

The Digital Economy in Latin American Foreign Trade: Post-Pandemic Challenges for Sustainable Development

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ABSTRACT: This article examines the digital transformation in Latin America's foreign trade and points out the emerging challenges and opportunities in the post-pandemic context of COVID-19. Digitalization has redefined trade structures and international trade dynamics, driving the growth of e-commerce and the modernization of customs processes. However, the region faces significant disparities in infrastructure, regulatory frameworks, and technological capabilities, which affect its global competitiveness. Through a detailed analysis of progress and obstacles between 2018 and 2023, this study identifies gaps and opportunities to strengthen digital integration and promote sustainable development. Data from official sources such as ECLAC and case studies of Latin American countries are used to assess the adoption of digital technologies in foreign trade. The results reveal that, although digitization has facilitated cross-border trade and improved operational efficiency, important challenges persist in cybersecurity, digital divides, and adaptation of public policies. This article makes an important contribution by offering a comprehensive view of how the digital economy is reshaping foreign trade in Latin America and provides valuable information for academics, policymakers, and private sector actors interested in the region's sustainable development and international competitiveness.

Keywords: digitalization, economy, trade, cross-border, sustainable development.

I. INTRODUCTION

Since 2019, the digital economy has established itself as a crucial factor in global economic development. In the context of the COVID-19 pandemic, virtual relationships in the social, business, and economic spheres intensified, turning the digital economy into a means of efficient, timely, and reliable exchange. This parallel

digital ecosystem has become indispensable in the integral development of nations, as it requires transactions in Latin America to adapt to maintain their relevance in today's economies [9, 10]. In this sense, digital transformation has not only modified commercial structures but has also redefined consumer behavior and business strategies, presenting challenges and opportunities for the Latin American region [8]. The improvement of world markets has been achieved with the presence of electronic commerce, which has become a key driver of international dynamics [11]. Accordingly, it is necessary that the nations that make up the Latin American territory deploy some strategies in order to implement individual systems that help to strengthen the region [12]. These strategies can range from the adoption of digital policies to the use of digital media. In fact, countries such as Chile, Peru, Argentina and Brazil have implemented them as a way to strengthen local sustainability; however, this implementation process has been gradual [13]. As a result, some countries in the region have lagged behind in the transition to a more robust digital economy. This situation has highlighted the existing disparities in infrastructure, regulatory frameworks and technological capabilities between countries [4]. The objective proposed in this study is to analyze the digital economy in Latin American foreign trade and its post-pandemic challenges for sustainable development. The specific objectives proposed are: 1) To describe the evolution of economic digitalization in Latin America between 2018 and 2023; 2) To contextualize foreign trade in the framework of the Latin American digital economy during the period 2019-2023; and 3) To identify the challenges of Latin American foreign trade in the context of the digital economy. The achievement of these objectives is intended to facilitate a better understanding of how countries have faced digital changes in their international trade activities, especially after the disruption generated by the COVID-19 pandemic around the world [5].

The purpose of the study is to provide a much broader and updated view of the digital transformation of foreign trade in Latin America, for which a time period from 2022 to 2023 is considered. In this regard, it is important to note that the academic literature is still scarce. The analysis explores recent historical developments, as well as projects future challenges, thus providing an excellent prospective perspective for the academic community, the private sector and policy makers. It also focuses on how the region has taken advantage of its strategic position to conduct trade in the new digital context [3], and how it has taken on the challenges that require it to modernize its international relations based on the use of technology [7]. This study is important because it presents an integrated analysis of economic digitalization, its impact on Latin America's foreign trade, provides a series of updated data and trend analysis supported by the most recent available measurements. It also identifies gaps and opportunities for achieving true sustainable development in the region through the digital economy. From another perspective, it analyzes how digital transformation affects the competitiveness of Latin American economies [2] and how much it influences export diversification [1]. The methodology consists of analyzing the most recent measurements that have been generated on the progress of economic digitalization and the characteristics of cross-border trade during 2022 and 2023. For this purpose, official data provided by the Economic Commission for Latin America and the Caribbean (ECLAC) were considered. The measurement analysis approach allows a detailed assessment of the impact of digitalization on international trade logistics, operational performance and physical assistance in the region [6]. It also investigates how some markets in the region are proactively adapting to the challenges posed by the pandemic through the digital economy, and how such adaptation influences future economic and trade development strategies in Latin America.

II. RELATED WORK

Since 1990, the concept of "sustainable development" has emerged as an essential paradigm in the global discourse, especially on human progress. During this time, there was a growing awareness of the interconnectedness of the challenges facing the world. Examples are an accelerated globalization of markets, an increase in environmental degradation and a huge increase in socioeconomic problems in the most vulnerable countries [14]. Faced with this reality, sustainable development offered a comprehensive and multidimensional response to the complex and interrelated challenges experienced. The origin and evolution of this concept is linked to the search for a balance between economic growth, social equity and environmental preservation. This grouping of three aspects, commonly known as the triple bottom line or

“triple bottom line”, represents one of the main pillars of sustainable development [19]. The implicit idea is that real progress cannot be measured exclusively in terms of economic advancement, but requires the inclusion of metrics of social well-being and ecological health. In this paradigm, it must be recognized that a complete social and institutional restructuring is required. This involves the reformulation of public policies, the redefinition of regulatory frameworks and the reconfiguration of governance structures at local, national and international levels. At the same time, sustainable development finds important support in scientific and technological advances that serve as catalysts for change and innovation [15]. In this understanding, it is necessary to highlight that science provides a series of knowledge that allows understanding the complex systems that govern planet Earth, while technology provides the tools to implement effective and scalable solutions. As far as companies are concerned, sustainable development is generating a paradigmatic transformation in the concept of their role and responsibility in society. The work of business organizations is no longer limited to the simple generation of economic profits, but is now oriented towards adopting an integral philosophy with the aim of creating value for the organization and for its various stakeholders [16]. This concept is known as “shared value creation” and suggests that companies are able and obliged to generate economic benefits that, at the same time, generate value for society and address its needs and challenges [20].

