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Are highly internationalized companies more sustainable? An empirical analysis in a regional context

Empresas mais internacionalizadas são mais sustentáveis? Uma análise empírica em contexto regional

¿son más sostenibles las empresas altamente internacionalizadas? Un análisis empírico en un contexto regional.

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ABSTRACT

Background: In recent decades, driven by globalization and the climate emergency, the themes of internationalization and sustainability have gained prominence, stemming from the unsustainability of prevailing consumption patterns and the migration of productive capital across nations.

Purpose: In this context, this study aims to verify the existence of an association between the degree of internationalization and green innovation in exporting companies located in the municipalities of Uberlândia and Ribeirão Preto.

Method: The study analyzed 122 exporting companies from Uberlândia and Ribeirão Preto, measuring their degree of internationalization and assessing their product, process, and green innovation profiles. The relationship between these dimensions was examined using Spearman's rank correlation test.

Results: The results demonstrated a strong and significant correlation between the Degree of Internationalization and the variables that comprise the constructs of green innovation in products, processes, and green innovation practices.

Conclusions: These findings corroborate this field of literature, demonstrating the relationship between internationalization and specific variables of green innovation in the context of regional companies, and also showing that more internationalized companies tend to be more transparent in their sustainable practices.

Keywords: internationalization degree; green innovation; correlation; regionality; sustainability.

RESUMO

Contextualização: A partir das últimas décadas, com o advento da globalização e da emergência climática, as temáticas de internacionalização e sustentabilidade ganharam destaque em uma conexão resultante da impossibilidade da manutenção dos padrões de consumo e da migração do capital produtivo entre as nações do globo.

Objetivo: Neste contexto, este estudo tem por objetivo verificar a existência de associação entre o grau de internacionalização e a inovação verde das empresas exportadoras localizadas nos municípios de Uberlândia e Ribeirão Preto.

Método: Foram analisadas 122 empresas exportadoras das cidades de Uberlândia e Ribeirão Preto, calculando-se o grau de internacionalização das mesmas e verificando o perfil de inovações de produtos, processos e práticas verdes, correlacionando as duas dimensões utilizando o teste de correlação de Spearman.

Resultados: Os resultados demonstraram uma forte e significativa correlação entre o Grau de Internacionalização e as variáveis que compõem os constructos de inovação verde de produtos, processos e práticas de inovação verde.

Conclusões: Esses achados corroboram com este campo da literatura demonstrando a relação entre a internacionalização e variáveis específicas de inovação verde em um contexto de empresas regionais, além de evidenciar que empresas mais internacionalizadas tendem a ser mais transparentes nas suas práticas sustentáveis.

Palavras-chave: grau de internacionalização; inovação verde; correlação; regionalidade; sustentabilidade.

RESUMEN

Contextualización: En las últimas décadas, con el avance de la globalización y la intensificación de la emergencia climática, los temas de la internacionalización y la sostenibilidad han adquirido un papel central, dada la interdependencia entre los patrones de consumo, la movilidad del capital produtivo y los impactos ambientales a escala global.

Objetivo: En este contexto, el presente estudio busca verificar la existencia de una asociación entre el grado de internacionalización y la innovación verde en empresas exportadoras ubicadas en los municipios de Uberlândia y Ribeirão Preto.

Método: Se analizaron 122 empresas exportadoras de las ciudades de Uberlândia y Ribeirão Preto. Se calculó su grado de internacionalización y se evaluó el perfil de innovaciones en productos, procesos y prácticas verdes, correlacionando ambas dimensiones mediante la prueba de correlación de Spearman.

Resultados: Los resultados demostraron una correlación fuerte y significativa entre el grado de internacionalización y las variables que conforman los constructos de innovación verde en productos, procesos y prácticas de innovación verde.

Conclusiones: Estos hallazgos respaldan la literatura existente al evidenciar la relación entre la internacionalización y variables específicas de innovación verde en un contexto de empresas regionales. Asimismo, indican que las empresas más internacionalizadas tienden a ser más transparentes en sus prácticas sostenibles.

Palabras clave: grado de internacionalización; innovación verde; correlación; regionalidad; sostenibilidad.

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1 INTRODUCTION

In the last few decades of the 20th century, globalization emerged as a significant phenomenon, characterized by the political and cultural integration of nations and the rise of financial capitalism, thanks in part to advancements in transportation and communication. This shift spurred international trade and led governments to prioritize attracting foreign investment, while also developing local infrastructure to enhance the competitiveness of established subsidiaries (Cardoso et al., 2008).

As a result, companies began to internationalize for new reasons. The transnationalization of corporations has become an essential driver of contemporary economic growth and market expansion. Whereas the initial motivation for international operations often centered on securing natural resources and accessing inexpensive labor, there has been a noticeable shift toward competitiveness, credibility, and long-term sustainability. This evolution has sparked discussions around the intricate relationship between humans, society, and the environment (Cardoso et al., 2008).

This topic gained prominence with the advent of the concept of Sustainable Development, introduced by the World Commission on Environment and Development in 1987 and further detailed in the Brundtland Report. Building on international discussions, the 2030 Agenda, launched by the United Nations (UN) in 2015, represents a comprehensive framework for advancing sustainable development. It outlines 17 Sustainable Development Goals (SDGs) aimed at ensuring peace and prosperity for all by 2030, striving for a balance between social, economic, and environmental sustainability while engaging governments, civil society, educational institutions, and businesses (UN, 2018).

Consequently, organizations face increasing pressure to adapt, not only from legislative frameworks but also from societal expectations. The growing awareness of climate change and environmental degradation, much of which can be attributed to corporate activities, necessitates that companies demonstrate a readiness to thrive in this evolving landscape. Those that prioritize sustainable practices may gain a competitive edge over those that do not (Santos, 2015). It can be concluded that a higher level of internationalization often correlates with improved sustainability, as such entities navigate increasingly complex and diverse environmental regulations (Suarez-Perales et al., 2017).

In this context, businesses must find a way to invest in environmental sustainability while still being profitable and meeting shareholders' needs. One effective strategy for achieving this balance is through Green Innovation. This practice encompasses product and process innovations that leverage technologies to save energy, reduce pollution, and facilitate waste recycling and environmental management (Chen et al., 2006).

As corporations expand in size and visibility, the expectation for them to adopt and implement sustainable practices intensifies. Additionally, international companies must comply with environmental and civil regulations that may differ significantly from those in their home countries, requiring even greater vigilance regarding sustainability practices. The literature indicates a positive correlation between internationalization and green innovation in various contexts, including large, state-owned enterprises and well-governed companies (Huang, 2026), as well as small and medium-sized enterprises in China (Liu, 2024) and Chinese multinationals (Zhang, 2023). Factors such as foreign direct investment, digitalization, and green knowledge further contribute to this positive relationship (Zhang, 2024; Marco-Lajara, 2023). The theoretical framework that supports the interplay between internationalization and green innovation is Institutional Theory, which suggests that organizations can enhance their growth and survival capacity in competitive environments by effectively satisfying their stakeholders (Zucker, 1987).

