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Digital Capabilities on Business Performance: Does It Matter?

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ABSTRACT

Objective: the study aims to address the central research question: How do digital capabilities impact the performance of digital businesses? We explore digital capabilities in the context of digital transformation, enhancing the understanding of this phenomenon for businesses through dynamic capability theory and defining digital capabilities based on previous studies. **Methods:** these capabilities are presented in the research model. A survey was conducted with 308 digital businesses, and the hypotheses were tested using partial least squares structural equation modeling. **Results:** this paper demonstrates the significant impact of digital capabilities on business performance, providing evidence that ecosystem orchestration capability is a precursor to other capabilities. **Conclusions:** we conclude that a critical factor for a digital business's success is its responsiveness. Digital capabilities are essential for a company's success in the new digital business landscape. Additionally, digital technologies enable entrepreneurs to create innovations that cross traditional industry boundaries, integrating digital and non-digital assets and scaling new ventures with new products, services, and business models. This study is valuable for managers to direct investments in digital technologies, integrate stakeholders, and respond quickly to customer demands to enhance performance.

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INTRODUCTION

Digital technologies have contributed enormously toward improving entrepreneurial processes (Deng et al., 2023). However, digital businesses must develop digital capabilities to keep up-to-date and be able to respond rapidly to market needs (Li et al., 2022; Von Briel et al., 2018).

Digital technologies enable entrepreneurs to create innovations that can cross traditional industry boundaries, integrating digital and non-digital assets and scaling new ventures with new products, services, and business models (Nambisan et al., 2017; Nambisan & Baron, 2021). These authors underscore the pivotal role of digital capabilities in the realm of entrepreneurship, highlighting how digital technologies empower entrepreneurs to break down the barriers of conventional industry boundaries, seamlessly integrating both digital and non-digital assets. In essence, digital capabilities serve as the bedrock upon which entrepreneurs build their innovative endeavors, allowing them to navigate the dynamic landscape of the digital age, transcend traditional constraints, and achieve unprecedented success (Heredia et al., 2022; Heubeck, 2023).

Thus, digital technologies have boosted the development of digital businesses around the world. In South America, Brazil stands out in this scenario, having 149 million internet users and 83 million e-shoppers. Companies like Amazon, Alibaba, Otto, La Poste, DHL, and Adidas have perceived this opportunity and are reaching these e-consumers. The Brazilian e-commerce segment ended 2022 with US$ 37.4 billion in earnings, a 20 percent increase compared to 2021 (e-Commerce Brazil, 2023).

It is essential to highlight that digital capabilities refer to the skills and processes that enable a business to effectively develop, mobilize, and utilize digital technologies to achieve strategic goals (Warner & Wäger, 2019). These capabilities encompass the ability to integrate digital tools into business operations, respond to market changes, and drive innovation (Bharadwaj et al., 2013). Digital business denotes businesses that primarily operate in the digital realm, leveraging technologies such as the internet, mobile applications, and digital platforms to deliver products and services (El Sawy et al., 2010; Wamba et al., 2017; Yoo et al., 2010). Consequently, digital businesses must develop digital capabilities to remain agile, not only by standardizing infrastructures but also by managing digital resources that are multifaceted and dynamic (Bharadwaj et al., 2013).

In the same vein, according to Chen et al. (2023), merely adopting digital technologies is insufficient; enterprises must have the capability to effectively deploy these tools to achieve their goals. As such, digital capabilities have proven to be a key part of a company's success in this new digital business landscape. Additionally, it is imperative for digital businesses to effectively leverage available technological resources. This capability provides companies with opportunities to gain competitive advantages and, consequently, create new business value (Heredia et al., 2022; Herold et al., 2023).

Despite the extensive research on digital capabilities, there is still a gap in understanding the specific relationship between these capabilities and the performance of digital businesses. Recent studies have highlighted the necessity for further research to understand how digital-related capabilities can drive digital innovation and competitive advantage, especially in different market contexts and industries (Kastelli et al., 2022; Malchenko et al., 2020). This investigation focuses on key variables such as digital capabilities, ecosystem orchestration, responsiveness, ecosystem connectivity, sensing, and process digitization, which will be elaborated upon in the subsequent sections of the paper.

So, this article aims to address the central research question: How do digital capabilities impact the performance of digital businesses? This study makes several contributions to the field. It provides a comprehensive definition of digital capabilities and digital business, empirically tests the impact of these capabilities on business performance, and highlights the importance of these capabilities, i.e., ecosystem orchestration, responsiveness ecosystem connectivity, sensing, and process digitization.

Furthermore, it offers valuable insights for managers to direct investments in digital technologies, integrate stakeholders, and respond quickly to customer demands. In the following section, we present the theoretical background and the hypotheses. The third section depicts the method, which is then followed by the results and the conclusion.

