



Digital Transformation: Exploring the Significance of Business Digitalization for Organizational Success

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Abstract

Digital transformation (DT) has emerged as a driving force reshaping businesses' strategic and operational landscape. This study investigates the interplay between digital strategy, inter-organizational collaboration, and innovation outcomes within the Colombian context, where significant governmental and organizational efforts have been invested in digitalization. Leveraging a structural equation modeling (SEM) approach, the research identifies the nuanced relationships among these constructs and their collective impact on organizational success.

The findings reveal that digital strategy directly influences inter-organizational collaboration, demonstrating its centrality in fostering partnerships and shared value creation. Colombian organizations with well-developed digital strategies exhibit stronger collaborative ties, attributable in part to national policies such as the National Digital Strategy 2023-2026, which emphasizes connectivity and digital literacy. However, the study uncovers only a modest direct effect of digital strategy on innovation outcomes, highlighting the challenges posed by the digital divide and limited infrastructure, particularly in rural regions.

A key contribution of this study is its demonstration of the critical role of inter-organizational collaboration in driving innovation outcomes. The results underscore that collaboration acts as a potent mediator, amplifying the positive effects of digital strategies on innovation. Organizations engaged in partnerships leverage shared knowledge, resources, and technologies, enabling creative problem-solving and enhanced adaptability. The robust relationship between collaboration and innovation underscores the importance of ecosystems that prioritize connectivity, inclusivity, and shared goals.

The research highlights contextual challenges affecting Colombia's digital transformation journey. While progress has been made, with increasing internet penetration and digital adoption among small and medium enterprises (SMEs), gaps in digital infrastructure and skills persist. These barriers restrict the effectiveness of digital strategies and necessitate targeted interventions, such as investments in rural connectivity and workforce training. The study emphasizes the need for a multi-faceted approach, integrating policy support, private-sector initiatives, and academic research, to bridge these gaps and enhance digital maturity across industries.

Methodologically, the research employs a robust design, including a self-administered survey and confirmatory factor analysis, ensuring reliability and validity in assessing the relationships among variables. The study's limitations, including its reliance on convenience

sampling, suggest avenues for future research, particularly exploring diverse sectors and longitudinal impacts of digital transformation initiatives.

Practical recommendations emerging from this study focus on enhancing digital infrastructure, fostering digital literacy, and promoting collaboration through innovation hubs and incentives. Policymakers and organizational leaders are urged to prioritize efforts that align digital strategies with broader economic and social goals, ensuring sustainable and inclusive growth. By addressing structural impediments and leveraging collaborative ecosystems, organizations can unlock the full potential of digital transformation, driving competitiveness and long-term success.

This study contributes to the growing body of literature on digital transformation by elucidating its complex dynamics within the context of a developing economy. Its findings offer actionable insights for organizations navigating the challenges of digitalization, providing a roadmap for achieving innovation-driven growth through strategic alignment and collaborative efforts.

Key words: Digital Transformation, Innovation, Digital Strategy, Competitiveness, Inter-Organizational Collaboration.

Introduction

The appearance of digital transformation provoked significant shifts in business operations and value creation (Damanpour & Gopalakrishnan, 2001). Consequently, the rise of digital transformation changed most aspects across companies, from their strategic frameworks to operational processes, capabilities, product offerings, and primary partnerships within expansive business networks (Bharadwaj et al., 2013). Moreover, digital transformation reshaped conventional ways of communication, encouraging international interactions between clients and suppliers, thereby transforming the dynamics of value creation (Hess et al., 2016; Fischer et al., 2020).

Competitiveness serves as a critical factor in the socio-economic and political development of nations, and Colombia is no exception. However, the current state of competitiveness in the country presents a troubling scenario. In 2018, Colombia dropped to the 60th position in the Global Competitiveness Ranking published by the World Economic Forum, reflecting minimal progress. This stagnation continued in the 2019 report, where Colombia maintained its 57th position with a score of 63 out of 100. Additionally, the World Competitiveness Center's findings further highlighted this decline, with Colombia's ranking slipping from 52nd place in 2019 to 58th place in 2023 (World Competitiveness Center, 2023). Adopting digitalization aligned with the principles of Industry 4.0 holds significant potential for enhancing the competitiveness of Colombian enterprises. The advantages associated with this approach include increased productivity, flexibility, competitiveness, and globalization. Therefore, it is essential to reevaluate the digital strategies and innovation frameworks currently employed in the national economic context (Cortés et al., 2017).

An area through which digital transformation drove value was catalyzing innovation (Li, Rao, & Wan, 2022). However, there was increasing evidence suggesting that the potential for innovation through digital technologies was more complex than initially perceived (Usai et al., 2021). It becomes evident that firms that exhibit greater adaptability to digital transformation tend to possess an increased capacity for innovation (Chatterjee, Grewal, & Sambamurthy, 2002). Yet, further research was imperative to understand which organizational strategies were most effective in integrating new digital capabilities, particularly in digital strategy, innovation outcomes, and inter-organizational collaboration (Ukko, et al., 2019; Helfat & Martin, 2015; Pagoropoulos, et al., 2017).

