



Article

The Business Digitalization Process in SMEs from the Implementation of e-Commerce: An Empirical Analysis

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Abstract: The main objective of this research is to carry out a comprehensive analysis of how e-commerce affects the performance of small and medium-sized enterprises (SMEs) in Mexico. This study will pay special attention to the role of business digitalization and the optimization of operational processes in this context. Our research involved creating a partial least squares structural equation model (PLS-SEM) to examine our hypotheses. According to our research, incorporating e-commerce, digitalizing business processes, and improving operational efficiency significantly contribute to corporate performance. Our results show direct effects that, together with indirect effects of business digitalization and operational efficiency, enhance the positive influence of online commerce. This research fills a gap in the literature by investigating the relationship between e-commerce, business digitalization, operational efficiency, and business performance. It provides essential insights into the direct impact of e-commerce on corporate performance and the indirect impact through the mediation of business digitalization and operational efficiency. The results show significant implications for business managers, as the findings can help them to invest in technologies that foster e-commerce, which, by improving business digitalization and operational efficiency, will result in better corporate performance and the ability to adapt to today's turbulent environment.

Keywords: e-commerce; business digitalization; operational efficiency; corporate performance; PLS-SEM



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1. Introduction

The COVID-19 pandemic has imposed crucial challenges on the functioning of organizations around the world [1]. Since its outbreak, numerous companies have incorporated diverse digital technologies, including big data, artificial intelligence, cloud computing, and the Internet of Things, to expedite the transition of their business operations to a digital framework [2]. As a result, we live in an era of digital transformation that pressures companies to modernize their business models [3] and causing a change in the way they market their products and services [4]. In light of this, many businesses are enhancing their technological capabilities and expanding their horizons to keep up with the ever-evolving digital era, striving to remain innovative and ahead of the curve [5].

The new digital transformation era towards e-commerce suggests a change in how products are marketed, redefining the types of offers and sourcing practices and strengthening links with target customers and suppliers [6]. Digitalization is a key aspect of this accelerated e-commerce transformation [7–9]. Digitalization pertains to the extent of a company's management systems, facilitating data integration and processes using various technologies [10]. Companies with a high level of digitalization can gather a broader range of data on their customers, orders, production, and the market [2]. Consequently, digitalization favors the collection of data, which will be a strategic resource in the current digital transformation era to drive corporate performance [11,12].

The large number of IT technologies incorporated into e-commerce allows companies to gain additional advantages, such as lower transaction costs, shorter production cycles, and a more comprehensive range of products on display and for sale [13]. Through these benefits, companies can optimize their business processes, improve customer service, and offer digital products and services [14]. All this will improve the operational efficiency in companies [15], understood as the maximum outputs attainable from each input level, which reflects best practices in resource allocation and production [16]. A company can achieve greater efficiency by using fewer resources to produce equal or larger outputs or more outputs while using fewer or equal resources compared with its competitors [17]. Some academics have highlighted the importance of measuring and improving operational efficiency to promote organizational progress [18,19] and improve corporate performance [20].

Despite the growing number of articles that have demonstrated the positive impact of e-commerce on corporate performance [21–23] in the SME sector, there are still only a few articles that discuss this relationship and even fewer from Latin American countries such as Mexico. The corporate aspects that will be most affected by the implementation of e-commerce are the digitization of the company, operational efficiency and, as a consequence, corporate performance. Consequently, the main objective of this article is to examine whether e-commerce favors SME performance in Mexico through business digitalization and operational efficiency. To do so, we analyze the effect of this relationship of implementing strategies aimed at promoting innovative processes that increase the level of digitalization in firms and improve their operational efficiency.

Focusing the study on Mexican SMEs when investigating the impact of e-commerce on their performance, along with the mediating effect of digitalization and operational efficiency, is justified for several compelling reasons. Firstly, Mexican SMEs are pivotal in the national economy, contributing significantly to employment and GDP. It is imperative to comprehend how e-commerce affects their performance for the country's economic development. Secondly, these SMEs face unique challenges, such as resource limitations, limited access to financing, and cultural and regulatory barriers that offer valuable insights into overcoming these obstacles and capitalizing on digital opportunities. Furthermore, the rapid growth of e-commerce in Mexico and its diverse business sectors allows for a comprehensive exploration of how various SMEs adapt and thrive, enabling the identification of the best practices applicable in Mexico and globally. In conclusion, the choice to focus on Mexican SMEs for this research is substantiated by their economic significance, distinctive challenges, e-commerce growth, and sector diversity, which together form a solid rationale for this research direction.

The study of the impact of e-commerce on Mexican SME performance is closely intertwined with the phenomenon of nearshoring with the United States, offering several compelling reasons for this connection. Firstly, Mexico's strategic geographical proximity to the United States makes it an enticing nearshoring destination, simplifying logistics, reducing transportation costs, and enhancing delivery efficiency for Mexican SMEs engaged in e-commerce with US counterparts. Secondly, Mexico's favorable trade agreements, including the United States–Mexico–Canada Agreement (USMCA), foster an environment conducive to e-commerce growth and collaboration between Mexican SMEs and US companies. Moreover, the competitive labor costs in Mexico enable these SMEs to deliver products and services at competitive prices to the US market through e-commerce, aligning with the primary motivation for nearshoring. Lastly, by establishing e-commerce relationships with US companies, Mexican SMEs gain access to a mature and expansive digital market, presenting opportunities for sales growth, market expansion, and overall business development. Thus, the nexus between e-commerce and nearshoring provides a valuable perspective for understanding how these dynamics impact Mexican SMEs' performance and growth within Mexico–US business interactions.

Hence, the following research questions have the following implications: Although the implementation of e-commerce is part of the business digitalization process, is it enough?

Could the implementation of e-commerce initiate the digital business transformation? How do e-commerce implementation, digitization, and operational efficiency affect corporate performance? How are they related?

This paper contributes to the literature by considering e-commerce as a key tool of corporate performance in Mexican SMEs, analyzing the relationship between the online format of the marketing function proposed by implementing e-commerce and corporate performance and incorporating the mediating effects of business digitalization and operational efficiency. The inclusion of these two effects seeks to provide a definitive answer to the inconclusive results of the published literature on the effects of e-commerce on SME performance [24,25]. Moreover, we present, as a novel approach, the moderating effect of business digitalization on the relationship between the implementation of e-commerce and corporate performance and on the relationship between operational efficiency and corporate performance.

In addition, the results can help SME managers invest in innovative projects that improve the online format of business channels, which will result in better performance and survivability in the current turbulent environment for SMEs by fostering the level of digitalization in companies and improving operational efficiency. These are the most important practical implications that cover the need to provide empirical work to create innovative strategies to foster e-business in SMEs [26,27].

