

Technological Absorptive Capacity and Performance in Microenterprises: The Mediating Role of Product Innovation in Ecuador

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Abstract– *Technological innovation is a key driver of global competitiveness; however, in Latin America, limited evidence persists on how microenterprises transform external technological knowledge into innovation and business performance. This study analyzes the influence of technological absorptive capacity on the performance of microenterprises, considering the mediating role of product innovation. A quantitative approach was adopted, with a descriptive and correlational scope, using a cross-sectional design. Data were collected through an online survey administered to 110 Ecuadorian microenterprise owners, and the data were analyzed using partial least squares structural equation modeling (PLS-SEM). The results show that technological absorptive capacity positively influences both product innovation and business performance, while product innovation directly contributes to performance. Overall, the model demonstrates adequate explanatory and predictive power, providing relevant evidence for understanding innovation and performance processes in microenterprises in emerging economies.*

Keywords– *Technological absorptive capacity, Product innovation, Business performance, Microenterprises.*

I. INTRODUCTION

Technological innovation has increasingly been recognized as a central driver of both firm-level competitiveness and broader economic development on a global scale. In this regard, the Global Innovation Report [1] identifies and ranks the world's top one hundred innovation clusters based on three key indicators: Patent Cooperation Treaty (PCT) applications, scientific output measured through authorship in peer-reviewed publications, and the geographical concentration of venture capital investments. The report highlights that leading innovation ecosystems are concentrated in regions such as Shenzhen–Hong Kong–Guangzhou (China), Tokyo–Yokohama (Japan), and San José–San Francisco (United States), underscoring the strong interdependence between technological advancement, knowledge creation, and entrepreneurial dynamism.

Within the Latin American context, however, the presence of such innovation clusters remains comparatively limited. According to [1], São Paulo (Brazil) ranks 45th, while Mexico City occupies the 79th position. Although these rankings reflect notable progress, they simultaneously reveal persistent structural constraints in the region's innovation capacity. This issue is particularly salient given that microenterprises represent a cornerstone of the productive structure in Latin America, contributing significantly to

employment generation and economic activity. Despite their relevance, these firms face considerable challenges in systematically and strategically adopting technological solutions [2]; [3].

Extant literature has documented multiple barriers associated with technological implementation in microenterprises. For instance, [4] identifies implementation costs as the primary obstacle to technology adoption, as reported by 43% of respondents. Moreover, perceptions regarding the profitability of specific technological tools vary substantially: customer relationship management (CRM) systems are perceived as profitable by 30% of respondents, social media platforms by 35.9%, artificial intelligence by 24.7%, and cybersecurity solutions by 33.7% [4]. These findings suggest that, while the strategic value of technology is widely acknowledged, its adoption remains uneven and constrained by both financial and organizational limitations.

Similarly, [5] report that perceptions of technological innovation are relatively high in terms of adoption (54.29%), yet resistance to change remains substantial (41.43%), constituting a critical barrier to competitiveness. Furthermore, marketing capabilities are positively evaluated by 47% of respondents, being regarded as a key mechanism for enhancing market participation [5]. These insights indicate that technological innovation is not solely contingent upon access to tools, but also on the organizational ability to assimilate and leverage technological knowledge within strategic and commercial processes.

From a strategic standpoint, prior research emphasizes that technological innovation serves as a fundamental source of competitive advantage [6], reinforcing the notion that firms capable of effectively leveraging innovation can strengthen their market positioning. Nevertheless, the manner in which microenterprises operationalize innovation varies considerably. In a study involving 105 micro and small enterprises, [7] find that 88% use the internet, 70% rely on digital marketing tools, and approximately 80% report increased sales attributable to social media usage. These findings highlight the transformative potential of digital technologies in enhancing business performance.

In addition, [8] identify multiple forms of innovation implemented by microentrepreneurs, with product innovation accounting for 32%, followed by marketing innovation (31%), process innovation (28%), and organizational innovation

(22%). This distribution suggests that product innovation constitutes a primary pathway through which microenterprises seek to improve their competitive position. However, empirical evidence is not entirely consistent across contexts. For example, [9] report that innovation and creativity are not perceived as significant drivers by respondents, whereas training and strategic management emerge as more influential determinants of performance.