Therefore, current research presents several fields of investigation. Initially, the literature lacks a comprehensive examination of the combined impact of digital strategy, innovation outcomes, and inter-organizational collaboration within the context of digital transformation in modern global markets. The digital strategy serves as a key element for enabling digital transformation, yet many contemporary firms struggle with integrating digital capabilities effectively, which may delay innovation outcomes for the firm and their environment (Bader et al., 2022). Consequently, it was crucial to investigate how these factors collectively contribute to the firm's success. Secondly, there remains a lack of real-world studies investigating the role of external actors in shaping the relationship between digital transformation and innovation results in an organization.

While prior studies highlight the significance of inter-organizational relationships in promoting innovation, the specific mechanisms through which digital transformation influences these relationships remain largely unexplored. Addressing these research gaps involves identifying the important roles of digital strategy, innovation outcomes, and inter-organizational collaboration. Therefore, the research question presented is:

What is the impact of digital strategy and inter-organizational collaboration on the results of innovation?

Objectives

Main objective:

The primary goal of this study is to analyze the relationship between digital strategy, innovation outcomes, and inter-organizational collaboration. This aims to explore how these elements interact within the context of digital transformation and contribute collectively to organizational success.

Secondary objectives:

1. **Digital Strategy and Collaboration:** Investigate the relationship between a firm's digital strategy and its capacity for inter-organizational collaboration, focusing on how strategic digital initiatives foster partnerships.
2. **Digital Strategy and Innovation Outcomes:** Establish the connection between a firm's digital strategy and its innovation outcomes, identifying how digital transformation facilitates or hinders innovation processes.
3. **Innovation Outcomes and Collaboration:** Examine the relationship between innovation outcomes and inter-organizational collaboration, aiming to understand the role of partnerships in enhancing innovation.

Theoretical background

The digital transformation of organizations represents a profound shift in how businesses operate, leveraging digital technologies to enhance performance and foster innovation. To fully understand its implications, this section explores the key variables central to this transformation: the adoption of digital tools and platforms, organizational adaptability, and their cumulative impact on success. By defining and examining these variables, the theoretical framework establishes a foundation for analyzing the role of digitalization in shaping modern business strategies and outcomes.

Digital strategy

A digital strategy is a comprehensive framework designed to guide the digital transformation of a business, ensuring its success in an increasingly digital world. It involves the integration of digital technologies into all areas of a business, fundamentally changing how the business operates and delivers value to customers. The core components of a digital strategy include a clear vision, goals, and objectives that help organizations navigate the uncertainties of the digital environment and adapt to rapid changes and innovations in the competitive market (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013).

Digital strategy is not only about technology; it is about reimagining the business itself. It requires a fusion of IT strategy and business strategy, reflecting the interconnected nature of modern business infrastructures where products, processes, and services are digitally intertwined (Matt, Hess, & Benlian, 2015). This strategy includes the coordination, prioritization, and implementation of digital transformations across various business operations, affecting products, processes and organizational structures. Moreover, a digital strategy aims to create an integrated business ecosystem that supports the strategic objectives of digital transformation, ensuring the provision of relevant digital infrastructure and enhancing services for all stakeholders. It also involves the use of digital marketing tactics to reach and engage targeted audiences, ultimately driving business growth (Morehouse & Saffer, 2018).

Firm-level innovation covers not only the integration of new technologies and methodologies but also the development of groundbreaking products and services, as well as modifications in existing operational practices (Damanpour & Gopalakrishnan, 2001). It is a multidimensional concept that extends beyond technological advancements, incorporating

changes in organizational culture, processes, and the overall strategic approach toward innovation. Digital strategy has emerged as a cornerstone in this process, playing a vital role in fostering innovation by accelerating the diffusion of innovative elements such as knowledge, technology, and essential resources throughout an organization. A well-executed digital strategy can create a competitive edge by streamlining processes and enabling more effective decision-making. The extent of progress in digital strategy correlates positively with the speed and certainty in which technology-related innovations can be adopted, in addition to enhancing the availability and allocation of resources needed for innovation (Li et al., 2022). Beyond the technological dimension, the success of digital strategy also hinges on the alignment of organizational goals and strategies and the development of key skills necessary for coordinating and managing technology-driven operations (Chatterjee et al., 2002; Li et al., 2018; Ukko et al., 2019; Li et al., 2022). Therefore, digital strategy is not only about the technology itself but also about how that technology is orchestrated within the organization to foster sustainable innovation in the future.

In the realm of digital strategy, forward-thinking managers play a crucial role by identifying and advocating for the adoption of emerging technologies, ensuring that their potential is fully realized within the organization (Chatterjee et al., 2002; Li et al., 2018). These managers actively champion digital transformation efforts, pushing for innovation that aligns with the company's strategic goals. Additionally, inter-organizational collaboration becomes a pivotal factor in facilitating successful digital transformations, as partnerships and alliances with other firms can lead to shared resources, knowledge, and expertise, ultimately improving innovation outcomes (Helfat & Martin, 2015; Li et al., 2018). Collaborative efforts help organizations overcome challenges that may arise during digital transformations by pooling resources and sharing best practices. Digitalization further disrupts traditional business norms by employing innovative strategies to leverage and enhance existing strategic assets, such as intellectual property, customer relationships, and supply chain networks (Ukko et al., 2019). This shift underscores the need to promote digital capabilities across all organizational levels, making it a strategic imperative in the current digital era (Pagoropoulos et al., 2017). Companies that prioritize the development of digital capabilities are better positioned to navigate the complexities of modern business landscapes, ensuring they remain competitive and innovative in the market.