The remainder of the manuscript is organized into five sections. In Section 2, we conduct an extensive literature review as the foundation to develop hypotheses that guide our empirical analysis. Next, Section 3 outlines the methodologies employed to gather and analyze data, which is followed by Section 4, which presents the results of our empirical investigation. In Section 5, we engage in a rigorous discussion that interprets these findings in the context of the existing literature, and lastly, Section 6 draws together our key findings and insights.

2. Literature Review and Hypotheses Development

As a first step in our analysis, we consider how the implementation of e-commerce contributes to the relevant aspects of business management such as the digitalization of the company, operational efficiency, and corporate performance and how they relate to each other.

2.1. Implementation of E-Commerce

Electronic commerce (e-commerce) is the most visible example of how information and communication technologies (ICTs) have transformed businesses and contributed to economic growth [15,28–31]. E-commerce involves the trading of goods and services through the Web [32]. This may include online payment, eliminating the need for face-to-face interaction between the buyer and seller [33]. “E-commerce can be defined in the most general sense as any commercial business activity where the parties communicate electronically without direct physical connection or the need for a physical exchange” [34]. The pandemic period that was experienced around the world due to the spread of COVID-19 has led to an exponential growth in e-commerce as an alternative to traditional commerce [35–37]. “While worldwide retail sales are expected to decrease by 3% in 2020, retail e-commerce sales are predicted to increase by 28%” [38]. The disappearance of social interactions gave rise to the need for e-commerce transactions in a very large group of companies [33,39].

2.2. Business Digitalization

Business digitalization is a digital transformation process that involves resources, structure, growth strategies, metrics, and goals [29] and implies developing digital capabilities [40]. The implementation of an e-commerce channel is part of business digitalization. In a broad sense, digitalization is a transformation in the business sphere that includes different business opportunities and business models, marketing alternatives, purchasing processes, and the transformation of local markets into global ones [40,41]. Digitalization is

an internal process that companies execute in order to transform their existing business model into a digitally based business model where the ICT is located at the core of the daily operations involving customers and providers in the business activity [42]. The rapid adoption in companies of modern information technologies such as big data, the Internet of Things, cloud computing, and the blockchain have provided the necessary tools to improve their business management skills [43]. “Digitalization trends are disrupting the ways in which firms do business” [28]. These capabilities of business models in the Industry 4.0 environment are part of the resource-based view [44], because digitalization capabilities are relevant to all the other capabilities of a firm [40] and are part of the value chain as a source of competitive advantage [45].

2.3. Operational Efficiency

The development of a company’s capabilities, such as e-commerce, contributes to increasing a firm’s degree of distribution and communication efficiency, as well as the level of digitalization of the company [30,40]. The operational efficiency is defined as “operating cost efficiency, which in turn relates to operating expenses of the business, like salary, rent, advertising, and other expenses. It has been generally accepted that the lower the operating expenses on sales volume, the better the operating cost efficiency” [31].

2.4. Corporate Performance

Corporate performance is another relevant concept to consider from an e-commerce perspective. Although the financial evaluation of the company has traditionally been the most widely used performance measure, the complexity of companies requires the need to contemplate other performance measures [46]. On the other hand, the implementation of e-commerce has an impact on different areas of the company, such as customers, finance, human resources management, and organization [17,30,35,40,47–49]. Corporate performance measures the company’s success beyond financials [50–54] in a way that integrates a broader set of measures such as “profit rate, ROA (return on assets), long-term profitability, sales growth rate and so on” [55]. Corporate performance includes financial, internal business, learning, and customer perspectives [46].

2.5. Hypothesis Development

The transformation process in the wake of the COVID-19 pandemic, which led many companies to embark on e-commerce, is, in many cases, the beginning of transforming their business model towards digitalization [36]. This is because the implementation of an e-commerce channel gives rise to the need to implement other digital processes, such as information exchange, customer service, warehouse management, invoicing, etc. [35]. Although the digitalization process is broader and deeper than the simple implementation of an electronic channel, there is no doubt that they have a direct relationship in the digital business transformation.

E-commerce increases the efficiency of the value chain (costs) and, therefore, the efficiency of the supply chain (disappearance of intermediaries in traditional trade) [17,34,56,57]. E-commerce capabilities are a driver of efficiencies and performance [30] because they have a huge impact on business processes [56] that can effectively improve operational efficiency [58]. Moreover, e-commerce intensifies competition among companies and competition improves their operational efficiencies [19]. In earlier stages of e-commerce implementation, it was already being observed that in e-commerce “shrinking distances and timescale, lowering distribution and transaction costs, speeding up product development, providing more information to buyers and sellers, and enlarging customer choice and supplier reach” [47] are indicators of improved operational efficiency.

Regarding the influence of e-commerce on corporate performance, we found a lack of consensus in the literature. Whereas some academics find that it has a direct impact through lower operational costs [35] and improved management of sales force customer transactions [48], other authors consider that the impact of e-commerce on corporate

performance is not direct but rather depends on how it affects other key aspects of business management, such as the company's characteristics or its market orientation [30,59]. In our opinion, e-commerce has a direct impact on corporate performance by enhancing marketing capabilities [34], the ability to draw and retain customers [59], or the resilience to situations caused by a global pandemic [33,35–38].

With this background, we consider that the implementation of e-commerce has positive effects on the business digitalization process and its operational efficiency, as well as its corporate performance. These situations are reflected in the following hypotheses:

H1a. *The implementation of e-commerce has a positive impact on the business digitalization of the company.*

H1b. *The implementation of e-commerce has a positive impact on the operational efficiency of the company.*

H1c. *The implementation of e-commerce has a positive impact on the corporate performance of the company.*

The digitalization of businesses is a very complex process due to the number of tools that can be applied to increase efficiency and effectiveness of a firm's business processes (e.g., Internet of Things, cloud computing, artificial intelligence, big data analytics, mobile and social media platforms, blockchain, and e-commerce) [60–62]. Digital capability is composed of three elements: data capture, connectivity, and analytical capability, which help companies create value and a competitive advantage; the underlying assumption is that it has a positive impact on company performance [63]. Existing studies reveal a relationship between digitalization and corporate performance from the resource-based view theory [64], because digitalization is a source of valuable, scarce, non-imitable, and irreplaceable resources [44], which together provide sustainable competitive advantages [65]. The essence of corporate performance is the formation of value and the extent to which digitalization contributes to value creation and its impact on organizational performance [66]. With this reasoning, we propose the following hypothesis:

H2a. *Business digitalization of the company has a positive impact on the corporate performance of the company.*

As a consequence of hypotheses H1a and H2a, we propose that the implementation of e-commerce has an indirect impact on corporate performance in the following:

H2b. *The implementation of e-commerce indirectly affects corporate performance through business digitalization.*

However, in addition to directly impacting corporate performance, digitalization also has an impact on operational efficiency. Business digitalization helps improve specific business processes [61,62] and company efficiency through valuable insights and actionable guidance [63,64], reduce costs, and increase flexibility [64,67] and productivity [68]. Digitalization improves internal efficiency by disrupting value chains and forcing companies to rethink different aspects of their business [65,66]. These capabilities provided by digitalization increase business success through process efficiency in all production areas [60]. "Researchers highlight that dynamic capabilities are critical to change the way of doing business by creating, delivering, and appropriating new forms of value in digital market environments" [69]. Thus, we propose the following hypothesis:

H3a. *The business digitalization of the company has a positive impact on the operational efficiency of the company.*

As a consequence of hypotheses H1a and H3a, we propose that the implementation of e-commerce has an indirect impact on operational efficiency in the following:

H3b. *The implementation of e-commerce indirectly affects operational efficiency through business digitalization.*

Regarding the relationship between operational efficiency and corporate performance, the academic literature has established strong links [17,45,61,62,64,67,68,70,71]. To im-

prove operational efficiency, it is necessary to redesign the logic of the value chain developed by M.E. Porter (1985) [17]. Redesigning the value chain for efficiency leads to cost reduction by improving productivity [61,72] through re-engineered processes and redesigned organizational structures [68]. These transformations produce greater profitability, growth, and market value for the company, which are the primary determinants of corporate performance [62].

Scholars “have measured organizational performance by using both financial and non-financial elements, including the market criteria such as return on investment (ROI), market share, the profit margin on sales, the growth of ROI, the growth of sales, the growth of market share, and overall competitive position” [73]. This implies that cost reduction enhances corporate performance [67]. Therefore, the following hypothesis reflects the relationship between organizational efficiency and corporate performance:

H3c. *Operational efficiency has a positive impact on corporate performance of the company.*

As a consequence of hypotheses H1a, H1b, H3a, H3b, and H3c, we observed indirect effects between business digitalization and corporate performance, implementation of e-commerce and operational efficiency, and implementation of e-commerce and corporate performance. This leads us to propose the following hypotheses:

H3d. *Business digitalization indirectly affects corporate performance through operational efficiency.*

H3e. *The implementation of e-commerce indirectly affects corporate performance through operational efficiency.*

H3f. *The implementation of e-commerce indirectly affects corporate performance through business digitalization and through operational efficiency sequentially.*

After examining direct and mediating effects, we also expect moderating effects. “The use of digital technologies to change a business model provides new revenue and value generation opportunities” [42]. This situation has given rise to the need for business digitalization and a new paradigm in business management, which scholars and managers have referred to as Industry 4.0 [61,74]. This paradigm implies that technology is integrated into business models, making them more or less successful and turning digitalization into a key variable in corporate management [75]. In this way, the digitalization of the company not only contributes globally to business performance but also conditions how aspects such as marketing (e.g., implementation of e-commerce) or organizational structure (e.g., operational efficiency) affect corporate performance [61].

The moderating effect of business digitalization has been studied in several fields: efficiency of a firm [58], new venture internationalization [76], intellectual capital, industrial organization [77], or customer participation and value creation [78]. From the point of view of our modeling, the moderating effect we analyze is how digitalization affects the relationship between e-commerce implementation and corporate performance, as well as the relationship between operational efficiency and corporate performance. In our opinion, further digitalization of the company makes the impact of e-commerce implementation and operational efficiency a greater contributor to corporate performance [58]. This situation is reflected in the following hypotheses:

H4a. *The business digitalization of the company has a moderating effect concerning the influence of implementation of e-commerce on corporate performance.*

H4b. *The business digitalization of the company has a moderating effect with respect to the influence of operational efficiency on corporate performance.*

Figure 1 shows the hypotheses formulated and the proposed model.

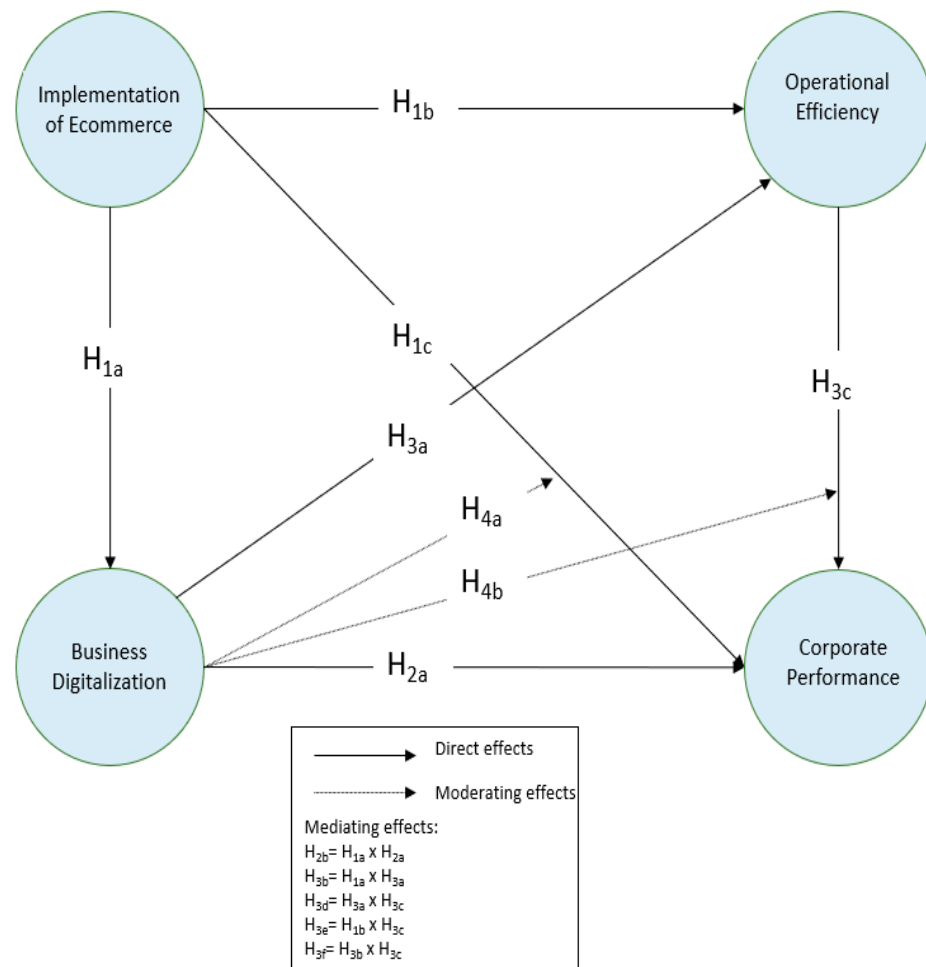


Figure 1. Proposed model.