The sustainable development approach proposes a generation of wealth that is compatible with the preservation of natural systems and the promotion of social equity. To achieve this requires a responsible society committed to the measurable and progressive reduction of inequalities in the world and to mitigating the environmental impact of economic activities [17]. Implementing this approach involves adopting responsible business practices, investing in clean technologies, promoting the circular economy and promoting social innovation. Each of these elements make up the main axis for achieving true holistic economic development, which does not focus solely on traditional macroeconomic indicators such as gross domestic product (GDP), but also takes into account metrics of social welfare, human development and quality of life [18]. The multidimensional vision of this approach considers that effective progress must be inclusive and sustainable, so that it benefits society as a whole and makes it possible to safeguard natural resources for future generations. In the midst of a modern world characterized by progressive digitalization and the emergence of the Fourth Industrial Revolution, economic development is mainly based on the capacity to generate added value within the digital ecosystem. This highlights the need for a comprehensive approach involving the economic, social and environmental dimensions of sustainable development in the context of the digital era [21]. The digital transformation provides new opportunities that favor promoting efficiency, innovation and connectivity; and, likewise, presents new challenges in terms of digital equity, privacy and cybersecurity. The effective implementation of sustainable development requires a systemic and collaborative approach that includes all social actors, namely: companies, governments, civil society organizations and citizens. In this regard, the United Nations Sustainable Development Goals (SDGs), adopted in 2015, provide a comprehensive framework for coordinated action towards a more sustainable and inclusive future. The 17 goals are interconnected and address the most pressing global challenges, ranging from eradicating poverty and hunger to climate work and promoting peace and justice.

In this sense, sustainable development has become a global imperative in the 21st century, offering a conceptual and practical framework for addressing the complex challenges facing humanity. Its effective implementation requires a fundamental change in production and consumption patterns, governance structures, and social values. As we move into an increasingly uncertain and complex future, sustainable development emerges as an ethical and strategic compass to guide decisions and actions toward a more equitable, prosperous, and ecologically balanced world. Currently, the digital economy represents a phenomenon capable of transforming the global socioeconomic scenario, as it redefines the structures and dynamics of human, business and commercial interaction. As a result of the confluence between technological innovation and the systematization of processes, this phenomenon has driven a revolution in knowledge management and decision making, essentially changing the profile of human behavior in its various dimensions [19]. In the midst of this reality, the “information technology society” is taking shape, characterized by an exponential increase in the volume and speed of social and economic operations. These operations are processed using advanced technological tools and resources that favor the accelerated

transmission and analysis of data. This activity fosters innovation and drives the modernization of commercial networks on a global scale [20]. With the arrival and expansion of information and communication technologies (ICTs), communication paradigms have been radically transformed. This revolution has emphasized the centrality of communication processes in production and service systems, overcoming national boundaries and giving a new twist to the dynamics of international interaction [21]. In particular, the Internet and its advances have brought about a unique technological convergence, contributing with expressive and relational resources in real time. This convergence has caused negotiation processes and human interaction to change, giving rise to the paradigmatic phenomenon known as “digitalization” [22]. La digitalización debe entenderse como una revolución holística que incluye el ámbito social y el económico. Con la digitalización ha tomado valor lo técnico, permitiendo que los conceptos abstractos se materialicen en realidades tangibles mediante la utilización de la automatización y la disrupción técnica [23]. A nivel individual, la digitalización ha impulsado una gran transformación en lo concerniente a las perspectivas, necesidades de consumo e ideas de confort de las personas. Dichos individuos, en este momento, pueden acceder de manera más rápida a bienes y servicios, al mismo tiempo que logran navegar en una realidad más ágil, dinámica e interconectada en tiempo real [24].

From an organizational perspective, digitization has generated multiple benefits: broader and more up-to-date access to information, greater proximity to customers, more agile and innovative processes, a more secure value chain, and, as a consequence, a more robust informational integration in decision-making processes [25]. On a global scale, companies have begun a transition to digital operating models, precipitating a macroeconomic shift in economic, social, and digital processes. This transformation has had an indisputable impact on the modes of commerce, both domestically and internationally, which are now predominantly executed through ICT [26]. The digital economy, also called the “new economy”, bases its strategies on the use of the Internet and new technologies for communication. This emerging paradigm has required substantial modifications in traditional organizational and methodological structures, giving rise to what has been called the Fourth Industrial Revolution [27], also known as the “Internet economy”, since it reflects the fact that economic activities are carried out primarily in the virtual environment. In this environment, e-commerce has become a network that supports the most relevant transactions, and with which it is possible to drive the progress of markets, especially in those countries whose economies lead the world [28]. The Internet has established itself as an essential pillar of the digital economy. The widespread use of these interconnected communications networks generates important economic benefits, including lower operating costs, diversification of production, reduction of capital-intensive needs, promotion of innovation, emergence of emerging economies and a valuable increase in consumption rates [29]. Likewise, the digital economy is understood as an “information economy”, focused on analyzing a series of data to inform economic decisions. This idea relies on fast and comprehensive tools that favor the advancement of technological platforms and allow decisions to be made in a more informed and efficient way [30]. Thus, the digital economy represents a set of economic and social transactions supported by the Internet and digital technologies; moreover, it adds value to productivity, fosters economic growth and promotes the return of capital [31]. The novelty of this economic system poses new rules for global transactions; it presents important opportunities and challenges for individuals, business organizations and countries alike. The outbreak of the COVID-19 pandemic in early 2020 triggered a series of profound transformations in the global economy, the effects of which extended well into 2021 [32]. This unprecedented phenomenon significantly altered production and marketing patterns worldwide, causing disruptions in supply chains, a marked decline in the export of raw materials, and a generalized contraction of international economic indicators. Paradoxically, these adverse circumstances led to an accelerated strengthening of the digital economy, facilitating more direct and efficient communication between producers and consumers [33].

In this sense, technology emerged as a crucial element for the reactivation of negotiations between companies and nations, after the initial collapse of import and export flows through conventional channels. As a consequence, electronic commerce or e-commerce experienced exponential growth, consolidating itself as a fundamental pillar in the international trade sector [34]. This rapid adoption of digital solutions not only enabled the continuity of business operations in an environment of physical constraints but also laid the groundwork for a broader and deeper digital transformation in the field of foreign trade. Digital

transformation understood as the integration of digital technologies in all aspects of business, has emerged as an unavoidable global trend, as it presents not only challenges but also significant opportunities for international trade players [35]. In this regard, Poncela [36] argues that there is a symbiotic relationship between trade and technology, where technological innovations not only facilitate trade operations but also substantially improve the traceability and control of shipments through advanced tracking systems based on mobile applications and online platforms. The digitalization of foreign trade, in addition to improving logistics, has had a significant impact on administrative and regulatory processes, making them simpler and faster. The use of specialized computer platforms has generated a real transformation in the management of procedures related to international trade; this has benefited exporters, allowing them to carry out operations with greater flexibility and efficiency [37]. In addition to reducing processing times and operating costs, digital tools also help to minimize human error and allow transparency in international transactions. Similarly, the emergence of new business models and internationalization strategies is largely due to the rapid adoption of digital technologies in foreign trade. Small and medium-sized enterprises (SMEs) have been favored, as digital platforms provide them with a way to access global markets, which they previously could not reach due to the presence of traditional barriers to entry. With these benefits, international trade becomes a freer and more pluralistic system, allowing a more diverse and equitable participation in global trade flows [38].