Nevertheless, while digital transformation is a strategic initiative with the potential to drive significant organizational change, its success is contingent on external factors, such as market

conditions, technological advancements, and the firm's ability to effectively navigate the external environment (Li et al., 2022). Organizations must remain agile and adaptable, continuously refining their digital strategies to stay ahead in an increasingly competitive market. As enterprises progress in their digital transformation journeys, they build robust digital infrastructures, which encompass various process optimizations, including efficient information distribution, enhanced data acquisition, in-depth analysis, and continuous optimization of internal operations. The digital infrastructure serves as a backbone for innovation, enabling organizations to implement changes more swiftly and efficiently. Moreover, as digital transformation efforts advance, the frequency of routine updates and the standardization of processes within the organization increase, allowing it to progressively align with the evolving digital economy and maintain its competitive edge.

Innovation results

Innovation results refer to the tangible and intangible outcomes derived from an innovation process (Chesbrough, 2019). These outcomes can manifest in various forms, including new or improved products, services, technologies, or processes that create value, enhance competitive advantage, and contribute to economic, social, or environmental benefits (Ioanid & Iliescu, 2022).

Innovation results are pivotal in driving value creation, whether through the development of new products or the enhancement of existing ones, generating economic, social, and environmental benefits. Successful innovation provides firms with a competitive edge, allowing them to differentiate their offerings and secure a stronger position in the market. Additionally, the outcomes of innovation extend beyond businesses, creating significant economic and social impacts, such as job creation, improved quality of life, and economic growth. From a knowledge-based perspective, innovation is centered on the generation and application of new knowledge to solve problems and deliver novel solutions. Technological advancements often underpin these results, leading to greater efficiency and effectiveness across industries. Moreover, innovation can be examined both as a process encompassing research, development, and commercialization and as an outcome, represented by the tangible results of these activities (Skorobogatova, Marakhovskaya, & Aborkina, 2022).

Research indicates that a clearly defined digital strategy can be a potent catalyst for innovation within organizations, given the rapid evolution of the digital world (Li et al., 2018; Ferreira et al., 2019; Soto Setzke et al., 2021). Research indicates that businesses that deliberately implement new

digital procedures see an increase in the innovation of their products and services (Ferreira et al., 2019), which is why establishing a corporate culture that welcomes and supports digital innovations is essential to this shift. Proactively utilizing digital opportunities to boost innovation is a crucial component (Khin and Ho, 2020), but fostering an innovative culture requires a staff that is driven, proficient in information technology, flexible, transparent, and risk-taking.

Li et al. (2018) conducted a study on the correlation between aligning technology with strategic goals in industrial branding processes and improved innovation performance. Researchers discovered that digital technologies could support unique performance mechanisms, like operational optimization, improved market trend detection, and easier adaptation to both gradual and abrupt changes (Li et al., 2018). Furthermore, research emphasizes how having access to real-time production data facilitates improved decision-making and logistics optimization, which results in longer-term processes that are more inventive and efficient. More user autonomy and enhanced communication are also made possible by new technologies (De Bruyne and Gerritse, 2018), both of which are critical for promoting innovation in a company while competing in a market.

Developing robust digital competencies is another crucial element of an effective digital strategy. Evidence indicates that organizations with robust digital capabilities are more apt to create better products and services (Hasselblatt et al., 2018; Parida et al., 2015; De Bruyne and Gerritse, 2018). These capabilities encompass more than simply technology; they also require efficiently distributing resources to accomplish organizational objectives (Oliver, 2018). Both the company and individuals must be adaptable to effectively handle the changes caused by digital transformation because the importance of modifying current processes and structures becomes essential, particularly when managing new and original product and service innovations (De Bruyne and Gerritse, 2018). To maintain a competitive edge in a competitive market, firms must allocate resources towards comprehending and leveraging emerging technology (Bienhaus and Haddud, 2018).

Consequently, we propose that Digital strategy has a positive impact on innovation results (H2)

Inter-organizational collaboration

Inter-organizational collaboration refers to the cooperative arrangements and interactions between different organizations aimed at achieving shared goals, leveraging resources (Nezami,

Bruijne, Hertogh, & Bakker, 2023). This collaboration can take various forms, such as alliances, networks, and partnerships, and is often driven by the need to address complex problems that single organizations cannot solve independently (Zahoor & Al-Tabbaa, 2020). Key aspects of these collaborations include: Resource Sharing, Knowledge Transfer and Creation, Trust and Relationship Building; and Innovation and Problem-Solving (Aunger et al., 2020).

Inter-organizational collaboration is a powerful strategy for organizations to achieve objectives that extend beyond their individual capabilities. By leveraging shared resources, fostering innovation, and building mutual trust, organizations can address complex challenges, seize new opportunities, and deliver value to stakeholders. However, successful collaboration requires careful planning, clear governance, and a commitment to overcoming cultural, operational, and strategic barriers. In an increasingly interconnected world, inter-organizational collaboration is a cornerstone of organizational resilience, growth, and sustainability (Holopainen, Saunila, & Ukko, 2023).