Regionality significantly influences internationalization processes, as noted by Gil, Klink, and Santos (2004). They describe it as a collective consciousness that brings together the citizens of a region through their shared culture, fostering a sense of solidarity aimed at regional development. This concept is understood through its symbolic meaning, shaped by historical and economic factors and relationships (Pozenato, 2001). Consequently, companies are influenced by the characteristics of their respective regions, which, in turn, affect their expansion strategies. Conversely, the globalization of organizations also impacts regional dynamics.

In light of this context, this study investigates the relationship between internationalization and green innovation among exporting companies in Uberlândia and Ribeirão Preto. Specifically, it seeks to determine whether there is an association between the degree of internationalization (DI) and the level of green innovation in these firms. An analysis was conducted on data from 122 companies to assess their degree of internationalization and to evaluate their profiles regarding innovations in products, processes, and green practices, thereby correlating these two dimensions. The selection of these municipalities is based on their regional and national economic significance. Uberlândia, known as the capital of the Triângulo Mineiro region, hosts several important organizations in the agribusiness sector and offers a strategic location with easy access to major capitals and distribution centers. Meanwhile, Ribeirão Preto is distinguished by its cluster of notable companies and significant socio-economic development.

This work ultimately highlights how these corporations and their regions can compete in an increasingly rigorous global market. It also aligns with the eighth goal of the 2030 Agenda, which promotes sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. Additionally, it addresses target 8.4, which focuses on improving global resource efficiency in consumption and production by 2030 while striving to decouple economic

growth from environmental degradation. In addition, it touches on Goal 9, which advocates for building resilient infrastructure and fostering sustainable industrialization and innovation. Here, target 9.4 emphasizes the need to modernize infrastructure and industries to enhance resource efficiency and promote the adoption of clean, environmentally sound technologies. Lastly, the findings contribute to Goal 12, which seeks to establish sustainable consumption and production patterns, particularly through encouraging companies, especially large and multinational ones, to embrace sustainable practices and integrate sustainability into their reporting cycles (UN, 2015).

2 THEORETICAL FRAMEWORK

2.1 Internationalization

Internationalization refers to the process through which a company increasingly engages in operations beyond its home country. As noted by Fleury (2012), it encompasses various social actors involved in globalization, including both public and private firms, as well as governmental and non-governmental organizations. Entry into foreign markets is typically structured through governance models that facilitate value creation, which can be categorized into traditional methods—such as exporting, forming partnerships, and making direct investments—and non-traditional approaches like capital access, innovation hubs, virtual presence, and managed ecosystems (Brouthers et al., 2022).

Understanding the complexity of internationalization has led to the development of various theoretical frameworks (Carneiro & Dib, 2007). According to Amal et al. (2013), these theories should be viewed as complementary. Generally, internationalization theories can be divided into two main traditional approaches: economic and behavioral, as well as more contemporary perspectives such as international entrepreneurship (Carneiro & Dib, 2007).

From a behavioral standpoint, which draws upon behaviorist theory, internationalization is seen as an incremental process characterized by gradual decision-making aimed at minimizing risk (Johanson & Vahlne, 1977). Key concepts in this perspective include the Uppsala Model, International Entrepreneurship, and the Networks Perspective. The Uppsala Model suggests that companies expand internationally in a sequential and gradual manner, which helps reduce uncertainties and build knowledge about foreign markets (Maioui & Gassemi, 2021; Cheriet, 2010). International Entrepreneurship focuses on innovative activities in foreign markets, regardless of the company's size or operational history (Oviatt & McDougall, 2005). The Networks approach posits that organizations often expand abroad to maintain their international networks, which may consist of clients, suppliers, and sometimes even competitors (Welch & Welch, 1996; Carneiro & Dib, 2007).

Conversely, the economic perspective relies on foundational theories such as transaction costs, with Dunning (1988) integrating these into the eclectic paradigm, also known as the OLI model (Ownership, Location, Internalization). This framework outlines the advantages that firms can leverage when operating internationally to counterbalance the challenges they face abroad. It is important to acknowledge that while there are benefits to internationalization, there are also significant hurdles. Companies strive to mitigate the disadvantages tied to their operations outside their home countries (Gorostidi-Martinez & Zhao, 2017).

Entering new markets is just one of the impacts of internationalization; the strategy also enhances brand strength, facilitates knowledge acquisition, and fosters a more competitive stance (Fischer, 2006). Ultimately, internationalization serves as a crucial tool for boosting both innovation and competitiveness in an increasingly integrated and competitive global environment.

Moreover, beyond market expansion, internationalization can enhance a company's innovative capabilities by granting access to new knowledge, technologies, networks, and investment opportunities. A study by Bansi, Andrade, and Galina (2021) with multinational companies from emerging economies indicated that international expansion can promote innovation and help firms maintain their competitive advantages by stimulating organizational learning and strategic development. Hence, internationalization evolves from being solely a market growth strategy to becoming a vital mechanism for enhancing business competitiveness through innovation.

The international involvement of companies can be understood from various dimensions, including the level of international diversification, managerial stance, organizational learning processes, commitment to international activities, and export frequency. In this context, the degree of internationalization serves as a multidimensional indicator that reflects the ongoing engagement of organizations in global operations and the adjustments they make to their strategies, resources, and structures (Floriani, 2010). This indicator has been approached in numerous studies within the field of international business (Sullivan, 1994), utilizing characteristics such as the proportion of foreign sales to total sales (Borsatto & Amui, 2019; Tianrui & Qianwen, 2026), assets, or workforce, and even various combinations of these factors (UNCTAD, 2025).

Given the dynamic nature of this subject, there is no universally accepted method for calculating the degree of internationalization. Research has shown that numerous formulas and indices have been developed, each emphasizing different dimensions and variables. Significant disparities are particularly evident between the economic and behavioral perspectives on internationalization, complicating the establishment of a standardized approach (Santos, 2015). Therefore,

the DI should be interpreted within a theoretical framework that supports its design, taking into account its ability to elucidate the causes and effects of companies' global expansion (Hassel et al., 2003).

2.2 Green innovation

Innovation is a crucial driver of regional and national economic development, as highlighted by Schumpeter (1988). It disrupts the equilibrium of existing systems, fostering new production patterns that differentiate innovative firms. With increased competitiveness, these organizations not only thrive in the marketplace but also attract new customer bases. Neo-Schumpeterian scholars build on this concept, emphasizing the importance of collaboration and knowledge exchange among diverse individuals, institutions, strategies, and technologies, thereby underscoring the value of creative thinking and teamwork (Kelley, 2005).