However, despite the benefits it offers, the digitization of foreign trade presents certain significant challenges. These include: continuous adjustment of existing regulatory frameworks to digital developments, data protection and cybersecurity, and bridging the digital divide between nations and economic sectors. Addressing each of these challenges requires close collaboration between governments, international organizations and the private sector in order to create common regulations and best practices to ensure that digital commerce takes place in a secure, efficient and equitable framework [39]. It should be noted that the COVID-19 pandemic had a major influence on the digital transformation of foreign trade, accelerating the emergence of trends and enabling this sector to grow and embrace innovation. The reality of living in a post-pandemic world shows that digitalization is a key element for the progress of international trade, as it provides significant opportunities for efficiency, transparency and inclusion in global markets.

III. MATERIAL AND METHOD

1. DATA COLLECTION

Secondary data collection was carried out in the information sources of some official agencies such as ECLAC and the International Labor Organization (ILO), as well as other regional and global databases. A review of the existing literature on digital economy, foreign trade and sustainable development was carried out; in particular, considering those studies that examine the impact of the COVID-19 pandemic. Likewise, case studies of Latin American countries that successfully implemented digitalization policies in their foreign trade were selected and analyzed.

2. RESEARCH DESIGN

The research presented a mixed design; this type of design combines qualitative and quantitative approaches, allowing a better understanding of the topic studied. A statistical analysis of economic data with qualitative interpretations of the sociopolitical context was carried out.

For the validation of results, data triangulation was carried out; that is, findings obtained from different sources were compared and contrasted with each other. Likewise, a group of experts in digital economy and foreign trade were consulted to validate the preliminary results and adjust the methodological approach if necessary. Finally, the results were presented in tables, graphs and maps showing the trends achieved; each presented a narrative analysis to contextualize the findings.

1.1 Quantitative Research Design

The analysis was conducted using descriptive statistical techniques, which allow us to evaluate the evolution of economic digitalization and its impact on Latin America's foreign trade between 2018 and 2023.

1.2 Qualitative Research Design

Qualitative methods such as content analysis and thematic coding were used in the interpretation of policy texts, regulatory frameworks and expert interviews. To identify common patterns, discrepancies and gaps in the implementation of the digital economy in foreign trade, a cross-national comparison between Latin American nations was carried out.

IV. DATA ANALYSIS

1. QUANTITATIVE DATA ANALYSIS

The pandemic has significantly accelerated digitization in Latin America, reducing the internet connectivity gap. By the end of 2023, internet penetration in the region reached 78%, with a notable increase in mobile broadband access. However, challenges persist in connection quality, both locally and internationally. As reported by the International Labor Organization [40], by late 2023, organizations in Latin America were distinguished by slower internet connections compared to developed economies, where around 90% of businesses, regardless of their size or type, operate with high-speed internet access. It is important to note that large Latin American companies generally enjoy better connectivity. However, considering that the region's business fabric is dominated by SMEs, the lower connection speed of the latter represents a significant gap in terms of competitiveness [40]. This situation limits access to business tools, digital storage, information centers, and applications essential for the technological operation of key processes [41]. Economic digitalization has driven Latin American countries to transform their business transactions through technology, including the large SME sector. During the pandemic and the subsequent years, Brazil, Chile, Colombia, and Mexico experienced a remarkable surge in the creation of business websites. In 2020, this growth reached 800% in Colombia and Mexico and approximately 360% in Brazil and Chile compared to prior years [41].

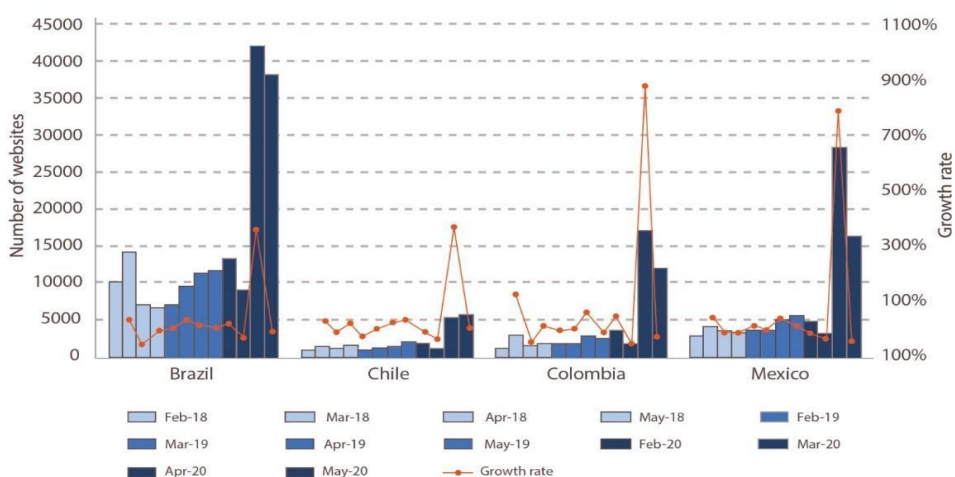


FIGURE 1. Selected Latin American countries. number of new websites.

The year 2020 represented for Brazil and Latin America, in general, the imperative need for digital inclusion and gave rise to commercial web channels that helped mitigate the economic impact of the pandemic. Activity on these websites remained subdued during 2020 and 2021. However, as the health crisis

passed, many companies in the region returned to traditional practices, neglecting the potential of the digital economy and leaving their digital business domains with little activity.

Despite the growth of business presence in the digital ecosystem, the technological potential has been underutilized. Digital businesses maintain a mostly passive presence on the web, with minimal variation in their active participation. In fact, in 2023 participation was lower than in 2022. The technological inclusion of Latin America compared to the member countries of the Organization for Economic Cooperation and Development (OECD) is only 18% [42] (Figure 3).