The relationship between digital strategy and inter-organizational collaboration is symbiotic. Digital strategies provide the tools and frameworks needed for effective collaboration, while collaboration enhances the development, implementation, and impact of these strategies (Hardy, Phillips, & Lawrence, 2003). Together, they drive innovation, operational efficiency, and sustainable growth, particularly in complex and interconnected industries. Organizations that align their digital strategies with collaborative efforts are better positioned to thrive in today's dynamic business landscape. Digital strategies are integral to enhancing inter-organizational collaboration by facilitating knowledge sharing, fostering innovation, and aligning success factors with strategic objectives.

Consequently, we propose that Digital strategy has a positive impact in inter-organizational collaboration (H1)

The relationship between inter-organizational collaboration and innovation outcomes is one of mutual reinforcement. Collaboration provides the diversity of thought, resources, and capabilities necessary to drive innovative ideas from conception to market. By working together, organizations can tackle complex challenges, co-create impactful solutions, and achieve innovation outcomes that are more ambitious, efficient, and far-reaching than those achieved

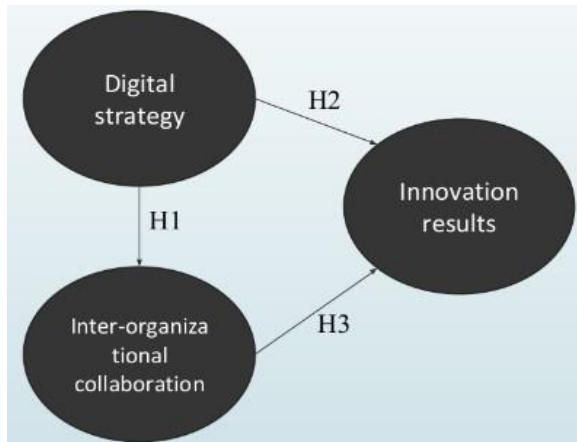
independently, with limited resources (Zahoor & Al-Tabbaa, 2020). Overcoming collaboration-related challenges is critical to unlocking its full potential and ensuring sustained innovation success. Inter-organizational collaboration significantly enhances innovation outcomes by leveraging organizational learning, dynamic leadership processes, and environmental adaptability (Kaya, Abubakar, Behraves, Yildiz, & Mert, 2020). While it incurs certain costs, the overall benefits to innovation performance, both in commercial and social contexts, are substantial. Firms must strategically manage these collaborations to maximize their innovative potential (Kaya, Abubakar, Behraves, Yildiz, & Mert, 2020).

Consequently, we propose that inter-organizational collaboration has a positive impact on innovation outcomes (H3)

Theoretical model:

Figure 1 presents the proposed research model, which delineates the direct relationships between digital strategy and innovation outcomes, as well as between inter-organizational collaboration and innovation outcomes. It also highlights the mediating role of inter-organizational collaboration in the relationship between digital strategy and innovation results. In the subsequent sections, we delve deeper into specific hypotheses that further explore how innovation outcomes are driven by key components of digital strategy and inter-organizational collaboration. These hypotheses provide a framework for understanding the complex interplay between digital strategy and collaborative efforts in fostering firm-level innovation, offering insights into how organizations can effectively leverage digital tools and partnerships to achieve sustainable competitive advantage.

Figure 1: Research model with hypothesis

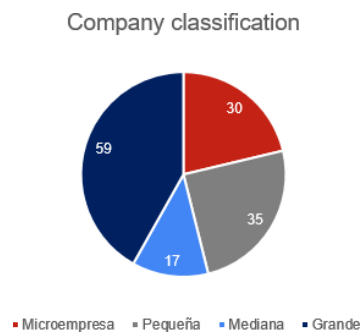


Note: By the authors

Methodology

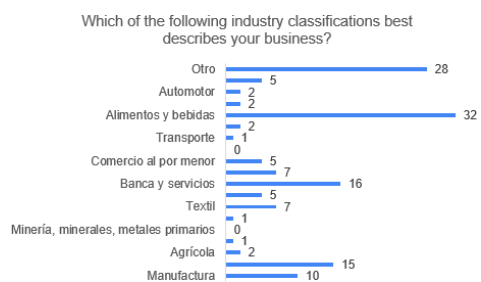
To evaluate the hypothesis, the research instrument, measurement constructs, and optimal model were created following the guidelines outlined by Hair et al. (2010). A self-administered questionnaire was crafted to gather data from users of e-government applications within local businesses and government organizations in Colombia. The questionnaire included a demographic section covering the industrial sector, company size, e-government area, and work area, followed by a set of conceptual variables intended to construct a model. This model was subsequently tested using both descriptive and inferential statistical analyses after data collection. A five-point Likert scale (ranging from strongly agree to strongly disagree) was employed to assess statements concerning the operationalization of the model's variables. Given the benefits of online surveys as noted by Evans (2005), an electronic survey was developed, and a link to the survey's website was distributed to potential participants via email.