To standardize guidelines for measuring innovation globally, the Organization for Economic Co-operation and Development (OECD) developed the Oslo Manual. This manual defines innovation as the introduction of a new or improved product (goods or services), process, marketing method, or organizational approach in business practices, workspace arrangements, or external relations (OECD, 2010). As such, innovation emerges as a vital catalyst for enhancing productivity within companies and fostering national growth (Garcia & Calantone, 2016). In today's climate of sustainability and escalating environmental challenges, businesses increasingly utilize innovation to address ecological issues linked to their production processes while simultaneously maintaining economic growth, consumer trust, and competitiveness (Tantayanubutr & Panjakajornsak, 2017).

The concept of "green innovation" is central to this discussion and it refers to the pursuit and development of ecological products, services, and processes that introduce a degree of novelty (Chen et al., 2012). The primary goal of green innovation is to mitigate or prevent environmental harm, thereby safeguarding the environment while catering to consumer preferences, all rooted in value creation and enhanced business revenues (Albort-Morant et al., 2017). Green innovation involves pioneering ideas that foster more environmentally friendly products and services throughout their lifecycle—from conception to disposal—without adversely affecting nature, ultimately benefiting environmental sustainability, the economy, society, and the firms involved (Guinot et al., 2022).

Beyond its environmental implications, green innovation possesses strategic significance, contributing to the enhancement of organizational reputation. Benefits stem from improved company image, competitive advantages, and efforts to strengthen brand identity (Agan et al., 2013). Consequently, the implementation of green innovation practices transcends mere environmental compliance, becoming integral to corporate strategies aimed at generating value and achieving competitive differentiation.

Furthermore, scholars like Chen (2006), Huang and Li (2017), Li (2014), and Hsueh (2013) categorize green innovation into four primary types: Green Product Innovation, Green Process Innovation, Green Innovation Practices, and Green Innovation Behaviors. Green Product Innovation focuses on creating energy-efficient, less polluting, and recyclable products, employing principles of green design (Chen, 2006; Huang & Li, 2017). Meanwhile, Green Process Innovation aims to conserve energy, reduce pollutant emissions, and promote recycling of waste (Sarkar, 2018; Shrivastava, 2018).

Green Innovation Practices encompass the processes, techniques, systems, and certifications that businesses adopt to minimize or prevent environmental damage (Li, 2014). This includes the implementation of "eco-innovation," which refers to actions that reduce negative environmental impacts while yielding competitive and financial advantages (Takalo & Tooranloo, 2021). Lastly, Green Innovation Behaviors comprise collective actions and awareness throughout the entire production process, focusing on reducing energy consumption, facilitating recycling, and utilizing clean technologies. These efforts can lead to waste minimization, streamlined processes, and, ultimately, cost reductions and increased operational efficiency (Hsueh, 2013).

Recent studies have highlighted a positive correlation between internationalization and sustainable innovation, particularly in the context of companies adopting green innovations. For instance, Suarez-Perales et al. (2017) found that organizations with higher levels of internationalization tend to embrace Green Product Innovation more readily. This trend is largely driven by the necessity for companies to align with stricter environmental regulations in international markets, ultimately enhancing their competitive and environmental standing within their industries.

Similarly, Pereira et al. (2019) noted that environmental regulations play a crucial role in encouraging internationalized companies to adopt green product innovations. The authors emphasize that regulatory demands foster the development of environmentally friendly packaging and the use of materials that are less detrimental to the environment, which in turn helps to bolster the corporate image among consumers in international markets.

2.3 Conceptual model and hypotheses

Recent studies have explored the relationship between internationalization and green innovation in companies, producing a range of results that can be positive, mixed, null, or even negative, based on the measurement of the variables involved. Huang (2026) argues that in large Chinese companies, an increase in internationalization correlates with a rise in green innovation; specifically, the higher the degree of internationalization, the greater the advances in green innovation.

Liu (2024) supports this claim by showing that internationalization not only has a significant positive correlation with innovation performance but also plays a vital role in promoting sustainability among small and medium-sized Chinese enterprises.

Conversely, Borsatto and Amui (2019) found that for large industries in both developed and developing nations, the degree of internationalization does not significantly influence green innovation efforts directly. Instead, it moderates the relationships between regulatory frameworks, competitiveness, and green innovation. Moreover, both Zhang, Zhong & Li (2023) and Zhang & Deborah (2024) emphasize that internal capabilities—such as governance structures, absorptive capacity, global management skills, and digitalization—enhance the green benefits stemming from internationalization.

In light of these findings and considering that external pressures from markets and governments, through regulations, set environmental standards that stimulate green innovation in exporting firms (Borsatto & Amui, 2019), we can see that a more pronounced external presence broadens access to knowledge, technologies, and environmental practices, thereby reinforcing green innovation (Zhang, Zhong & Li, 2023). Furthermore, internationalization also improves financing conditions and encourages investments in green R&D, which, in turn, mediates the effect on the adoption of green innovations (Liu, 2024; Huang, 2026).

With these considerations in mind, we present the Conceptual Model of the research along with its corresponding hypotheses (Figure 1).

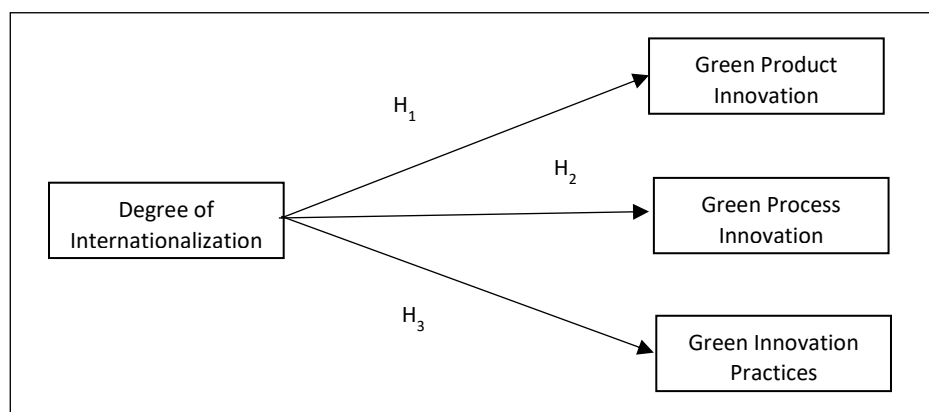


Figure 1. Conceptual Model

Source: prepared by the authors.

H₁: A strong positive correlation exists between the level of internationalization and the implementation of green product innovations (GPI) in exporting firms.

