Lisbon School of Economics & Management
Universidade de Lisboa

MASTER

MANAGEMENT AND INDUSTRIAL STRATEGY

MASTER´S FINAL WORK

DISSERTATION

THE RELATIONSHIP BETWEEN INNOVATION AND INTERNATIONALISATION AT NATIONAL LEVEL

CLÁUDIA FILIPA RODRIGUES NUNES

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SUPERVISION:

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Abstract

This study aims to investigate the role of innovation in the internationalisation of countries, more precisely, the relationship between the Global Innovation Index (GII) and export performance. By analysing a macroeconomic perspective, it is intended to fill a gap in the literature that has mostly focused on studies at the business level. Panel data from 2018 to 2023 were analysed, using Ordinary Least Squares (OLS) econometric models, with fixed effects and dummy variables. The study identifies the dimensions of the GII that have the greatest influence on export capacity and examines the impact of the COVID-19 pandemic in three phases: before, during, and after the crisis. The results show that certain components of innovation have a significant and positive relationship with export levels, and contribute to the international business and innovation literature, offering insights at the national level and during a period marked by global disruption.

Keywords: Innovation, Global Innovation Index, Internationalisation, Exports, COVID-19

Resumo

Este estudo tem como objetivo investigar o papel da inovação na internacionalização dos países, mais precisamente a relação entre o Índice Global de Inovação (GII) e o desempenho das exportações. Ao analisar uma perspetiva macroeconómica, pretende-se preencher uma lacuna na literatura que se tem concentrado em grande medida em estudos ao nível empresarial. Foram analisados dados em painel de 2018 a 2023, usando modelos econométricos Ordinary Least Squares (OLS), com efeitos fixos e variáveis dummy. O estudo identifica as dimensões do GII que apresentam maior influência na capacidade exportadora e examina o impacto da pandemia de COVID-19 em três fases: antes, durante e depois da crise. Os resultados mostram que certas componentes da inovação têm uma relação significativa e positiva com os níveis de exportação, e contribuem para a literatura internacional de negócios e inovação, oferecendo insights ao nível nacional e durante um período marcado pela disrupção global.

Palavras-chave: Inovação, Índice Global de Inovação, Internacionalização, Exportações, COVID-19

Acknowledgments

First, I would like to express my deep gratitude to Professor Nuno Crespo for his constant availability, patience and guidance throughout the preparation of this dissertation. His constructive criticism and suggestions were fundamental in all phases of this work.

I would also like to thank all the professors and collaborators who have marked my academic career, as well as ISEG – Lisbon School of Economics & Management, for the excellent environment and opportunities provided over these years.

To my family, I thank all the support, encouragement and understanding shown along this journey. To friends and colleagues, I appreciate the motivation and support throughout this process. The endless presence and words of encouragement were essential to overcome the challenges faced.

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Glossary

ADF – Augmented Dickey-Fuller

APEC – Asia-Pacific Economic Cooperation

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

GII – Global Innovation Index

ICT's – Information and Communication Technologies

INSEAD – Institut Européen d'Administration des Affaires

IP – Internationalisation Process

IQR – Inter-Quartile Range

ISO – International Organization for Standardization

OLS – Ordinary Least Squares

R&D – Research and Development

SMEs – Small and Medium-sized Enterprises

SPSS – Statistical Package or Social Sciences

UNCTAD – United Nations Conference on Trade in Development

VIF – Variance Inflation Factor

WIPO – World Intellectual Property Organization

1 Introduction

The global scenario is increasingly competitive and dynamic, and international management is a requirement for business success. The number of companies that derive a large part of their revenues through international operations has been increasing (Arbelo, Pérez, & Gómez, 2024). These trends influence organisations to recognize the need to develop international management skills, especially companies operating in emerging and developing markets, which are gaining increasing relevance on the global stage (Luthans & Doh, 2018).

Going back to 1962, Chandler identified that the final stage of business growth consisted of diversification into international markets (Chandler, 1962). The latest studies have confirmed that global economic growth has been strongly driven by the development of innovation and technology, which have become pillars of the modern organizational structure, and also constitute the basis for the sustainability and survival of companies (Pereira, et al., 2024). In this sense, long-term business resilience depends not only on its ability to improve processes and efficiency, but also on its ability to innovate and adapt to changing market demands (Cassiman, Golovko, & Martínez-Ros, 2010).

Innovation, in turn, plays an important role in organizational productivity, contributing to entry and permanence in export markets (Cassiman, Golovko, & Martínez-Ros, 2010). In the early 2000s, different models regarding innovation systems began to emerge, such as the Global Innovation Index (GII), a tool developed by Cornell University, Institut Européen d'Administration des Affaires (INSEAD) and the World Intellectual Property Organization (WIPO), with the aim of measuring the innovative performance of countries, and providing forecasting processes to measure national competitiveness (Nasir & Zhang, 2024).

Some studies, at the firm-level, such as Bahl, Lahiri and Mukherjee (2021), found a negative relationship between internationalisation and innovation of firms operating in transition economies, due to the scarcity of resources and unstable institutional environments (Bahl, Lahiri, & Mukherjee, 2021). However, the broader literature suggests that analysing the relationship between the levels of innovation measured by the GII and the degree of internationalisation of companies allows a better understanding of

how structural factors impact the international positioning of countries (Ietto-Gillies, Frenz, & Filippetti, 2011).

With the realization of this study, it is intended to understand the strategic role of innovation in the internationalisation of countries, especially in the impact of the GII on exports. Although there are several studies that analyse the relationship between innovation and internationalisation at the microeconomic level, focusing on specific companies or sectors, there is still an important gap in understanding this phenomenon from a macroeconomic perspective. This study seeks to fill this gap by investigating how a country's level of innovation, as measured by the GII, relates to its export performance.

The main objective is to answer the following research question: "How does the level of innovation of countries, measured by the Global Innovation Index, influence their internationalisation, particularly in the performance of their exports?" To respond to the identified problem, the relationship between the sub-indices of the GII and the evolution of the countries' exports will be empirically analysed, to identify which sub-indices better explain the degree of internationalisation of the respective countries.

In fact, the impact of innovation has been and continues to be widely studied, however, this study contributes to the introduction of a new approach with variables that have not been sufficiently explored. Most of the literature studies the influence of GII as a single indicator (Nasir & Zhang, 2024), however, this study investigates the impact of GII in a disaggregated way. This approach allows us to understand the factors that drive internationalisation. Another relevant aspect of this study is the chosen analysis period, which reflects the impacts felt in three distinct phases, the years before, during and after the COVID-19 pandemic. This temporal choice also allows us to capture the effects caused by the crisis generated by the pandemic.

This study was prepared with the collection of panel data for the period ranging from 2018 to 2023. Diagnostic tests were performed and, subsequently, Ordinary Least Squares (OLS) models were estimated, as well a model with fixed effects and a fixed effects model with dummy variables. With this methodology, it was possible to identify more precisely the relationships between the sub-indices of the GII and the evolution of the countries' exports, and to understand more clearly the influence of the crisis period on the variables analysed.

The study is divided into five additional chapters, after this introductory one. In chapter 2, a literature review was carried out on the fundamental themes of the research and, afterwards, in chapter 3, the conceptual framework and the formulation of hypotheses based on the literature are presented. The following chapter (4) explains with the methodological options. In chapter 5, the empirical analysis of the data was carried out, through the estimation of econometric regressions and the respective discussion of the results obtained. Finally, in chapter 6 is presented the respective conclusions of the results and the theoretical and practical implication, as well as the limitations felt and what is the future research on the subject.

2 Literature Review

2.1 Internationalisation

The process of internationalisation refers to the expansion of activities beyond national and cultural borders and is not a recent concept in the economic literature. With increasing globalization, the internationalisation of countries has evolved to accentuated levels in the last decade (Luthans & Doh, 2018). Studies related to international businesses are deeply impacted by the historical context and the geographical location in which they are framed, therefore, their generalized analysis becomes complex outside a given spatial and temporal scenario (Calvelli & Cannavale, 2019).

In the study by Calvelli and Cannavale (2019), it was possible to identify that the main determinants for the internationalisation process of companies from a given country consist of the notion of obligation, as the only alternative to continue business growth, filling supply voids in the foreign market, creating "Born Global" companies focused on accelerated and sustainable growth, safe and controlled investment through Foreign Direct Investment (FDI), acquiring knowledge of better developed markets, and bridging the technological gap present in both the domestic and foreign markets (Calvelli & Cannavale, 2019).

According to the study by Chandler (1962), multinational companies grow in stages, starting with a focus on the rapid expansion and accumulation of resources, which allows for increased knowledge about the fluctuations of the domestic market. As the company establishes its resource base, the goal becomes to ensure sustainable growth and gain a competitive advantage (Chandler, 1962). When the domestic market reaches saturation, the need for diversification arises, at which time companies begin their expansion into the international market (Chandler, 1962; Calvelli & Cannavale, 2019).

By defining internationalisation as an evolutionary process, it is associated with a growing commitment to strengthening the business until it reaches an adequate level of growth (Santangelo & Meyer, 2017). When products reach a stage of maturity or saturation in the domestic market, internationalisation becomes an essential step for continued growth (Calvelli & Cannavale, 2019). For this expansion to be successful, it must be carried out through a gradual sequence of commitments, allowing companies to adapt and strengthen over time (Santangelo & Meyer, 2017).

The main factors that support the evolutionary theory indicate that the lack of experience in international management can lead companies to reevaluate their expansion strategies, prioritizing the integration of existing operations. The continuous development of management skills, together with adapting to new market dynamics, is key to sustainable and successful growth (Santangelo & Meyer, 2017). In addition, to expand its activities to new markets, the company must optimize its portfolio of strategic business areas, taking advantage of the profits from the already consolidated businesses to invest in new areas. By using its strong position in the market, the company can expand its operations and ensure continuous growth (Calvelli & Cannavale, 2019).

Another determining factor for the internationalisation of companies remains in the exploitation of supply voids by foreign organizations (Calvelli & Cannavale, 2019). Supply chain collaboration stands out as a crucial strategy for business competitiveness, because it demonstrates how companies can overcome individual limitations by establishing strategic partnerships (Gohr, Faustino, Amorim, & Oliveira, 2018).

When local companies discontinue certain operations because they do not consider them profitable enough, supply voids are created, and its origins gaps in the supply of products or services. These gaps represent valuable opportunities for foreign companies that, by taking advantage of them, can expand into new markets. By acting as internal operators, these companies can respond to the high local demand, benefiting from the absence of sufficient suppliers and often skipping traditional stages of the internationalisation process (Calvelli & Cannavale, 2019).