Despite these contributions, the existing body of literature reveals a critical gap in understanding how microenterprises transform external technological knowledge into tangible innovation outcomes and, subsequently, into enhanced firm performance. In particular, there is a scarcity of empirical studies that simultaneously examine technological absorptive capacity, product innovation, and business performance within microenterprises, especially in the Latin American context.

Addressing this gap, the present study aims to examine the impact of technological absorptive capacity on microenterprise performance, incorporating product innovation as a mediating mechanism. By doing so, this research seeks to provide robust empirical evidence that advances current understanding in the fields of entrepreneurship and innovation, while offering relevant managerial and policy implications.

II. LITERATURE REVIEW

A. *Technological absorptive capacity, product innovation, and microenterprise performance*

Technological absorptive capacity refers to a firm's ability to identify, assimilate, and apply external technological knowledge for strategic purposes, thereby constituting a key organizational resource for competitiveness [10]. In the context of microenterprises, this capability is particularly relevant, as these firms often lack formal R&D structures and rely largely on external sources of knowledge to innovate [11]. Product innovation, in turn, is understood as the introduction of new or significantly improved goods or services that enable firms to respond more effectively to market needs [12]. Microenterprise performance reflects the firm's ability to achieve positive outcomes in terms of growth, positioning, and long-term sustainability [13]. Accordingly, the literature recognizes that the interplay among technological knowledge, innovation, and performance represents a central pillar for microenterprise survival.

From a theoretical perspective, the relationship between technological absorptive capacity and product innovation rests on the premise that firms capable of internalizing external knowledge are more likely to transform such knowledge into innovative solutions [14]. In microenterprises, this relationship becomes even more salient, as technological information acquired from suppliers, customers, or business networks may help compensate for internal resource constraints [15]. Moreover, the effective assimilation and application of this knowledge facilitates the adaptation of existing products and

the development of new value propositions. Thus, absorptive capacity operates not only as a mechanism of organizational learning but also as a direct driver of product innovation [17]. Therefore, higher levels of technological absorptive capacity are expected to significantly foster product innovation in microenterprises.

The relationship between technological absorptive capacity and microenterprise performance can be theoretically explained by these firms' ability to convert knowledge into sustainable competitive advantages [18]. When microenterprises develop capabilities to acquire and apply technological knowledge, they improve operational efficiency, market responsiveness, and strategic decision-making [19]. Likewise, the adoption of appropriate technologies contributes to process optimization, cost reduction, and the strengthening of the value proposition offered to customers [20]. In this sense, absorptive capacity functions as a strategic resource that directly affects business performance, even in the absence of explicitly radical innovations. Consequently, from a theoretical standpoint, greater technological absorptive capacity is expected to positively influence microenterprise performance.

H1. Technological absorptive capacity positively influences product innovation in microenterprises.

H2. Technological absorptive capacity positively influences microenterprise performance.

B. *Product innovation and microenterprise performance*

Product innovation represents a strategic mechanism through which microenterprises can differentiate their offerings and respond more effectively to market dynamics [21]. In highly competitive environments, the introduction of new or improved products enables microenterprises to attract consumer attention, strengthen market positioning, and generate greater perceived value [22]. Product innovation also facilitates adaptation to changes in customer preferences and emerging environmental demands, which is especially relevant for resource-constrained organizations [23]. In this context, the ability to adjust product features, functionalities, or presentations contributes to improving both commercial and operational performance. Therefore, product innovation emerges as a key factor that directly affects microenterprises' ability to sustain and enhance their performance.

From a theoretical perspective, the relationship between product innovation and microenterprise performance is explained by these firms' ability to translate improvements in their offerings into economic and competitive outcomes [24]. Product innovation may lead to higher sales, stronger customer loyalty, and expanded market share, even in contexts characterized by high uncertainty [25]. Furthermore, the continuous renewal of offerings enables microenterprises to reduce product obsolescence and remain relevant when competing against larger firms [26]. Accordingly, product innovation functions not only as a tool for differentiation but also as a driver of business performance. Therefore, higher levels of product innovation are expected to positively influence microenterprise performance.

H3:Product innovation positively influences microenterprise performance.

III. METHODOLOGY

This study adopted a quantitative approach with a descriptive and correlational scope, aimed at examining the proposed relationships among technological absorptive capacity, product innovation, and performance in Ecuadorian microenterprises. A cross-sectional research design was employed, with data collected at a single point in time through a structured questionnaire administered to microenterprise owners.