H₂: There is a significant positive relationship between the extent of internationalization and the adoption of green process innovations (GPrI) among exporting companies.

H₃: A positive link has been identified between the degree of internationalization and the uptake of green product innovations (GPI) within exporting companies.

3 METHODOLOGY

The aim of this study is to examine the relationship between the degree of internationalization and the green innovation practices of exporting companies situated in the municipalities of Uberlândia and Ribeirão Preto. This research is characterized as descriptive, employing a qualitative-quantitative approach, which allows for both qualitative and quantitative data interpretation.

Primary data for this study were gathered from 122 exporting companies in these two key cities in Brazil, Uberlândia (in the state of Minas Gerais) and Ribeirão Preto (in the state of São Paulo). The companies were identified using the Lists of Exporting and Importing Companies provided by the Secretariat of Foreign Trade (SECEX), accessible on the Federal Government's portal, covering the period from 2019 to 2021.

Data collection was conducted using a questionnaire designed for a research project funded by Research Support Foundation of the State of Minas Gerais (FAPEMIG). This questionnaire consisted of 28 questions, which had previously received approval from the Research Ethics Committee (REC) of the Federal University of Uberlândia (CAAE: 58154522.5.0000.5152). The questionnaire was adapted based on validated models in both internationalization (Floriani, 2010) and green innovation (Huang, Li, 2014; Cai, Li, 2018; Hojnik, Ruzzier, 2016). The data collected reflected the internationalization and green innovation profiles of the firms and have been analyzed in earlier studies (Oliveira, 2023). The current research focuses on specific variables: the degree of internationalization of the companies and the degree of green innovation, assessed through the constructs of Green Product Innovation (GPI), Green Process Innovation (GPrI), and Green Innovation Practices (GIP) (Oliveira, 2023).

To determine the degree of internationalization of the companies studied, we calculated the ratio of External Sales to Total Sales. While internationalization is inherently a complex and multidimensional phenomenon, the use of a unidimensional metric is justified by its widespread acceptance in international business literature. This is particularly true for studies aiming to establish a direct proxy for export performance and market engagement (Grant, 1987; Qian & Li, 1998; Ruigrok & Wagner, 2003; Capar & Kotabe, 2003; Rubashkina et al., 2015; Chen et al., 2016; Kumar et al., 2021; Liu et al., 2024). Although the effectiveness of this metric has been debated (Hennart, 2011), it remains relevant due to the availability of sales data from secondary sources, which simplifies access compared to other more specific, and time-consuming variables (Borsatto & Amui, 2019).

A descriptive analysis was conducted to characterize the internationalization profile of the companies in the sample. It is important to clarify that the aim of this research is to identify patterns of bivariate association, rather than to establish cause-and-effect relationships, due to the cross-sectional design of the data. Additionally, a descriptive analysis of the green innovation profile was performed, framing the research as descriptive with a quantitative approach.

The descriptive statistics included the calculation of measures of central tendency, such as the mean and median, as well as measures of dispersion like standard deviation, minimum, and maximum values. Before carrying out the inferential tests, the dataset was examined for outliers and missing values, revealing no anomalies that could compromise the sample's integrity. The degrees of Green Product Innovation (GPI), Green Process Innovation (GPII), and Green Innovation Practices (GIP) were operationalized through the arithmetic mean of the items that constituted each construct on the Likert scale.

To determine the existence and strength of the association between the degree of internationalization and the dimensions of green innovation, the Shapiro-Wilk normality test was applied. The results showed that the variables did not follow a normal distribution ($p < 0.05$), rendering the use of parametric techniques and traditional linear regression models inappropriate. Consequently, the Spearman correlation test was used, a non-parametric test suitable for situations where ties among variables may occur (Puth, Neuhäuser, Ruxton, 2015). This was applicable to this research since the dimensions of Green Innovation were assessed using a five-point Likert scale. All statistical analyses were conducted using StataMP 13 software.

As this is a non-parametric bivariate correlation analysis aimed at examining the direct relationships between the primary constructs, control variables such as company size and sector of activity were excluded from the statistical model. These were reported descriptively and acknowledged as a limitation of the research scope.

4 ANALYSIS AND DISCUSSION OF RESULTS

4.1 Profile of exporting companies

This study examined a sample of 122 internationalized companies based in Uberlândia, MG, and Ribeirão Preto, SP, two cities that play a crucial role in both the regional and national economies. Located in the Southeast region of Brazil, this area is home to 90% of the country's exporting firms (Brasil, 2023). Among the sample, fourteen organizations belong to the Miscellaneous Products Manufacturing sector, making it the largest group. This is closely followed by the Machinery and Equipment Manufacturing sector and the Textile Products Manufacturing sector, each comprising thirteen companies. Additionally, significant representation is seen in the Wood Products Manufacturing and Food Products Manufacturing sectors (Figure 2).

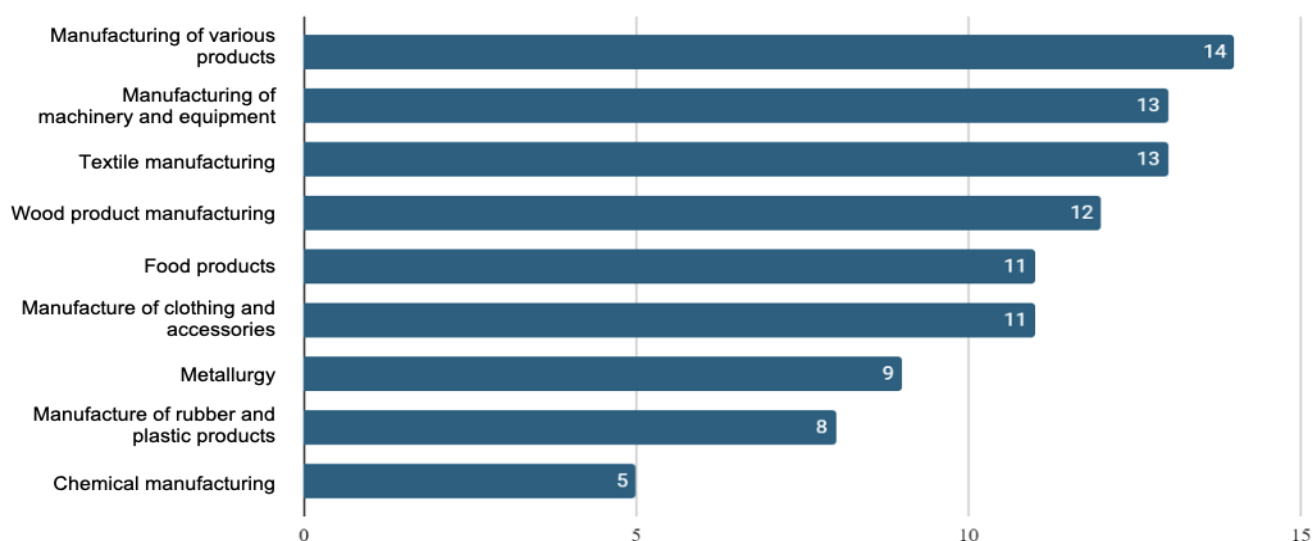


Figure 2. Sectors with 5 or more companies

Source: prepared by the authors.