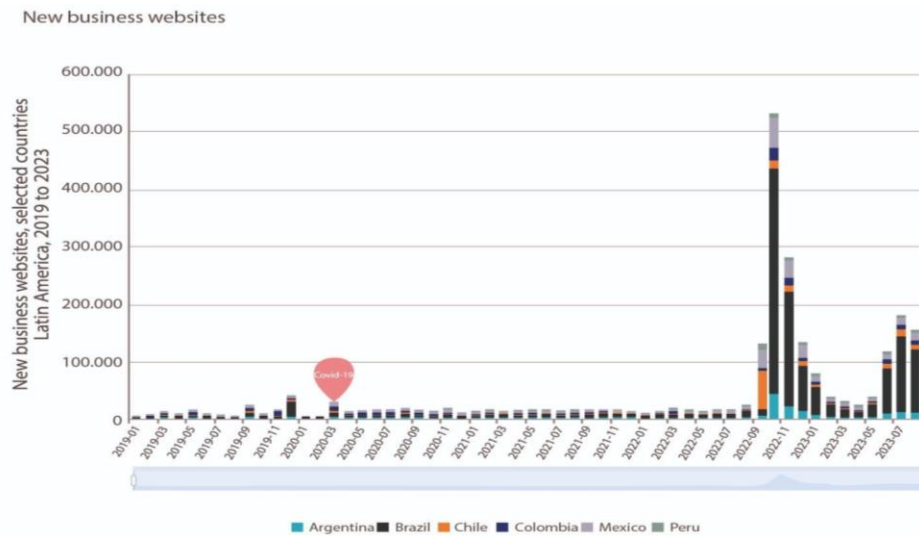


FIGURE 2. Business Webs. selected countries in Latin America, 2023.

This situation reflects the fact that the current gap in Latin America is characterized by the limited use of technology and the lack of momentum in technological transformation throughout the value chain of organizations. This translates into lower technological competitiveness in production processes, supply chains, logistics, and marketing. Although progress has been made in basic aspects such as Internet access coverage and confidence in electronic payments and transactions, full technological dynamization is still in its initial stages.

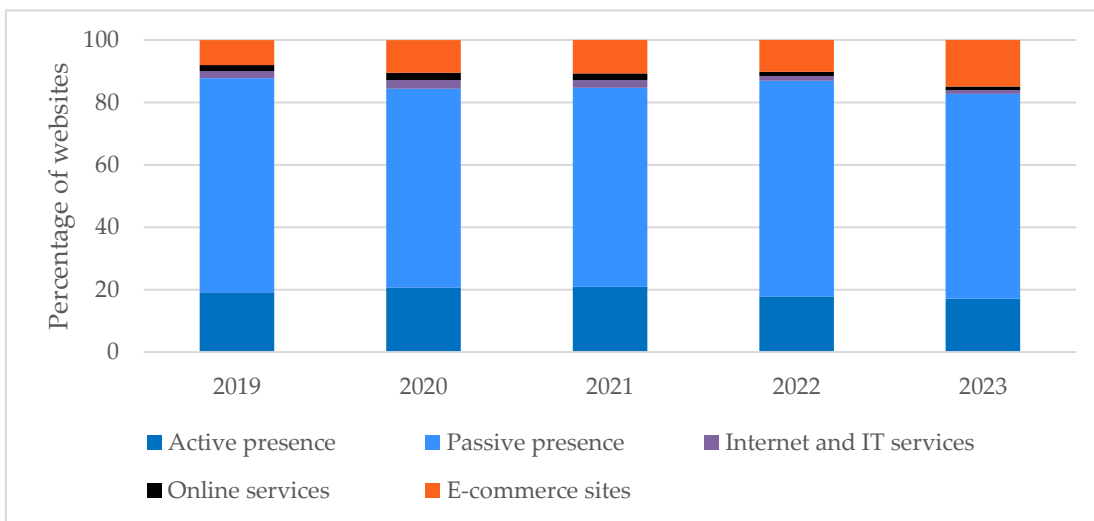


FIGURE 3. New business websites by type of online presence. Selected countries in Latin America, 2023.

In terms of digital services, Latin American countries have worked to improve the transparency and reliability of online business. Access to digital accounts exceeds 90% in markets such as Brazil, Argentina, Colombia, and Chile, and reaches 80% at the regional level. Latin America stands out for the growth of digital payments and online shopping. However, cybersecurity remains a challenge, particularly in Mexico, despite the development of digital platforms and infrastructure [42] (Table 1).

Table 1. Leading countries in the process of digitalization of the economy.

Country	Electronic transactions	Consumer protection	Protection of personal information	Cybercrime
Brazil	X	X	X	X
Chile	X	X	X	
Colombia	X		X	X
Mexico	X	X	X	

In summary, according to ECLAC [43, 44], the scope of the digital economy can be summarized as:

- 78% of 18 countries have a national digital agenda, although without an allocated budget.
- 48 % of the 33 countries have a cybersecurity strategy.
- 69 % of the 33 countries have implemented personal data protection laws.

In this regard, Brazil stands out positively among Latin American nations, as it shows greater e-competitiveness with a significant number of companies using the internet, e-banking, online sales platforms, and technology in their supply chains, which evidences a broad digital culture. On the other hand, Chile, Colombia, and Mexico, despite advances in business digitalization since 2018, still maintain a high volume of cash transactions and show a slower digital transformation. The adaptation of foreign trade of goods and raw materials to the digital era involves a significant transformation of the customs system. This process mainly seeks to reduce operating and tax costs, as well as to simplify administrative procedures. The goal is to optimize sales prices, maximize profits, and increase the competitiveness of the entire value chain. Latin American customs have shown progress in their modernization, orienting maritime and land transport towards new service standards and reducing costs in the global supply chain [44]. An important milestone in this process is the World Trade Organization's Trade Facilitation Agreement, which entered into force in 2017. This agreement focuses on simplifying procedures without compromising legality, tax collection, public health protection, and the environment, focusing on improving efficiency, competitiveness, and quality [45].