At the same time, it can also be analysed that the institutional environment exerts a significant influence on business operations, whether through formal rules imposed by the government or cultural guidelines. Thus, institutional voids arise when there are failures in institutions, hindering interactions in the market, increasing transaction costs and, consequently, reducing economic efficiency (Srinivasan, 2023).

The presence of institutional gaps, while a challenge, also creates opportunities for companies that have the resources and skills to fill them, enabling them to gain competitive advantages. To address these challenges, companies can adopt different strategies, such as internalisation, geographical grouping, establishing strategic alliances or adapting to market conditions. In addition, it is possible to collaborate with political

authorities to promote new rules and regulations, especially in developing markets, aligning business objectives with state interests and thus facilitating expansion into countries with weaker institutions (Srinivasan, 2023).

In recent years, the economic environment of companies has become increasingly complex, driven by the advancement of technological innovations and globalization. Foreign competition has intensified, forcing companies to innovate continuously, both in their core markets and in new areas (Pereira, et al., 2024). In this context, the product life cycle theory, analysed by Vernon (1966), suggests that companies start their internationalisation process by developing innovative technologies, first achieving a dominant position in the domestic market before expanding into foreign markets. This strategy reduces the risks associated with the maturity phase of products, while closing technological gaps between countries (Calvelli & Cannavale, 2019).

The increasing complexity of the business environment has driven practices such as open innovation, where companies can acquire technology externally and accelerate their innovative efforts and extend their reach. However, it is important to reduce the technological gap between rich and poor countries, contrary to the idea that technology is a global public good accessible to all. Thus, technological dissemination and adoption have become determining factors for economic growth, reinforcing the need for effective internationalisation strategies and continuous innovation (Pereira, et al., 2024).

Internationalisation thus emerges as a fundamental strategy to correct the technological gap between the domestic market and foreign markets. Companies that gain a leading position in the domestic market can take advantage of this advantage by joining partners and expanding into countries with a high demand deficit. This approach allows not only to reduce market unpredictability, but also to transfer technology and innovation to less developed countries, promoting technological modernization and sustainable economic growth (Calvelli & Cannavale, 2019).

The concept of "Born Global" was presented by McKinsey and Company (1993), in a study that revealed that an extraordinary number of companies are born with an international orientation, entering multiple markets soon after their creation (Rasmussen & Madsen, 2002). This approach contradicted traditional theories of internationalisation,

namely the theory of internationalisation by stages (Calvelli & Cannavale, 2019; Andersson, 2025).

In recent decades, there has been a growing tendency for Small and Medium-sized Enterprises (SMEs) to integrate rapidly into international markets (Calvelli & Cannavale, 2019; Knight, 2000). The "Born Global" stands out in this context, driven by factors such as the reduction of trade barriers, increased competition, access to advanced technology and the small size of the internal market (Knight, 2000; Andersson, 2025). In addition, there has been increasing emphasis on the role of globally minded entrepreneurs, whose strategic vision allows them to identify international opportunities from the beginning of the business activity (Andersson, 2025).

International expansion since the beginning of business activity not only allows entry into new and potentially more lucrative markets but also strengthens the company's competitiveness and facilitates access to new product ideas, innovations in manufacturing processes and cutting-edge technology. In this scenario, small businesses can become engines of growth as they promote innovation and broader economic development (Knight, 2000).

Market imperfections drive companies to adopt internationalisation strategies, such as FDI, since this form of entry into international markets offers greater control over operations (Calvelli & Cannavale, 2019). The Eclectic Paradigm, also known as OLI framework, developed by Dunning (1988), explains that, for a company to expand internationally, it must have three essential competitive advantages: ownership (O), location (L) and internalization (I). When a company has these advantages, it is strategically positioned to carry out FDI. The goal is not only to achieve market leadership, but also to increase profitability and strengthen global presence (Benabed , 2024). To exploit the advantages of ownership in international markets, the company must be large, so it must have already achieved economies of scale in the domestic market and is more predisposed to overcome barriers to entry from foreign markets, as well as the ability to take on the high risks involved in expansion (Calvelli & Cannavale, 2019).

Internationalisation through FDI occurs mainly due to the uncertainty faced by companies in foreign markets (Calvelli & Cannavale, 2019). However, the decision to carry out FDI is mostly preceded by the process of exporting goods, since experience with

exports increases the probability that a company will decide to invest directly in the foreign market, especially when there is uncertainty about the local environment (Conconi, Sapir, & Zanardi, 2016).

When there is a lot of uncertainty in the internationalisation process, FDI offers greater control over operations in the foreign market, which helps reduce risks related to ignorance of local regulations, consumer preferences, and other market conditions. In this process, companies often start with exports, testing the market before making riskier decisions, such as making direct investments. As the company gains experience and realizes that profitability in the foreign market justifies the costs, it chooses to invest directly, establishing subsidiaries or production facilities. In this way, internationalisation follows a gradual process, where exports precede FDI, allowing the company to manage uncertainty and the costs of entering foreign markets (Conconi, Sapir, & Zanardi, 2016).

The first experiences of foreign development, such as those of Kojima (1978) e Ozawa (1979), found that FDI was trade-oriented and exploited the specific conditions of destination countries, in contrast to models aimed at protecting technological advantages (Calvelli & Cannavale, 2019). This difference in approach reveals that traditional models of internationalisation are not sufficient to explain how companies acquire knowledge of the foreign market. The resource-based view highlights that organizational knowledge allows for critical competitive advantage, where companies are focused on hiring individuals with specialized knowledge. Knowledge creation and transfer are essential for the growth of multinational companies, allowing them to tap into new markets by combining diverse types of knowledge (Fletcher & Harris, 2012).

In addition, the effects of internationalisation in host countries have sometimes been underestimated, as the diffusion of knowledge has made it possible for local companies to assimilate skills and compete with early adopters. The acquisition of knowledge, often neglected in conventional theories, can constitute a direct objective of internationalisation. In this way, internationalisation provides a new perspective, providing access to innovative resources and promoting learning and innovation (Calvelli & Cannavale, 2019).

The Internationalisation Process (IP) approach reinforces this perspective, considering internationalisation an intensive process of knowledge acquisition. The

importance of experiential knowledge in choosing and entering foreign markets is underlined, as well as in setting the pace of international expansion. IP portrays internationalisation as a cumulative learning process, advocating for a gradual and incremental approach as companies acquire the necessary market knowledge (Fletcher & Harris, 2012).

The commitment decisions of companies during internationalisation are based on different types of knowledge. Firstly, knowledge of opportunities or problems is assumed to initiate decisions. Secondly, the assessment of alternatives is based on knowledge about relevant aspects of the market environment and about the performance of various activities. In general, knowledge covers information about present and future demand and supply, competition, distribution channels and payment terms, varying according to the country and the period under analysis (Johanson & Vahlne, 1977).

2.2 Internationalisation and Innovation

Global economic growth has been influenced by the speed of development of innovation and technology, which has not only become a fundamental principle of organizational structure but has also consolidated itself as the basis for the survival of companies (Pereira, et al., 2024). In this context, the relationship between innovation and internationalisation emerges as a widely studied theme, in which research shows that they are concepts with bidirectional interaction, through linear causality, which impacts the performance of companies in global markets (Filippetti, Frenz, & Ietto-Gillies, 2017; Cassiman, Golovko, & Martínez-Ros, 2010; Pereira, et al., 2024). The combination of internationalisation and organizational innovation results in synergistic benefits for the growth of international markets (Pereira, et al., 2024).

The survival of a company's business is determined not only by its ability to improve its processes and efficiency, but also by the company's ability to innovate and adapt to changing market demand. Innovation directly impacts organizational productivity, which consequently facilitates entry into export markets (Cassiman, Golovko, & Martínez-Ros, 2010). Companies with superior innovative capabilities stand out and compete more effectively in the international market, which facilitates their insertion in foreign activities (Filippetti, Frenz, & Ietto-Gillies, 2017). The example given by the logic of the product life cycle exposes that successful product innovation increases

the productivity of the company, making it more likely to enter the export market (Cassiman, Golovko, & Martínez-Ros, 2010). The presence of an innovative organizational culture makes companies more apt for the internationalisation process, making them more effective and allowing companies to stand out in global markets (Pereira, et al., 2024).

On the other hand, companies operating in international environments are exposed to markets with a significantly higher level of competition. International markets are characterized by a greater diversity of cultures and distinct contexts of innovation. In this dynamic and highly competitive environment, organizations have the possibility to acquire new knowledge and enriching experiences, which contribute to the improvement of innovation performance (Filippetti, Frenz, & Ietto-Gillies, 2017; Cassiman, Golovko, & Martínez-Ros, 2010). In addition, constant exposure to different market realities encourages companies to invest in innovative solutions to stand out from the global competition. Consequently, this process leads to a positive impact on international competitiveness (Cassiman, Golovko, & Martínez-Ros, 2010). Thus, it is observed that companies that adopt internationalisation strategies, such as exporting products or services, generally have higher levels of innovation (Pereira, et al., 2024). This phenomenon occurs because the need to adapt to the requirements of different markets stimulates the search for new ideas, technologies and innovative processes (Cassiman, Golovko, & Martínez-Ros, 2010). Thus, it is possible to see a direct positive effect on the innovative capacity of the business (Pereira, et al., 2024; Filippetti, Frenz, & Ietto-Gillies, 2017).

The relationship between innovation and internationalisation establishes a cumulative and dynamic cycle in which more innovative companies have a competitive advantage, which facilitates their expansion into international markets. On the other hand, by internationalizing, companies operate in diversified environments and absorb knowledge and experiences from different innovation contexts. This continuous learning process contributes to the improvement of its innovative performance and further strengthens its position in the global market (Frenz, Filippetti, & Ietto-Gillies, 2012).

The analysis of these interactions also applies at the macroeconomic level, since the behaviour of companies is directly influenced by the economies of the countries where

they are based or where they operate. In this macroeconomic context, the pattern of international trade has undergone significant transformations in recent decades due to growing global economic integration and the strengthening of trade relations between countries. In the theory of international trade, technological innovation is highlighted in determining the international competitiveness of a country, which reflects the importance of innovation for its economic growth, as well as the consolidation of its position in the global market (Frenz, Filippetti, & Ietto-Gillies, 2012).