The data highlights a clear alignment with the national export trends outlined in the document "Profile of Brazilian Exporting Companies," released by the Ministry of Development, Industry, Trade and Services in June 2023. Notably, 64.9% of Brazil's exporting firms operate within the industrial sector, which encompasses the factories mentioned earlier. This concentration reflects a strategic effort to enhance information sharing, streamline supplier and market interactions, balance labor supply and demand, and foster the generation and dissemination of knowledge (Brasil, 2023).

A significant portion of these companies—51 in total—was established in the 2000s, with 2004 and 2006 marking the peak years for new openings, each witnessing eight startups. The 1980s and 1990s also contributed to the landscape, yielding 28 and 24 openings, respectively. Furthermore, the international expansion of these companies surged in the 2000s, reaching an unprecedented high during the 2010s. In 2016, a remarkable year, 12 out of 122 firms were venturing into international markets. This trend of internationalization gained traction in the 1990s and became increasingly prominent at the start of the new millennium.

4.2 Internationalization profile

After identifying the profile of the companies in our sample, we verified their internationalization status and calculated their degree of internationalization. This calculation was based on the ratio of External Sales to Total Sales, a method commonly applied in various studies within the field of international business (Grant, 1987; Sullivan, 1994; Qian, 1998; Ruigrok & Wagner, 2003; Capar & Kotabe, 2003; Rubashkina et al., 2015; Chen et al., 2016; Kumar et al., 2021; Liu et al., 2024).

Among the companies evaluated, the most internationalized is in the food manufacturing sector, boasting an impressive internationalization index of 71.94%. This figure indicates a significant orientation of its activities toward global markets. Following closely, the second most internationalized company in the beverage manufacturing sector has a 51.44% index, also demonstrating a strong focus on international business. Additionally, companies in the Agriculture, Livestock, and Related Services sector achieved an index of 42.8%.

Figure 3 illustrates the ten companies with the highest globalization index (GI) along with their respective sectors. Notably, aside from the top two companies with considerably high GIs, the remaining companies in the sample display a similar internationalization profile.

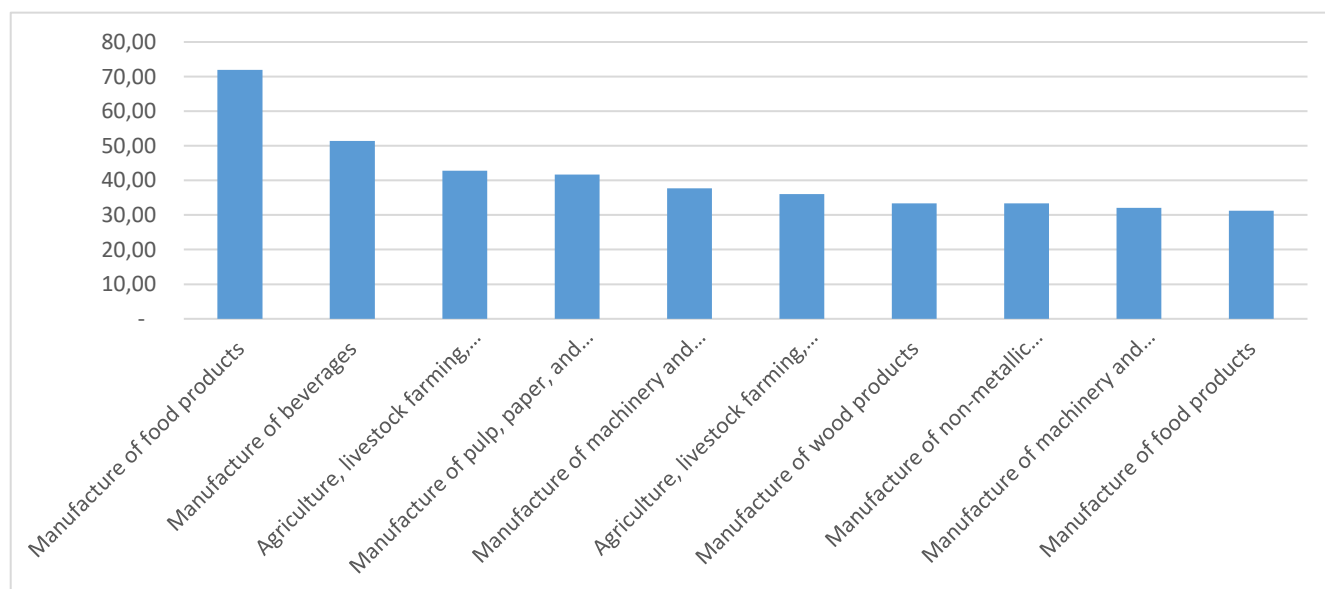


Figure 3. Sectors of the 10 companies with the highest degree of internationalization

Source: prepared by the authors.

Among the various methods companies used to operate internationally, exporting emerged as the most favored approach, with 104 companies participating in this strategy. This preference stems from the lower investment and risk associated with exporting, despite potential limitations posed by logistical challenges and tariff barriers. As a result, exporting often serves as the first step in the internationalization process for many firms (Johanson & Vahlne, 1977).

The primary destinations for these exports were France and Argentina, each attracting 11 firms, while Germany and Portugal followed closely with 10 firms each. Italy, Chile, and the Netherlands were also notable destinations, with 9 firms exporting to each of these countries. According to the Profile of Brazilian Exporting Firms (Brasil, 2023), a significant 61% of exporting companies opted to trade with Latin American nations in 2020, with Argentina and Chile being among the leading partners. The existing trade agreements and tariff benefits facilitated by Mercosur significantly contribute to this preference. Notably, exports to European Union countries experienced the second-highest growth rate from 2018 to 2020, just behind the United States (Brasil, 2023).

In addition to exporting, companies also pursue partnerships — such as franchises, licensing agreements, and production contracts — as a strategy for reducing financial risks and sharing operational costs. This model was adopted by 7 of the responding firms, primarily targeting Chile and France. A further avenue for international engagement is direct investment abroad, which includes establishing stores, distribution centers, or research and development facilities. A total of 21 companies employed this method, with France being a top destination again, alongside the United States, the Netherlands, and Germany.