Data analysis was conducted using partial least squares structural equation modeling (PLS-SEM) with SmartPLS, given its suitability for estimating predictive relationships in moderate sample sizes and models involving latent variables [27]. First, the measurement model was assessed based on reliability and validity criteria. Subsequently, the structural model was estimated to test the proposed hypotheses.

In Ecuador, microenterprises constitute the core of the productive sector and represent a major source of employment, accounting for more than 90% of all economic units [28]. Consistent with this context, the target population of the study comprised 110 owners of Ecuadorian microenterprises, selected through non-probability convenience sampling based on accessibility and willingness to participate.

For the development of the research instrument, a structured questionnaire was designed using validated scales from prior studies, adapted to the constructs under analysis: technological absorptive capacity [29]; [30], product innovation [31]; [32], and microenterprise performance [33]; [34]. The survey was administered online through Google Forms, yielding 110 valid responses for statistical analysis.

A. Sample description

The sample profile reflects a predominantly operational and commercial orientation. Regarding educational attainment, secondary education was the most common level (43.6%), followed by university education (27.3%), while postgraduate education accounted for 11.8%. This distribution suggests heterogeneity in the technical capabilities available for managing innovation.

In terms of business experience, most respondents reported between one and three years of experience (37.3%) or less than one year (31.8%), indicating that the sample is largely composed of relatively young microenterprises. By sector, commerce predominated (60%), followed by services (22.7%). Regarding technology adoption, the most widely used tools were social media (72.7%) and digital marketing (58.2%), whereas management systems (30.9%) and e-commerce platforms (26.3%) showed lower levels of penetration.

TABLE I
SAMPLE CHARACTERIZATION

Education	N	%
Primary education	10	9,1
Secondary education	48	43,6
Technical/Vocational education	9	8,2
University education	30	27,3
Postgraduate education	13	11,8
Years of experience	N	%
Less than 1 year	35	31,8
1–3 years	41	37,3
4–6 years	21	19,1
More than 6 years	13	11,8
Business sector	N	%
Commerce	66	60
Services	25	22,7
Production/Manufacturing	13	11,8
Agro-industry	6	5,5
Technology adoption	N	%
Social media	80	72,7
Digital marketing tools	64	58,2
Management systems (CRM, ERP)	34	30,9
E-commerce platforms	29	26,3
None	10	9,1

Note. The data were obtained from a survey conducted among microenterprise owners in Ecuador.

B. Measurement model assessment: Construct reliability and validity

To rigorously support the proposed model under the PLS-SEM approach, methodological literature consistently emphasizes that the analysis should begin with the assessment of the measurement model, as the quality of the structural model estimates depends directly on the reliability and validity of the latent constructs. In this regard, outer loadings and their statistical significance were examined, along with Cronbach's alpha, composite reliability (ρ_A and ρ_C), and average variance extracted (AVE), following widely accepted criteria in empirical research based on PLS-SEM [27].

As shown in Table 2, the evidence robustly supports both the reliability and convergent validity of the constructs. First, outer loadings range between 0.821 and 0.943, exceeding the recommended threshold of 0.70 and confirming a substantial relationship between indicators and latent variables. Additionally, all items exhibit high t-values (15.264–63.018), confirming their statistical significance and relevance in measurement. Second, internal consistency is excellent: technological absorptive capacity achieves $\alpha = 0.929$, with composite reliability values of $\rho_A = 0.930$ and $\rho_C = 0.950$; product innovation reports $\alpha = 0.852$, $\rho_A = 0.856$, and $\rho_C = 0.900$; and microenterprise performance records $\alpha = 0.903$, $\rho_A = 0.907$, and $\rho_C = 0.932$. Finally, AVE exceeds the 0.50 threshold in all cases (0.825, 0.692, and 0.776, respectively),

indicating that each construct explains the majority of the variance in its indicators.

In summary, the results confirm that the measurement model meets the required psychometric quality criteria, thereby enabling subsequent analysis of discriminant validity and the structural model with solid empirical support.

