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INNOVATION IN SMES: PRODUCTIVITY AND TECHNOLOGICAL INNOVATION IN SMALL AND MEDIUM-SIZED LATIN AMERICAN ENTERPRISES.EMPIRICAL ANALYSIS AND PROPOSAL FOR A MODEL APPLICABLE TO THE REGIONAL CONTEXT.

SUMMARY

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Micro, small, and medium-sized enterprises (MSMEs) play a fundamental role in the economic and social development of Latin America. Beyond their individual contribution to the gross domestic product (GDP) these organizations serve as a vital source of employment, generate family income, and strengthen the local productive fabric. Collectively, they contribute significantly to community well-being, territorial development, and the reduction of socioeconomic inequalities. For this reason, the study of MSMEs should not be limited to their direct economic contribution; it must also encompass their impact on the population's quality of life and the sustainable growth of their respective territories.

In the Cuban context, economic transformations implemented in recent years have fostered greater openness toward market mechanisms, the creation and strengthening of MSMEs, and increased autonomy for municipalities and provinces to drive their own development. These changes have been accompanied by policies focused on local development, which recognize the importance of leveraging the specific resources, capabilities, traditions and potential of each territory. Both the economic guidelines approved by the Communist Party of Cuba and various government provisions have emphasized the need for local governments to play an active role in identifying and addressing economic and social challenges through the efficient use of available resources.

Against this backdrop, innovation emerges as a strategic element for achieving higher levels of competitiveness and economic growth. Many experts agree that innovation is one of the most significant factors influencing both business and territorial development. Innovative MSMEs contribute to market expansion, job creation, productive diversification and a more balanced distribution of wealth. While some economic schools of thought once argued that large corporations were better equipped to innovate due to their superior financial and technological resources, subsequent research has shown that MSMEs possess distinct advantages, such as more flexible organizational structures, more efficient internal communication and greater agility in decision-making. These characteristics allow small and medium-sized enterprises (SMEs) to adapt more easily to environmental changes and develop innovative processes tailored to the needs of their markets. However, the development of innovation in this sector faces significant limitations, particularly in developing countries and emerging economies. Key obstacles include financial constraints, a lack of technological resources, limited managerial training, and difficulties in accessing collaborative networks that could foster the exchange of knowledge and experience.

Specialized literature acknowledges that innovation should not be understood solely as the incorporation of new technologies, but also as the implementation of new organizational methods, business strategies, management approaches and mechanisms for corporate cooperation. In this context, collaborative relationships among companies, universities, research centers, government agencies and other institutions become essential factors for strengthening the innovative capabilities of SMEs. Such interactions facilitate knowledge transfer, collective learning and the creation of solutions tailored to the specific needs of each territory.

One strategy that has gained international prominence for fostering such processes is the development of business clusters. Clusters are geographic concentrations of related companies and institutions that cooperate to enhance their competitiveness, productivity and innovation. Their significance lies in their ability to leverage economies of scale, share resources, facilitate knowledge exchange and generate sustainable competitive advantages. Furthermore, clusters strengthen ties between the business sector, academic

institutions and public agencies, fostering the creation of innovation ecosystems capable of driving regional development.

In various developed and developing countries, governments have promoted policies aimed at establishing and strengthening clusters as a response to the structural limitations faced by small and medium-sized enterprises (SMEs). These initiatives have demonstrated that business cooperation can contribute significantly to economic growth, job creation and the enhancement of territorial competitiveness. Moreover, open innovation and the active participation of diverse stakeholders in local development processes facilitate the creation of more effective solutions to contemporary economic and social challenges.

Nevertheless, in Latin America, several persistent difficulties limit the impact of innovation on local and regional development strategies. These include insufficient institutional support for entrepreneurs, the rigidity of certain public policies, shortcomings in business management, a lack of understanding regarding market dynamics and an absence of strategic planning. Such limitations constrain the growth potential of SMEs and hinder their ability to generate positive impacts within the territories where they operate.

The situation described highlights a contradiction between the growing need to promote business innovation and the limitations inherent in public policies designed to support this process. This issue is particularly significant in Latin America, where SMEs represent a substantial portion of the productive fabric and serve as a primary engine for local economic development. Consequently, it is necessary to design methodological approaches and management models that integrate business innovation with territorial development strategies, fostering effective coordination among businesses, governments, academic institutions and other social stakeholders.

This research is rooted precisely in the need to contribute to strengthening local and regional development by promoting innovation within SMEs and refining public policies related to this sector. To this end, it proposes the design of a conceptual model and a general procedure for evaluating and enhancing the innovative capabilities of businesses, while simultaneously considering the economic, social, and environmental dimensions of sustainable development.

In general terms, this study seeks to provide theoretical and practical tools that facilitate the formulation of more effective strategies to strengthen business competitiveness, improve public management and promote sustainable territorial development processes. In doing so, it aims to offer an alternative that contributes to the growth of small and medium-sized enterprises (SMEs), the well-being of communities and the economic progress of Latin American countries with particular attention to the Cuban context and its current challenges regarding economic and social transformation.

The primary purpose of Chapter 1 was to establish the theoretical and practical framework underpinning research into innovation within small and medium-sized enterprises (SMEs) and its contribution to local and regional development strategies in Latin America. To this end, an extensive literature review was conducted, covering both classic and contemporary authors, alongside an analysis of research indexed in international scientific databases most notably Scopus. This chapter identified key theoretical approaches concerning innovation, business clusters, territorial development and innovative strategies applicable to Latin American

SMEs, thereby forming the conceptual foundation for the subsequent design of the model proposed in this research.

A central focus of the chapter was the study of the historical origins of innovation clusters. The research traced the initial theoretical foundations to the work of Alfred Marshall (1920), who explained how the geographic concentration of firms could generate external economies and competitive advantages comparable to those enjoyed by large corporations. Subsequently, Becattini and other researchers developed the concept of the "industrial district," highlighting the significance of the social, cultural and economic relationships embedded within a specific territory. Later, Porter further refined this perspective by introducing the modern concept of the "business cluster" defined as a geographic concentration of interconnected firms and institutions that simultaneously cooperate and compete to enhance their productivity, innovation, and competitiveness.

The literature review revealed that clusters currently serve as a fundamental tool for fostering knowledge transfer, collective learning and the generation of innovations. Furthermore, it was shown that innovation within clusters is not limited solely to the creation of new products; rather, it also encompasses organizational, technological, commercial and managerial improvements. As a result of this analysis, it was concluded that there is an international consensus that clusters strengthen business competitiveness through cooperation among companies, universities, research centers and government bodies.

The second aspect addressed in the chapter concerned the study of innovation within clusters in the Latin American context. The literature review revealed that SMEs face significant structural limitations that hinder their innovation processes, most notably, insufficient access to financing, limited capacity for investment in research and development, a lack of technological knowledge and poor coordination between companies and support institutions, compounded by weak public policies and a lack of continuity in innovation programs.

