring resource consumption, environmental impacts, and waste release throughout a product's entire life cycle (i.e., from the extraction of raw materials to the final disposal)	86	3.330	0.189
	Innovations aimed at reducing the number of materials or replacing them with sustainable ones	99	0.187	0.911
	Reduced packaging or packaging that is reusable	84	0.027	0.987
	Fairtrade practices and the use wof organic products	69	7.248	0.027**
	The company's value proposition is related to economic, social, and environmental criteria	101	0.521	0.77
	Suppliers actively involved in sustainable supply chain management aimed at developing new products and/or processes that integrate sustainability	102	1.206	0.547
Business model	Mechanisms that seek to motivate customers to assume their responsibilities through their consumption	95	3.561	0.169
	Customer relationships based on sustainability challenges	97	2.322	0.313
	A financial model that reflects an appropriate distribution of economic costs and benefits among the company's stakeholders	98	0.744	0.744
	A financial model responsible for the ecological and social impacts of the company	49	0.009	0.009***

Source: Prepared by the authors.

[1] The means refers to the company's level of agreement on applying such practices on a scale from 1 to 5, in which 5 is the highest level of agreement.[2] The mean for each dimension was calculated from the arithmetic mean of its variables.

Level of significance between means: *** p<0.01; ** p<0.05; * p<0.1.

By observing the data in Table 4, one can note several differences in adopting some sustainability-oriented innovation practices when considering the degree of company internationalization. These differences refer to practices that include practices to reduce the consumption of energy, water, materials/resources, and replacing inefficient processes; policies that promote the preservation of the environment; new processes that bring more efficiency and contribute to sustainable practices; products that have a less aggressive design to

the environment and reduce the use of raw materials, and fair-trade practices and using organic products. Regarding the business model, differences were noted regarding a financial model responsible for the company's ecological and social impacts.

These findings corroborate Hojnik *et al*. (2018), who reported that internationalization is one of the main drivers of eco-innovation. Additionally, the authors believe that internationalization compels companies to learn and implement eco-innovation through cleaner and environmentally sustainable production technologies, products, and services that relate to some of the practices that are more present in companies with a better relationship with the international market. Companies in an international market can stand out even more by diversifying their products and services, which are aspects present in the sustainability-oriented practices identified herein and that improve the company's economic performance standards (Chen *et al*., 2016; Bojnec & Tomšič, 2020). Alves (2019) further corroborates this theme by stating that companies have achieved international recognition and expansion by directing their production processes to sustainable products and processes. With this, the differentials between companies with different degrees of internationalization are likely related to their exposure to different markets.

Some practices identified can contribute to compliance with legislation and adopting certifications. For instance, García-Quevedo *et al*. (2019) found that industries exposed to international competition are likelier to adopt environmental management systems to indicate environmental credentials in foreign markets. Moreover, the higher the degree of internationalization, the likelier the firm will adopt green certifications (Luan *et al*., 2016). In fact, adopting practices that integrate innovation and sustainability can ensure organizational survival and generate competitive advantage in a way that substantially benefits the company's reputation and performance (Khattak *et al*., 2021; Leal-Rodríguez *et al*., 2018). These advantages may explain the differences between companies with different degrees of internationalization.

Nevertheless, it should be noted that the company depends on adopting a sustainable business model and production processes whose opportunities for investment in sustainable innovations are effective (Barbieri & Santos, 2020).

Final considerations

Operating in international markets represents a corporate competitiveness factor; however, the foreign market has a series of requirements concerning sustainability. Therefore, this study analyzed the differences in adopting sustainability-oriented innovation practices and the business model of industrial companies considering their degree of internationalization.

According to our findings, there are differences in adopting some of the sustainability-oriented innovation practices presented herein when considering the companies' degree of internationalization. These differences refer to practices that include reducing the consumption of energy, water, materials/resources and replacing inefficient processes, policies that promote the preservation of the environment, and new processes that improve efficiency and contribute to sustainable practices. Such practices denote an environmental concern, considering that they seek better use of natural resources and their preservation.

Moreover, significant differences were also evidenced regarding products with a less environmentally aggressive design, reduced use of raw materials, and use of fair trade practices and organic products, demonstrating consumer concern in terms of these aspects. Regarding the business model, differences were noted concerning a financial model responsible for the company's ecological and social impacts, showing that companies that operate in foreign markets have included the social, environmental, and economic dimensions of sustainability in their business models.

In this sense, this study addressed the themes of sustainability-oriented innovation in the context of internationalized companies and showed that some of the variables analyzed differ regarding companies adopting some sustainability-oriented innovation practices when considering their degree of internationalization.

Theoretical and managerial implications

This work contributes to the literature as it investigates the emerging research topic of internationalization and sustainable innovation and analyzes Brazil, a developing country, as most researchers have only considered developed countries (Chiarvesio *et al*., 2015; Šūmakaris *et al*., 2020).

The expansion of internationalized companies to developing countries implies more intense environmental management within the company, and this expansion can strengthen the company's 'green' image (Gómez-Bolaños *et al*., 2020). In addition, there is a tendency to replicate foreign sustainability practices (Asuquo, Dada, & Onyeogaziri, 2018). For instance, Borsatto, Bazani, and Amui (2020) found that the degree of internationalization did not directly affect companies' green innovation.

Circular economy and international market orientation are an agenda for future research. Regarding managerial implications, the importance of adopting sustainable practices is quite evident, contributing to competitiveness, expanding markets, and increasing the company's legitimacy. Hence, the data provided herein can be particularly useful for managers seeking to improve sustainable practices in search of a sustainable business model to meet the demands of the international market.

Limitations and future research

One limitation is the impossibility of generalizing the results presented and discussed, considering that the analysis is limited only to Brazilian industrial companies. Future studies can assess specific industrial sectors, regulatory aspects, and company size. Enterprise supply chain management is also a research trend that, according to Šūmakaris, Ščeulovs, & Korsakienė (2020), can be used to compare industrial companies from developed countries with ones from

emerging countries. Using other statistical techniques is also recommended to assess the relationships resulting from adopting sustainability-oriented innovation practices and the business model of internationalized industrial companies.

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