TABLE II
RELIABILITY AND CONVERGENT VALIDITY

Constructs	Loadings	Cronbach's Alpha	Composite Reliability (ρ_A)	Composite Reliability (ρ_C)	Average Variance Extracted (AVE)
Technological absorptive capacity	CAT1 0.891	0.929	0.930	0.950	0.825
	CAT2 0.943				
	CT3 0.905				
	CAT4 0.894				
Product innovation	IP1 0.821	0.852	0.856	0.900	0.692
	IP2 0.857				
	IP3 0.822				
	IP4 0.828				
Microenterprise performance	RM1 0.887	0.903	0.907	0.932	0.776
	RM2 0.892				
	RM3 0.909				
	RM4 0.833				

Note. The measurement model results confirmed internal reliability and convergent validity, with factor loadings > 0.70 , AVE > 0.60 , and Cronbach's alpha exceeding 0.80.

The discriminant validity of the constructs was assessed using the HTMT criterion, which is widely recommended for evaluating the adequate distinction between constructs in PLS-SEM models [35]. The results presented in the table 3 confirm both conceptual and empirical distinctiveness among the variables, as all HTMT coefficients fall below the critical threshold of 0.90. Specifically, the relationship between technological absorptive capacity and product innovation reaches 0.664, while the association between product innovation and microenterprise performance is 0.793. Likewise, the HTMT value between technological absorptive capacity and performance is 0.846, further supporting adequate discriminant validity.

TABLE III
DISCRIMINANT VALIDITY (HTMT)

Constructs	Technological absorptive capacity	Product innovation	Microenterprise performance
Technological absorptive capacity			
Product innovation	0.664		
Microenterprise performance	0.846	0.793	

Nota. Todos los valores HTMT fueron inferiores a 0.85.

C. Structural model assessment

Collinearity among the constructs was examined using the variance inflation factor (VIF) to rule out potential issues of explanatory redundancy that could distort the estimation of structural model coefficients [27]. In this regard, the results indicate acceptable levels of collinearity, as all values fall well below the critical thresholds recommended in PLS-SEM ($VIF < 3.3$ or < 5). Specifically, the relationship between technological absorptive capacity and product innovation shows a VIF of 1.000, while the paths associated with microenterprise performance report values of 1.551. Therefore, the findings confirm the absence of multicollinearity and support the stability of the structural estimates.

TABLE 4
COLLINEARITY STATISTICS

Structural paths	VIF
Technological absorptive capacity $\rightarrow$ Product innovation	1.000
Technological absorptive capacity $\rightarrow$ Microenterprise performance	1.551
Product innovation $\rightarrow$ Microenterprise performance	1.551

Note. All VIF values were below the critical threshold of 5.

D. Predictive relevance of the model

The predictive relevance of the model was assessed using the coefficients of determination (R^2), adjusted R^2 , and the Q^2 predict indicator, complemented by error metrics such as RMSE and MAE, in line with established guidelines for evaluating predictive performance in PLS-SEM [27].

First, product innovation reports an R^2 of 0.355 (adjusted $R^2 = 0.349$), indicating a moderate level of explanatory power. In addition, the Q^2 predict value of 0.333 confirms adequate predictive relevance for this construct.

Second, microenterprise performance achieves an R^2 of 0.691 (adjusted $R^2 = 0.686$), reflecting substantial explanatory power. This is further supported by a Q^2 predict value of 0.594, which indicates strong predictive capability.

Furthermore, the error metrics (RMSE and MAE) exhibit values consistent with stable and reliable predictions.

TABLE 5
PREDICTIVE RELEVANCE OF THE MODEL

Constructs	R^2	Adjusted R^2	Q^2 predict	RMSE	MAE
Product innovation	0.355	0.349	0.333	0.842	0.660
Microenterprise performance	0.691	0.686	0.594	0.657	0.485

Note. The model demonstrated moderate explanatory power and acceptable predictive relevance.

E. Hypothesis testing

To test the proposed hypotheses, a partial least squares structural equation modeling (PLS-SEM) approach was employed using SmartPLS, applying the bootstrapping procedure to estimate the statistical significance of the model's path coefficients. This method enables the simultaneous assessment of direct relationships among latent constructs, considering both the explained variance and the precision of the estimates through t-statistics and p-values derived from resampling [35].

In this context, a coefficient is considered statistically significant when the t-value exceeds the critical threshold and the p-value is below 0.05, thereby providing empirical support for the proposed relationships and strengthening the model's explanatory validity in highly dynamic organizational contexts such as microenterprises. The results of the hypothesis testing are presented in Table 6.