The relationship between innovation and internationalisation plays a key role in the development of countries' long-term economic sustainability (Kafouros, Buckley, Sharp, & Wang, 2008). In this sense, internationalisation reinforces innovative capacity by providing access to diversified resources and scientific knowledge, enabling the development of innovations with greater added value. On the other hand, expanding into multiple markets allows companies to reduce associated costs, mitigate regional economic risks, and exploit technological advancements. As a result, companies are favoured with better financial returns from their innovations and ensure greater financial stability and sustainable growth (Kafouros, Buckley, Sharp, & Wang, 2008).

Operating in foreign markets puts companies in contact with more intense competition, as they face new local and international competitors with different market approaches and strategies (Kafouros, Buckley, Sharp, & Wang, 2008; Wagner, 2007). Increased competition creates additional pressure for companies to differentiate themselves, which in turn increases the need for continuous innovation, both in creating new products and improving existing processes. Thus, internationalisation has a significant impact on strengthening its innovative capacity, since the search for new markets and the adaptation to different conditions constantly require new solutions and creative ideas. Presence in international markets favours the improvement of the company's innovative performance, encouraging it to reinvent itself and innovate more effectively to remain competitive (Wagner, 2007; Hagemejer & Kosala, 2011).

On the other hand, the adoption of innovative practices is essential for companies to start their internationalisation process or to engage in international business activities. Improving processes and developing solutions that meet the needs of international markets create a solid foundation for global expansion. Innovation, especially in the

development of new products, boosts competitiveness and facilitates the entry of companies into new markets, just as evidence indicates that more innovative companies are more productive and are better able to adapt to global demands. Therefore, in addition to traditional export incentive policies, it is essential to invest in fostering innovation, ensuring that companies acquire sustainable competitive advantages and expand their international presence more effectively (Cassiman, Golovko, & Martínez-Ros, 2010).

2.3 The Global Innovation Index

The Global Innovation Index is a tool that annually evaluates the innovation capacity of countries. The index was developed by Cornell University, INSEAD and WIPO to help developing countries keep up with technological changes and to assess competitiveness and global economic policy. This index is an essential resource for governments, business leaders and researchers, as it offers insights into the strengths and weaknesses of national innovation ecosystems (Nasir & Zhang, 2024).

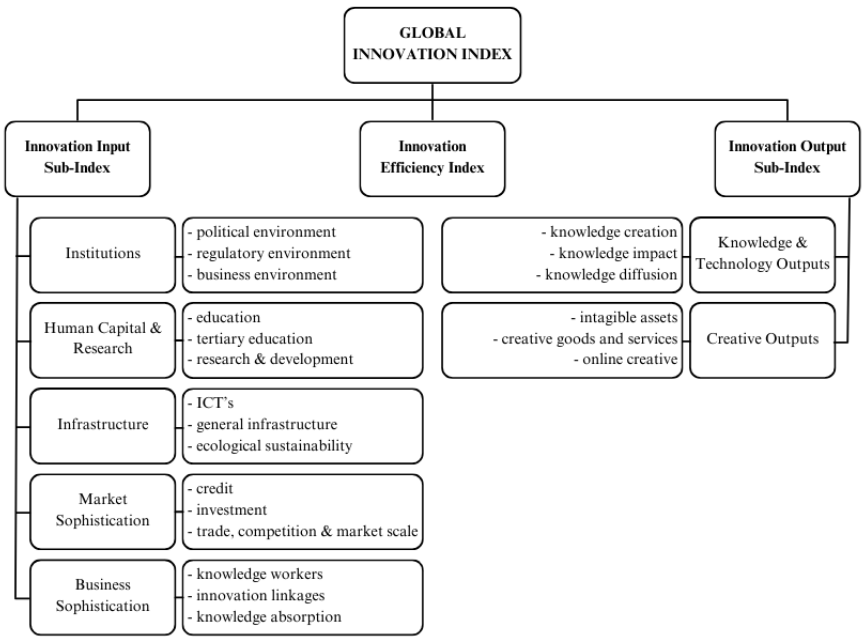
Developed in 2007, GII aims to respond to the need from a broader perspective, covering several dimensions of innovation. Its main purpose is to assess the capacity and levels of innovation of different countries, using innovation entry and exit criteria, in order to identify enablers and barriers to innovation in different countries, offering a more complete understanding of the global innovation dynamics (Nasir & Zhang, 2024).

The objectives of the GII are to place countries in a ranking based on their innovative performance, providing comparative data that allow understanding how countries use their resources when innovating, support the formulation of innovation policies, encourage the sharing of innovative practices between countries, facilitate research and analysis of the impact of innovation on economic competitiveness. Meeting these targets allows us to understand and improve countries' innovation capacity (WIPO, 2022).

The GII is composed of a table of a total of 81 indicators distributed in seven pillars and divided into two main categories: the Innovation Input Index and the Innovation Output Index. The Innovation Input Index evaluates the factors that provide innovation to a country, divided into five pillars: Institutions, which evaluate the political, regulatory and business environment; Human Capital and Research, examines the quality of secondary and higher education and the levels of research & development;

Infrastructure, which includes the analysis of the availability of information and communication technologies (ICT's), general infrastructures and ecological sustainability; Market Sophistication, analyses the ease of obtaining credit, the level of investment and market and competition conditions; and Business Sophistication, which addresses the quality of workers' knowledge, innovation linkages and the capacity to absorb knowledge. The Innovation Output Index measures the results of innovation and reflects the production and commercialization of innovations, divided into two pillars: Knowledge Results and Technology Results, which involves the creation of new knowledge, its impact and dissemination; and Creative Products, which evaluates intangible assets, creative goods and services, and online creativity (WIPO, 2022). Figure 1 outlines the GII's basic structure.

Figure 1 - The GII's basic structure.



Source: Masir & Zhang, 2024

By combining these indicators, the index highlights not only which are the leaders in innovation, but also identifies which countries are rapidly improving their innovation ecosystems. The countries that lead the ranking benefit from well-developed institutions, robust infrastructure, prominent levels of investment in Research and Development (R&D) and dynamic business environments, and middle-income countries that have made

significant strides in improving their innovation capacities stand out (Nasir & Zhang, 2024).

As previously mentioned, the GII is a policy tool that helps governments and companies identify the strengths and weaknesses of their innovation ecosystems. With this detailed analysis, decision-making at the national or regional level is easier, and for developing countries, it allows us to understand which indicators countries should improve to strengthen innovation capacity. The index encourages international collaboration by highlighting best practices, promoting dialogue between countries, and providing insight into different regions' responses to rapid technological and global economic changes (Nasir & Zhang, 2024).

3 Conceptual Framework and Hypothesis

The conceptual framework for this study aims to explore the relationship between the GII pillars and the export performance of countries as a measure of internationalisation.

The GII is an indicator that evaluates each country's innovation across various dimensions, including institutions, human capital & research, infrastructure, market sophistication, business sophistication, knowledge & and products, creative products (WIPO, 2022). By examining these pillars, we can obtain insight into how innovation capabilities are linked to countries' ability to be more successful in international markets (Cassiman, Golovko, & Martínez-Ros, 2010; Nasir & Zhang, 2024).

In this context, export performance is used as an indicator of internationalisation capacity, reflecting a country's ability to compete in foreign markets. The relationship between innovation and export has been studied (Filippetti, Frenz, & Ietto-Gillies, 2017; Cassiman, Golovko, & Martínez-Ros, 2010), as more innovative countries tend to produce goods and services with higher added value and more competitive internationally (Frenz, Filippetti, & Ietto-Gillies, 2012).

This study aims to explore how the various components of the GII influence a country's export capacity. The conceptual model will help to clarify how innovation-driven factors contribute to export growth.

3.1 The relationship between Institutions and Exports

According to North (1990, p. 477), institutions represent the "rules of the game of a society". With this statement, North (1990) compares institutions as conventions, codes of conduct, norms of behaviour and statutory laws, which reduce the existence of imperfect and asymmetric information, as well as regulate and offer a stable structure to society, which facilitates clearer decision-making and reduces power imbalances among participants (Faundez, 2016; North, 1990).

Institutions significantly influence the decision-making in different countries, which shape the entire decision-making process by establishing norms, guidelines, and boundaries (Lynch & Jin, 2016). The structure of society is influenced by several important findings, including the definition of law as an institution, where laws and legal systems guide the behaviour of individuals and organisations; historical knowledge as a means of understanding institutional processes, avoiding old mistakes and replicating successful practices; the influence of cultural behaviours in political decision-making reinforces the relevance of individuals in the development of institutions, since the choices of leaders and citizens shape institutions over time (Faundez, 2016).

There are several studies that explore the connection between institutions and the decision-making process of countries in the international market, among other aspects such as international political and economic activities (Porter, 1990; Tan & Wang, 2011; Lynch & Jin, 2016). Institutions represent the basis and structure on which economic and social development is based, both domestically and internationally. In addition, they create an environment advantageous to sustainable growth (Eden & Potter, 1993; Kobrin, 2001; Lynch & Jin, 2016).

Institutions play an essential role as the main driver of long-term economic development, as they provide a structural foundation that sustains continued growth, promoting stability and creating an environment conducive to sustainable progress in a steady way over time (Acemoglu, Johnson, & Robinson, 2005; Álvarez, Barbero, Rodríguez-Pose, & Zofío, 2018). High-quality institutional environments facilitate

international trade, as they are characterized by pluralistic and inclusive organizations, in which the different actors do not have the ability to monopolize or restrict market power, accordingly promoting greater transparency and fairness in economic relations, which in turn results in an improvement in trade flows (Álvarez, Barbero, Rodríguez-Pose, & Zofío, 2018). Thus, our first hypothesis arises:

Hypothesis 1 (H1): Institutions show a positive relationship with the countries' exports.

3.2 The relationship between Human Capital & Research and Exports

The concept of human capital refers to assets such as the individual's education, skills, and experience, which must be continuously revised and updated, resulting in an increase in economic value (Coleman, 1988). The role of human capital and research has a fundamental contribution to the innovation activity of countries, due to the elevated level of knowledge, skills, and human experience, which encourage the creation of more innovative activities within a given industry (Dakhli & De Clercq, 2004).

In addition, human capital can be described as the knowledge of individuals acquired through academic education and vocational training, as well as knowledge acquired through exchanges between industry stakeholders, which facilitate the sharing of knowledge between network partners, contributing to the development and innovation of the sector (Dakhli & De Clercq, 2004; Bianchi, 2001).