Despite these limitations, the literature shows that participation in clusters allows SMEs to compensate for many of these shortcomings through business cooperation, shared access to specialized knowledge and engagement with universities and research centers. A significant aspect identified in this section is the importance of the "Triple Helix" model (university-industry-government), which is considered one of the most effective mechanisms for fostering sustainable innovation ecosystems. This model facilitates knowledge generation, technology transfer and the implementation of policies aimed at regional productive development.

The research also revealed that the structure of Latin American clusters is highly heterogeneous. There are clusters based on natural resources, traditional manufacturing, knowledge intensive services, technology driven industries and firms integrated into global value chains. However, most of these clusters exhibit low levels of investment in research and development, which limits their innovative capacity.

Another key objective of this chapter was to analyze the relationship between innovation, clusters and local development. To this end, a descriptive, retrospective bibliometric study was conducted using data from the Scopus database. A total of 1,692 scientific documents published between 2013 and 2023 and concerning innovation within clusters, SMEs and local development were analyzed.

This analysis helped identify significant trends in research on innovation within clusters, SMEs and local development. The results show that the field of business administration accounts for the largest share of

publications, representing 36.3% of the total analyzed, with 2022 recording the highest volume of research on this topic. Furthermore, it was found that 71.8% of the published documents are scientific articles, reflecting a growing academic interest in this field of study. The countries with the highest scientific output were the United States, the United Kingdom and the Russian Federation. Furthermore, high-impact specialized journals such as *European Planning Studies*, *Competitiveness Review*, *Regional Studies*, *Actual Problems of Economics* and *Journal of Business Research* emerged as the primary sources for the dissemination of knowledge. Additionally, using the software VOSviewer, a keyword network was constructed, which identified "innovation" as the central concept linked to local development and business clusters. The analysis revealed that cluster policies began to gain international relevance around 2017 and that the involvement of SMEs in these studies represents a relatively recent line of research. Overall, the findings demonstrate that innovation within clusters fosters increased regional competitiveness, knowledge transfer, the strengthening of production linkages, access to international markets, job creation and economic growth, while also contributing to territorial sustainability. However, it was also noted that a lack of appropriate public policies and sustained support programs can significantly limit the success, development and long-term viability of these initiatives.

One of the most significant contributions of this chapter is the identification and comparison of the primary innovation strategies implemented by Latin American SMEs. To achieve this, a systematic review was conducted using the ELR (Relevant Literary Space) method, involving a search within the Scopus database in December 2024.

The search was delimited to the 2020–2025 period and encompassed research within the fields of business, management, economics and finance. It included scientific articles, reviews, book chapters and conference papers published in either English or Spanish. Initially, 49 relevant documents were identified, collectively garnering 399 citations. Subsequently, through statistical sampling procedures and criteria for scientific relevance, 21 articles were selected for detailed analysis. These were supplemented by the five most-cited works from the last five years, providing an up-to-date and representative overview of the innovation strategies employed by SMEs.

The literature review identified five predominant innovation strategies. The first is product innovation, which focuses on developing new products or significantly improving existing ones to address evolving market needs and create sustainable competitive advantages. This strategy offers benefits such as differentiation from competitors, access to new market segments and an increase in the value added to a firm’s offerings, thereby strengthening the organization’s market position.

The second strategy identified is process innovation, which centers on optimizing internal activities through the integration of new technologies, tools, or management methods. Its primary objective is to enhance operational efficiency and improve organizational performance. Key benefits include cost reduction, increased productivity and the continuous improvement of production and administrative processes all of which are essential for strengthening the competitiveness of SMEs in increasingly dynamic environments. The third strategy is open innovation, which promotes collaboration between companies and various external stakeholders, such as universities, research centers, customers, suppliers and government institutions. This approach makes it possible to leverage external knowledge, capabilities and resources to jointly develop

innovative solutions. Its advantages include access to specialized knowledge, a reduction in the individual costs associated with research and development and the acceleration of learning processes and innovation generation within organizations.

Furthermore, business model innovation is identified as a strategy focused on transforming how companies create, deliver and capture value. This approach seeks to adapt organizations to new market conditions by creating new revenue streams or redefining their value propositions. Its primary contributions lie in an enhanced capacity to adapt to environmental changes, the diversification of economic activities and increased organizational flexibility for responding to complex competitive landscapes.

Ultimately, the research determined that technological innovation constitutes the most comprehensive strategy with the greatest transformative potential for Latin American SMEs. This strategy is based on the incorporation and development of technologies that optimize products, processes, services, and management models. Key benefits include increased productivity, the digitalization of processes, expansion into international markets, and the ability to integrate with other innovation strategies. The findings demonstrate that technological innovation acts as a cross-cutting element, capable of simultaneously enhancing product, process, and business-model innovation, as well as open innovation; it thus serves as a fundamental strategic tool for driving business growth, competitiveness, and the sustainable development of SMEs.

The research results show that innovation has become a primary driver of competitiveness for Latin American SMEs, helping them adapt to increasingly dynamic and demanding environments. Furthermore, the study highlights that clusters are an effective mechanism for promoting innovation, technology transfer, and regional development by facilitating cooperation among various economic and institutional actors. In this context, collaboration between companies, universities, and governments is essential for creating sustainable innovation ecosystems capable of generating long-term competitive advantages. Nevertheless, financial constraints remain the primary barrier to innovation for SMEs, limiting investment in research, development, and the adoption of new technologies. Despite this, digitalization and the integration of emerging technologies are the fastest-growing trends in Latin America, with approximately 46% of the region's SMEs currently undergoing digital transformation. Finally, among the strategies analyzed, technological innovation was identified as having the greatest economic and financial impact, given its capacity to integrate with and simultaneously boost product, process, and business-model innovation as well as open innovation making it a key factor for sustainable growth and business competitiveness. This chapter was developed using a combination of theoretical and empirical methods, which provided a scientific foundation for the research and ensured rigor in the analysis of the data. The theoretical methods employed included bibliographic analysis and synthesis, which facilitated the integration and systematization of key conceptual contributions regarding innovation, clusters, and local development; the historical-logical method, used to examine the evolution of these concepts and understand their development across different contexts; the inductive-deductive method, which enabled the derivation of generalizations from specific evidence and their comparison against existing theoretical frameworks; and a specialized documentary review, focused on examining scientific literature, reports, and reference documents relevant to the subject of study. Furthermore, the empirical methods included a bibliometric study to assess research trends concerning innovation and clusters within SMEs; an analysis of keyword networks using VOSviewer software, which helped identify thematic relationships and emerging lines of research; a systematic literature review utilizing the ELR (Relevant Literary Space) method to select

and analyze the most significant scientific contributions; a comparative analysis of innovation strategies implemented by SMEs; and the statistical processing of data obtained from the Scopus database, which facilitated the generation of objective results and the formulation of conclusions grounded in scientific evidence.