TABLE 6
HYPOTHESIS TESTING RESULTS

Structural paths	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics (O/STDEV)	p-values
Technological absorptive capacity → Product innovation	0.596	0.589	0.100	5.979	0.000
Technological absorptive capacity → Microenterprise performance	0.558	0.565	0.071	7.806	0.000
Product innovation → Microenterprise performance	0.368	0.363	0.079	4.674	0.000

Note. All hypothesized relationships were statistically significant ($p < 0.001$), confirming the positive effects of digital interaction and trust on purchase intention.

The results for each hypothesis are presented as follows:

H1. Technological absorptive capacity → Product innovation

The findings indicate that technological absorptive capacity exerts a positive and statistically significant effect on product innovation ($\beta = 0.596$; $t = 5.979$; $p = 0.000$), thereby supporting H1. This result suggests that, as microenterprises strengthen their ability to acquire, assimilate, and apply external technological knowledge, they enhance their capacity to develop new or improved products, enabling more effective responses to market needs.

Moreover, the magnitude of the effect reflects a substantive relationship between technological learning and innovation, consistent with the notion that knowledge-based intangible resources are critical for transforming information into innovative outcomes. In line with this, prior studies argue that technological innovation fosters differentiation and strengthens competitive advantages, particularly in firms with flexible structures such as microenterprises [6].

H2. Technological absorptive capacity → Microenterprise performance

Similarly, technological absorptive capacity demonstrates a positive and statistically significant effect on microenterprise performance ($\beta = 0.558$; $t = 7.806$; $p = 0.000$), confirming H2. This finding indicates that the ability to incorporate technological knowledge not only promotes innovation but also directly translates into performance improvements, whether through process optimization, enhanced commercial efficiency, or greater strategic adaptability.

Furthermore, the magnitude of the coefficient suggests that absorptive capacity constitutes a key determinant of performance even before innovation has fully materialized in observable changes to the product portfolio. In this regard, recent studies highlight that the adoption of digital tools and the strategic use of technology contribute to improved business outcomes, including increased sales and competitiveness in SMEs [7].

H3: Product innovation → Microenterprise performance

Finally, the results confirm that product innovation positively influences microenterprise performance ($\beta = 0.368$; $t = 4.674$; $p = 0.000$), supporting H3. This finding demonstrates that the introduction of new or improved products serves as a relevant mechanism for enhancing business performance, as it strengthens perceived customer value, promotes differentiation, and stimulates stronger market responses.

Although the effect is smaller compared to the direct impact of absorptive capacity, it remains statistically robust and theoretically consistent, suggesting a dynamic in which innovation acts as an additional explanatory pathway for performance. Consistent with this, prior research on microenterprises indicates that product-oriented innovation is among the most prevalent forms and holds strong potential for improving competitive performance [8], particularly when aligned with commercial strategies.

Figure 1 presents the proposed model, which illustrates three key relationships: (1) technological absorptive capacity drives product innovation, (2) this capability directly influences microenterprise performance, and (3) product innovation further reinforces such performance.

From a practical perspective, these relationships suggest that microenterprises can enhance their performance by developing systematic mechanisms to capture external technological knowledge (e.g., from suppliers, customers, networks, and training), integrate it into their processes, and translate it into tangible improvements in their product

offerings. Additionally, the model provides managerial guidance by highlighting the importance of prioritizing low-cost, high-impact actions such as applied training, gradual adoption of digital tools, and market feedback to strengthen innovation and sustain business outcomes.

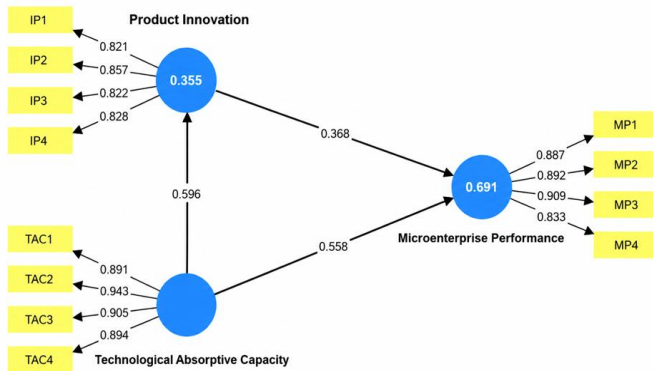


Fig. 1. Proposed model

Note. The figure illustrates the proposed model, showing relationships among technological absorptive capacity, product innovation, and microenterprise performance, including standardized path coefficients and indicator loadings.