Figure 2: Company Classification



Note: By the authors

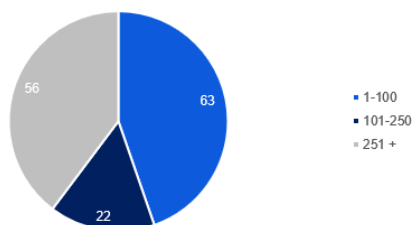
Figure 3: Industry Classification



Note: By the authors

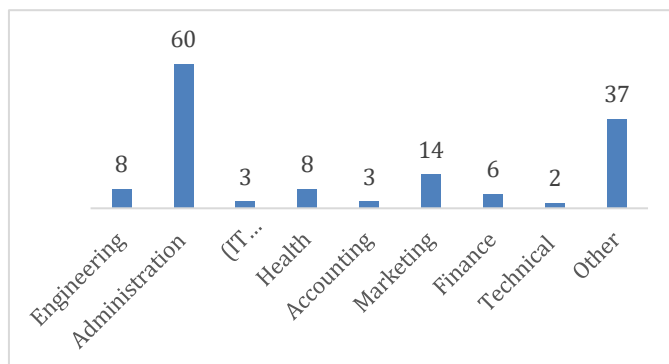
Figure 4: Employee Classification

Total number of current full- and part-time employees



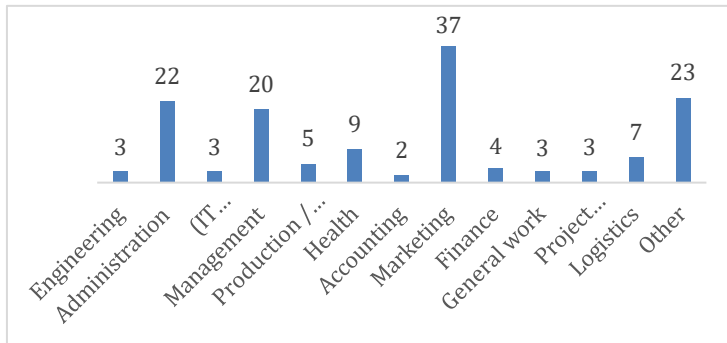
Note: By the authors

Figure 5: Profession Classification



Note: By the authors

Figure 6: Work Area Classification



Note: By the authors

To process the information and to verify the proposed model (Figure1), the statistical software SPSS and IBM AMOS were employed to conduct a confirmatory factor analysis (CFA) to investigate the predictive relationships between the variables and the fit of the model, based on the 141 responses obtained from the online survey. Also, the indicators of internal consistency of the questionnaire data were used to estimate the significance and the positive impact that Digital Strategy (Es) and Interorganizational Collaboration (CI) could have on Innovation Results (RI) and Operational Effectiveness (EO).

The Cronbach's alpha coefficient is a measure of the internal consistency of the items in the questionnaire. Generally, values above 0.7 are considered acceptable, while those above 0.8 are regarded as good. As shown in the results, Digital Strategy (Es) achieved an alpha of 0.840, Interorganizational Collaboration (CI) scored 0.858, and Innovation Results (RI) reached 0.908. These findings indicate a strong interconnectedness among these variables, confirming the relevance of the constructs evaluated.

Table 1: Cronbach Alpha

Variable	Number of items	Cronbach Alpha
Digital Strategy-Strat	4	0.840
Interorganizational Collaboration-CI	4	0.858
Independence model	6	0.908

Note: By the authors

In Table 2, the CMIN is reported as a key indicator for assessing model fit. A lower CMIN value relative to the degrees of freedom (df) suggests a better fit between the proposed model and the observed data. The default model yielded a CMIN value of 121.971 with 51 degrees of freedom, resulting in a CMIN/df ratio of approximately 2.392. This ratio falls within the acceptable range, indicating that the model demonstrates a reasonable fit to the data (Byrne, 2016)

Table 2: CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	28	78,080	50	,007	1,562
Saturated model	78	,000	0		
Independence model	12	1206,859	66	,000	18,286

Note: By the authors

In Table 3, the Root Mean Square Residual (RMR) serves as a crucial indicator of model fit, reflecting the average difference between observed and estimated values. A lower RMR value indicates a better fit, and the default model achieved an RMR of 0.052, suggesting a satisfactory approximation of the data. Additionally, the Goodness-of-Fit Index (GFI) is used to assess how well the model corresponds to the observed data, with values above 0.9 considered indicative of a strong fit. The default model demonstrated a GFI of 0.884, supporting the conclusion that the model adequately captures the relationships present in the data.

Table 3: RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,039	,920	,876	,590
Saturated model	,000	1,000		
Independence model	,488	,236	,097	,200

Note: By the authors

Furthermore, the baseline comparison illustrated in Tables 2, 3, 4, and 5 outlines various fit indices that evaluate the performance of the proposed model against a baseline model. The indicators such as the NFI (Normed Fit Index), RFI (Relative Fit Index), IFI (Incremental Fit Index), TLI (Tucker-Lewis Index), and CFI (Comparative Fit Index) are employed to assess the model's fit, with values approaching 1 signifying an improved fit. In the default model, all fit indices exceed 0.9, indicating that it performs exceptionally well in comparison to the baseline, thereby confirming the model's suitability in representing the observed data (Singh, 2009; Xia& Yang, 2019).

Table 4: Baseline Comparisons

Model	NFI	RFI	IFI	TLI	CFI
	Delta1	rho1	Delta2	rho2	
Default model	,935	,915	,976	,968	,975
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Note: By the authors

In Table 5, the Root Mean Square Error of Approximation (RMSEA) is presented as a critical measure for assessing model fit. The RMSEA provides an estimate of the discrepancy between the model and the observed data per degree of freedom, with values below 0.08 generally considered indicative of a good fit. The default model exhibited an RMSEA value of 0.100, suggesting that while the model demonstrates an adequate fit, there may be room for improvement in how well it approximates the underlying data structure.