As a general finding, the chapter concludes that innovation is an essential strategic factor for the sustainable growth of SMEs and for local and regional development in Latin America. Innovation clusters emerge as structures capable of strengthening business competitiveness, facilitating knowledge transfer, and stimulating the economic development of territories. Furthermore, it is shown that technological innovation represents the strategy with the greatest transformative potential, given its capacity to integrate with other forms of innovation and accelerate the digitalization of businesses. However, to maximize these benefits, it is crucial to strengthen public policies, facilitate access to financing, and consolidate the collaboration between universities, businesses, and the government. Finally, this chapter provides the theoretical, methodological, and conceptual foundation that underpins the design of the innovation model proposed in the thesis, justifying the need to develop tools that can strengthen innovation within SMEs and contribute effectively to local and regional development strategies in Latin America.

The primary objective of Chapter 2 was to analyze the influence of technological innovation on the productivity of small and medium-sized enterprises (SMEs) in Latin America, identifying the factors that foster or hinder innovation, as well as the varying effects of different innovation strategies on business performance. The chapter begins by acknowledging that low productivity is one of the main obstacles to economic growth in the region and that technological innovation serves as a strategic tool for enhancing business competitiveness and ensuring the sustainability of organizations in increasingly dynamic and digitized markets.

The research was conducted within a context marked by the acceleration of digital transformation particularly following the COVID-19 pandemic which compelled companies to adopt new technologies, implement remote work arrangements, and rethink their business models. Although 86% of Latin American SMEs recognize innovation as a key factor for overcoming crises and improving competitiveness, significant barriers persist related to financing, the availability of technology, the qualifications of human capital, and a lack of public policies aimed at strengthening innovation processes.

The first part of the chapter was dedicated to establishing a conceptual framework for technological innovation. It was defined as the introduction of changes based on scientific and technological knowledge that result in new products, services, or processes, or in significant improvements to existing ones, with the goal of increasing business competitiveness.

The theoretical review demonstrated that technological innovation is not limited to the adoption of equipment or digital tools; rather, it entails organizational transformations, shifts in business management, and strategies designed to capitalize on the opportunities presented by the technological environment. Various authors consulted agree that firms that develop internal innovation capabilities are better equipped to adapt to disruptive changes and sustain long-term competitive advantages.

Several factors have been identified that influence the capacity of SMEs to develop and implement technological innovation processes. Among the most significant are the availability of financial resources essential for funding research, development, and the acquisition of technology and the capacity to absorb knowledge, which determines a firm's ability to incorporate and leverage information and technologies from its external environment. Additionally, the level of preparedness of human capital is crucial for managing and adapting innovations to meet organizational needs. Access to advanced technologies is a key element for modernizing processes and enhancing business competitiveness, while an organization's capacity to manage innovation processes enables the effective coordination of resources and the transformation of technological initiatives into concrete outcomes. Finally, the existence of public support policies such as financing programs, tax incentives, training, and institutional strengthening plays a decisive role in fostering an environment conducive to innovation and the sustainable growth of SMEs.

The review also highlighted that, in developing countries such as those in Latin America the adoption and adaptation of external technologies serve as an important pathway for innovation, although the greatest benefits are typically realized when these technologies are combined with internal innovation capabilities.

A significant portion of this chapter was dedicated to examining the current status of Latin American SMEs regarding technological innovation and digitalization. According to data analyzed from the Global Innovation Index (WIPO) and various regional sources, there are approximately 16.3 million SMEs across the ten Latin American countries that rank highest in terms of innovation. Of these, 80.5% are micro-enterprises, 13.3% are small enterprises, and nearly 2% are medium-sized enterprises.

The findings reveal the existence of substantial technological gaps among Latin American SMEs. Data from the World Bank's Enterprise Surveys indicate that a significant proportion of these firms have yet to incorporate innovation processes into their operations. Among small businesses, 67.1% did not introduce process innovations, and 59.3% did not develop product or service innovations. Similar patterns were observed among medium-sized enterprises, where 57.5% did not implement process innovations, and 52.1% did not carry out product or service innovations. These results reflect the challenges many organizations face in incorporating innovation into their business strategy and improving their competitiveness in increasingly dynamic markets.

Furthermore, significant limitations were identified regarding the use of information and communication technologies. The analysis revealed that approximately 44% of small businesses do not have their own website, and 15% lack a corporate email address, a clear indication of low levels of digitalization. This situation restricts these firms' ability to communicate with customers and suppliers, expand their presence in national and international markets, and capitalize on the opportunities presented by digital transformation. Consequently, these shortcomings negatively affect productivity, competitiveness, and the potential for business growth in the region.

Based on this assessment, the hypotheses guiding the research were formulated. The first hypothesis (H0) posited that efforts toward technological innovation do not yield positive effects on business productivity. The second hypothesis (H1) proposed that different innovation strategies result in varying outcomes regarding the technological achievements of these firms. Finally, the third hypothesis (H2) stated that technological innovation has positive and distinct effects on the productivity of SMEs. These hypotheses served as the

foundation for an empirical evaluation of the impact of technological innovation on the performance and competitiveness of Latin American enterprises.

To test these hypotheses, the study employed the Crépon, Duguet, and Mairesse (CDM) methodology, a framework widely recognized in international literature for analyzing the relationship between innovation and business productivity. This approach allowed for an examination, from a microeconomic perspective, of how corporate investments in technological innovation activities translate into innovative outcomes and, subsequently, into productivity gains. The methodology was carried out in three stages. In the first stage, the factors influencing a firm's decision to invest in technological innovation were analyzed using econometric models, adjusted via the Heckman procedure to account for potential selection bias. In the second stage, the effect of these investments on the probability of introducing product and process innovations was studied, using bivariate Probit models that allowed for the simultaneous evaluation of both types of innovation. Finally, in the third stage, the impact of technological innovation on firm labor productivity measured as the logarithm of sales per employee was examined using ordinary least squares (OLS) estimation.

The empirical analysis was based on data from three major international sources: the World Bank’s Enterprise Surveys, the *Statistical Yearbook of Latin America and the Caribbean*, and the Global Innovation Index. Initially, the dataset comprised 6,275 Latin American SMEs from the manufacturing, services, commerce, and mining and extraction sectors. However, because the research focused exclusively on firms engaged in innovation activities, the final sample consisted of 2,569 SMEs, representing 41.5% of the total number of firms analyzed. Based on this, inferential statistical techniques were applied to validate the formulated hypotheses and determine whether significant relationships exist between technological innovation and firm productivity, thereby providing robust empirical evidence to support the study’s conclusions.

The results obtained from applying this methodology demonstrate that technological innovation is closely linked to the structural characteristics of firms and their productive performance. In the first stage of the analysis, it was found that SMEs with a higher likelihood of investing in innovation activities are those that are larger in size, have foreign capital participation, invest more heavily in fixed capital, possess prior experience in innovation, and operate in more competitive markets. Furthermore, it was shown that foreign ownership and capital intensity have a positive influence on both endogenous and exogenous innovation, while public and bank financing serve as key determinants in the decision to undertake innovation activities.