3. Methods

3.1. Sample and Data Collection

The research was conducted in the first quarter of 2022 using a sample obtained from telephone surveys conducted by a specialist company. The survey focused on CEOs, as they have the most knowledge about their company’s current state and future plans. The companies included in the sample were chosen and arranged using a method called simple random sampling. The list of companies was obtained from the DENUE, which is a part of the National Economic Information Subsystem (SNIE). DENUE serves the purpose of providing users, both specialized and non-specialized, with the identification, location, and contact details of companies in Mexico. The study divided the group of companies into different categories based on their industry and size and taking into account the goals of the research and the available data on the population’s characteristics. The researchers created two groups, one to represent the specific sub-sector of activity of the companies and the other to represent their size.

After eliminating incomplete or erroneous responses, the final sample was made up of 4121 Mexican SMEs that had the distribution shown in Table 1.

Table 1. Sample distribution.

Industry	Total		Micro Size		Small Size		Medium Size	
	N	%	N	%	N	%	N	%
Primary Sector	132	3.20%	52	2.28%	31	2.96%	49	6.23%
Extractive Industries	67	1.63%	7	0.31%	12	1.14%	48	6.10%
Manufacturing Industries	855	20.75%	395	17.29%	209	19.92%	251	31.89%
Energy, Water, Recycling	44	1.07%	22	0.96%	11	1.05%	11	1.40%
Construction	126	3.06%	41	1.79%	43	4.10%	42	5.34%
Trade	668	16.21%	460	20.13%	132	12.58%	76	9.66%
Services	1630	39.55%	915	40.04%	468	44.61%	247	31.39%
Other Activities	599	14.54%	393	17.20%	143	13.63%	63	8.01%
TOTAL	4121	100%	2285	100%	1049	100%	787	100%

To ensure the survey was easily understood, a pretest was conducted with eight reliable companies before starting the fieldwork. Once the final sample was obtained, checks were performed to eliminate issues related to non-response bias and common method bias. To address non-response bias, the sample was divided into two groups (80% of the first responses were included in one group, and the remaining responses were in the second), and an ANOVA test revealed no significant differences in responses between them. To rule out common method bias, a single factor test was conducted [79]; the findings showed that six factors accounted for 63.75% of the total variance, with the primary latent factor accounting for 32.25%. As a result, it can be concluded that there were no problems caused by common method bias. This allowed for successful completion of the fieldwork [80].

Finally, in order to determine if the effects discovered in this study are valid, we utilized G*Power 3.1.9.4 software [81] to assess whether the sample size was appropriate. With two connections to the final dependent variable in mind, and assuming an average effect size of 0.15, an alpha level of 0.05, and a power of 0.95, the results indicated that a minimum of 107 observations was required [82]. This number is significantly lower than the sample size used in the present research.

3.2. Measurement Variables

To investigate the hypotheses presented in this study, based on the previous literature, four latent variables were established—implementation of e-commerce, operational efficiency, business digitalization, and corporate performance. These variables were defined as composites in mode A, since there is a presumed definitive relationship between the indicators and the latent variables. Additionally, mode A (reflective) was utilized due to the high correlation between the indicators used to construct each variable. A 5-point Likert scale was used to measure each latent variable, with responses ranging from strongly disagree (1) to strongly agree (5). Table 2 displays the composition and explanation of the variables used in this study.

Table 2. Variables used in the research.

Implementation of e-Commerce	
What technologies do you use in your company and how important are they? Please indicate the degree of importance for your company on a scale from 1 to 5, where 1 is not very important to 5 very important [13,83–87]:	
EC_001	Own website
EC_002	We make sales on our own e-commerce portal
EC_003	E-commerce in Marketplace (Amazon or equivalent)
EC_004	Social networks for commercial purposes
EC_005	Big data and data analysis software

Table 2. *Cont.*

Business Digitalization	
Indicate the degree of agreement or disagreement on a scale of 1 to 5 on the following aspects related to the digitalization strategy [29,87,88]:	
BD_001	We are well aware of the possibilities and advantages of digitalization
BD_002	We allocate significant resources to digitize the business
BD_003	The business model is evaluated and updated in terms of digitalization
BD_004	Our employees are prepared for the digital development of the company
BD_005	Our managers are well trained in digitalization
BD_006	The degree of process automation is high in my company
BD_007	We use digitalization in the organizational management of the company
BD_008	Our company regularly organizes training for digital transformation
Operational Efficiency	
In comparison with your direct competitors, indicate where your company stands on the following performance indicators [89–95]:	
OE_001	Quality of your products
OE_002	The efficiency of production processes
OE_003	Changes or improvements in existing products/services
OE_004	Changes or improvements in production processes
Corporate Performance	
In comparison with your direct competitors, indicate where your company stands on the following performance indicators [96–99]:	
CP_001	Customer satisfaction
CP_002	Speed of sales growth
CP_003	Profitability
CP_004	Employee satisfaction
CP_005	Level of absenteeism

3.3. Statistical and Econometric Procedures

In the previous section, it was mentioned that our model consists of four type A composites; therefore, according to [81,100], the most suitable technique for analyzing the relationships between variables is PLS-SEM. Moreover, this technique is particularly useful when there are multiple relationships with mediating and moderating effects, as is the case with our model. We ran this model for both confirmatory and explanatory purposes, using SmartPLS 4.0.7 software [100]. We developed a partial least squares structural equation model (PLS-SEM) for the purpose of studying confirmatory and predictive aspects of the model. In addition, as suggested by [101], to ensure accuracy, the bootstrapping procedure was conducted with 10,000 samples.

PLS-SEM, or partial least squares structural equation modeling, stands as an alternative to conventional statistical methods such OLS regression, canonical correlation, or covariance-based SEM for studying the relationships between independent and dependent variables [102]. It falls under the category of second-generation multivariate data analysis techniques and offers a robust and efficient statistical approach. The use of powerful software, such as SmartPLS, in this study enhances its effectiveness [103]. PLS-SEM has transformed empirical research by enabling the simultaneous examination of numerous relationships between independent and dependent variables, providing researchers with a high level of confidence in their findings [97].