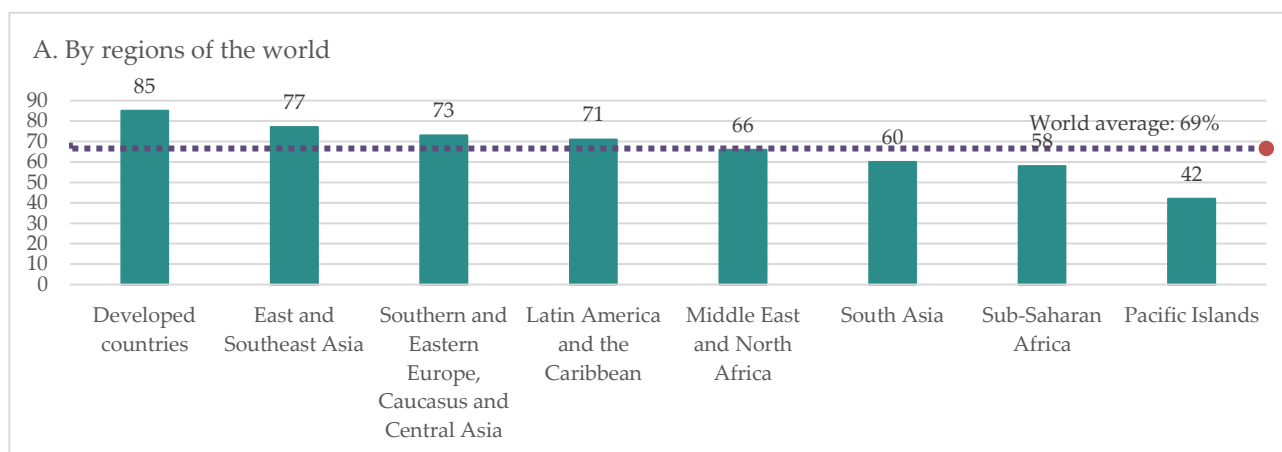


FIGURE 4. Results of the 2023 United Nations Global Survey on Digital and Sustainable Trade Facilitation

In the first half of 2023, Latin America reached an average implementation rate of 71% in digital and sustainable trade facilitation, surpassing the global average by a small margin. Nevertheless, significant disparities exist among countries, with 8 out of the 11 nations falling below the regional average being located in the Caribbean [44] (Figure 4).

However, Latin America is 14 percentage points below developed countries in terms of digital trade facilitation. Only 25% of the countries in the region are within the acceptable indices, while 15% show moderate coverage and the rest are below the acceptable percentiles [44] (Figure 5).

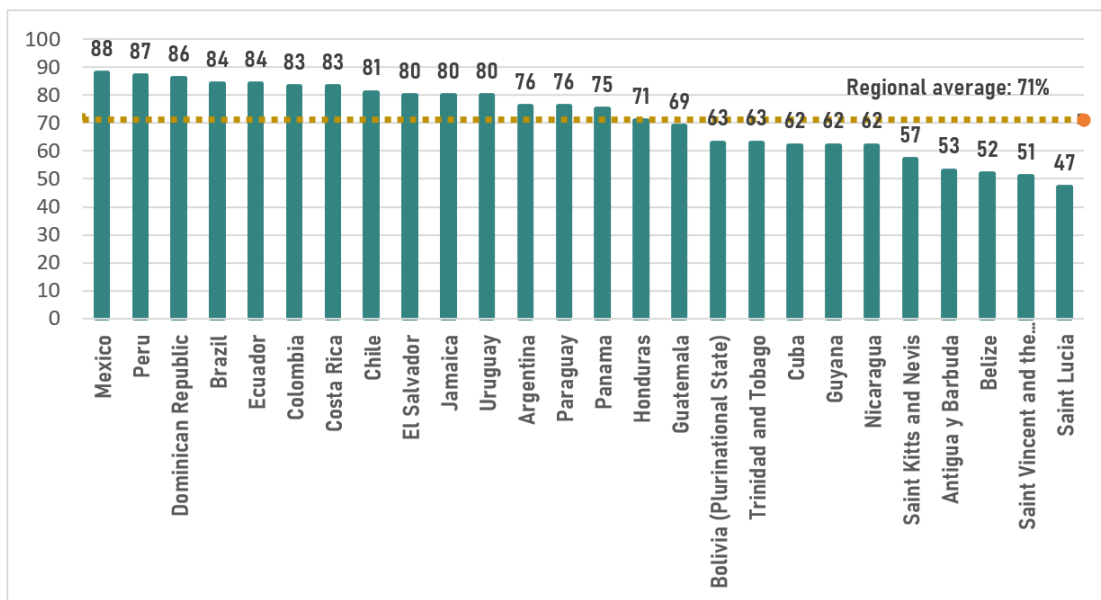


FIGURE 5. Results of the 2023 United Nations Global Survey on Digital and Sustainable Trade Facilitation.

Peru stands out among the best-performing countries in Latin America, with a value of 1.5 out of 2 in the OECD's trade facilitation index. The country intends to continue advancing in digital competitiveness for foreign trade facilitation, aligning itself with the objectives of the Community Interoperability Project (Intercom) [46].

However, most Latin American countries must continue to improve their customs modernization management. According to the OECD evaluation [44], the area with the worst performance is trade digitalization, as shown in Table 2:

Table 2. Measures with the highest and lowest implementation rates in Latin America.

Category	Most implemented measures	Percentage	Measures less implemented	Percentage
Transparency	Consultation with stakeholders on regulatory initiatives	86	Preliminary decisions on tariff classification and origin.	69
	Publication of commercial regulations on the Internet	82	Independent procedures for review of customs decisions.	69
	Post-clearance audit	92	Facilities for authorized economic operators.	80

Formalities	Risk management Processing before the arrival of the goods Acceptance of copies	87	Setting and publishing average timelines for the clearance of goods.	67
	Institutional arrangements and cooperation	Creation of national trade facilitation committees.	92	Harmonization of procedures and formalities with neighboring countries at border points.
Cooperation between border control agencies.		87	Delegation of border controls to customs by other control agencies.	10
Trade paperless	Automated customs processing system.	97	Electronic submission and issuance of preferential origin certificates.	47
	All customs and trade enforcement agencies at border crossings have internet connectivity. Air cargo manifests are sent electronically.	89	Electronic application for customs payment reimbursement.	41
Trade cross- border paperless	Legislation on electronic transactions	86	Electronic exchange of animal health and phytosanitary certificates.	46
	Issuance of digital certificates by authorized entities.	67	Electronic exchange of customs declarations.	42

The adoption of the electronic single window for foreign trade, a key component in the digitalization of customs procedures, reveals shortcomings in over 50% of the countries in the region:

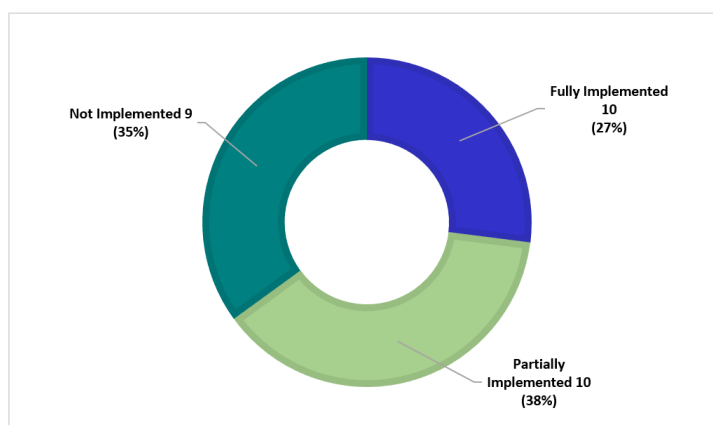


FIGURE 6. Status of implementation of the Electronic Single Window for foreign trade, May 2023.

In addition to facilitating customs procedures, countries must focus on the use of digital finance in foreign trade. However, only Argentina and Uruguay have had positive experiences in adopting technologies such as blockchain or artificial intelligence (AI) in their customs processes.

The year 2023 was a complex period for international trade, as it was affected by global political and financial imbalances. Currency contractions in the major economies of Europe and the United States, religious conflicts, and crises in some sectors in China impacted regional transactions of goods and services [44] (Figure 7).

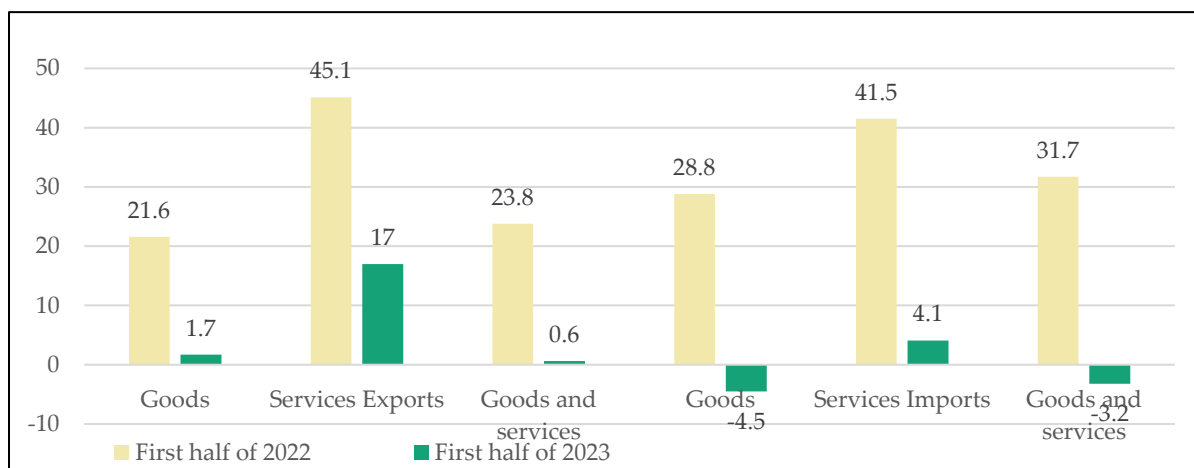


FIGURE 7. Status of implementation of the Electronic Single Window for foreign trade, May 2023.

Likewise, there was a decrease in exports and imports of goods in all sectors, as a result of the internal recessions in the destination countries, especially China and the United States, together with the fall in prices due to the reduction in operating costs, mainly in logistics and transportation of goods. In contrast, trade in services was more dynamic, with increases in both exports and imports. However, the general behavior of transactions is below the year 2022, which closed with growth in both activities [45].

It is important to highlight the recovery of the tourism sector in the region, which has contributed positively to the export of services. The reactivation of international tourism, together with the reduction of maritime costs, has had a favorable impact on the region's travel exports. In addition, the modern services market shows remarkable stability [45].

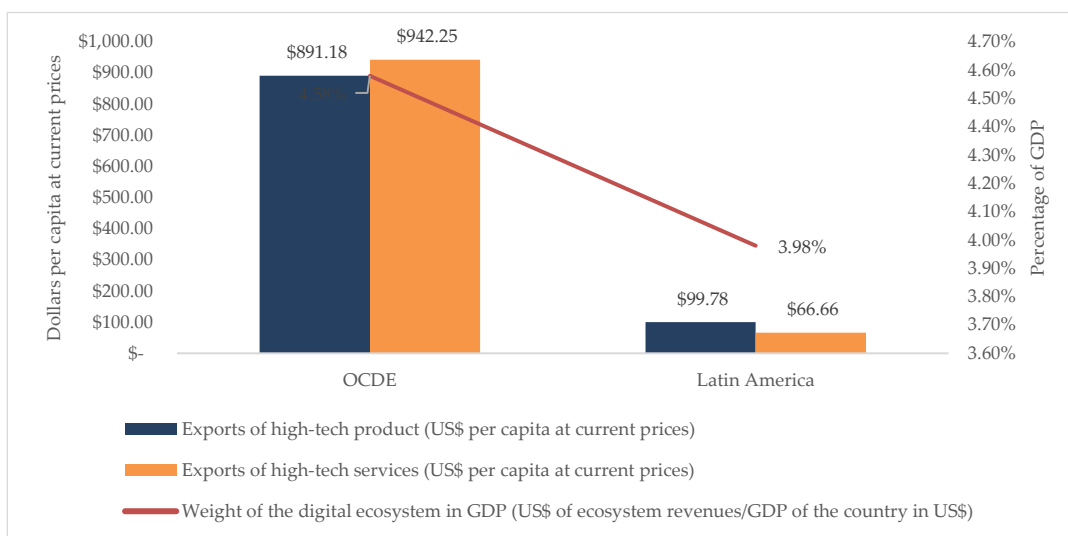


FIGURE 8. OECD and Latin America, weight of the digital ecosystem in GDP and exports of high-tech products and services, 2020.

However, in Latin America, the growth of digital infrastructure has not been fully translated into a source of economic transformation. When comparing the digital ecosystem between OECD member countries and Latin America, significant differences are found in terms of GDP generation and exports of high-tech services and products [41] (Figure 8).

This reality, related to the limited exploitation of digital services, is associated with the weak momentum of the industry in the region, as detailed in Table 3:

Table 3. Proportion of development of digital industries.