In the second stage, which focused on evaluating the relationship between investment in innovation and the technological outcomes achieved, it was observed that greater investment effort significantly increases the probability of a firm introducing technological innovations. The results indicated that endogenous innovation has a stronger effect on the generation of technological innovations than exogenous innovation, although both contribute positively to achieving innovative outcomes. It was also found that these strategies have a more significant impact on process innovations than on product innovations, thereby confirming hypothesis H1, which posits that different innovation strategies have distinct effects on the technological outcomes of SMEs.

Finally, the third stage analyzed the effects of technological innovation on firm labor productivity. The evidence revealed that process innovations lead to significant gains in productivity, whereas product innovations showed no statistically significant effects during the period under analysis. Additionally, it was determined that both endogenous and exogenous innovation contribute positively to firm performance;

however, endogenous innovation had a substantially greater impact on labor productivity and organizational competitiveness. These results validated hypothesis H2 and confirmed that technological innovation has positive and distinct effects on the productivity of Latin American SMEs. In particular, they highlight the importance of strengthening internal innovation capabilities as a pathway toward sustainable growth and greater business competitiveness.

One of the most significant contributions of this chapter lies in the distinction between endogenous and exogenous innovation, two approaches that provide a deeper understanding of how SMEs generate and leverage knowledge to improve their performance. Endogenous innovation refers to activities carried out within the organization itself, such as research and development (R&D), staff training, industrial design, market research, and the strengthening of organizational capabilities. Exogenous innovation, by contrast, involves incorporating resources and knowledge from the external environment for instance, through the acquisition of machinery and equipment, specialized software, consulting services, technology transfer processes, and the hiring of specialized technical services. The findings demonstrate that both strategies are complementary and contribute positively to the innovation process; however, endogenous innovation is more effective at driving productivity and business competitiveness, as it builds lasting internal capabilities, fosters organizational learning, and creates sustainable competitive advantages. Furthermore, the study found that process innovations have a more immediate impact on labor productivity by enhancing operational efficiency and reducing costs. Product innovations, conversely, typically require a longer timeframe to translate into tangible economic benefits, as they depend on factors such as market acceptance, commercialization, and the successful development of new business opportunities.

It has been demonstrated that technological innovation is a decisive factor for the economic growth, productivity, and competitiveness of Latin American SMEs. The results show that companies that incorporate technological innovation processes are able to increase labor productivity, reduce operating costs, improve the quality of their products and services, strengthen their digitalization processes, and enhance their ability to enter national and international markets. Furthermore, the adoption of innovative technologies fosters greater business competitiveness, enabling organizations to respond more rapidly to environmental demands and generate sustainable advantages over their competitors. However, the study also identified various economic and financial barriers that limit the development of these innovative processes—most notably, insufficient access to financing, high costs associated with technological investment, a shortage of specialized personnel, deficiencies in digital infrastructure, and weak institutional and governmental support. These limitations hinder the ability of SMEs to innovate systematically; therefore, it is necessary to strengthen financing, training, and public support mechanisms to fully leverage the economic and financial benefits derived from technological innovation.

The chapter concludes that technological innovation is an essential condition for improving the productivity and competitiveness of SMEs in Latin America. The findings led to the rejection of the null hypothesis (H0) and the acceptance of hypotheses H1 and H2, demonstrating that innovation efforts have a positive impact on business performance, an impact that varies depending on the type of strategy implemented. The primary conclusion of this part of the research is that endogenous innovation yields greater economic and productive benefits than exogenous innovation, as it strengthens internal capabilities and fosters sustainable competitive advantages. Additionally, process innovation was found to have a significantly greater impact on labor

productivity compared to product innovation. Finally, it is recommended that public policies aimed at business development should not be limited to providing financing for the acquisition of technology; rather, they should also promote the development of internal innovation capabilities, the strengthening of human capital, investment in research and development, and the consolidation of digitized business ecosystems capable of sustaining the long-term growth of small and medium-sized enterprises (SMEs).

The primary objective of Chapter 3 was to analyze the relationship between technological innovation and the productivity of small and medium-sized enterprises (SMEs) in the municipality of Mayarí, Cuba, a context characterized by a low-income economy heavily influenced by institutional, financial, and technological factors. Unlike studies conducted in countries with well-established innovation systems, this research focused on a setting where innovation depends not only on research and development activities but also on the ability of firms to learn, adapt, and make the most of limited resources.

This chapter begins with the premise that innovation is an essential element for increasing business productivity, fostering local development, and strengthening territorial competitiveness. However, it acknowledges that in Cuba, there are numerous constraints linked to the economic embargo, limited access to financing, technological shortcomings, and the specificities of the country's economic model that shape the innovation performance of SMEs. As part of the contextual analysis, the chapter examines the recent evolution of Cuban SMEs following the enactment of Decree-Law 46 in September 2021, which provided a legal framework for the creation and operation of micro, small, and medium-sized enterprises in Cuba. This reform marked a significant shift within the country's economic modernization process, allowing for greater private-sector participation in production and service activities.

The study reveals that SMEs have become increasingly important to the national economy, contributing to job creation, the production of goods and services, and the revitalization of local economies. Nevertheless, their development has been slower than anticipated due to structural and regulatory limitations that restrict access to financing, foreign investment, technology, and international markets. The analysis also shows that most Cuban SMEs are concentrated in sectors such as food production and commercialization, manufacturing, services, information technology, repairs, and construction. Geographically, Havana, Granma, Villa Clara, and Holguín are among the provinces with the highest concentration of these economic entities.

The analysis identifies several challenges that hinder the development of business innovation within Cuban SMEs. Key barriers include restrictions on accessing foreign capital, a scarcity of funding sources, technological limitations, and an insufficient supply of the inputs necessary for production. Added to this are the difficulties in entering international markets, the existence of complex bureaucratic processes that slow down business operations, the impact of the U.S. economic embargo on access to resources, technologies, and markets, as well as the still-limited coordination among universities, businesses, and local governments to promote knowledge transfer and innovation. These constraints limit the ability of SMEs to modernize their production processes, adopt new technologies, and strengthen their competitiveness. Nevertheless, despite these existing challenges, SMEs have managed to establish themselves as a significant player within the Cuban economy, contributing substantially to job creation, the diversification of the productive landscape, and the advancement of local development initiatives that foster economic and social growth in their respective territories.

A significant portion of the chapter was dedicated to the conceptual analysis of innovation in low-income countries, particularly within the Cuban context. The literature review revealed that in such economies, innovation often manifests differently than it does in developed nations. While innovation in developed countries is predominantly driven by research and development (R&D), economies like Cuba's more frequently rely on the adoption, adaptation, and improvement of existing technologies, as well as innovations in organizational, commercial, and management practices. The authors consulted agree that financial constraints, infrastructure limitations, and restricted access to international markets compel firms to develop more flexible forms of innovation tailored to their specific realities. In this context, concepts such as inclusive, frugal, open, and learning-based innovation alongside technological adaptation take on particular importance. Furthermore, the theoretical framework highlights that entrepreneurial capacity, accumulated knowledge, and engagement with other actors within the innovation system are fundamental factors for overcoming the structural limitations inherent in emerging economies.