Dakhli & De Clercq (2004) described a study based on 59 countries, and Kwan & Chiu (2015) studied the performance of 120 economies, which both concluded that countries with higher levels of individual specific human capital had more patents, indicating a greater capacity for knowledge creation, and had higher percentages of high-tech exports (Dakhli & De Clercq, 2004; Kwan & Chiu, 2015). These results are related to the fact that these countries with stronger human capital have more creative workers, such as engineers and technicians, who have the ability to be creative and pay more attention to detail, particularly when working in units with a strong culture of innovation (Miron, Erez, & Naveh, 2004). On the other hand, senior management of companies that have better strategic leadership skills have a more considerable influence on product market innovations and companies' management innovations, contributing to the increase of a country's exports (Elenkov, Judge, & Wright, 2005; Helfat & Martin, 2015). This

way, strategic leadership in companies allows not only to boost business innovation, but also to develop more efficient products and technological processes to meet international demand and thus strengthen the country's position in exports of products and services (Aulakh & Kotabe, 1997; Cavusgil & Knight, 2004).

Other authors have studied the relationship between investments in education, worker productivity, and Gross Domestic Product (GDP) growth (Becker, 1975; Schultz, 1961; Contractor & Mudambi, 2008). The study of Chuang (2000) found a positive relationship between human capital accumulation and Taiwanese exports between 1952 and 1995. However, there are also studies in the literature with inverse conclusions, such as Denison (1983), who found inverse or insignificant relationships between the level of education attained and the growth of labour productivity, and Wolff (2000) that found that the change in the level of education was not a significant determinant of the growth of labour productivity. However, Levin and Raut (1997) found that there was no direct effect of human capital growth on GDP growth, if the export sector uses human capital more efficiently than the rest of the economy, and therefore concluded that the ratio of human capital to exports significantly affected GDP growth (Contractor & Mudambi, 2008). Although the relationship is not clear, we consider the theoretical argument that relates human capital to the increase in exports, so that we hypothesize:

Hypothesis 2 (H2): Human capital & research show a positive relationship with the countries' exports.

3.3 The relationship between Infrastructure and Exports

In the literature, the recognition of infrastructure has often been an important index of trade facilitation, i.e., adequate infrastructure can significantly improve trade transactions (Portugal-Perez & Wilson, 2012). Annually, governments invest more than one trillion dollars in infrastructure, globally, in various areas, such as transport, energy and telecommunications, which are fundamental for economic development and to encourage international trade (Lefevre, Leipziger, & Raifman, 2014).

Trade costs correspond to transport and other costs at the international level, which are determinants of a country's ability to grow in the world economy, as weak transport and communications infrastructure prevents countries from participating in global trade networks (Limão & Venables, 1999). Nowadays, there is the facilitation of

international trade through the reduction of tariffs and policies that reduce export and import costs (Portugal-Perez & Wilson, 2012). These liberalisations indicate that the effective rate of protection obtained through transport costs is, for various countries, significantly higher than that obtained by tariffs (Limão & Venables, 1999). It is important to understand this complex relationship, as a country's trade flows can be adjusted and influenced by its own reforms and those of its trading partners. In this sense, the simplification and standardization of administrative formalities and procedures in international trade is implicit (Portugal-Perez & Wilson, 2012).

Border facilitation alone does not explain the simplification of international trade, so it is important to note the influence provided by the business environment, the quality of infrastructure, transparency, and national regulation. These factors shape export performance through the cost channel that can be divided into two dimensions, such as the "hard" dimension, corresponding to tangible assets such as roads, ports, highways and telecommunications, or a "soft" dimension that encompasses the entire customs management and business environment (Portugal-Perez & Wilson, 2012).

The study by Wilson, Mann, and Otsuki (2003) measured the impact of trade facilitation, notably through the efficiency of each country's infrastructure, on trade performance for Asia-Pacific Economic Cooperation (APEC) countries. They found that intra-APEC trade turnover increased significantly if member countries with lower indices improved port efficiency capacity. Based on the previous discussion, we formulate the following hypothesis:

Hypothesis 3 (H3): Infrastructures show a positive relationship with the countries' exports.

3.4 The relationship between Market Sophistication and Exports

The study of global trade dynamics has led to the emergence of research on the factors that influence export performance (Yazawa, 2023; Shavshukov & Zhuravleva, 2023). The sophistication of the market, characterized by high regulation, technological innovation and efficient mechanisms, is one factor that intends to justify the efficiency and competitiveness of a country's domestic market. Advanced regulatory frameworks, such as the "twin peaks" model in the United Kingdom, promote efficiency and competitiveness, protecting consumers and mitigating systemic risks. In addition,

sophisticated markets rely on innovation and international coordination to address modern challenges such as digital financial products and corruption, which reinforces the importance of robust regulations to sustain resilient and competitive markets (Shavshukov & Zhuravleva, 2023).

These attributes allow for the establishment of an environment of innovation in the production of high-quality goods and services, which in turn allow effective competition in international markets (Carbone & Henke, 2012).

Countries with advanced markets invest in robust regulation to foster safe environments that are conducive to the adoption of new financial technologies. These advances drive innovation, which translates into the production of exclusive and higher quality goods, which become more competitive globally. These countries, supported by effective regulatory policies, can charge higher prices and obtain a larger market share in the international market (Shavshukov & Zhuravleva, 2023).

Advanced markets rely on strong regulatory frameworks that provide legal certainty and economic stability, encouraging long-term investment and promoting international trade. These institutions also contribute to a country's reputation by becoming more attractive trading partners (Shavshukov & Zhuravleva, 2023; Carbone & Henke, 2012).

Sophisticated markets allow the continuous development of diversified industries to remain competitive, i.e. a competitive internal market encourages companies to innovate and improve efficiency to maintain their position in the market. This competitive pressure only ensures the success of the most efficient and innovative companies, which results in better export quality. Companies are also influenced to produce high-quality, differentiated products through innovation and continuous improvement, which are often more in demand in international markets, enabling countries to achieve better export performance (Shavshukov & Zhuravleva, 2023; Carbone & Henke, 2012). Hence, we suggest the following hypothesis:

Hypothesis 4 (H4): Market sophistication shows a positive relationship with the countries' exports.

3.5 The relationship between Business Sophistication and Exports

To increase competitiveness, business sophistication is a strategic approach that countries are adopting, as it suggests that advancing and improving trade practices within a country can significantly improve its performance in international trade (Lall, Weiss, & Zhang, 2006). Business sophistication encompasses components, including innovation in product development, efficient management processes, strategic marketing, and the effective use of technology and human resources (Lall, Weiss, & Zhang, 2006; Razavi, Abdollahi, Ghasemi, & Shafie, 2012). Countries that invest in and develop these sophisticated trade practices can produce higher quality goods and services, thereby increasing their competitiveness in the global market (Lall, Weiss, & Zhang, 2006).

When a country develops advanced business practices, it is possible to produce goods and services differentiated by quality and innovation due to a wide range of benefits of sophisticated practices such as branding, marketing strategies, and value chain management. Countries that stand out in business sophistication can charge higher prices in their exports (Razavi, Abdollahi, Ghasemi, & Shafie, 2012).

This business strategy not only streamlines production, but also increases the performance of international business networks, such as clusters (Lall, Weiss, & Zhang, 2006; Razavi, Abdollahi, Ghasemi, & Shafie, 2012). Organizational clusters are concentrations of interconnected entities and industries that share common markets, support enhanced collaboration, and function as specialized and personalized service providers to support companies in stimulating innovation activities (Kolluru & Suresh, 2020).

A relevant aspect of business sophistication is that it provides efficient management of the value chain, which in turn impacts exports. Countries that facilitate their production processes, optimize logistics and manage supply chains effectively are able to reduce their production costs and improve the quality of their final products, which not only allows the profitability of companies in each country, but also makes exports more competitive in terms of prices and reliability (Lall, Weiss, & Zhang, 2006).

Although the sophistication of the business offers an attractive structure, its implementation requires investments in education, infrastructure and technology. Institutional and cultural barriers can arise, especially in economies dependent on

traditional industries. In these cases, governments and organizations must work together to create an environment that fosters innovation by promoting incentives for R&D, improving intellectual property protection and facilitating access to international markets (Lall, Weiss, & Zhang, 2006; Razavi, Abdollahi, Ghasemi, & Shafie, 2012).

Business sophistication becomes essential for advancing trade practices and thus improving export performance at the national level. As global markets become more competitive, with business sophistication, nations can ensure sustained economic growth and prosperity through improved export performance (Razavi, Abdollahi, Ghasemi, & Shafie, 2012), so we consider a positive relationship between business sophistication and national exports, suggesting the following hypothesis:

Hypothesis 5 (H5): Business sophistication shows a positive relationship with the countries' exports.

3.6 The relationship between Knowledge & Technology Outputs and Exports

Increased investment in R&D drives technological development, which in turn increases the efficiency and competitiveness of economic sectors, promoting innovation and enabling countries with different income levels to benefit from access to more modern financial services (Gharbi & Kammoun, 2023). Countries that devote more resources to R&D tend to have a better performance in terms of technological exports, as by innovating they create a flow of products with high value added that are more attractive to international buyers and build a stable basis for sustainable growth, promoting an environment of continuous innovation improvement (Franco & de Oliveira, 2017)

On the other way, education also plays a key role, as the quantity and quality of universities is often correlated with a more skilled workforce, which is essential for driving innovation. In the context of high-tech exports, well-skilled labour can significantly increase a country's ability to develop technologies and bring them to market. It should be noted that universities function as research and innovation hubs, providing the infrastructure and intellectual resources necessary for technological advances, in addition to forming bridges between academia and industry, facilitating the transfer of knowledge and innovation (Torres-Samuel, et al., 2020).

Effective investments in R&D and education make it easier for countries to transform knowledge into marketable technologies and services. These countries have superior technological results, which reflect a greater capacity to innovate and compete in the global market and thus increase their export performance (Torres-Samuel, et al., 2020).

The relationship between knowledge, measured through investment in R&D and levels of education, and technological outcomes is an essential argument for explaining countries' export capacities for goods and services. Investments in R&D together with a strong educational base make it possible to improve the technological competitiveness and productivity of these countries (Franco & de Oliveira, 2017; Torres-Samuel, et al., 2020). Adopting this approach, we can formulate the following hypothesis:

Hypothesis 6 (H6): Knowledge & Technology Outputs shows a positive relationship with the countries' exports.