Latin America	OECD	USA	Western Europe
Digital Industries Development Index of 18.63	Digital industries development index of 35.64	Digital industries development index of 43.21	Digital Industries Development Index of 35.75

Latin America is characterized as a consumer but not a producer of digital services. Only 26% of the most popular websites are of local origin. Although 50% of the population actively participates in the digital universe, the local supply of products and services has not been able to consolidate into a dynamic and sustainable process of value creation [41]. In conclusion, Latin America continues to lag in the digital industry of trading modern services for export. This situation will persist until modern foreign trade policies are implemented and greater digital business professionalism is fostered in the region.

1. QUALITATIVE DATA ANALYSIS

Foreign trade in Latin America has experienced heterogeneous management, responding to local needs and accelerating due to globalization. The boom in cross-border e-commerce has driven significant growth in the region, especially in the aftermath of the pandemic. Thus, since the first decade of the 2000s, countries have begun to incorporate e-commerce provisions in their agreements, recognizing their relevance in the digital era (Table 4).

Table 4. E-commerce agreements.

Country	Type of agreements	With the EE. UU.	With EU
Countries that are members of the Pacific Alliance (Chile, Colombia, Mexico, and Peru).	Substantive agreements between them contain chapters on electronic commerce, both among themselves and with partner countries of more advanced economies.	All countries have been included in agreements with this country concerning electronic commerce, with emphasis on the prohibition of charging tariffs on digital products transmitted	Colombia and Peru. Signed in 2012, it establishes the commitment to develop regulations on the protection of personal information; digitally publish and accept trade-related documents; and adopt measures for online consumer protection.
	Treaties of e-commerce with Asia and the Pacific,		EU and Mexico in 2018 updated the original 1997 agreement. It highlights the prohibition of requiring the transfer or access to the source code of computer programs.

Central American countries, including Panama and the Dominican Republic.	particularly Australia, China, Taiwan, the Republic of Korea, and Singapore. Comprehensive and Progressive Agreement for the Trans-Pacific Partnership (CPTPP).	electronically and the obligation to grant them national and most-favored-nation treatment.
Member of the Southern Common Market (Mercosur) (Argentina, Brazil, Paraguay and Uruguay)	Little integration agreement in the area of electronic commerce.	
Members of the Caribbean Community State (Caricom): Plurinational State of Bolivia, Cuba, Ecuador, Venezuela (Bolivarian Republic of)		
El Salvador, Honduras, Costa Rica, Dominican Republic, Nicaragua and Guatemala.		DR-CAFTA establishes the non-imposition of tariffs on digital products transmitted electronically, and that they will receive national and most favored nation treatment.

Cross-border digital trade in Latin America reflects the existing disparities in regional trade policies in traditional foreign trade [41]. The United States has emphasized the importance of homogenizing procedures to facilitate transactions between countries in the region, to which only Mexico, Uruguay, Chile, Colombia, and Peru have responded substantially. It is striking that Bolivia, Cuba, Paraguay, and Venezuela have not participated in any trade or economic integration agreement that explicitly addresses electronic commerce.

The absence of common patterns among the aforementioned agreements hinders the comprehensive development of e-commerce in the region. Nevertheless, it is important to recognize the individual efforts made based on particular commercial interests, to harmonize the dynamics of e-commerce by transactions with their partners [41]. In this context, the following regulatory developments stand out:

- The Economic Complementation Agreement No. 73 (ECA No. 73) between Chile and Uruguay, in force since December 2018, which recognizes international trade as an engine for development and emphasizes trade facilitation to streamline and reduce costs of cross-border trade.
- The Digital Economy Agreement between Chile, Singapore, and New Zealand seeks to establish a favorable framework for ICT companies, fostering the export of products and services by addressing essential areas like data flow, artificial intelligence, digital identity, non-discrimination of digital products, and privacy.
- The Electronic Commerce Agreement No. 75 between Chile and Ecuador, signed in August 2020, covers 24 chapters, including market access, rules of origin, trade facilitation, and electronic commerce, among others.

In this sense, it can be observed that Chile has stood out for establishing strategic alliances for its foreign trade relations based on information technologies, which increases its competitiveness, modernization, and openness to digital transactions. In contrast, the rest of the countries in the region have not established substantial cross-border agreements that promote online exchange in the context of the digital economy, which is consolidating as a contemporary paradigm.

Within the framework of the evolution of foreign trade in Latin America, it is imperative to analyze the following critical aspects that influence its development and global competitiveness (Table 5):

Table 5. Foreign trade challenges.

Weaknesses	Strengths
<ul style="list-style-type: none"> - Insufficient adoption of digital technologies in production processes and e-commerce. - Significant lag in investment in science, innovation, and new technologies, both in the public and private sectors. - Need to strengthen the institutional framework in the technology sector to promote innovation and development. - Insufficient investment in improving the quality and scope of connectivity. - Customs and trade policies that require greater adaptation to the digital era. 	<ul style="list-style-type: none"> - Progressive reduction of the digital infrastructure gap. - Growing adoption of digital sales channels (18% of companies in the region). - Substantial improvement in corporate Internet access. - Significant increase in the use of electronic banking services by the business sector. - Increasing openness of regional trade policies towards digitalization.

The digital transformation of foreign trade in Latin America presents a complex and multifaceted landscape. Although notable advancements have been achieved in some areas, significant challenges persist that need to be tackled in a strategic and coordinated approach. It is therefore essential to recognize that, beyond its role as a consumer of technology services and importer of digital solutions, Latin America must position itself as a proactive player in the global digital economy. To achieve this goal, it is imperative that the region:

Implement comprehensive policies to promote innovation and technological development. Substantially increase public and private investment in digital infrastructure and the training of specialized human capital. Modernize its regulatory frameworks to facilitate cross-border e-commerce and the adoption of new technologies in production and logistics processes. Foster collaboration between academia, business, and government to create strong innovation ecosystems. Develop national and regional export strategies for digital services and products with high technological added value.

The adoption of these measures is crucial to boost export operations and position the region as a relevant participant in global digital value chains. Otherwise, Latin America's economic progress and international competitiveness in the digital era will remain long-term goals, potentially widening the gap with other more advanced regions in this area.

In this sense, the future of Latin American foreign trade in the digital economy will depend largely on the ability of the region's countries to overcome their structural weaknesses, capitalize on their emerging strengths, and adopt a proactive stance in the digital transformation of their economies. Only through a concerted and sustained effort in this direction will Latin America be able to aspire to a leading role in global trade in the 21st century.