To assess the relationship between innovation and the productivity of SMEs in Mayarí, the structural model developed by Crépon, Duguet, and Mairesse (CDM) one of the most widely recognized and internationally utilized methodologies for studying business innovation, was adapted. This model enabled a comprehensive analysis of the factors influencing the generation of innovation within firms, distinguishing between technological and non-technological innovation while simultaneously evaluating the impact of each on business productivity. Additionally, it allowed for an examination of the differences between formal and informal enterprises, a particularly relevant aspect in the Cuban economic context, where both types of organizations coexist and play a significant role in local productive activity. The research also incorporated a set of explanatory variables related to the entrepreneurial spirit of managers, the level of human capital available within the firm, the degree of formalization, access to financing sources, participation in clusters or cooperation networks, the level of market competition, and the geographical location of the firms. These variables provided a more precise understanding of the factors that either foster or constrain innovation processes and their impact on productive performance. To ensure the robustness of the results and address potential endogeneity issues between innovation and productivity, the study employed econometric models specifically Probit and Bivariate Probit as well as Two-Stage Least Squares (2SLS) estimation, using access to subsidized credit and various indicators of entrepreneurial capabilities as instrumental variables. This methodological approach yielded more consistent estimates and a better understanding of the role that innovation plays in the growth and productivity of SMEs in the municipality of Mayarí.

The research was conducted through a survey of 50 manufacturing enterprises in the municipality of Mayarí during September 2024, with the support of the Municipal Government's Department of Local Development. The sample consisted of 25 formal and 25 informal enterprises, allowing for a balanced comparison between both types of organizations. The surveyed enterprises primarily belonged to sectors strategic to the local economy, such as food production and processing, urban agriculture, food service, textile manufacturing, carpentry, and artisanal production. Data collection was carried out via structured, in-person interviews, which yielded detailed information on the innovative activities implemented by these enterprises between 2020 and 2023.

The descriptive results revealed a significant presence of innovative activities within the business landscape of Mayarí. It was found that 78% of the enterprises had developed some form of innovation during the analyzed

period; specifically, 70% implemented technological innovations, while 40% introduced non-technological innovations, primarily related to management and marketing. Furthermore, 63% of the enterprises were part of a business cluster or cooperation network, and 69% operated mainly within local markets, reflecting a strong connection to the territory. However, only 5% of the enterprises had access to subsidized loans, highlighting the financial constraints that hinder innovation processes. Additionally, it was observed that formal enterprises exhibited higher levels of productivity, larger business scale, greater access to specialized human capital, and more intensive innovative activity compared to informal enterprises confirming the positive influence of formalization on both innovative capacity and business performance. The results obtained from applying the model demonstrated that the innovative capacity of SMEs in Mayarí is conditioned by various internal and external factors. In the first stage of the analysis, it was found that variables such as business formality, entrepreneurial spirit, the availability of qualified employees, participation in clusters, access to subsidized financing, market competition, and a favorable geographical location exert a positive and significant influence on innovation. Among the most notable findings is that formal businesses are more likely to introduce technological innovations compared to informal ones, primarily due to their better access to resources, knowledge, and institutional support. However, regarding non-technological innovations related to management and marketing practices the differences between formal and informal businesses were less significant. Furthermore, entrepreneurial spirit was identified as one of the most decisive factors in the innovation process, demonstrating that entrepreneurial capabilities play a fundamental role in contexts where financial and technological resources are limited.

In the second stage of the research, a positive relationship was confirmed between innovation and business productivity. Econometric estimates demonstrated that firms with higher levels of innovation achieve better results in terms of labor productivity, thereby validating the strategic importance of innovation for business growth. The findings revealed that technological innovation has a greater impact than non-technological innovation, particularly when firms implement improvements to their products and production processes. Specifically, it was estimated that firms increasing their innovation activities from medium to high levels could boost their labor productivity by approximately 11.7%. Furthermore, technological innovations generate productivity gains of nearly 14%, while non-technological innovations yield improvements of around 7%. These results highlight that, although both types contribute positively to business performance, technological innovation serves as the primary driver of productivity and competitiveness for SMEs underscoring the need to promote policies and strategies that foster its adoption and development within the Cuban economic context.

One of the most significant contributions of this chapter was the analysis of how business formality influences innovation and productivity among SMEs in Mayarí. The results showed that formal firms exhibit higher levels of innovation, achieve greater productivity, and are better able to leverage the benefits of technological innovation compared to informal firms. This advantage is primarily linked to better access to financing, technologies, cooperation networks, and institutional support mechanisms. Conversely, informal firms tend to focus their activities on local markets and face greater challenges in accessing financial resources, technological equipment, and expansion opportunities. Nevertheless, the research also indicated that these firms frequently develop organizational and managerial innovations, demonstrating a notable capacity to adapt to the economic and structural constraints of their environment. Overall, the results support the idea that business formalization is a strategic factor for strengthening the innovative capacity of organizations,

increasing their productivity, and facilitating their integration into more sustainable and competitive economic growth dynamics.

The study demonstrated that technological innovation has a direct and significant impact on the economic development of the municipality of Mayarí and on the sustainability of Cuban SMEs. Key benefits identified include increased labor productivity, improved operational efficiency, reduced production costs, higher quality of products and services offered, strengthened business competitiveness, the creation of local employment, and contributions to territorial development. These findings show that the incorporation of technologies, the modernization of production processes, and the adoption of innovative practices are essential tools for improving business performance and fostering economic growth within territories.

However, the research also identified significant financial and structural constraints that limit the development of innovation processes within SMEs in Mayarí. Key challenges include limited access to credit, a scarcity of foreign investment, restricted access to advanced technologies, inadequate digital infrastructure, existing regulatory hurdles, and the effects of the economic embargo. These conditions hinder the ability of firms to invest in innovation, adopt new technologies, and expand their operations, thereby limiting their potential for growth, competitiveness, and business consolidation. Consequently, it is essential to strengthen financing mechanisms, foster more favorable regulatory environments, and broaden access to technological resources all of which would bolster the innovation process and contribute more effectively to local and national economic development.

The chapter concludes that innovation is the primary driver of labor productivity for SMEs in Mayarí, regardless of their level of formality. Nevertheless, formal enterprises derive greater productivity gains from innovation particularly through the adoption of technological innovations. The findings indicate that technological innovation has a more significant impact than non-technological innovation, and that factors such as entrepreneurship, human capital, cluster participation, market competition, and access to financing play a crucial role in facilitating innovation processes.

Furthermore, it was established that innovation is not merely a byproduct of economic development, but rather a fundamental mechanism for achieving it especially in low-income economies like Cuba’s. Therefore, it is recommended that public policies be strengthened to facilitate access to financing, promote digitalization, develop business capabilities, encourage cooperation among firms, universities, and local governments, and foster the creation of innovation ecosystems that enable SMEs to serve as effective engines for local and territorial development.