IV. DISCUSSION

The discussion of the findings confirms that technological absorptive capacity constitutes a key strategic mechanism for explaining the dynamics of innovation and performance in Ecuadorian microenterprises. Overall, the model demonstrates moderate explanatory power for product innovation and substantial explanatory power for performance, suggesting that the processes of acquiring, assimilating, and applying technological knowledge represent a critical lever for sustaining competitiveness in organizations characterized by structural constraints.

Moreover, the positive Q^2 predict values for both constructs support the model's predictive relevance, reinforcing its usefulness in understanding firm behavior in emerging contexts, in line with PLS-SEM guidelines [27].

Regarding H1, the findings indicate that technological absorptive capacity significantly influences product innovation, demonstrating that external technological learning translates into innovative outcomes when effectively internalized by microenterprises. This result aligns with prior literature emphasizing the role of technological innovation as a source of differentiation and competitive advantage in small-scale organizations, where structural flexibility facilitates rapid adaptation of offerings [6]. Thus, this study contributes to the debate by empirically demonstrating that, even in microenterprises, absorptive capacity can act as a direct antecedent of innovation, challenging the traditional view that such processes are limited to firms with formal R&D structures.

With respect to H2, the positive effect of absorptive capacity on performance confirms that technological knowledge generates direct benefits in terms of efficiency, strategic adaptability, and commercial outcomes. This finding is consistent with recent evidence suggesting that the adoption of digital technologies enhances sales and competitiveness in SMEs, particularly through marketing tools and digital platforms [7]. Furthermore, the relevance of this relationship is especially pronounced in Ecuador, where the business landscape is dominated by microenterprises, highlighting the importance of policies and strategies aimed at strengthening internal technological capabilities.

Finally, H3 confirms that product innovation positively influences performance, suggesting that portfolio renewal contributes to improved positioning and stronger market responsiveness. Although this effect is smaller than the direct impact of absorptive capacity, its significance supports the argument that product innovation represents a key pathway for enhancing performance, particularly in microenterprises where this type of innovation is both common and feasible [8].

Collectively, the results suggest that strengthening absorptive capacity and translating it into product innovation constitutes an effective strategy for improving microenterprise performance in Latin American contexts.

V. CONCLUSIONS

This study confirms that technological absorptive capacity is a critical determinant of the competitive performance of Ecuadorian microenterprises, as it significantly influences both product innovation and business performance. Specifically, the findings demonstrate that microenterprises that enhance their ability to acquire, assimilate, and apply external technological knowledge increase their capacity to develop new or improved products, representing a relevant pathway for adaptation and differentiation in dynamic markets.

Additionally, the results show that absorptive capacity exerts a direct and substantial effect on performance, suggesting that technological knowledge not only drives innovation but also improves efficiency, decision-making, and strategic responsiveness. Finally, product innovation emerges as a complementary mechanism that contributes to performance, confirming that portfolio renewal is a key strategy for sustaining business outcomes in microenterprises.

From a managerial perspective, the findings suggest that improving microenterprise performance requires prioritizing actions aimed at strengthening technological absorptive capacity as a strategic capability. In practical terms, owners can implement systematic mechanisms to capture external knowledge through supplier relationships, customer feedback, participation in business networks, and applied training.

Furthermore, it is recommended to foster an organizational learning culture oriented toward translating knowledge into concrete decisions, such as improvements in

product features, design, quality, or functionality. Complementarily, management should promote the gradual adoption of low-cost, high-impact digital tools such as social media, digital marketing, and commercial platforms integrating them within a strategic framework that links innovation with performance outcomes. In this way, the evidence provides actionable guidance for microentrepreneurs to design learning and innovation routines that support sustainability and growth.

Despite its contributions, this study presents several limitations that should be considered when interpreting the results. First, the use of non-probability convenience sampling limits the generalizability of the findings to other microenterprise populations. Second, the cross-sectional design prevents the establishment of dynamic causal relationships and the assessment of how variables evolve over time. Additionally, the data are based on self-reported perceptions from owners, which may introduce social desirability bias.

Future research should expand the sample size, incorporate longitudinal designs, include objective performance indicators, and explore additional variables such as digital capabilities, market orientation, or contextual factors, in order to deepen the understanding of the mechanisms that enhance innovation and performance in Latin American microenterprises.

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