Table 5: RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,063	,034	,090	,202
Independence model	,351	,334	,369	,000

Note: By the authors

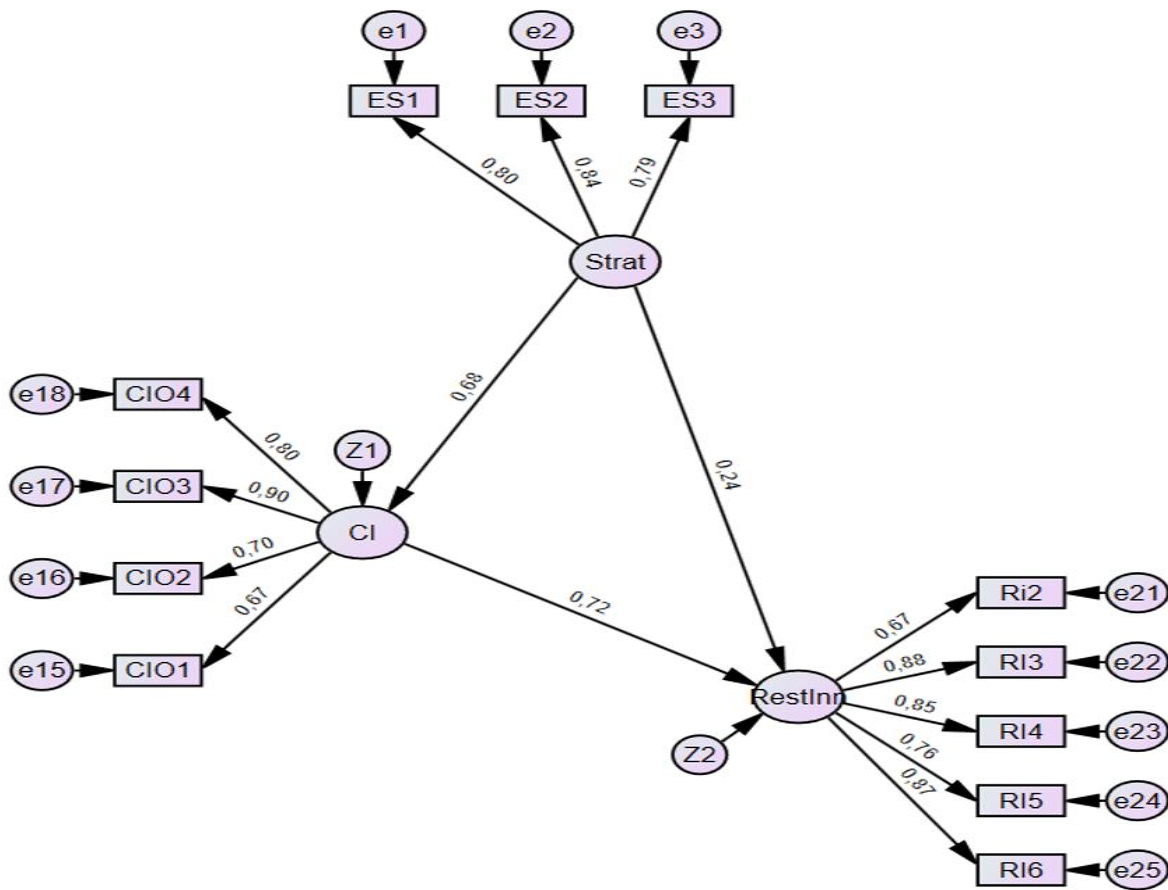
Results

The SEM results (Table 7 and Figure 7) provide support for H1, indicating a robust and positive relationship between Interorganizational Collaboration (CI) and Digital Strategy (Strat) ($b = 0.519$, $p < 0.001$). This finding underscores the notion that effective collaboration between organizations significantly enhances a robust digital strategy, aligning with the hypothesis that inter-organizational collaboration directly influences digital strategy.

Furthermore, the analysis confirms partially H2, demonstrating that Digital Strategy (Strat) has a positive effect on Innovation Results (RestInn) ($b = 0.152$, $p = 0.05$). This result highlights the importance of a well-defined digital strategy in driving innovation within organizations, suggesting that strategic digital initiatives are essential for achieving successful innovation outcomes. The results emphasize that while a well-defined digital strategy has a statistically significant positive effect on innovation outcomes, the modest effect size suggests that its impact, though meaningful, is one piece of a more complex puzzle. This partial confirmation of the hypothesis indicates that organizations cannot rely solely on digital strategy to drive innovation but must consider complementary factors, such as organizational culture, employee capabilities, and infrastructure readiness. The findings highlight the necessity of embedding digital initiatives into broader business processes, ensuring alignment with organizational goals to maximize their innovation-driving potential. For organizations, this means that strategic investments in digital tools and processes must be accompanied by fostering an innovation-friendly environment that supports experimentation, collaboration, and agility. Furthermore, businesses must continuously evaluate and adapt their digital strategies to address industry-specific challenges and market dynamics.