Chapter 4 focused on analyzing the impact of technological investment on the economic growth of Latin American countries, employing the Generalized Method of Moments (GMM) methodology. This research begins by recognizing the importance of technology as a driver of economic development, as it contributes to increased productivity, innovation, and the competitiveness of economies. However, despite the progress made in the region regarding digitalization and technological modernization, Latin America continues to face significant challenges related to insufficient investment in technological infrastructure, research and development (R&D), human capital formation, and institutional strengthening.

This chapter addresses a critical issue, as numerous studies have demonstrated the positive influence of technological innovation on economic growth in both developed and emerging economies. Nevertheless, there is limited empirical evidence regarding how technological investment directly impacts the growth of the Gross Domestic Product (GDP) in Latin American countries, particularly when accounting for their specific structural, institutional, and macroeconomic characteristics. In this context, the research seeks to determine whether technological investment truly acts as a driver of economic growth in the region, or if other factors condition its effectiveness. The theoretical review presented in this chapter highlights that technology occupies a central role in modern theories of economic growth. Endogenous growth models argue that the accumulation of knowledge, innovation, and technological progress expand an economy's production possibilities and sustain long-term productivity gains.

Various international studies have shown that variables associated with technological development such as investment in research and development, patents, trademarks, and information and communication technologies (ICT) have positive effects on the economic growth and competitiveness of nations. Research conducted by organizations such as ECLAC (CEPAL) indicates that investment in ICT has contributed significantly to GDP growth in countries like Brazil, Chile, Argentina, and Mexico. However, it is also recognized that technological investment alone does not guarantee positive outcomes; it must be accompanied by appropriate institutional, educational, and productive conditions that enable the efficient absorption and utilization of such technologies.

Specialized literature further notes that Latin American countries face significant structural limitations that hinder the translation of technological investment into sustained economic growth. Key among these limitations are low investment in human capital, governance issues, institutional deficiencies, low productivity, and a lack of sufficient integration between innovation systems and productive sectors. To evaluate the relationship between technological investment and economic growth, a dynamic panel data econometric model was employed, using the Generalized Method of Moments (GMM) , a tool considered highly robust for analyzing complex economic relationships characterized by endogeneity.

Initially, a methodological review of static panel data models including fixed-effects and random-effects models was conducted. Subsequently, statistical tests, such as the Hausman test and the Hansen test, demonstrated the need for a dynamic model capable of adequately controlling for the endogeneity present among the variables. Consequently, the Arellano-Bover/Blundell-Bond System GMM was selected, given its ability to handle unbalanced panels, account for autocorrelation, and utilize lagged variables as instruments. This methodology allowed for a more precise estimation of the impact of technological investment on GDP growth, while simultaneously controlling for the influence of other macroeconomic factors. The research was based on a panel dataset comprising information from ten Latin American countries over a ten-year period, drawing primarily from the statistical records of the United Nations Conference on Trade and Development (UNCTAD). To assess the relationship between technological investment and economic growth, the study incorporated variables such as the annual growth of the Gross Domestic Product (GDP), a technological investment index, the real interest rate, inflation, the unemployment rate, and various macroeconomic control variables. Given that technological investment was represented by several highly correlated indicators, a factor analysis using principal components was applied to construct a single index that synthesizes the available information and mitigates potential multicollinearity issues. The consistency and validity of this index were

verified using the Kaiser-Meyer-Olkin (KMO) statistic and other tests of factor consistency. Subsequently, a descriptive analysis of the variables was conducted, and the Levin, Lin, and Chu unit root test was applied to assess the stationarity of the panel data. The results confirmed that the analyzed series were stationary, thereby ensuring the statistical validity of the subsequent econometric estimates and providing methodological robustness to the analysis of the relationship between technological investment and economic growth in Latin America.

The results obtained through the estimation of the GMM model yielded findings of great relevance for understanding the relationship between technological investment and economic growth in Latin America. Contrary to the premise held by a significant portion of traditional economic theory which associates higher levels of technological investment with sustained increases in economic growth this research revealed a negative or statistically insignificant relationship between the two variables in most of the countries analyzed. The estimated coefficients were negative, particularly for Argentina, Brazil, Chile, Colombia, Cuba, and Ecuador; this suggests that an increase in technological investment does not necessarily lead to higher Gross Domestic Product (GDP) growth rates in the short term. In some instances, higher levels of technological investment were even associated with lower economic growth rates, reflecting potential challenges related to technological absorption capacity, structural economic limitations, and a lack of effective integration between technological investment and the productive system.

Among the key findings, it is notable that technological investment yielded significant negative coefficients in most of the countries studied, with the effects being most pronounced in Argentina, Brazil, and Chile. Cuba also exhibited a negative relationship between technological investment and economic growth. Similarly, macroeconomic variables such as inflation and unemployment showed significant negative impacts on GDP growth, confirming that economic instability remains a major obstacle to the region's development. Conversely, the real interest rate showed positive effects in several countries notably Brazil, Colombia, and Mexico suggesting that more robust financial systems can facilitate better resource allocation and foster productive investment. Furthermore, the research identified a phenomenon of economic convergence consistent with neoclassical growth theory, which posits that economies starting from lower levels of development tend to experience relatively higher growth rates, gradually narrowing the gap with more advanced economies. These results demonstrate that while technology is necessary for development, it requires complementary conditions such as skilled human capital, adequate infrastructure, macroeconomic stability, and effective public policies to translate into sustainable economic growth.

One of the most significant contributions of this chapter is the demonstration that technological investment, on its own, does not guarantee higher levels of economic growth. The findings suggest that the effectiveness of such investment depends on a range of complementary factors that enable the proper utilization of the technologies being adopted. Key among these factors are the quality of human capital, the population's educational level, the technological absorption capacity of firms, the quality of institutions, the availability of productive infrastructure, the implementation of public policies that foster innovation, and macroeconomic stability. In the absence of these conditions, technological investment can become a substantial expense that fails to translate into productivity gains or long-term, sustainable economic growth.

The research also highlights that many Latin American countries face significant challenges in efficiently integrating new technologies into their production systems, a phenomenon known as "technological absorption capacity." This limitation substantially diminishes the potential benefits of technology-related investments, as firms and organizations often lack the necessary capabilities to fully utilize, adapt, and leverage such advancements. Furthermore, it was observed that a large share of technological investment in the region is tied to the importation of equipment, software, and technologies developed abroad, without a corresponding strengthening of local innovation, research, and development capabilities. This creates a technological dependency that constrains the generation of domestic value-added and reduces the positive impact these investments could otherwise have on the economic growth and competitiveness of Latin American nations.