2. MIXED-METHODS DATA ANALYSIS

The progression of digitalization in Latin America from 2018 to 2023 has been characterized by notable advancements, primarily fueled by the necessity to adapt following the impacts of the COVID-19 pandemic. During this period, the region experienced an accelerated adoption of digital technologies, which became the

foundation for business continuity in a reality characterized by physical and social restrictions. Thus, the digital economy in Latin America presents a real progress, especially because an environment that favors technological transformation in specific areas was generated; for example, e-commerce, business infrastructure and electronic transactions. However, this progress has not occurred uniformly throughout the region, due to constant challenges. Among the most important aspects is the existing disparity in the quality of Internet connectivity. The reality shows that large companies have high-end connectivity; however, SMEs, the majority of the region's business fabric, have lower quality connections [32]. The digital divide that is evident limits the ability of SMEs to take full advantage of the digital applications and tools required to compete in such a globalized market. Another element to consider is the lack of knowledge and distrust regarding the use of digital technologies among the different economic actors, especially in SMEs. This has led to a limited use of these technologies, being used only in basic activities such as consulting information online and sending e-mails.

The adaptation of Latin American foreign trade to digitalization between 2019 and 2023 was a complex and uneven process, which revealed the limitations and opportunities of the region in the digital economy. Although the integration of technology in foreign trade has been evident, with e-commerce emerging as an essential component, the results in terms of exports have been disappointing [36]. Although some sectors, such as tourism and modern services, showed initial growth, by 2023 this momentum began to slow down. This slowdown can be attributed, in part, to competition from developed markets that, having achieved greater digital competencies, have managed to significantly reduce operating costs, diminishing the attractiveness of the Latin American market. From a management perspective, the lack of effective cross-border integration processes has been a notable obstacle. While some nations have made progress in implementing digital agendas, the absence of a coordinated strategy at the regional level has limited the growth of foreign trade and the development of emerging businesses in modern service sectors. This has resulted in an underutilization of installed capacity in the region, which has negatively affected the competitiveness of SMEs, which have not been able to fully benefit from digitalization to expand their operations in global markets [46].

The challenges facing foreign trade in Latin America within the digital economy framework are diverse and profound, requiring a strategic and coordinated approach by governments and economic actors in the region. First, governments must reorient their efforts towards customs modernization [46], considering the demands of the digital environment that have emerged as a result of global economic disruption [41]. Investment in technological transformation should be prioritized over legal reforms that, until now, have been managed individually and uncoordinatedly. However, one of the main obstacles has been the lack of harmonization in rules and regulations between countries, especially in key areas such as taxation, customs management, and cross-border data management [45]. This lack of uniformity has limited the potential of cross-border foreign trade, which has not yet managed to surpass the threshold of 20% of total transactions in the region. Furthermore, although foreign trade facilitation has been recognized as a priority, especially in reducing operating costs through technologies such as the electronic single window, the reality is that the implementation of these tools is still insufficient [37]. Only 27% of Latin American countries have fully adopted this system, which highlights one of the main structural weaknesses of the region in its transition to an integrated digital economy. To move towards foreign trade that is in tune with the digital economy, it is essential to foster a strong digital culture and promote regional policies that support the digitization of production, logistics, and transportation systems [41], [42], [45]. In the short term, the full implementation of the Foreign Trade Single Window (SW) is a crucial goal that, if achieved, could significantly improve the competitiveness and efficiency of foreign trade in the region.

V. CONCLUSION

The health crisis caused by COVID-19 significantly accelerated the adoption of digital technologies in the region, resulting in improved internet connectivity and greater use of digital tools. However, considerable obstacles persist in the quality of connectivity, a factor that disproportionately affects small and medium-sized enterprises (SMEs), limiting their competitiveness in the global market. Although there have been important advances in digitization, it is necessary to take into account that the impact has not been the same among Latin American nations. This is due to the significant differences that exist in technological

infrastructure, regulatory frameworks and technological capabilities. These disparities hinder the full digital integration of these countries, making it impossible for the advantages offered by the digital economy to be fully exploited. The benefits of digitalization range from boosting cross-border trade to improving operational efficiency in certain sectors. However, these advantages are not taken advantage of by many companies in the region, as they maintain a passive digital presence, generating an underutilization of their technological potential. This situation negatively affects competitiveness within digital value chains.

With respect to the regulatory framework, it was established that certain countries have made real progress in including electronic commerce in their international agreements, allowing digital trade to emerge. Despite this, the adoption of such measures has been uneven, generating little integration in the region's digital foreign trade.

Another extremely important aspect is the modernization of customs, which is a decisive component that facilitates foreign trade in the digital era. Although progress has been made in this area, the implementation of technologies such as the electronic single window is not enough, and there are still huge differences between countries on this issue. However, although digitalization represents important opportunities for optimizing the competitiveness and sustainability of foreign trade in Latin America, the region faces enormous challenges. It is therefore necessary to increase investment in digital infrastructure, optimize the quality of connectivity and modernize regulatory frameworks. All of this will enable adaptation to the demands of the digital economy. The future success of Latin American foreign trade will depend, to a large extent, on the ability of countries to overcome these structural weaknesses, capitalize on their emerging strengths, and adopt a proactive stance in the digital transformation of their economies. Ultimately, only through a strategic and coordinated approach will Latin America be able to improve its international competitiveness and play a more prominent role in 21st-century global trade.

Funding Statement

This research received no external funding.

Author Contribution

Conceptualization, H.B.G.C., S.A.C.L., C.P.M.D. and J.M.A.C.; methodology, D.M.C.C., M.E.V.T. and G.R.A.A.; software, H.M.A.L.; validation, H.B.G.C., S.A.C.L. and C.P.M.D.; formal analysis, J.M.A.C. and D.M.C.C.; investigation, all authors; resources, M.E.V.T. and G.R.A.A.; data curation, H.M.A.L.; writing—original draft preparation, H.B.G.C., S.A.C.L., C.P.M.D., and J.M.A.C.; writing—review and editing, D.M.C.C., M.E.V.T. and G.R.A.A.; visualization, C.P.M.D.; supervision, H.B.G.C. and S.A.C.L.; project administration, H.B.G.C., M.E.V.T., H.M.A.L.; funding acquisition, M.E.V.T. and G.R.A.A. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data is contained within the article.

Acknowledgments

The authors are very grateful to the people who motivated our research.

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