Additionally, H3 is also supported, as the relationship between Innovation Results (RestInn) and Interorganizational Collaboration (CI) was found to be positive ($b = 0.876$, $p < 0.001$) and very strong. This implies that while a strong digital strategy fosters collaboration, it may not directly impact innovation outcomes without the mediation of collaboration.

Figure 7: Structure model results



Note: By the authors

Table 6: Regression weights

	Estimate	S.E.	C.R.	P	Label
CI ← Strat	,519	,086	6,002	***	H1: Confirmed
RestInn ← CI	,876	,163	5,379	***	H3: Confirmed
RestInn ← Strat	,152	,077	1,959	,05	H2: Partially confirmed

Note: By the authors

Conclusion

The results of this study demonstrate that in Colombia, digital strategies have a significant impact on inter-organizational collaboration. This strong positive relationship suggests that Colombian organizations with well-developed digital strategies are more likely to engage in effective collaboration with other entities. One reason for this strong impact in Colombia in our current context is due to the government's targeted investments in digital infrastructure through initiatives like the National Digital Strategy 2023-2026. By expanding connectivity and prioritizing digital literacy, this strategy supports a collaborative ecosystem where resources and information flow freely between sectors, facilitating effective partnerships (Access Partnership, 2024). Additionally, Colombia has made significant progress in expanding internet access and digital literacy, which facilitates inter-organizational collaboration through digital means. As of 2023, 63% of the Colombian population was using the internet. This increased connectivity provides a foundation for organizations to implement digital strategies and collaborate more effectively. Additionally, the government's efforts to bridge the digital divide, particularly in rural areas, are creating new opportunities for organizations to connect and work together across different regions of the country (U.S. Department of Commerce, n.d.).

The second finding of this study reveals a robust and significant relationship between inter-organizational collaboration and innovation outcomes in Colombia. This strong positive correlation suggests that Colombian organizations engaging in collaborative efforts with other entities are substantially more likely to achieve enhanced innovation results. This pronounced impact can be attributed to two key factors within the Colombian context: first, the government's recent emphasis on digital transformation initiatives, exemplified by events like the EU-LAC Digital Alliance Days in Cartagena de Indias, which foster collaboration and innovation across sectors by focusing on areas such as artificial intelligence and inclusive connectivity (BMZ Digital, 2023). Second, there is an increasing trend of digital adoption among Colombian small and medium-sized enterprises (SMEs), with recent surveys indicating that 63% of medium-sized enterprises have reached advanced levels of digital transformation (CIPE, 2024). This growing digital maturity enables organizations to collaborate more effectively, share knowledge, and jointly innovate. Together, these factors create an environment where inter-organizational collaboration

significantly enhances innovation outcomes, allowing organizations to leverage shared capabilities and resources to drive creative solutions and technological advancements.

The third and last finding of this study reveals a modest impact of digital strategies on innovation results in Colombia, as indicated by the standardized estimate of 0.152. This outcome can be contextualized within Colombia's unique digital landscape. The country grapples with significant challenges in digital infrastructure, particularly evident in the stark digital divide where over 40% of households lack internet access, especially in rural areas (MinTIC, 2023). This connectivity gap inherently limits the private sector's capacity to fully harness digital technologies for innovation and value creation. Furthermore, despite progress in developing its digital economy, Colombia faces a persistent shortage in digital skills and talent across its workforce. The National Digital Strategy 2023-2026 acknowledges this deficit, emphasizing the need to bolster digital competencies to enhance overall competitiveness (DNP, 2023). These structural impediments— inadequate digital infrastructure and insufficient digital literacy – provide a plausible explanation for the limited efficacy of digital strategies in driving innovation within Colombian businesses. The relatively low standardized estimate underscores the complex interplay between digital initiatives and innovation outcomes, highlighting the need for comprehensive policies that address both technological access and human capital development to fully unlock the potential of digital transformation in Colombia's business landscape.

This study underscores the vital role of digital strategies in shaping the innovation landscape of Colombian organizations. The research findings reveal that while digital strategies have a modest direct impact on innovation outcomes, their influence is significantly amplified when combined with inter-organizational collaboration. The robust relationship between collaboration and innovation underscores the importance of partnerships in driving creative problem-solving, resource sharing, and knowledge exchange. In essence, digital strategies serve as enablers that foster an environment conducive to innovation by leveraging the power of collaboration.

In the Colombian context, the partial effect of digital strategies on innovation outcomes can be attributed to systemic challenges such as insufficient digital infrastructure and limited digital literacy. These barriers hinder the ability of organizations, particularly small and medium enterprises (SMEs), to fully harness the potential of digital transformation. However, the strong

relationship between inter-organizational collaboration and innovation suggests a path forward: organizations must prioritize building networks and alliances to compensate for these limitations. By pooling resources and expertise, firms can address structural gaps and enhance their capacity for innovation.

Moreover, the study highlights the pivotal role of policy frameworks, such as Colombia's National Digital Strategy 2023-2026, in creating an enabling environment for digital transformation. Policies that promote connectivity, digital literacy, and public-private partnerships have a cascading effect, facilitating collaboration and innovation across sectors. This underscores the need for a holistic approach that integrates technological, organizational, and policy dimensions to drive sustainable growth.