PLS-SEM excels at estimating the relationships between constructs and evaluating the model's capacity to clarify the target variables. Its versatility in estimating models with intricate relationships, all without demanding excessive prerequisites, has made it widely

utilized in various scientific domains, including economics, social sciences, and educational sciences, among others [104].

PLS-SEM consists of two fundamental components:

1. **Structural Model:** This represents the theoretical model, illustrating the dependency relationships between independent and dependent variables. It helps in understanding how different variables are interconnected and influence one another.
2. **Measurement Model:** This part demonstrates the relationships between constructs and their respective indicators. It helps ensure that the selected indicators effectively measure the constructs they are intended to represent.

Together, these components allow researchers to analyze and understand complex relationships within their data and test hypotheses in a holistic manner [105].

In the measurement model analysis, we performed several assessments to ensure the quality of our measurements:

1. **Loadings Analysis:** We examined the loadings of the indicators, which represent the simple correlations between each indicator and its respective construct. These loadings help us understand how well each item measures the intended construct.
2. **Reliability Analysis:** To assess the reliability of our constructs, we utilized various measures, including:
3. **Cronbach's Alpha:** This statistic assesses the internal consistency of a test or scale. It indicates how closely related the items in a construct are. A higher Cronbach's alpha suggests greater reliability.
4. **Composite Reliability:** This measure evaluates the reliability of a construct by considering the correlations between its indicators. It provides an insight into the consistency and stability of the construct.
5. **Dijkstra–Henseler Rho Ratio:** This ratio is another indicator of composite reliability, offering an alternative perspective on the internal consistency of a construct.

Reliability is a crucial aspect of measurement because it ensures that the data collected accurately reflects the intended constructs, minimizing measurement errors. It demonstrates the degree to which responses are consistent and stable across different items within the same construct [106]. Composite reliability is a valuable measure in assessing the reliability of constructs in a scale or measurement model. It differs from Cronbach's alpha in that it does not assume that all constructs have the same weight. Instead, composite reliability takes into account the loadings of each indicator in the causal model. In essence, composite reliability is calculated by treating the loadings of each indicator as simple regressions of the effect variable using the ordinary least squares procedure. This approach considers the relationships between the indicators and their respective constructs as they are specified in the theoretical model, providing a more accurate picture of the reliability of each construct. Composite reliability is a robust indicator because it considers the unique contributions of each indicator to its construct, taking into account both the strength and direction of these relationships. It is a valuable tool to ensure that the constructs used in a study are reliable and that the data accurately reflect the underlying theoretical concepts [79]. The Dijkstra–Henseler rho ratio is another important measure of construct reliability; it plays a unique role in assessing the reliability of constructs in a scale or measurement model. It is noteworthy that this measure typically falls between the values of Cronbach's alpha and composite reliability [80]. Convergent validity is a crucial aspect of assessing the quality of a measurement model in structural equation modeling (SEM). It helps determine whether a construct is accurately measured by its indicators. The average variance extracted (AVE) is one of the commonly used indicators to assess convergent validity [107].

The assessment of the model's discriminant validity involves two key steps:

Firstly, adhering to the Fornell–Larcker criterion [107] we ensured that the correlations between pairs of latent variables did not surpass the square root of the average variance extracted (AVE) for each respective latent variable [98]. This step helps confirm that these latent variables are distinct constructs.

Secondly, we scrutinized the heterotrait–monotrait (HTMT) values. HTMT gauges the average correlations between indicators measuring the same construct compared with the average correlations of indicators measuring different constructs that represent different phenomena [80]. This analysis is instrumental in verifying that the model's latent variables are indeed measuring separate constructs.

Lastly, the measurement model's overall goodness-of-fit was assessed by examining the standardized root mean square residual (SRMR). The SRMR is an indicator that considers the correlations between indicators measuring the same construct in relation to the correlations between indicators measuring different constructs, which represent distinct phenomena [82]. This step completes the evaluation of the measurement model's validity.

Concerning the structural model, we will employ the variance inflation factor (VIF) to ensure that there are no issues with multicollinearity. VIF quantifies the level of correlation between a variable and all the other variables within the model [80].

For evaluating the model's explanatory power, we turn to the coefficient of determination (R²). R² signifies the portion of variability in a dependent variable that the statistical model can anticipate.

Additionally, we utilize f^2 to gauge the effect size [107]. This metric measures the extent to which an exogenous construct contributes to the explanation of a specific endogenous construct in terms of R².

4. Results

As stated by [80], the analysis of a model through PLS-SEM starts with the analysis of the measurement model and then carries out the analysis of the structural model. In our case, the structural model will be analyzed in three stages: analysis of the direct effects, analysis of the mediating effects, and analysis of the moderating effects.

4.1. Measurement Model

The objective of measuring model analysis is to ensure the reliability and validity of the items that make up the constructs and the constructs themselves [108]. The results of the performed tests are shown in Table 3.

The reliability of the constructs is analyzed through the loads, which must report a value higher than 0.7 [109]. This happens in all the items except for two, but their values are higher than 0.6, so these items can be kept within the model. In order to confirm the reliability of the constructs, we calculated Cronbach's Alpha, composite reliability [110], and the Dijkstra–Henseler rho ratio [111]. The results must exceed 0.7 to establish reliability, which was the case for all the constructs [109]. Similarly, we assessed the convergent validity of the variables using the average variance extracted (AVE), which was established by confirming that all results surpassed the minimum threshold of 0.5 [112].

The measurement model analysis proceeds with the discriminant validity examination, which involves applying the Fornell–Larcker criterion [107]. This criterion requires that the correlations between any pair of variables should not surpass the square root of the average variance extracted (AVE) for each of these variables. As indicated in Table 4, the variables included in the model satisfy the Fornell–Larcker criterion. Moreover, discriminant validity has been confirmed by ensuring that all heterotrait–monotrait (HTMT) ratio values do not exceed the maximum threshold of 0.85 [109].

Furthermore, the quality of the study was evaluated by ensuring that for both the saturated and the estimated model, the standardized root mean square residual (SRMR) did not surpass a threshold of 0.08 and that the normed fit index (NFI) was above the minimum established of 0.9 [113]. Based on these findings, the model specifications appear to be a good fit.

Table 3. Measurement model results.