3.7 The relationship between Creative Outputs and Exports

In the global economic context, creative products have acquired particular importance due to their ability to influence exports and the growth of countries (Gouvea & Vora, 2018). Creative goods and services may correspond to industry, design, fashion, or product technology, often, they are innovative, with high value added and the ability to generate intellectual property, they are highly dependent on the culture of each country, yet serve as an engine of economic performance (Gouvea & Vora, 2018; Goel, 2022).

The study elaborated by Goel (2022) shows that, over a period of 5 years, creative goods and services enhance economic growth. First, they contribute to GDP growth, indicating that as the volume of creative goods increases, the country's economy expands proportionally. Subsequently, countries that obtain high quality standards, such as International Organization for Standardization (ISO) certifications, allow products to meet international references and thus increase the demand for these products (Goel, 2022).

Among the various forms of creative production, the export of creative goods acquires a relevant role due to its correlation with the economic growth of countries (Goel, 2022). This correlation is essentially due to the fact that creative products often have

exclusive cultural characteristics, appealing to greater demand in international markets, and also the low volatility of prices felt in creative products, which affects the export of other types of products, providing more stability to the export revenues of each country (Nerisanu, Cristescu, Stoyanova, & Vasilev, 2020; Gouvea & Vora, 2018).

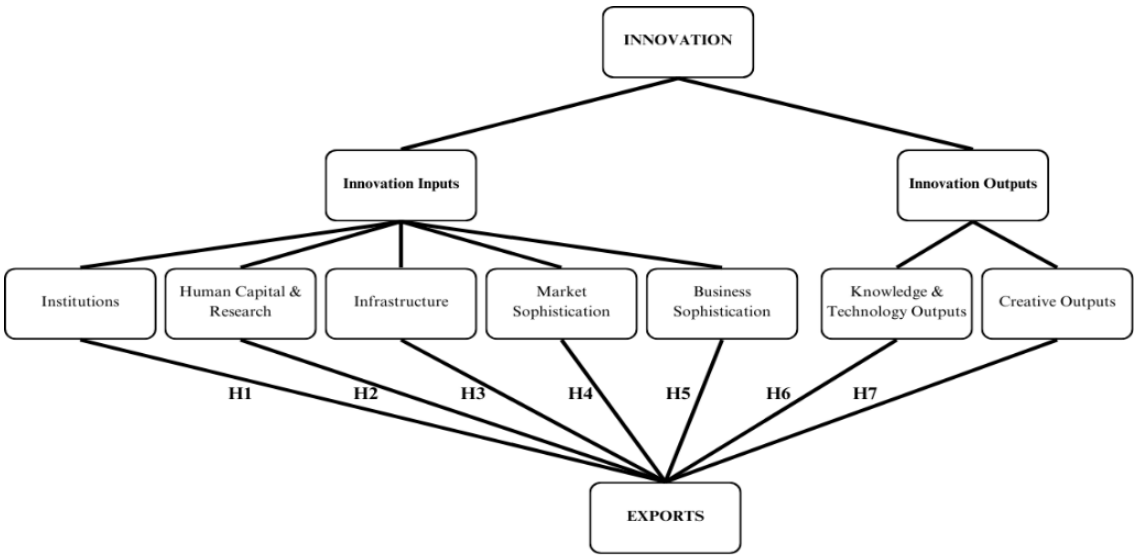
Governments and policymakers play a significant role in creating strategies that foster creative industries and promote the export of creative goods, recognising them as an engine of economic growth. Such policies can include investing in education and training in arts and design, providing financial incentives for creative startups, and promoting national brands on the global stage (Nerisanu, Cristescu, Stoyanova, & Vasilev, 2020).

Countries' creative outputs represent important drivers in global growth and play a central role in the countries' export landscape, due to their innovative and distinctive culture of production that holds an ability to generate intellectual property (Goel, 2022). We can formulate the following hypothesis:

Hypothesis 7 (H7): Creative Outputs shows a positive relationship with the countries' exports.

Our conceptual model provides an overview of the proposed hypotheses (Figure 2).

Figure 2 Conceptual Model



Source: Author's own development.

4 Methodology

This research adopts a quantitative approach with the objective of answering the central question of this study: "How does the level of innovation of countries, measured by the Global Innovation Index, influence their internationalisation, particularly in the performance of their exports?" The focus is to determine under what conditions there is a cause-effect relationship between a country's level of innovation and its level of internationalisation, as well as to identify which aspects of innovation, measured through the GII pillars, have the greatest influence on this process.

The nature of the available data justifies the choice of the quantitative methodology, which allow the application of statistical and econometric techniques to evaluate the proposed hypotheses. The data collected allow the construction of an econometric model that allows the identification of statistically significant relationships between the variables, to provide an insight into the role of innovation in the internationalisation process.

4.1 Sample and data description

This study analyses the influence of a country's innovation capacity, measured by the GII, on its internationalisation capacity, represented by the level of exports. The sample comprises 69 countries, although not all of them have complete data for each year of the period analysed, which runs from 2018 to 2023. The data used correspond to the indicators that assess the innovation capacity of each country, according to the GII, and cover a time horizon that includes previous years of the COVID-19 pandemic, the crisis period, and the recovery phase. This selection allows for a comprehensive analysis of changes and trends in countries' innovative capacity in different global contexts. In total, the records included 384 observations.

As previously mentioned, the goal of this study is to examine the influence of a country's innovation capacity on its internationalisation capacity, represented by the level of exports. The analysis employed an econometric approach, assessing the previously formulated hypotheses. The models include explanatory variables based on the GII indicators, as well as macroeconomic control variables, allowing the evaluation of both the individual impact of each GII pillar and the joint effect on the dependent variable (exports).

The dependent variable used corresponds to Exports (Exp_t) as a representative measure of the level of internationalisation. Exports reflect the ability of national products and services to enter the global market, this indicator shows the adaptation of countries to international standards and demands, which corresponds to a central characteristic of the internationalisation process. The volume of a country's exports is associated with the degree of economic development, showing how the country manages to convert technological advances into concrete results on the international stage. Thus, by analysing exports, it is possible to obtain a comprehensive view of the international presence of an economy, providing a comparable measure for the level of internationalisation among the various countries under analysis (Cassiman, Golovko, & Martínez-Ros, 2010). The data information on Exports originated from the World Bank (World Bank, 2024).

The explanatory variables are made up of the scores of the seven pillars of the GII: Institutions (Ins_t), Human Capital & Research (HCR_t), Infrastructure (Inf_t), Market Sophistication (MS_t), Business Sophistication (BS_t), Knowledge & Technology Outputs (KTO_t), and Creative Outputs (CO_t). The GII provides information on these indicators from 2007 to 2024, however, for the present study we chose to analyse the years 2018 to 2023, as explained above.

Since the internationalisation process is influenced by several other variables, some control variables were introduced. These variables were the GDP per capita, because it adjusts the size of the economy to avoid the interference of differences in the level of development and the average income of each country, and countries with higher GDP per capita tend to invest more in innovation and have a greater capacity to integrate into global value chains, which in turn influences exports (Sojoodi & Baghbanpour, 2024); the effective real exchange rate, since the exchange rate is an important factor that affects trade, the more competitive it makes a country's products more accessible in the international market, increasing foreign demand (Sudarusnan, Prasetyo, Suparmono, & Partina, 2021); and inflation rate, that has a significant negative impact on both short- and long-term exports of manufactured goods, since it raises production costs and can increase the value of the local currency, reducing the competitiveness of products in the international market (Sumiyati, 2020). The control variables were provided directly from the World Bank database (The World Bank, 2024).

Table 1 summarizes the operationalization of the measures for all variables, as well as the data sources.

Table 1 - Variables, measures, and data sources

Variable	Measure	Source
Exports	Natural logarithm of exports. Exports are goods and services produced domestically and sold to buyers in other countries, used as a key indicator of internationalisation.	Data from World Bank, 2018-2023
Institutions	The score of the institutions' indicator from GII. Institutions evaluate the political, regulatory and business environment.	Data from WIPO, 2018-2023
Human Capital & Research	The score of the human capital & research's indicator from GII. Human Capital and Research examines the quality of secondary and higher education and the levels of research & development.	Data from WIPO, 2018-2023
Infrastructure	The score of the infrastructure's indicator from GII. Infrastructure includes the analysis of the availability of information and communication technologies (ICT's), general infrastructures and ecological sustainability.	Data from WIPO, 2018-2023
Market Sophistication	The score of the market sophistication's indicator from GII. Market Sophistication analyses the ease of obtaining credit, the level of investment and market and competition conditions.	Data from WIPO, 2018-2023
Business Sophistication	The score of the business sophistication's indicator from GII. Business Sophistication addresses the quality of workers' knowledge, innovation linkages and the capacity to absorb knowledge.	Data from WIPO, 2018-2023
Knowledge & Technology Outputs	The score of the knowledge and technology results' indicator from GII. Knowledge and Technology Results involves the creation of new knowledge, its impact and dissemination.	Data from WIPO, 2018-2023
Creative Outputs	The score of the creative products' indicator from GII. Creative Products evaluates intangible assets, creative goods and services, and online creativity.	Data from WIPO, 2018-2023
Gross Domestic Product per capita	Natural logarithm of Gross Domestic Product per capita. Gross Domestic Product per capita represents the total monetary of all goods and services produced within a country per person.	Data from World Bank, 2018-2023
Effective real exchange rate	Natural logarithm of effective real exchange rate. Effective real exchange assesses a country's currency value relative to the currencies of its trading partners.	Data from World Bank, 2018-2023
Inflation rate	Inflation rate is the percentage increase in the general price level of goods and services in an economy	Data from World Bank, 2018-2023

4.2 Method of analysis

As the database presents values for 6 different years (2018 to 2023), the information will be treated with panel data. Thus, to test the previous hypotheses, an *OLS Regression*, a *Regression with Fixed Effects* and a *Regression with Fixed Effects* with dummy variables were used, presented as follows:

$$Exp_t = \beta_0 + \beta_1 Ins_t + \beta_2 HCR_t + \beta_3 Inf_t + \beta_4 MS_t + \beta_5 BS_t + \beta_6 KTO_t + \beta_7 CO_t + \beta_8 GDPp/c_t + \beta_9 Xe\ rate_t + \beta_{10} Inflation_t + \varepsilon_t$$

First, a Pearson's correlation analysis will be performed to identify the intensity and direction of the linear relationships between the variables, helping in the selection of the most relevant and in the preliminary detection of multicollinearity. To deepen this analysis, the Inflated Variance Index (VIF) will be calculated, allowing the identification of possible high collinearities between the explanatory variables. In cases where data involve time series, stationarity tests, such as the Augmented Dickey-Fuller (ADF) test, will be conducted to ensure that the series are stationary. These procedures ensure the robustness of the econometric model and were estimated using the Statistical Package for Social Sciences (SPSS) Software version 29.