To delve deeper into the characteristics of these companies' internationalization efforts, 17 advantages of operating abroad were identified. Companies were invited to rate how beneficial each aspect was to their international expansion process, using a scale from 1 to 5, where 1 indicated minimal advantage, and 5 signified significant advantage. The results are summarized in Table 1.

Table 1

Advantages of operating abroad

Description/Advantage	Average	Standard deviation
Entering/developing new markets	3.98	0.66
Being in the main client's market	3.86	0.79
Accessing suppliers	3.77	0.9
Building an export base to other countries	3.77	0.78
Being where competitors operate	3.72	0.76
Mitigating trade barriers	3.59	0.71
Reducing bureaucracy	3.36	0.8
Maintaining/developing markets where the company already operates	3.31	1.32
Obtaining lower tax burdens and/or subsidies	2.96	0.74
Reducing transportation costs	2.9	0.84
Reducing exchange rate volatility	2.81	0.76
Accessing natural resources	2.63	1.12
Environmental regulations	2.59	0.91
Establishing partnerships to develop green products or processes	2.46	0.95
Labor availability	1.96	1.12
Labor market regulations	1.94	0.99
Reducing wage costs	1.71	0.9

Source: prepared by the authors.

The results of the research highlighted several key advantages for corporations operating internationally. These advantages include entering and developing new markets, establishing a presence within key client markets, accessing suppliers, and building an export base for other countries. Companies also benefit from maintaining and expanding their markets, establishing a footprint where competitors operate, and mitigating trade barriers. These findings align with established literature on the benefits of the internationalization process (Jung et al, 2016; Grant, 2017; Lu & Beamish, 2004), which are supported by economic theory (Dunning, 1988). On the other hand, the least cited benefits pertain to labor availability, wage cost reduction, and labor market regulation. To better understand these results, it is helpful to consider two factors: the primary trading partners of these companies and the functioning of current global value chains (Table 2).

Since the mid-1980s and especially after 1990, a revolution in information and communication technologies has transformed production and consumption processes. This shift has made it feasible to coordinate various stages of production remotely. The notable wage disparities between countries make this fragmentation economically viable. This new organizational structure has emerged to reinvigorate capital accumulation, injecting dynamism into a productive process that had begun to stagnate (Gomes, 2020).

In analyzing the global landscape, the distinction between countries in the Global North and South, or between "developed" and "developing" nations, proves significant. These distinctions help clarify how different regions fit into global networks. Typically, countries in the Global North have business headquarters with concentrated research and development centers, innovation hubs, and points for final product dispatch. Conversely, developing nations receive segments of production, mainly focused on commodities due to lower labor costs, less stringent labor laws, and more readily accessible natural resources (Gomes, 2020).

For companies based in Uberlândia and Ribeirão Preto, many of their primary trading partners are developed European countries like France and Germany. As a result, the advantages previously mentioned may not apply, given that the workforce in these nations tends to be more skilled and their labor and environmental regulations are more stringent. This is reflected in the responses regarding Environmental Regulation, which was viewed unfavorably by the participating companies (Table 1).

Lastly, it is noteworthy that one of the advantages highlighted by the companies was the opportunity to establish partnerships aimed at developing green products or processes. Although not rated as a top benefit of internationalization,

69 companies scored this advantage between 3 and 5. This indicates a growing recognition among these firms of the importance of such partnerships in fostering ecological innovation.

The research also delves into the various actors involved in facilitating the international expansion process. Respondents were presented with twelve options and asked to rank their perceived level of assistance on a scale from 1, indicating "no assistance," to 5, meaning "substantial assistance" (refer to Table 2). The data analysis revealed a connection to the behavioral theory of Networks and suggests that the learning experiences of these companies may be closely linked to their partnerships within these networks, which both influence and are influenced by the ongoing process of internationalization (Welch & Welch, 1996).

Table 2

Groups of supporters in the internationalization process

Description/Advantage	Average	Standard deviation
Other businesspeople (no commercial relationship)	3.63	1.09
Clients or suppliers	2.64	0.75
Banks/investment entities	2.56	0.58
The company's own employees	2.44	0.83
Government	2.09	0.66
The partnership we have with a Brazilian company	2.04	1.18
The partnership we have with a foreign company	1.72	1.19
New employees with the new required skills	1.5	0.92
Auditors/consultants	1.22	0.55
Institutions supporting entrepreneurs	1.18	0.48
Trade association/Chambers of commerce and industry	1.08	0.3
Universities	1	0

Source: prepared by the authors.

The findings highlight that the primary source of support for companies venturing into international markets came from fellow entrepreneurs who have no commercial ties to these internationalized firms. This insight points to potential opportunities for action by government entities, business support organizations, associations, and chambers of commerce — essentially institutions connected to public policy. These bodies, through strategic initiatives stemming from political sectors, can play a significant role in facilitating the internationalization process for companies (see Table 2).

One noteworthy observation is the role of universities, as they did not contribute at all to the internationalization endeavors of the 122 participating companies. This raises an important question: is the lack of support due to a deficiency of initiatives from universities regarding this issue, or do such initiatives exist but are not well-publicized or embraced by entrepreneurs? It is crucial to understand the root of this disconnection.

4.3 Green innovation profile

To better understand the green innovation profiles of the companies involved in this research, a series of questions were created. Respondents were asked to indicate their level of agreement with each statement, using a scale from 1 (strongly disagree) to 5 (strongly agree).

The findings on Green Product Innovation revealed that a majority of companies prioritize the use of environmentally friendly materials when designing their products. They also focus on creating sustainable packaging for new items, recovering end-of-life products for recycling, and employing eco-labeling practices. While the results showed commendable levels of commitment to these initiatives, it is noteworthy that very few organizations "strongly agreed" with the statements provided, resulting in an average agreement level of 3 (see Table 3).

Table 3

Green Product Innovation (GPI)

Description/Advantage	Average	Standard deviation
Usage of environmentally friendly material	3.31	0.88
Recovery of end-of-life products and recycling	3.24	1.05
Usage of eco-labeling	3.2	1.11
Improvement and design of environmentally friendly packaging	3.13	0.9

Source: prepared by the authors.

In terms of Green Process Innovation, the findings indicated that most companies have implemented various measures in their production processes. These measures include minimizing energy consumption during the production, use, and disposal of goods; adopting cleaner technologies to reduce costs and limit pollution; recycling, reusing, and remanufacturing materials; and aiming to generate little to no toxicity during manufacturing. Similar to green product innovation, a significant number of respondents expressed agreement at levels 3 and 4. While they tend to support the

adoption of these practices, there is a minority that completely disagrees, highlighting a balance in the adoption of these measures without drastic fluctuations (see Table 4).