A key methodological aspect of this chapter was the rigorous validation of the econometric model employed, ensuring the reliability and consistency of the results. Various statistical tests confirmed the absence of significant residual endogeneity, the validity and appropriateness of the instruments used for estimation, and the statistical independence of the residuals thereby satisfying the fundamental assumptions required by the GMM (Generalized Method of Moments) methodology. Additionally, the results demonstrated that the model possesses adequate predictive power to explain the relationship between technological investment and economic growth in the countries analyzed. Specifically, the Hansen, Sargan, and second-order autocorrelation (AR(2)) tests yielded satisfactory results, confirming the robustness and stability of the estimates. Consequently, it can be concluded that the findings are statistically valid and provide solid empirical evidence for analyzing the dynamics of technological investment and its impact on economic growth in Latin America, thereby reinforcing the credibility of the research conclusions. From an economic and financial perspective, the findings in this chapter have significant implications for the design of public policies and development strategies in Latin America. The research demonstrates that investment in technology should not be viewed as an isolated solution for driving economic growth; rather, it must be part of a comprehensive development strategy that incorporates other essential elements to maximize its effectiveness. Key among these are strengthening the educational system, developing specialized human capital, building modern digital infrastructure, ensuring macroeconomic stability, bolstering institutions, fostering local innovation, and consistently increasing investment in research and development (R&D). The combination of these factors creates the necessary conditions for technologies to be absorbed, adapted, and efficiently utilized within national productive systems. Furthermore, the results confirm that variables such as inflation and unemployment remain major obstacles to the region’s economic growth, as they hinder investment, reduce productivity, and limit the capacity to generate added value. Consequently, there is a clear need to implement policies focused on economic stability, the creation of quality jobs, and the strengthening of technological and productive capabilities all with the goal of transforming technological investment into a genuine engine for sustainable development and regional competitiveness.

The chapter concludes that, in general terms, technological investment has not generated the expected positive impact on the economic growth of Latin American countries during the period analyzed. The results obtained using the GMM model show that, in most cases, the relationship between technological investment and GDP growth is either negative or statistically weak. This necessitates a rethinking of the traditional view that greater technological investment automatically leads to higher economic growth; it further demonstrates that while technology is a necessary condition for driving economic development, it is not a sufficient one. Its

effectiveness depends on the presence of institutional, educational, productive, and technological capabilities that allow for the proper utilization of the investments made. Furthermore, factors such as inflation, unemployment, and the structural weaknesses of Latin American economies continue to limit their growth potential. Therefore, the chapter's primary contribution lies in demonstrating that technology-based development strategies must be accompanied by profound transformations in education, innovation, infrastructure, and political and institutional stability, so that technological investment can truly become an effective lever for sustainable economic growth in Latin America.

Chapter 5 serves as the thesis's integrative proposal, with the primary objective of designing a technological innovation model aimed at strengthening the competitiveness, productivity, and sustainability of small and medium-sized enterprises (SMEs) in Latin America. The need for this model arises from the findings in previous chapters, which revealed that Latin American SMEs face significant constraints regarding access to financing, technology adoption, digitalization, human capital development, and innovation capacity.

Addressing these challenges, the chapter proposes a comprehensive model called LATINNOVA, conceived as a strategic tool to facilitate digital transformation and business innovation among SMEs in the region. The model seeks to overcome the limitations of traditional approaches by integrating various dimensions of technological innovation and adapting them to the specific economic, social, and institutional conditions that characterize Latin America. The design of the model was based on an exhaustive review of the scientific literature on technological innovation, business competitiveness, and regional development. Methodologically, a conceptual design approach was employed, drawing on deductive analysis, theoretical comparisons of innovation models, and a synthesis of findings from the bibliometric component of the research.

Through this theoretical review and comparative analysis, key factors influencing business innovation were identified. These incorporate insights from several widely recognized theoretical frameworks, including the Triple Helix model which promotes interaction among universities, businesses, and the state the Innovation Clusters theory focused on cooperation and collective learning Open Innovation based on the exchange of knowledge among various stakeholders Innovation Ecosystems which emphasize the importance of collaborative networks and innovation approaches rooted in digital transformation. Building on these foundations, the LATINNOVA model was developed, offering a more flexible perspective tailored to the realities of Latin American SMEs. Its primary theoretical contribution lies in positioning the firm as the central axis of the innovation process, with digital technology serving as a cross-cutting element that integrates the various dimensions of innovation. In this way, the model moves beyond traditional approaches which rely exclusively on institutional or territorial structures by incorporating digital collaboration, technological platforms, and virtual networks as essential mechanisms for the generation and dissemination of knowledge. Furthermore, the model acknowledges the structural limitations faced by SMEs in the region such as financing constraints, low levels of technological training, and the need for affordable, scalable solutions and was therefore designed to be flexible, replicable, and adaptable to the diverse economic, productive, and business contexts found across Latin America.

The primary outcome of this chapter was the design of the LATINNOVA model (Technological Innovation Model for Latin American SMEs), conceived as a comprehensive tool to drive business transformation through the strategic incorporation of technological innovation. The model is structured around five fundamental

components that interact in a complementary manner to strengthen the competitiveness, productivity, and sustainability of SMEs. First, it addresses technological innovation within business models, promoting the use of technologies such as cloud computing, automated marketing, digital commercialization platforms, the Internet of Things (IoT), and service automation, with the goal of creating more flexible, scalable, and customer-oriented business models. Furthermore, it incorporates technological innovation into products through tools such as augmented reality, artificial intelligence, predictive analytics, 3D printing, and blockchain technology, which enable the development of products and services with greater added value and the capacity to adapt to new market demands.

Likewise, the model integrates technological innovation into processes, aimed at optimizing operational efficiency through technologies such as robotic process automation (RPA), intelligent ERP and CRM systems, IoT sensors, data analytics, and artificial intelligence applied to business operations thereby contributing to cost reduction, quality improvement, and increased productivity. Additionally, it incorporates technology-enabled open innovation, fostering collaboration between SMEs and external stakeholders through crowdsourcing platforms, incubators, accelerators, innovation networks, collaborative platforms, and blockchain solutions that facilitate the secure exchange of knowledge and resources. Finally, the model acknowledges the significance of the internal and external business environment, accounting for the involvement of universities, local governments, chambers of commerce, financial institutions, international organizations, research centers, and business networks the interaction of which creates an ecosystem conducive to innovation, collaborative learning, and sustainable development. Overall, LATINNOVA proposes a systemic and integrative vision of technological innovation, capable of adapting to the specific conditions and needs of Latin American SMEs. To facilitate practical implementation, the LATINNOVA model incorporates a structured procedure consisting of five interrelated stages that allow for the systematic management of technological innovation processes within Latin American SMEs. The first stage, known as "initial diagnosis and assessment," aims to identify the company’s current status regarding its technological capabilities, level of digitalization, productivity, available resources, and strategic needs, utilizing tools such as SWOT analysis, interviews, questionnaires, and data analysis. Subsequently, in the "strategic planning" stage, priority areas for innovation, technologies to be implemented, strategic objectives, and performance indicators are established, drawing on methodologies such as the Business Model Canvas, process mapping, and planning diagrams. The third stage involves "technological application," where the selected technologies are effectively integrated through system installation, staff training, pilot testing, and the organizational adjustments necessary to ensure the success of the transformation process. Next, the "impact evaluation" stage allows for the measurement of achieved results using indicators related to productivity, costs, quality, customer satisfaction, and return on investment (ROI), thereby facilitating evidence-based decision-making. Finally, the "scalability and continuous improvement" stage seeks to ensure the sustainability of the innovation process by expanding the implemented technologies, establishing strategic alliances, maintaining ongoing technological monitoring, and strengthening continuous organizational learning. Together, these five stages provide a practical and flexible guide for SMEs to adopt technological innovation in a gradual, controlled manner that is aligned with their growth and competitiveness objectives.