5 Data Analysis and Discussion of Results

In this chapter, an analysis of the relationship between the variables previously described will be conducted, with the objective of empirically verifying the hypotheses previously outlined. Firstly, a summary and mainly descriptive analysis of the results obtained will be undertaken, to identify possible patterns and trends among the indicators. Then, the results obtained will be discussed and compared with the literature review previously analysed, in order not only to test the hypotheses formulated, but also to deepen the understanding of the phenomena analysed.

5.1 Data Analysis

In a preliminary analysis of the data, it was possible to identify several elements that may compromise the quality of the estimates obtained through regression, such as the presence of extreme outliers, a marked asymmetry in the distributions, high kurtosis values and excessively wide variances. According to Wooldridge (2013), in several

situations, the application of logarithmic transformations proves to be effective in reducing the oscillation of the variables, making the estimates of OLS less susceptible to the influence of atypical observations. It also states that the use of logarithms is especially appropriate for positive variables, especially when they present high dispersion. Models in which the dependent variable appears in logarithmic form, i.e., *log(y)*, they tend more often to satisfy the classical assumptions of the linear model. Although it is generally more demanding to predict the value of *y* from a regression of *log(y)*, this approach has advantages, such as a higher probability of linearity, homoscedasticity and normality of the residuals (Wooldridge, 2013).

Based on these principles, the logarithmic transformation of the dependent variable, as well as the explanatory variables GDP and exchange rate, was carried out with the aim of improving the quality of the estimates obtained. In the study of Choi and Lee (2021), the authors analysed the exporter-importer and exporter-product networks, using logarithm-weighted links of export values for each year, between 1962 and 2018. This procedure allowed them to examine the distribution of the weights of the outbound connections from each country (Choi & Lee, 2021). On the other hand, Ouyang (2024) highlights that the values of GDP per capita have particularly high magnitudes, and the logarithmic transformation of this variable is essential to normalize its distribution, thus facilitating regression analysis. Such transformation contributes significantly to the reduction of asymmetry, making the data more suitable for the application of econometric modelling techniques. Additionally, he observed the real effective exchange rate that reflects the dynamic nature of exchange rate fluctuations, and the application of a logarithmic transformation in this variable not only promotes a more linear relationship with the other variables of the model but also allows a more accurate interpretation of the estimated coefficients (Ouyang, 2024).

The summary analysis of the variables, presented in Table 2, reveals distinct patterns among the selected indicators. The *Exports* variable presents the mean (4.99) and the median (5.04) close, which suggests symmetry and stability of the data. The same is visible in the variables corresponding to innovation, except for the *Infrastructure* and *Business Sophistication* variables that show asymmetry, which implies the presence of some countries with high values that distort the mean. Analysing the control variables, only *Inflation* shows signs of asymmetry. Regarding the amplitude of the variables,

Institutions and *Market Sophistication* stand out with greater amplitudes, revealing strong discrepancies between countries, while *Exports* and the *Exchange Rate Index* present lower variance and Inter-Quartile Range (IQR), which tells us that their values are more concentrated and stabilized.

Regarding the asymmetry coefficient, variables such as *Exchange Rate* (1.87) and *Inflation* (3.17) show strong positive asymmetry, on the other hand, *Infrastructures* and *GDP per capita* reveal negative asymmetries, while indicators such as *Creative Outputs* and *Market Sophistication* show asymmetries close to zero, suggesting symmetrical and stable distributions. In the kurtosis coefficient, the *Exchange Rate* (13.05) and *Inflation* (15.06) stand out, with high values, which shows the presence of outliers and a very concentrated distribution around the mean, on the other hand, variables such as *Institutions* and *Business Sophistication* have negative kurtosis, indicating a flatter distribution and less possibility of the existence of extreme values.

Table 2 - Descriptive Statistics

Variable	N	Mean	Median	Range	IQR	Variance	Min	Max	Skew	Kurt
Exports	384	4.9887	5.0414	4.4456	1.2733	0.6264	2.1247	6.5703	-0.4075	0.0462
Institutions	384	67.1652	68.2870	86.1463	25.2874	264.1507	12.2576	98.4040	-0.2673	-0.5457
Human capital & research	384	39.7415	39.4361	71.9000	24.5168	229.4482	1.4000	73.3000	-0.1085	-0.9399
Infrastructure	384	48.7858	51.5727	55.9000	18.0112	144.2381	14.0000	69.9000	-0.5922	-0.4038
Market sophistication	384	47.7203	47.0245	82.5734	18.9723	215.2318	4.4266	87.0000	0.0025	0.3570
Business sophistication	384	38.9214	36.1181	62.3283	26.7207	227.3459	13.4798	75.8081	0.3085	-1.0832
Knowledge & technology outputs	384	32.8363	31.2500	71.0908	21.8243	232.0973	3.8092	74.9000	0.3506	-0.6380
Creative outputs	384	32.6301	32.4500	67.3555	21.5336	199.3457	1.1619	68.5174	0.0232	-0.7402
GDP per capita	384	1.1757	1.2582	2.8406	0.9118	0.3206	-0.7144	2.1262	-0.5923	-0.2509
Exchange rate index	384	1.9927	1.9894	0.9477	0.0805	0.0078	1.7307	2.6784	1.8684	13.0543
Inflation	384	5.4973	3.9747	66.9388	5.0753	50.3463	-10.6192	56.3197	3.1745	15.0581

Source: Author's calculation, using SPSS.

Table 3 shows the Pearson correlation matrix of the variables studied. The variables with the greatest positive association with *Exports* are the *Human Capital & Research* and *Knowledge and Technology Outputs*. All these variables present correlations above 0.73, indicating a very strong relationship with *Export* performance. Variables such as *Infrastructures* and *Business Sophistication* show moderate correlations (between 0.65 and 0.70), indicating that, although relevant, their impact on *Exports* is less expressive.

Moreover, macroeconomic variables such as the *Exchange Rate* and *Inflation* showed a negative correlation (-0.101 and -0.127), which indicates that the appreciation of the national currency and inflation reduces the competitiveness of exports.

Table 3 - Pearson's Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11
1. Exp	1										
2. Inst	.516**	1									
3. HCR	.753**	.741**	1								
4. Inf	.702**	.799**	.831**	1							
5. MS	.612**	.726**	.711**	.677**	1						
6. BS	.694**	.749**	.835**	.813**	.677**	1					
7. KTO	.732**	.682**	.835**	.800**	.651**	.894**	1				
8. CO	.653**	.711**	.798**	.821**	.695**	.847**	.833**	1			
9. GDP p/c	.705**	.787**	.835**	.909**	.646**	.824**	.761**	.807**	1		
10. Xe rate	-.101*	-.116*	0.033	-0.039	0.050	-0.027	0.063	.106*	0.000	1	
11. Inflation	-.127*	-.395**	-.190**	-.277**	-.311**	-.292**	-.207**	-.205**	-.273**	.218**	1

Significance levels: ** p < 0.01; * p < 0.05.
Note: Exp: Exports; Inst: Institutions; HCR: Human Capital & Resources; Inf: Infrastructures; MS: Marketing Sophistication; BS: Business Sophistication; KTO: Knowledge & Technology Outputs; CO: Creative Outputs; GDP p/c: GDP per capita; Xe rate: Exchange rate index

To verify the existence of multicollinearity between the independent variables included in the regression model used to explain the variation in *Exports*, the analysis of the VIF was performed. The results of the analysis, as presented in Table 4, show that all VIF values are less than 10 and tolerance values are greater than 0.10. Given the larger sample size, these results reinforce the absence of evidence of significant multicollinearity between the variables, thus ensuring greater confidence in the validity of the estimates obtained (Hair, Black, Babin, & Anderson, 2009; Wooldridge, 2013).

Table 4 - Variance Inflation Factor

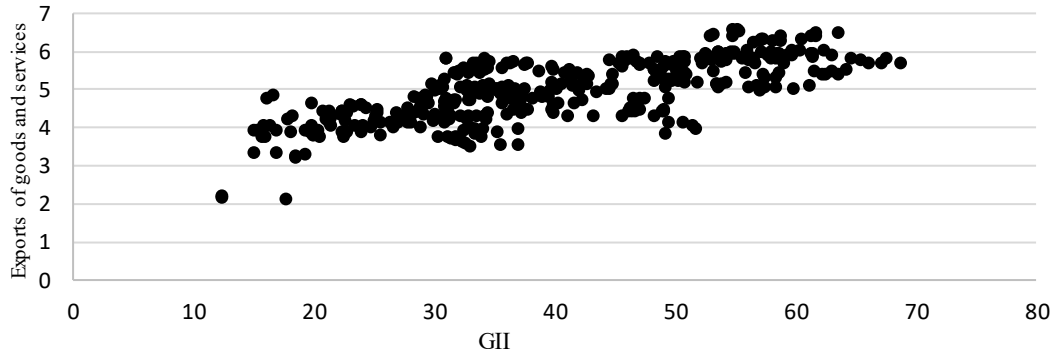
Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Institutions	0.253	3.957
Human capital & research	0.182	5.483
Infrastructure	0.126	7.926
Market sophistication	0.367	2.722
Business sophistication	0.127	7.859
Knowledge & technology outputs	0.149	6.727
Creative outputs	0.195	5.137
GDP per capita	0.129	7.723
Exchange rate index	0.833	1.201
Inflation	0.764	1.309

Dependent Variable: Exports of goods and services

To test the presence of unit roots, the ADF manual test was calculated in SPSS, where the coefficient of LAG_Y is negative and highly significant ($p < 0.001$), with a value of -1.005. This indicates that the null hypothesis of the presence of a unit root (non-stationarity) can be rejected with a high level of confidence, so the time series is stationary (i.e., it has no unit root). According to the Durbin-Watson test, the regression value was 2.063, indicating the absence of serial autocorrelation in the regression residuals. In the heteroscedasticity test, the value of the Breusch-Pagan test is 0.000, which is far below the critical value of the chi-square distribution with 11 degrees of freedom ($\chi^2_{11} \approx 19.675$ for $\alpha = 0.05$), so there is no evidence of heteroscedasticity, the model residuals seem to have constant variance (homoscedasticity). Regarding the normality of errors, the Central Limit Theorem suggests that with large samples, sample distributions tend to be roughly normal, even if the original data are not exactly normal (Wooldridge, 2013).