Table 4

Green Process Innovation (GPri)

Description/Advantage	Average	Standard deviation
Recycling, reusing, and remanufacturing materials	3.36	1.01
Low energy consumption, such as water, electricity, gas, and gasoline during production/use/disposal	3.32	0.91
Less or no toxicity in the manufacturing process	3.27	1.04
Use of cleaner technology to save energy and prevent pollution	3.22	1

Source: prepared by the authors.

Another important aspect to consider is the degree to which companies adhere to Green Innovation Practices. In terms of total environmental quality management — which involves a continuous improvement process at all production stages to achieve strategic environmental progress — 31 firms completely disagreed that they engage in such practices, while 42 indicated an agreement level of 4. Only 11 companies fully agreed (see Table 5).

Among the respondents, 36 firms completely disagreed with having ISO 14000 Certification, while 28 confirmed that they do hold this certification (see Table 5). This certification is significant because it comprises a set of international standards designed to provide guidelines and tools that enhance effective environmental management systems within organizations. Achieving ISO 14000 certification can lead to a positive corporate image, increased credibility, cost reductions, compliance with laws and regulations, and enhanced international competitiveness, which aids in the export process (Sestrem, 2022).

Results concerning multifunctional cooperation aimed at enhancing environmental practices and product dosing to minimize material and energy consumption are unsatisfactory. No company fully endorsed cooperation for environmental improvements, with only 15 selecting level 4 for the first item. Furthermore, only two organizations fully agreed that they adjust product formulations to reduce material and energy usage, while 24 disagreed. These findings reveal a lack of pursuit of cooperative initiatives, which could hinder companies' sustainability performance.

Lastly, when it comes to designing products for reuse, recycling, and material and component recovery, as well as avoiding the discharge of hazardous substances, the results are more balanced. This may indicate a more favorable inclination among companies toward these environmentally responsible practices.

Table 5

Green Innovation Practices (GIP)

Description/Advantage	Average	Standard deviation
Avoiding the discharge of hazardous/harmful/toxic substances	3.35	1.05
ISO 14000 certification	3.11	1.55
Total environmental quality management	2.91	1.35
Product design for reuse, recycling, material recovery, components	2.91	1.04
Product dosing to reduce material/energy consumption	2.78	1.12
Multifunctional cooperation for environmental improvements	2.37	0.97

Source: prepared by the authors.

4.4 Relationship between degree of internationalization and green innovation

To explore the relationship between the degree of internationalization and green innovation among exporting companies in Uberlândia and Ribeirão Preto, a Spearman correlation test was conducted. This test analyzed the DI, as detailed in section 3, alongside the constructs of Green Product Innovation (GPI), Green Process Innovation (GPri), and Green Innovation Practices (GIP). Additionally, a more granular analysis of the variables within each construct was performed to enhance our understanding of their interactions with DI. Results marked with an asterisk (*) are considered significant, with higher values indicating a stronger correlation.

In Table 6, we see the correlation results between DI and the variables comprising the GPI construct. Notably, there is a strong and statistically significant relationship between “Use environmentally friendly material” and “Use eco-labeling” in more internationalized companies. These findings align with the views of Suarez-Perales et al. (2017), who suggest that businesses with a higher degree of internationalization are more inclined to adopt Green Product Innovation to comply with stringent foreign environmental regulations. However, the variable “Improving and designing environmentally friendly packaging for new products” did not demonstrate a significant correlation with the companies' degree of internationalization. This contrasts with Pereira et al. (2019), who emphasized the importance of eco-friendly packaging for enhancing international corporate image. The lack of a significant association in this regional study suggests that, for these companies, the suitability of the product itself—such as materials and labels—takes precedence over packaging innovations during the

internationalization process. Considering that the goal of Innovative Product Development (IPD) is to create energy-efficient, less polluting, recyclable products designed with environmental considerations in mind (as noted by Chen, 2006; Huan & Li, 2017), it appears that companies aiming to broaden their global market presence tend to prioritize the adaptation of inputs and materials to meet international environmental standards before focusing on packaging enhancements.

Table 6

Degree of Internationalization and Green Product Innovation

Variable	Coef	p-value
Use environmentally friendly materials	0.227*	0.012
Improve and design environmentally friendly packaging for new products	0.173	0.056
Recover end-of-life products and recycle them	0.194*	0.032
Use eco-labeling	0.195*	0.031

Source: Research data.

Caption: * splendor is significant at the 0.05 level; ** brightness is significant at the 0.01 level.

The analysis of the DI and IPrV, as shown in Table 7, indicates a noteworthy trend: companies that are more internationally oriented tend to place greater emphasis on implementing green processes such as "low energy consumption during production/use/disposal" and "utilization of cleaner technologies to minimize pollution." These findings resonate with the innovation goals associated with green processes, which, according to Sarkar (2018), focus on energy conservation, reduction of harmful gas emissions, and effective waste recycling.

Furthermore, the adoption of clean technologies highlights an essential advantage of having an external presence, as noted by Zhang (2023). This presence opens avenues for accessing advanced environmental knowledge and technologies that enhance production efficiency. Interestingly, the variable concerning "lower or zero toxicity in the manufacturing process" did not demonstrate a strong correlation with a company's degree of international expansion.

Environmental considerations in production processes are closely tied to compliance with regulations governing water use, waste management, and emissions control. Consequently, companies that pursue internationalization often strive to align with these regulations to lower compliance costs and fulfill international standards. The study implies that more globally integrated firms adopt green processes not only as a regulatory measure but also as a strategic move to sustain competitiveness, which is affirmed by Tantayanubutr and Panjakajornsak (2017).

Table 7

Degree of Internationalization and Green Process Innovation

Variable	Coef	p-value
Low energy consumption, such as water, electricity, gas, and gasoline during production/use/disposal	0.246**	0.006
Use of cleaner technology to save and prevent pollution (energy, water, and waste)	0.246**	0.006
Recycling, reusing, and remanufacturing materials	0.197*	0.029
Less or no toxicity in the manufacturing process	0.156	0.086

Source: Research data.

Caption: * correlation is significant at the 0.05 level; ** correlation is significant at the 0.01 level.

The results of the correlation test between DI and GIP reveal a notable, statistically significant association between greater internationalized companies and their adoption of sustainable practices across all analyzed variables (see Table 8). The variable "Total Environmental Quality Management" showed the highest coefficient (coef. 0.377**), followed closely by "Product Design for Reuse, Recycling, and Material and Component Recovery" (coef. 0.328**). The strength of these coefficients supports the findings of Huang (2026) and Liu (2024), indicating that a higher degree of internationalization directly fosters both sustainability and innovation performance.