Composite Indicators	Mean	SD	Loading	t-Student	α	ρ_A	ρ_C	AVE
Implementation of E-commerce					0.808	0.813	0.867	0.569
EC_001	2.616	2.062	0.810	130.086				
EC_002	2.049	1.962	0.842	153.669				
EC_003	1.787	1.927	0.724	69.308				
EC_004	3.278	1.828	0.667	64.945				
EC_005	1.779	1.907	0.713	75.144				
Business Digitalization					0.939	0.940	0.949	0.702
BD_001	3.654	1.249	0.695	71.181				
BD_002	3.109	1.358	0.851	150.978				
BD_003	3.008	1.369	0.857	174.739				
BD_004	3.145	1.304	0.847	145.059				
BD_005	3.305	1.317	0.852	159.828				
BD_006	2.922	1.314	0.847	147.708				
BD_007	3.024	1.334	0.877	202.844				
BD_008	2.961	1.363	0.864	173.057				
Operational Efficiency					0.774	0.778	0.854	0.595
OE_001	4.211	0.927	0.791	104.048				
OE_002	4.061	0.924	0.772	98.517				
OE_003	3.638	1.554	0.775	83.675				
OE_004	3.454	1.585	0.746	72.133				
Corporate Performance					0.813	0.830	0.870	0.574
CP_001	4.324	0.863	0.784	104.917				
CP_002	3.967	0.971	0.811	113.763				
CP_003	3.980	0.931	0.795	93.947				
CP_004	4.173	0.897	0.777	83.718				
CP_005	3.719	1.146	0.601	41.823				

Significance and standard deviations (SD) performed by a 10,000-repetition bootstrapping procedure. α : Cronbach’s alpha; ρ_A : Dijkstra–Henseler’s composite reliability; ρ_C : Jöreskog’s composite reliability; AVE: Average variance extracted; All loadings are significant at a 0.001 level.

Table 4. Discriminant validity.

		I	II	III	IV
I	Business Digitalization	0.838	0.358	0.729	0.499
II	Corporate Performance	0.302	0.758	0.301	0.830
III	Implementation of E-commerce	0.644	0.236	0.754	0.409
IV	Operational Efficiency	0.415	0.684	0.322	0.771

HTMT ratio over the diagonal (bold). Fornell–Larcker criterion: square root of AVE in diagonal (italics) and construct correlations below the diagonal.

4.2. Structural Model: Direct Effects

We began the analysis of the structural model by ruling out the existence of multicollinearity issues. To do this, we analyzed the variance inflation factor (VIF). The results in Table 5 show that the VIF values fluctuate between 1 and 1.934, far from the maximum value of 3 recommended by [109]. These results allow us to rule out multicollinearity problems.

Next, the magnitude, significance, and sign of the direct relationships established in the model were analyzed. In order to perform this analysis, a one-tailed percentile bootstrapping test was conducted with 10,000 subsamples and a significance level of 5% to obtain the t-values and confidence intervals.

The results shown in Table 6 and Figure 2 show how the implementation of e-commerce positively and significantly influences the business digitalization and operational efficiency ($\beta = 0.644$ *** and $\beta = 0.094$ ***, respectively), accepting H1a and H1b. However, the findings show how the implementation of e-commerce does not influence corporate performance ($\beta = -0.012$ ns), rejecting H1c.

Table 5. Multicollinearity assessment.

		I	II	III
I	Business Digitalization		1.934	1.709
II	Implementation of E-commerce	1.000	1.771	1.709
III	Operational Efficiency		1.412	

Table 6. Structural model assessment.

	Path	SD	T-Value	f2	CI		H	Supported	
					5%	95%			
Direct effects									
Impl. Of E-commerce > Business Digitalization	0.644	0.010	65.752 ***	0.709	0.628	0.660	H1a	YES	
Impl. Of E-commerce > Operational Efficiency	0.094	0.019	4.988 ***	0.006	0.064	0.125	H1b	YES	
Impl. Of E-commerce > Corporate Performance	-0.012	0.015	0.797	0.000	-0.037	0.013	H1c	NO	
Business Digitalization > Corporate Performance	0.032	0.018	1.808 *	0.001	0.003	0.061	H2a	YES	
Business Digitalization > Operational Efficiency	0.354	0.020	17.927 ***	0.089	0.322	0.386	H3a	YES	
Operational Efficiency > Corporate Performance	0.687	0.013	6.302 ***	0.634	0.664	0.705	H3c	YES	
Indirect effects									
Individual indirect effects									
VAF									
Impl. Of E-commerce > Business Digitalization > Corporate Performance	0.021	0.011	1.806 *		0.002	0.039	9.17%	H2b	YES
Impl. Of E-commerce > Business Digitalization > Operational Efficiency	0.228	0.014	16.786 ***		0.206	0.250	70.81%	H3b	YES
Business Digitalization > Operational Efficiency > Corporate Performance	0.242	0.015	16.654 ***		0.219	0.267	88.32%	H3d	YES
Impl. Of E-commerce > Operational Efficiency > Corporate Performance	0.064	0.013	4.961 ***		0.043	0.086	27.95%	H3e	YES
Impl. Of E-commerce > Business Digitalization > Operational Efficiency > Corporate Performance	0.156	0.010	15.730 ***		0.140	0.173	68.12%	H3f	YES
Moderating effects									
Business Digitalization × Impl. Of E-commerce > Corporate Performance	0.083	0.013	6.302 ***		0.061	0.105			
Business Digitalization × Operational Efficiency > Corporate Performance	0.023	0.016	1.444		-0.003	0.051			
Global indirect effects									
Business Digitalization > Corporate Performance	0.242	0.015	16.654 ***		0.219	0.267	88.32%		
Impl. Of E-commerce > Corporate Performance	0.241	0.014	17.265 ***		0.218	0.264	100.00%		
Impl. Of E-commerce > Operational Efficiency	0.228	0.014	16.786 ***		0.206	0.250	70.81%		
Total effect									
Business Digitalization > Corporate Performance	0.274	0.022	12.734 ***		0.239	0.309			
Impl. Of E-commerce > Corporate Performance	0.229	0.016	14.443 ***		0.203	0.255			
Impl. Of E-commerce > Operational Efficiency	0.322	0.014	22.520 ***		0.299	0.346			
Operational Efficiency > Corporate Performance	0.684	0.013	5me05 ***		0.664	0.705			

R² adjusted [95% CI in brackets]: Business Digitalization: 0.415 [0.394; 0.436]; Operational Efficiency: 0.177 [0.158; 0.198]; Corporate Performance: 0.477 [0.455; 0.501]. f2: Size Effect Index; 95PCI: 95 Percentile Confidence Interval; VAF: Variance Accounted Formula, ×100 represents the proportion mediated. Significance, standard deviations, and 95% bias-corrected CIs were performed by a 10,000-repetition bootstrapping procedure; *: $p < 0.05$; ***: $p < 0.001$. Only total effects that differ from direct effects are displayed.