Figure 3 shows an upward trend, and there is a positive correlation between a country's level of innovation and the volume of exports. The graph shows that the more innovative a country is (the higher the GII), the higher its level of exports tends to be. Despite the general trend, there is a notable dispersion of points, which suggests that other factors also influence exports, in addition to the innovation index.

Figure 3 - Scatter Plot of Exports by GII



Source: Author's calculation, using SPSS.

To identify the impact of the pandemic on the relationship between innovation and the flow of exports, a disaggregated analysis of the regression model was carried out in four sub-models, the results of which are summarized in Table 5. Initially, only the variables corresponding to the period before the pandemic (2018 and 2019) were considered. Next, the regression was estimated for the period corresponding to the pandemic (2020 and 2021). Subsequently, the

estimate for the post-pandemic period (2022 and 2023) was made. Finally, the complete model was estimated, integrating all variables for the total period (2018 to 2023).

In the formulation of the hypotheses, it was hypothesized that the GII sub-indices positively influence the increase of *Exports* of a given country, contributing to the increase in the degree of internationalisation.

The *Institutions* variable presents negative and statistically significant values across all models, but in models 1, 2 and 4 presenting a significance level of $p < 0.01$, and in model 3 of $p < 0.05$. These results indicate the existence of a negative relationship between the quality of the *Institutions* and the volume of *Exports*, which leads to the conclusion that hypothesis H1 is not supported.

Table 5 - OLS Regressions of Innovation on Exports

Dependent Variable: Exports				
Independent Variables	**Model 1 Pre-crisis Period (2018-2019)**	**Model 2 Crisis Period (2020-2021)**	**Model 3 Post-Crisis Period (2022-2023)**	**Model 4 Period 2018-2023**
Constant term	6.955*** (1.413)	8.317*** (1.142)	8.643*** (0.878)	7.462*** (0.597)
Inst	-0.031*** (0.007)	-0.035*** (0.007)	-0.010** (0.005)	-0.021*** (0.003)
HCR	0.012** (0.006)	0.015*** (0.006)	0.012* (0.007)*	0.016*** (0.005)
Inf	0.036*** (0.010)	0.016 (0.010)	-0.026*** (0.009)	0.004 (0.005)
MS	0.022*** (0.006)	0.021*** (0.005)	0.015*** (0.005)***	0.016*** (0.003)
BS	-0.001 (0.008)	-0.001 (0.007)	-0.022*** (0.008)	-0.005 (0.004)
KTO	0.021*** (0.007)	0.020*** (0.006)	0.034*** (0.007)	0.021*** (0.004)
CO	-0.016** (0.0018)	0.003 (0.007)	-0.001 (0.006)	-0.005 (0.004)
GDP p/c	0.373* (0.214)	0.369* (0.220)	0.975*** (0.190)	0.549*** (0.110)
Xe rate	-1.915** (0.662)	-2.257*** (0.510)	-2.174*** (0.407)	-1.855*** (0.277)
Inflation	0.010 (0.010)	0.006 (0.006)	0.009 (0.005)	0.007 (0.004)*
Observations	111	137	136	384
R-squared	0.756	0.708	0.736	0.702

Standard errors reported in parentheses. Significance levels: * $p < 0.10$; ** $p < 0.05$, *** $p < 0.01$.
Note: Exp: Exports; Inst: Institutions; HCR: Human Capital & Resources; Inf: Infrastructures; MS: Marketing Sophistication; BS: Business Sophistication; KTO: Knowledge & Technology Outputs; CO: Creative Outputs; GDP p/c: GDP per capita; Xe rate: Exchange rate index

The *Human Capital & Research* variable reveals positive and statistically significant values in model 1 ($p < 0.05$), in models 2 and 4 ($p < 0.01$) and in model 3 (p

< 0.10). These results suggest a positive association between *Human Capital & Research* and *Export* volume, meaning that hypothesis H2 is supported.

The variable *Infrastructures* demonstrates positive and statistically significant values in model 1 ($p < 0.01$). Although models 2 and 4 also have positive values, these are not statistically significant. Model 3 presents negative and statistically significant coefficients ($p < 0.01$). Thus, hypothesis H3 is partially accepted, since only model 1 proves a positive and statistically significant relationship between *Infrastructure* and *Export* volume.

The *Market Sophistication* variable presents positive and statistically significant values in all estimated models ($p < 0.01$), indicating a positive relationship between the sophistication of the markets and the volume of *Exports*. Thus, hypothesis H4 is supported.

The *Business Sophistication* variable shows negative values in all models, being statistically significant only in the model 3. As these results do not demonstrate a positive relationship between *Business Sophistication* and *Exports*, hypothesis H5 is not supported.

The *Knowledge & Technology Outputs* variable presents positive and statistically significant values for all the models analysed ($p < 0.01$), supporting the existence of a positive relationship between the *Knowledge & Technology Outputs* and the volume of *Exports*. Thus, hypothesis H6 is supported.

The *Creative Outputs* variable presents a negative and statistically significant value in model (1) ($p < 0.05$). In models 2, 3 and 4, the values are not statistically significant, although model 2 presents a positive sign. With these results, hypothesis H7 is not supported.

To control for unobservable and country-specific factors, such as cultural or structural differences that remain constant over time, a regression with fixed effects was estimated. This approach allows isolating the impact of the explanatory variables of interest, eliminating the influence of unchanged characteristics between countries that could bias the results.

Table 6 - Fixed Effects Regressions of Innovation on Exports

Dependent Variable: Exports		
Independent Variables	**Model 5**	**Model 6**
Constant term	4.1449***	4.3623
	(0.2667)	(0.1838)
Inst	-0.0014**	-0.0002
	(0.0006)	(0.0007)
HCR	-0.0001	-0.0007
	(0.0012)	(0.0014)
Inf	-0.0002	-0.0019
	(0.0012)	(0.0014)
MS	-0.0006	0.0014
	(0.0008)	(0.0008)
BS	0.0026**	0.0015
	(0.0011)	(0.0011)
KTO	0.0007	-7.53e-06
	(0.0015)	(0.0012)
CO	-0.007	-0.0010
	(0.0006)	(0.0006)
GDP p/c	1.1740***	0.9125***
	(0.0929)	(0.1490)
Xe rate	-0.2579**	-0.2080**
	(0.1190)	(0.0650)
Inflation	0.0021***	0.0011
	(0.0007)	(0.0008)
Year 2019		-0.0096
		(0.0061)
Year 2020		-0.0515***
		(0.0093)
Year 2021		-0.0023
		(0.0112)
Year 2022		0.0549***
		((0.0126)
Year 2023		0.0358**
		(0.0141)
Observations	384	384
Groups	71	71
R-squared	0.74	0.80

Standard errors reported in parentheses. Significance levels: * $p < 0.10$; ** $p < 0.05$, *** $p < 0.01$.
Note: Exp: Exports; Inst: Institutions; HCR: Human Capital & Resources; Inf: Infrastructures; MS: Marketing Sophistication; BS: Business Sophistication; KTO: Knowledge & Technology Outputs; CO: Creative Outputs; GDP p/c: GDP per capita; Xe rate: Exchange rate index

In addition, a regression with fixed effects was estimated, which also incorporates the variable year, to capture the specific influence of each year and, thus, control for any shocks or trends common to all countries over the period analysed.

In model 5, without including the variables associated with the years, it is verified that the *Institutions* variable has a negative impact on *Exports* and is statistically significant at $p < 0.05$. The *Business Sophistication* variable has a positive influence and is also statistically significant for the same level ($p < 0.05$). The variables *Human Capital & Resources*, *Infrastructures*, *Market Sophistication*, *Knowledge & Technology Outputs*, and *Creative Outputs* present values that are not statistically significant. Thus, only H5 is statistically supported in this model, showing a positive relationship with *Exports* at $p < 0.05$.

In model 6, which includes the fixed effects associated with each year, it is observed that most of the explanatory variables lost statistical significance. Although not statistically significant, the *Market Sophistication* and *Business Sophistication* variables have coefficients that positively influence *Exports*, while *Institutions*, *Human Capital & Resources*, *Infrastructures*, *Knowledge & Technology Outputs*, and *Creative Outputs* have a negative influence on *Exports*.

Regarding the temporal variables, it is possible to verify that the years 2019 and 2020 had negative effects on exports, only the coefficient for the year 2020 presents a significance for $p < 0.01$. While the years 2022 and 2023 show significant positive effects for $p < 0.01$ and $p < 0.05$, respectively.

5.2 Discussion of Results

This study seeks to answer the research question "How does the level of innovation of countries, measured by the Global Innovation Index, influence their internationalisation capacity, particularly in exports?". The results presented above provide statistical evidence that the GII sub-levels explain the level of exports of a given country. At the statistical level, the variables included explain 70.2% of the variations in exports, applying fixed effects the variables start to explain 80.0% of the variations in *Exports*.

In models 1, 2 and 3, in which the data were separated by the periods established in view of the pandemic context, there are some important changes in the relationship between innovation and exports, compared to what was expected. We found that the variables *Human Capital & Research*, *Market Sophistication* and *Knowledge & Technology Outputs*, as in the regression of the overall period analysed in model 4, the positive and statistically significant coefficients remained throughout the three periods.

The results obtained on the sub-index *Human Capital & Resources* confirm the studies of Dakhli & De Clercq (2004) and Kwan & Chiu (2015) who concluded that higher levels of human capital in a country corresponds to an increase in the capacity to create thought, which in turn leads to an increase in export capacity. Carbone, Anna & Henke, Roberto (2012) relate the market sophistication index with the trends of world exports in the food industry, verifying a positive relationship between both, which is in accordance with this study. As analysed by Carbone & Henke (2012), in their study of the positive relationship between the measurement of the sophistication of the Italian food sector and exports in that same sector, the *Market Sophistication* variable showed a positive relationship with exports, highlighting its importance in the country's export capacity. Regarding the variable *Knowledge & Technology Outputs*, the results are lined up with the study done by Torres-Samuel et al. (2020) where they found that Latin American countries had different contributions to the GDP according to research and development expenditures, this variable being the main contribution to high-tech exports in Latin America studied by them.