One of the most significant methodological contributions of the LATINNOVA model is the incorporation of a comprehensive system of metrics and indicators that allows for the empirical validation of its implementation

and an objective assessment of the progress made by SMEs at each stage of the innovation process. During the diagnostic phase, indicators are proposed to measure the company's level of digitalization, its innovation capacity, its SWOT-based innovation index, and its degree of technological maturity, thereby establishing a baseline for decision-making. In the strategic planning phase, the model considers metrics related to investment in research and development (R&D), the alignment of innovation initiatives with business objectives, and staff participation in innovation projects. Meanwhile, the technology implementation stage evaluates aspects such as the percentage of automated processes, the time required to implement new technologies, the return on technological investment, and the level of adoption of the tools introduced.

Furthermore, the model includes impact indicators designed to measure outcomes in terms of labor productivity, sales growth derived from innovation, operational efficiency, customer satisfaction, and quality-related costs. Finally, the continuous improvement stage incorporates metrics to assess the sustainability and evolution of the innovation process such as the number of innovations implemented, the level of digital expansion achieved, an organizational sustainability index, and the Net Promoter Score (NPS), which measures customer loyalty and the likelihood of recommendations. The integration of these indicators makes the LATINNOVA model a practical, measurable, and verifiable tool, adaptable to various economic sectors; it facilitates the ongoing monitoring of progress and ensures that innovation management is evidence-based and results-oriented.

Applying the LATINNOVA model generates significant economic and financial benefits for Latin American SMEs by providing a structured methodology for incorporating technological innovation into their production and management activities. Among the primary expected impacts are an increase in business productivity through the optimization of processes and resources, a reduction in operating costs via the automation and digitalization of operations, improved organizational efficiency, and higher quality in the products and services offered. Furthermore, the model strengthens a company's ability to adapt to market dynamics, facilitates access to new domestic and international markets, boosts business competitiveness, and contributes to long-term organizational sustainability. From a financial perspective, LATINNOVA promotes more efficient use of available resources, improves the return on technology investments, and reduces the risks associated with decision-making based on limited or insufficient information. In addition, it fosters the creation of collaborative networks among companies, universities, financial institutions, and entrepreneurship support organizations facilitating access to financing, specialized knowledge, and opportunities for shared innovation thereby strengthening the growth and sustainable development capabilities of SMEs in Latin America.

The chapter concludes by proposing the LATINNOVA model, a comprehensive tool designed specifically to address the needs of Latin American SMEs. Unlike traditional models, this approach integrates technological, organizational, open, and strategic innovation within a systemic framework that acknowledges the region's structural limitations. It demonstrates that innovation must be approached as a continuous, multidimensional process capable of transforming products, processes, business models, and forms of collaboration. Furthermore, it highlights the importance of supporting technological adoption with training, financing, institutional cooperation, and mechanisms for ongoing evaluation.

Ultimately, the model makes an original contribution to the literature on business innovation by integrating the five most relevant innovation strategies identified through this research into a single, flexible, and adaptable

operational framework. Its implementation can serve as an effective tool for strengthening the competitiveness, productivity, and sustainable development of Latin American SMEs, thereby contributing significantly to economic growth and regional development across Latin America.

In summary, the primary objective of this thesis was to design a technological innovation model for Latin American SMEs, aimed at enhancing their productivity, competitiveness, and sustainability. This was based on an analysis of the relationship between innovation, business development, and economic growth within various Latin American contexts. To achieve this, the research was structured into five chapters, combining bibliometric, econometric, and conceptual design approaches. Initially, a bibliometric study on innovation, clusters, and local development was conducted, identifying innovation as the key factor linked to strengthening regional competitiveness, facilitating knowledge transfer, and driving economic growth. Subsequently, the relationship between technological innovation and productivity in Latin American SMEs was analyzed using the Crépon, Duguet, and Mairesse (CDM) methodology. The findings demonstrate that technological innovation particularly endogenous innovation and process innovation generates significant positive effects on business productivity. Furthermore, a specific study was conducted on SMEs in the municipality of Mayarí, Cuba, which revealed that more innovative firms exhibit higher levels of productivity. It was also found that factors such as business formality, human capital, entrepreneurship, access to financing, and participation in clusters significantly foster innovation. Additionally, by applying the Generalized Method of Moments (GMM) to a sample of ten Latin American countries, the study analyzed the influence of technological investment on GDP growth. The results indicate that technological investment alone does not guarantee greater economic growth; rather, it requires complementary conditions, specifically those related to the quality of human capital, macroeconomic stability, institutional frameworks, and technological absorptive capacity.

From a methodological standpoint, the research demonstrated the value of combining various scientific approaches to analyze a complex phenomenon such as technological innovation. The application of theoretical methods including document analysis, the historical-logical method, analysis-synthesis, and an inductive-deductive approach facilitated the construction of a solid conceptual foundation. Meanwhile, empirical methods such as bibliometric studies, knowledge network analysis (using VOSviewer), systematic literature reviews, CDM models, and GMM-based econometric estimations provided robust quantitative and empirical evidence to validate the proposed hypotheses. The results confirm that innovation is a key determinant of both firm-level productivity and economic development, though its impact is contingent upon various structural and contextual variables that influence its effectiveness.

The primary contribution of this thesis is the development of the LATINNOVA model (a Technological Innovation Model for Latin American SMEs). This integrative framework encompasses five fundamental dimensions: business model innovation, product innovation, process innovation, open innovation, and the internal and external business environment. The model also incorporates a comprehensive implementation process comprising diagnosis, strategic planning, technological application, impact assessment, and continuous improvement supported by an integrated system of indicators for the objective measurement of outcomes. From an economic and financial perspective, LATINNOVA offers significant potential to boost firm productivity, reduce operating costs, enhance organizational efficiency, improve the quality of products and services, facilitate access to new markets, and strengthen business sustainability. Furthermore, it promotes more efficient allocation of financial resources, increases the return on technological investments, and fosters

the creation of collaborative networks that improve access to financing, specialized knowledge, and opportunities for shared innovation. Consequently, the research concludes that technological innovation managed through a comprehensive approach tailored to the realities of Latin America serves as a strategic tool for fostering the sustainable growth of SMEs, strengthening regional competitiveness, and contributing to the economic and social development of Latin America.