It is also important to highlight that every variable within this construct showed a significant correlation with the degree of internationalization among private institutions, albeit to varying extents. This result aligns with the previous discussion regarding the stronger relationship of green innovation practices with corporate internationalization, suggesting a more profound impact than that of green product and process innovations. The robust correlation identified with ISO 14000 Certification (coef. 0.289) further substantiates Sestrem's (2022) assertion that such standards are crucial for enhancing credibility and minimizing barriers in export processes. As articulated by Li (2014), these green innovation practices not only aim to ensure compliance but also seek to boost financial profitability and global competitiveness.

The strong correlation observed between GI and PIV can be analyzed through the lens of Institutional Theory, suggesting that these practices are adopted as part of a strategic pursuit for international legitimacy (Zucker, 1987). Companies operating in foreign markets often encounter diverse institutional pressures, and through the process of isomorphism, they tend to adopt socially accepted environmental structures and norms to enhance their survival and competitiveness globally (Meyer & Rowan, 1991). By emphasizing indicators such as Total Environmental Quality Management and securing ISO 14000 certification, organizations signal conformity and reduce uncertainties in the eyes of international stakeholders. This is achieved through standardization and voluntary initiatives, such as the Global Compact,

which serve as tools to mitigate trade barriers and boost institutional credibility. Ultimately, internationalization emerges as a catalyst for adopting more transparent sustainable practices, in which the pursuit of acceptance in the external environment takes precedence over mere efficiency (Zucker, 1987).

Table 8

Degree of Internationalization and Green Innovation Practices

Variable	Coef	p-value
Total environmental quality management (Continuous improvement process at all stages of production in order to achieve strategic improvements from an environmental point of view)	0.377**	0.000
ISO 14000 certification	0.289**	0.001
Multifunctional cooperation for environmental improvements	0.206*	0.023
Product dosing to reduce material/energy consumption	0.285**	0.001
Product design for reuse, recycling, material recovery, components	0.328**	0.000
Avoiding the discharge of hazardous/harmful/toxic substances	0.250**	0.005

Source: Research data.

Caption: * correlation is significant at the 0.05 level; ** correlation is significant at the 0.01 level.

The analysis of the relationship between the Degree of Internationalization (DI) and Green Innovation indicates that expanding into foreign markets is a significant driver for adopting sustainable practices among companies in the Uberlândia and Ribeirão Preto region. The results from the Spearman correlation test reveal that this association varies depending on the specific aspect analyzed.

In summary, the data confirm that internationalization for companies in Uberlândia and Ribeirão Preto go beyond mere market growth; it acts as a catalyst for enhanced sustainability. Notably, stronger correlations are observed in the Practices construct (PIV) compared to Products (IPV) and Processes (IPrV), suggesting that the impact of internationalization is felt more acutely at the management and organizational levels before it translates into technological innovations in products or processes. This underscores the tendency for more internationalized companies to demonstrate greater transparency and structure in their sustainable practices.

The findings of this research contribute to the literature by offering deeper insights into the interplay between internationalization and specific variables of green innovation, particularly within a regional context. Considering the various ways to measure green innovation and the degree of internationalization, this research highlights the internal factors within companies that are essential for pursuing sustainable management—factors that not only align with international market demands but also contribute to global objectives for sustainable development in all its dimensions.

5 FINAL CONSIDERATIONS

This study aimed to investigate the relationship between the degree of internationalization and green innovation among exporting companies based in the municipalities of Uberlândia and Ribeirão Preto. To achieve this, data from 122 exporting companies in these cities were analyzed, which allowed for a thorough examination of their internationalization and green innovation profiles. The degree of both internationalization and green innovation was calculated to correlate the two dimensions and assess their relationship.

The results of the correlation test between the degree of internationalization and the components of green innovation (encompassing products, processes, and practices) indicated a robust and statistically significant association in most cases. Within the IPV construct, specifically, the variables "Use of environmentally friendly materials" and "Use of eco-labeling" exhibited the strongest associations with the most internationalized companies. In the IPrV construct, "Low energy consumption during production/use/disposal" and "Use of cleaner technology to save and mitigate pollution" were notably linked to the most internationalized firms. Furthermore, in the PIV construct, a strong statistical significance was found among highly internationalized companies across all variables, with "Total environmental quality management" and "Product design for reuse, recycling, and material recovery" demonstrating high coefficients.

These findings enrich the existing literature by exploring the internal factors that influence the adoption of green innovation practices during the internationalization process. While previous research, such as that by Peñasco et al. (2017), highlighted a modest impact of international factors on the adoption of eco-innovation, this study enhances the conversation by identifying specific aspects of green innovation that correlate and do not correlate with internationalization.

Consequently, this research provides valuable insights for the field, highlighting strengths and areas needing further investigation to help Brazilian companies align with the global movement toward environmental sustainability while pursuing internationalized operations. This insight allows private institutions to evaluate their internal actions and those of their partners and competitors, identifying strong performance areas and sectors where investment is necessary to remain competitive in the global market. Beyond the private sector, the results also inform the development of public policies that support entrepreneurs pursuing internationalization and sustainable growth, both critical to Brazil's economic advancement and its international relations, thereby enhancing the country's reputation among current and prospective global partners.

In summary, we must emphasize the need for greater collaboration between academia and the private sector within various regions. The findings of this research are underpinned by established theoretical frameworks and studies, illustrating the connection between university insights and the practical experiences encountered in the market. However, the respondents do not fully recognize the value of partnerships with academic institutions and students in fostering internationalization and green innovation within corporations. This disconnection indicates a misalignment that warrants attention. As Schumpeter (1988) noted, collaboration among distinct institutions is crucial for innovation and long-term sustainability.

It is essential to acknowledge the limitations of this research, which affect the scope of its conclusions. Primarily, the sampling focuses on a specific region, which restricts the generalizability of the findings to that geographic area. Additionally, the degree of internationalization examined was limited to economic performance metrics (specifically export intensity), neglecting other operational and behavioral dimensions crucial for assessing companies' international expansion. Moreover, the absence of organizational and environmental control variables, such as company size and industry type, may skew the results, preventing the establishment of clear cause-and-effect relationships. Thus, the findings are better viewed as indicators of bivariate associations rather than definitive causal links.

Looking ahead, there are numerous opportunities for further research that can deepen our understanding of this topic and help formulate effective organizational policies and cultures. For instance, replicating this study in other parts of the country could reveal broader national patterns and regional nuances. Additionally, employing varied questionnaires can yield complementary insights into companies' internationalization processes, enhancing the robustness of the analysis. The application of multivariate multifactorial models, such as regression or Structural Equation Modeling (SEM), can test the durability of these relationships while controlling for the firms' structural characteristics over time. Finally, incorporating additional variables into the analysis could provide entrepreneurs and public officials with a comprehensive view of actionable strategies to position Brazilian companies as leaders in the international market, ultimately enhancing the country's soft power.

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