Regarding business digitalization, the results show a positive and significant influence on corporate performance and operational efficiency ($\beta = 0.032 *$ and $\beta = 0.354 ***$, respectively), accepting H2a and H3a. Finally, as can be observed, the operational efficiency influences corporate performance ($\beta = 0.687 ***$), accepting H3c.

The analysis of R² reveals that this model accounted for 41.5% of the variability in business digitalization, 17.1% in operational efficiency, and 47.7% in corporate performance. Furthermore, according to [114], a minimum value of 0.10 is established, and the values of 0.75, 0.50, and 0.25 are considered as substantial, moderate, and weak, respectively [109]. Hence, these findings confirm the model’s satisfactory explanatory power.

To wrap up the examination of the structural model, we examined the effect size (f2). This metric quantifies the impact of each independent variable on the corresponding dependent variable. The findings indicate that the implementation of e-commerce strongly impacts business digitalization and operational efficiency strongly impacts corporate performance [82].

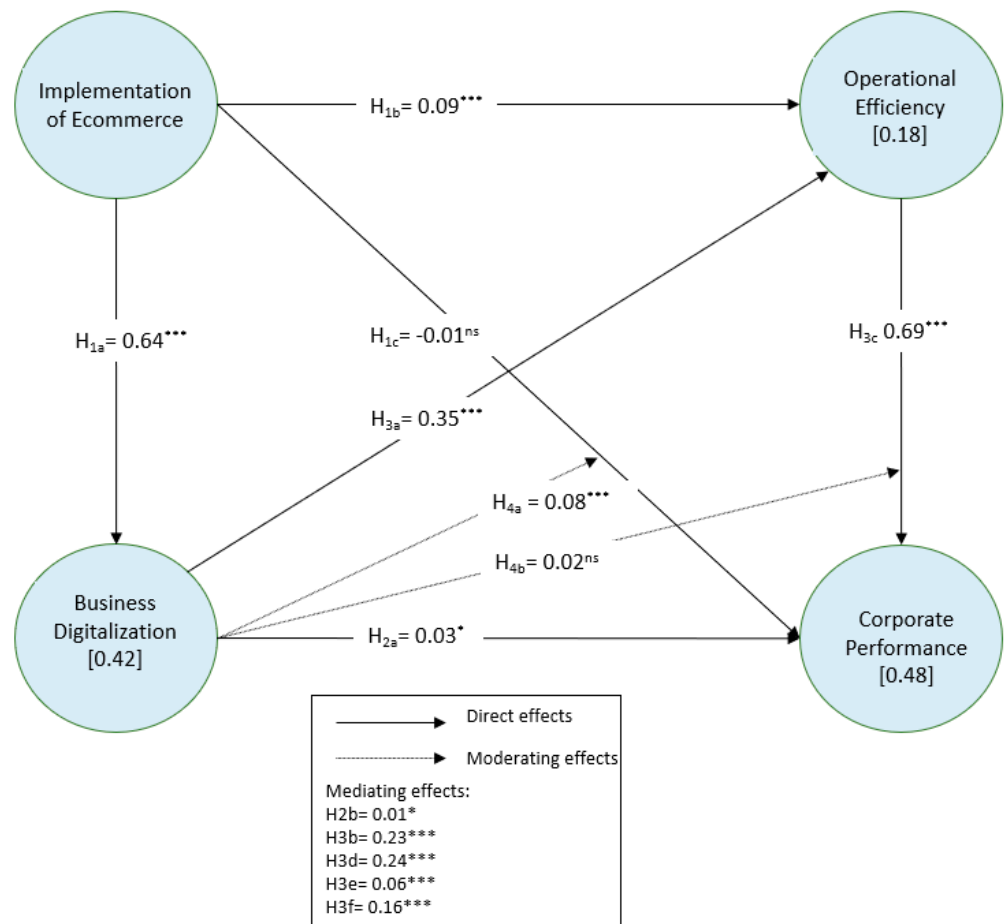


Figure 2. Results (**<math> < 0.001</math>; * <math> < 0.050</math>; ns > 0.050).

In Figure 2, the standardized path coefficients and R^2 values are presented. The standardized path coefficients indicate the extent to which the predictor variables contribute to the variance of the endogenous variables [115]. Furthermore, the R^2 values for each dependent variable are displayed, representing the proportion of variance explained by the variables that predict that particular dependent variable.

4.3. Structural Model: Mediating Effects

After analyzing the relationships established through direct effects, we verified the existence of indirect effects through mediating relationships. The results in Table 6 show how business digitalization mediates the impact of the implementation of e-commerce on corporate performance ($\beta = 0.021$ *) and on operational efficiency ($\beta = 0.228$ ***), accepting H2b and H3b. Similarly, operational efficiency mediates the relationship between business digitalization and corporate performance ($\beta = 0.242$ ***) and implementation of e-commerce and corporate performance ($\beta = 0.064$ ***), accepting H3d and H3e. Finally, the findings show a sequential mediation of business digitalization and the operational efficiency of the relationship between the implementation of e-commerce and corporate performance ($\beta = 0.156$ ***), accepting H3f.

Regarding the magnitude of the indirect effect, quantified by the variance accounted for (VAF), the indirect effect of business digitalization on corporate performance is 88.32%, and the indirect effect of the implementation of e-commerce on operational efficiency is 70.81%. On the other hand, the indirect effect of the implementation of e-commerce on corporate performance is 100%, with 8.71% through business digitalization, 26.55% through operational efficiency, and 64.73% through business digitalization and operational efficiency sequentially, offsetting the non-significant negative direct effect.

4.4. Structural Model: Moderating Effects

The above results show H4b is not supported, as the moderating effect of business digitalization on the relationship between operational efficiency and corporate performance ($\beta = 0.023$; $p > 0.05$) is insignificant.

However, the results allow us to accept H4a. The results of the interaction analysis are presented in Figure 3. To investigate how business digitalization impacts the relationship between the implementation of e-commerce and corporate performance, this study used the method established by [116] to examine the conditional moderating effect. The findings confirm that the positive effect of the implementation of e-commerce on corporate performance is moderated by business digitalization ($\beta = 0.083$ ***). Figure 2 provides a detailed view of the moderating effect slope, showing that the impact of the implementation of e-commerce on corporate performance is stronger when the company has a more advanced digitalization. Although in the first levels of the implementation of e-commerce this is not true, as soon as the company reaches an adequate level this effect is clearly fulfilled.