The findings also have broader implications for global markets. As industries become increasingly interconnected, the lessons from Colombia's digital transformation journey can inform strategies in other developing economies. The emphasis on collaboration as a mediator between digital strategies and innovation is particularly relevant in regions facing similar challenges in infrastructure and skills development.

Recommendations

To address the challenges within Colombia's digital landscape and strengthen the impact of digital strategies on interorganizational collaboration and innovation, targeted efforts in infrastructure, education, policy, and collaboration are essential. Expanding investments in digital infrastructure, particularly in underserved rural areas, should be a priority in Colombia. Private and public entities should partner up, which could be leveraged to extend signal or WI-FI access across isolated regions, reducing connectivity inequalities. Additionally, implementing advanced network technologies like 5G, the fifth generation of cellular network technology and fiber optics would improve connectivity speed and reliability, creating a strong foundation for digital transformation and inter-organizational collaboration.

Focusing on digital literacy through targeted workforce training can make a big difference, especially in rural areas and industries struggling with the digital divide. By developing specialized programs that teach essential skills like data analytics, cybersecurity, and artificial intelligence, we can equip workers with the tools they need to succeed in today's job market. Partnering with educational institutions to integrate these skills into school curriculums would not only prepare future generations for a digital economy but also to start building an educated community and society in Colombia, especially in rural areas.

Incentives and platforms that encourage knowledge sharing among small and medium-sized enterprises are equally important. Establishing regional digital innovation hubs would give SMEs access to resources, mentorship, and networking opportunities. These hubs, ideally part of larger government-led initiatives, could serve as knowledge-sharing centers, especially in areas with limited internet access. Grants or tax incentives to support inter-organizational projects could further strengthen collaboration, promoting the co-development of digital tools and industry-wide solutions that enhance innovation.

Addressing talent shortages in digital fields through retention programs and on-the-job training could help close the skills gap. Offering scholarships, job placements, and housing incentives would make digital careers more attractive, while continuous learning programs within companies could ensure that employees acquire and retain relevant digital skills. Such initiatives

would also reduce brain drain, keeping highly skilled professionals within Colombia and supporting long-term digital transformation.

A national digital awareness campaign could increase adoption of digital tools, particularly among SMEs that may lack the resources or knowledge to integrate these tools fully. This campaign, by sharing case studies and practical resources, could illustrate the tangible benefits of digital transformation. Simplifying access to digital tools through partnerships with technology providers coupled with subsidies or low-cost licenses would make it feasible for smaller enterprises to utilize essential digital platforms.

Policy improvements that encourage innovation are also necessary. Funding and tax incentives for digital-focused R&D efforts would attract investment into research projects that contribute to the digital ecosystem. Regular assessments of digital initiatives' impact would allow policymakers to adjust strategies to remain relevant. By tracking metrics like internet access rates, digital adoption, and collaboration outcomes, the government could refine programs and measure their success effectively.

Finally, public-private collaboration to accelerate digital transformation would be invaluable. Joint initiatives, such as developing digital transformation roadmaps aligned with national and regional goals, would unify efforts across sectors. Establishing online platforms for knowledge exchange would enable public and private entities to share best practices, solutions, and tools, helping smaller businesses to progress in their digital journeys. By addressing these areas, Colombia can build a robust digital foundation, enhance digital skills, and foster an ecosystem where collaboration and innovation thrive, enabling effective digital strategies and elevating the country's business landscape.

Limitations

A notable limitation of this study is its reliance on a convenience sample, which, although efficient for data gathering, may introduce a bias by capturing organizations that are already engaged or interested in digital transformation initiatives. This approach could potentially skew the findings toward digitally mature firms, limiting the generalizability of the results across less digitally engaged sectors or regions in Colombia. By predominantly representing companies already inclined toward digital initiatives, the study might not fully reflect the challenges and needs of other types of organizations, particularly those in less accessible or underrepresented areas. This limitation highlights the need for caution when applying the findings to the broader Colombian business landscape.

Future research could address this limitation by employing a randomized and more representative sampling method. Such an approach would provide a wider view of digital transformation across diverse industries and geographic areas, ensuring that the study's findings better represent Colombia's entire business ecosystem. Additionally, longitudinal studies would be valuable for capturing the evolving effects of digital transformation over time. By examining these factors longitudinally, future research could reveal trends in digital transformation and assess how sustained efforts in digital initiatives impact innovation and inter-organizational collaboration, providing a more dynamic and comprehensive understanding of these processes.

Expanding the sample to include small and medium-sized enterprises (SMEs) from rural or underserved regions in Colombia would further enrich the analysis. Including these types of organizations would help highlight specific challenges and opportunities that vary between urban and rural areas, such as digital infrastructure gaps and differences in access to resources and training. Such an approach would ensure a more inclusive view of digital transformation across Colombia's varied regions and could inform targeted policies to address the unique needs of rural businesses.

Finally, sector-specific studies could offer a deeper understanding of how industry-specific factors influence digital adoption and collaborative practices. By focusing on particular industries, future research could reveal unique barriers and advantages within each sector, allowing for more tailored recommendations to optimize digital transformation. This focused approach would help

maximize the relevance and impact of digital strategies across Colombia's economic landscape, ensuring that digital transformation efforts are well-aligned with the distinct characteristics and demands of various industries.

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