The variable *Institutions* had a negative impact in the three periods, but was more pronounced during the pandemic, this variation is contradictory to what was expected but may be related to the high amount of protectionist policies. During the pandemic, several supply chains were affected and the confinement measures applied had a clear negative impact on countries' exports (Verschuur, Koks, & Hall, 2020). Álvarez et al. (2018) also warns about the importance of both the institutional conditions of destination and the institutional distance between exporting and importing countries, which in the present study are factors that were not considered. In the period before the pandemic, *Infrastructures* positively affected *Exports*, in line with the evidence obtained by Portugal-Perez and Wilson (2012), that conclude that the influence of infrastructure on exports is increasingly important, especially for richer countries. During the crisis

installed by the pandemic, there was a reversal of the impact of this sub-index, starting to exert a negative and statistically significant influence, which relates to the increase of restrictions in supply chains (Verschuur, Koks, & Hall, 2020).

The sub-index of *Business Sophistication* did not present statistically significant results in models 1 and 2, and in model 3 it was found that it exerts a negative and statistically significant influence. Despite Lall, Weiss, & Zhang (2006) have concluded that the sophistication index supports the level and quality of exports, it also highlights that sophistication is relatively poorly related in cases of technology-intensive activities. The influence of this variable, although negative, is significant and allows us to understand that more sophisticated companies operate in large global chains, with higher demands, so they are more vulnerable to the logistical shocks felt during the COVID-19 pandemic (Baldwin & Freeman, 2021), and, in the World Investment Report 2022, the United Nations Conference on Trade in Development (UNCTAD) warned about the risk that the recovery in international investments would stagnate, harming efforts to finance sustainable development, and countries redirected efforts to the recovery of domestic markets, due to the risks still present in the international market (UNCTAD, 2022).

The variable *Creative Outputs* presented negative coefficients, being only statistically significant in model 1. Contradicting the results obtained by Gouvea & Vora (2018), which indicated that the creative products that a country exports have a direct impact on its export performance, that is, the more creative and innovative the exported products, the better the export performance of that country.

In the model 4, it is possible to realise that the variables *Human Capital & Resources*, *Market Sophistication* e *Knowledge & Technology Outputs* had positive and statistically significant impacts on a country's exports, as observed in the models 1, 2 and 3. Obtaining these coefficients allows us to confirm once again the studies previously analysed. However, the sublevels *Institutions*, *Infrastructures*, *Business Sophistication* and *Creative Outputs* did not show a positive relationship with innovation performance, contrary to what has been suggested by several authors (Lynch & Jin, 2016; Portugal-Perez & Wilson, 2012; Lall, Weiss, & Zhang, 2006; Gouvea & Vora, 2018). The observed variation of these four variables showed the same pattern of behaviour previously identified in models 1, 2 and 3.

In the fixed-effects regression analysis (Model 5), the objective was to control for unobserved characteristics that are country-specific and do not vary over time. In this model, only the variables *Institutions* and *Business Sophistication* have statistically significant coefficients. The *Institutions* have a negative and statistically significant effect on *Exports*, which, once again, goes against the theoretical literature, which associates better institutional quality with increased external competitiveness (Álvarez, Barbero, Rodríguez-Pose, & Zofío, 2018). On the other hand, *Business Sophistication* has a positive and significant impact on exports, which is in line with the arguments of Lall, Weiss and Zhang (2006). The other sub-indices, namely *Human Capital & Research*, *Infrastructure*, *Market Sophistication* and *Knowledge & Technology Outputs*, did not present statistical significance, suggesting that, in this model, their variations do not present sufficient statistical evidence to explain the fluctuations in exports between countries (Wooldridge, 2013).

In model 6, the dummy variables for the years were introduced to the fixed-effects model in order to evaluate the effect of the pandemic. It was found that most of the GII sub-indices lost their statistical significance, so there is not enough statistical evidence to affirm the variations in the volume of *Exports* (Wooldridge, 2013). Only the variables *Market Sophistication* and *Business Sophistication* had a positive coefficient. In the temporal analysis, the year 2020, the period in which it felt the restrictions in the context of the COVID-19 pandemic, had a statistically significant and negative impact on the *Exports*, with an average decrease of -0.0515, which allows us to prove that this year has been an exceptionally difficult year for global trade. The year 2019 did not present a statistically significant impact. While the years 2022 and 2023 stood out for their remarkable recoveries, with positive and statistically significant coefficients. These results reflect the effort to restructure the global economy, according to the report released in 2023 by the World Trade Organization. Despite the increase in the vulnerabilities of global chains, due to the growing risks with dependence on a small number of economies for certain products and the increase in trade tensions, there was an increase in the participation rates in international trade (Mariasingham, Lumba, & Jabagat, 2023).

Regression analysis with fixed effects (model 5) and the inclusion of dummies variables (model 6) reveals a decrease in the statistical significance of most GII subindices. The performance of these regressions was based on excluding structural

factors, specific to each country, which do not vary over time, so this loss of the significance of the variables reinforces that these individual factors strongly influence the volume of exports. Structural factors such as financial development and regional integration allow countries to be inserted in global value chains and thus increase export capacity with increased resilience in periods of crisis (Zhang, Chen, & Liu, 2024).

6 Conclusion

This study confirms the importance of the level of innovation, measured by the GII, as a factor with a high explanatory capacity for the number of exports made in each country, since it explains between 70% and 80% of the variance of exports. However, it also demonstrates that the innovation-internationalisation relationship is complex and conditioned by external factors, as is the case analysed in the health crisis of 2020 and 2021, and structural characteristics of the countries. By examining the way different dimensions of GII affect exports, we answer the research question: "How does the level of innovation of countries, measured by the Global Innovation Index, influence their internationalisation, particularly in the performance of their exports?"

The variable *Institutions* had a negative impact on exports in all periods analysed, having been more pronounced during the pandemic. The results challenge traditional theories, but it was found that during the pandemic period, protectionist policies were applied, and supply chains were disrupted, which consequently, shook the functioning of institutions. Regarding *Human Capital & Research*, the OLS regression models indicated a positive and statistically significant effect, confirming that high levels of human capital are associated with greater export capacity. Yet, in the fixed-effects models, this variable has lost significance. The variable *Infrastructure* had a positive impact before the pandemic. During the pandemic, the effect became negative and statistically significant, reflecting the logistical obstacles and disruptions in supply chains felt during this period. In models 5 and 6, the variable did not present statistical significance, making it impossible to understand the effect felt by the intrinsic factors of each country.

The *Market Sophistication* proved to be consistently positive and significant in models 1 to 4. The financial system and the attractiveness of investments positively influence the growth of exports. In model 5, it lost statistical significance, but again had a positive impact on model 6, even during the pandemic years. In the case of *Business Sophistication*, there was no significant impact on models 1 and 2. In model 3, a significant negative effect emerged, due to the increasing vulnerability felt by the most sophisticated companies to the disruptions caused by the pandemic. In model 4, there was no statistically significant relationship. In model 5, a positive and significant effect was

observed, stating that the greater the business sophistication, the greater the export capacity.

The *Knowledge & Technology Outputs* showed a positive and statistically significant impact in models 1 to 4, thus reinforcing the role of R&D investment in high-tech exports. However, this variable lost significance in models 5 and 6. As for *Creative Outputs*, only in model 1 a statistically significant negative impact was identified, which suggests that creative and innovative products do not promote export performance. In the other models, no significant relationship was observed with exports.

The temporal analysis focused on the period from 2019 to 2023 (model 6) revealed that the years 2020 and 2021 had a negative and statistically significant impact on exports, reflecting the adverse effects of the pandemic felt in the influence of innovation on export capacity. In 2019, it did not show a significant impact, while the years 2022 and 2023 showed positive and significant effects, concluding that there was a recovery in global trade, despite the vulnerabilities felt in value chains and which affected some GII indicators.

In view of the results obtained, it is concluded that, to increase export capacity, countries should prioritize the strengthening of innovation as a central factor, given its high explanatory power on export performance. Investment in human capital and research, the development of quality infrastructure, and the sophistication of markets are fundamental. In periods without a crisis context, business sophistication and the incentive to the production of technological goods stand out as strategic elements. On the other hand, the negative effects observed in variables such as institutions and infrastructures, during the period of instability, demonstrate the importance of institutional resilience and logistical robustness to maintain international competitiveness in adverse scenarios.

6.1 Theoretical Implications

The results of this study have relevant implications for understanding the relationship between innovation and export performance, especially in contexts of external shock, such as the COVID-19 pandemic. The negative impact of institutional quality on exports is highlighted, contradicting the traditional literature and suggesting that, in times of crisis, formal institutions can introduce inflexibilities that limit export capacity. On the other hand, human capital, market sophistication and results in

knowledge and technology confirm the importance of intangible assets and innovation as determinants of competitiveness, especially in OLS models. The loss of significance of several variables in fixed-effect models indicates that the effects of innovation vary according to the structural characteristics of countries, which demonstrates the importance of contextual and temporal analyses in international trade.

6.2 Practical Implications

This study highlights the importance of public policies focused on the qualification of the workforce and the development of more competitive domestic markets. The limited impact of creative products suggests that their effects may depend on the national degree of technological maturity. Finally, the period analysed showed the negative effects of the pandemic in 2020 and 2021, followed by a recovery in 2022 and 2023, indicating the need for short-term public policies to foster long-term innovation strategies.

6.3 Limitations and Future Research

Despite the relevant contributions of this study to understand the relationship between innovation and export performance, there are some limitations. First, the data used, from the GII, as a of indices, do not represent detailed information from each country. Even though they are robust sources, the data do not allow us to capture specific details, such as public policies implemented, especially because some GII indicators are not updated in the mentioned year itself. With the disaggregation of the GII, more detailed data were obtained on the determinants of internationalisation, still the use of models with fixed effects, which control the unique and constant characteristics of each country, isolates the impact of specific variables over time, explaining the loss of significance of some variables.

Another limitation is related to the choice of the analysis period (2018 to 2023). Although this interval allows us to capture the impacts of the COVID-19 pandemic, it restricts the observation of long-term trends and can be influenced by temporary conditions, such as the case of the pandemic. In addition, this study focuses only on the exclusive use of quantitative variables. Hence, a possible complementary study could follow a more in-depth qualitative analysis of the political and cultural factors that also influence the export capacity of nations.

Given the limitations, it is recommended that future studies extend the temporal approach to include longer periods, allowing the identification of more stable structural patterns between innovation and exports. It would also be pertinent to incorporate qualitative analyses, such as case studies by country or region, that can deepen the understanding of the institutional, cultural and political specificities. Finally, future research could also investigate the indirect effects of innovation, such as its influence on attracting FDI, the sophistication of value chains, or the diversification of exports.

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