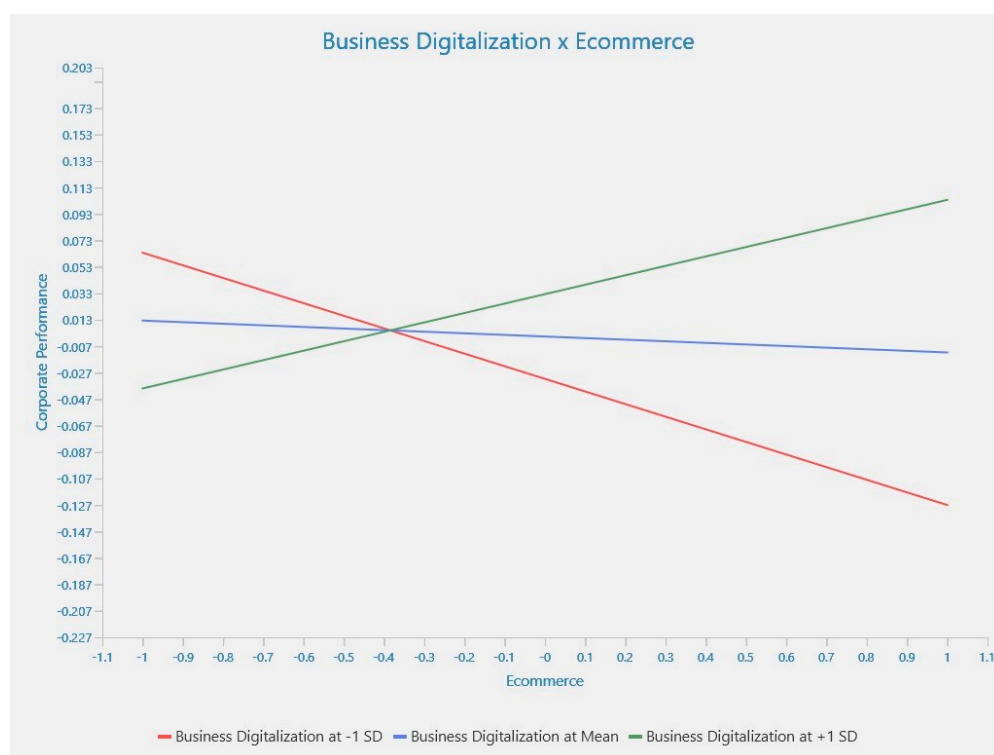


Figure 3. The moderating effect of business digitalization on the relationship between the implementation of e-commerce and corporate performance.

5. Discussion

The comprehensive examination of the data provides strong support to the research framework. To begin with, the results show us that there is a positive correlation between the implementation of e-commerce, business digitalization, and operational efficiency. This confirms the findings of scholars such as the authors of [19,58], who affirm that e-commerce has a great influence on strategic management and business planning. Thus, we found that the implementation of e-commerce positively influences digitization and operational efficiency, as previous work has shown [15,58]. However, we must differentiate between concepts that can easily be confused with each other. The empirical analysis shows that the implementation of e-commerce is not digitalization, even if it is part of it, as the academic literature points out [29,40,41]. Digitalization is a more complex business process. This means that the implementation of e-commerce has no direct impact on corporate performance [23], contrary to expectations and to what previous works showed us (H1c

rejected) [64]. For the implementation of e-commerce to affect corporate performance, it must be mediated or moderated by other business processes.

In addition, business digitalization and operational efficiency are key concepts that directly affect corporate performance [64]. Both concepts not only directly affect performance but also serve as a vehicle for the successful impact of the implementation of e-commerce on corporate performance. The results show that business digitization mediates and moderates and that operational efficiency is as an intermediary. This is consistent with the previous academic literature that finds business digitization and operational efficiency to be key capabilities in the development of business performance [44,58,64,66].

In conclusion, these results lead us to conclude that the implementation of e-commerce will only impact corporate performance if it initiates the process of business digitalization and contributes to corporate efficiency. Although the implementation of e-commerce has served to maintain businesses in the scenario posed by the COVID-19 pandemic [35–37], especially for SMEs, business development requires additional actions.

6. Conclusions

The theoretical implications of the study are to consider the implementation of e-commerce as a part of business digitalization, and they are therefore considered in the academic literature as part of the digitalization process. Our study contributes to the knowledge in this field by confirming that e-commerce is only a part of the whole, since we found that if e-commerce is not accompanied by complete digitalization in all areas of the company, this channel does not have significant effects on corporate performance. This is because the implementation of e-commerce does not involve the level of corporate transformation required for business digitalization (e.g., the implementation of e-commerce can be outsourced to a marketplace).

Another effect of digitalization found in the literature is its contribution to operational efficiency. Our study shows that the implementation of e-commerce should contribute to the digitalization process and operational efficiency, both directly and through digitalization. The extent to which these processes are activated will affect the corporate performance. Although some studies show a direct relationship between digitalization and efficiency, the relationship between e-commerce implementation and efficiency is not as well established in the literature, a gap that we have contributed to filling.

On the other hand, the digitalization of SMEs has been scarcely addressed by academics, perhaps because it is considered a space reserved for large companies. Our study shows that the digital transformation process can also be carried out in smaller companies. All companies must follow the digital transformation present in today's societies. Our study shows that the digital transformation process can also be carried out in smaller companies. The digital transformation present in today's societies must be followed by companies, since Industry 4.0 is a process that concerns everyone and SMEs contribute to more than 80% of its wealth. This situation is not only observed in Mexican SMEs but also in developed and developing economies in general.

The managerial implications are clear. Digital transformation includes the implementation of e-commerce but should not be limited to this. The success of corporate performance depends on properly tuning the implementation of e-commerce as part of the digitalization of business and must be accompanied by advances in operational efficiency. To the extent that these processes are developed simultaneously, the performance of organizations will reach higher levels.

Although this study provides valuable insights into digital transformation in Mexican SMEs, it has some limitations that suggest future directions for research. First, there is a need to extend the generalizability of the results beyond Mexico, considering revalidation in different geographical and economic contexts. Further studies could focus on comparing the effects of digital transformation on corporate performance in countries with diverse economic realities, which would further enrich our understanding of this phenomenon. Second, new variables that could influence the relationship between digital transformation

and corporate performance can be explored, further enriching the theoretical framework and understanding of this phenomenon. Finally, although this article focuses on SMEs, future research could broaden its scope by analyzing the impact of digital transformation on larger firms, allowing for a broader comparison and a more complete understanding of its implications across different firm sizes. These considerations open the way to a valuable body of further research in this field.

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