THEORETICAL BASIS AND HYPOTHESES DEVELOPMENT

In the current era of rapid technological advancements, digital capabilities are pivotal for businesses striving to maintain competitive advantage and drive innovation. These capabilities enable firms to efficiently utilize digital technologies, facilitating better decision-making, enhancing customer experiences, and optimizing operational efficiencies. The importance of digital capabilities is underscored by their role in enabling organizations to adapt to dynamic market conditions, integrate new digital tools seamlessly, and leverage data for strategic insights (Kane et al., 2015; Vial, 2021). Furthermore,

digital capabilities are critical for fostering agility within organizations, allowing them to swiftly respond to disruptions and capitalize on emerging opportunities. This agility is particularly vital in industries undergoing digital transformation, where the ability to innovate and scale rapidly can significantly impact a firm's market position (Verhoef et al., 2021; Westerman et al., 2014). As digital ecosystems become more complex, the development of robust digital capabilities ensures that businesses can navigate these environments effectively, collaborate with diverse stakeholders, and create sustainable value through continuous innovation (Ross et al., 2019; Warner & Wäger, 2019).

The term 'digital capabilities' is constructed around key concepts such as "the abilities to develop, mobilize, and use organizational resources," as indicated by Tams et al. (2014, p. 299), "based on digital technology platforms," as noted by Yoo et al. (2012, p. 1400), and "to respond to the environment and add value," as highlighted by Kohli and Grover (2008, p. 28). These elements collectively form a comprehensive understanding of digital capabilities.

It is essential to recognize that digital capabilities necessitate a combination of skills and processes within a digital business. The mere acquisition and possession of resources do not guarantee superior performance, especially in markets where firms have similar access to these resources. Instead, organizations must develop unique capabilities by integrating and enhancing resources to make them more valuable and inimitable. This perspective is aligned with the resource-based view (RBV) and dynamic capabilities framework, which emphasize the importance of developing unique capabilities that can provide a competitive advantage (Teece et al., 1997).

The concept of dynamic capabilities plays a central role in understanding how businesses adapt to the rapidly changing digital environment. Dynamic capabilities are defined as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al., 1997). This theoretical approach is highly relevant due to the dynamic and turbulent nature of the digital business landscape, which requires firms to adapt their strategies and operations to stay competitive continuously (Eisenhardt & Martin, 2000; Teece, 2007).

Our study grounds itself in the dynamic capabilities to explore how digital capabilities — comprising ecosystem orchestration, responsiveness, ecosystem connectivity, sensing, and process digitization — enable businesses to thrive in digital markets. The dynamic capabilities perspective emphasizes three main processes: sensing opportunities and threats, seizing these opportunities, and reconfiguring resources and capabilities to maintain competitiveness (Teece, 2007).

So, it is understandable that digital capabilities refer to a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Nadkarni & Prügl, 2021; Sambamurthy et al., 2003). These capabilities are embedded within the firm's social, structural, and cultural context, allowing for sustained competitive advantage through continuous innovation and adaptation.

The mobilization of resources and the development of new organizational capabilities are crucial. This involves focusing on various organizational aspects such as personnel, facilities, structures, and processes to ensure quality, speed, storage, and information flow. These improvements enable enhanced client relationships and superior performance in the digital world. As noted by Bharadwaj et al. (2013), the integration of digital tools into business operations is essential for driving innovation and responding to market changes effectively.

Synthesizing these definitions, we propose the following comprehensive definition: 'Digital capabilities are the combination of skills and processes of a business to develop, mobilize, and use organizational resources supported by digital technology platforms to respond to the environment and add value to the organization.'

Besides, we noticed that it is necessary a combination of skills and processes of a digital business because it is not clear whether the mere acquisition and possession of packages of resources is enough to achieve superior performance, especially when most of the firms have access to markets with similar factors. On the contrary, organizations should develop new capabilities by adding resources that would make them comparatively more valuable and inimitable.

Digital capabilities can be understood by the theories of resources and capabilities, which explain the construction of capabilities. They refer to the firms' capability to integrate, build, and reconfigure capabilities, internal and external resources to create superior capabilities that are incorporated into their social, structural, and cultural context (Nadkarni & Prügl, 2021; Sambamurthy et al., 2003).

We understand that the mobilization of resources and new organizational capabilities becomes vital, focusing on people, facilities, structures, to ensure quality, speed, storage, and information flow, which will enable improvements in processes and client relationships and, thus, superior performance in the digital world.

So, we synthesize all the definitions encountered in this definition: 'Digital capabilities are the combina-

tion of skills and processes of digital business to develop, mobilize, and use organizational resources supported by digital technologies platforms to respond to the environment and add value to the organization.'

The theoretical approach must be considered. Due to the dynamic and turbulent scenario in which digital business is inserted, we are using the dynamic capability approach. We decided for this perspective because, according to Eisenhardt and Martin (2000) and Teece et al. (1997), in dynamic markets, it makes sense to use dynamic capabilities to build new resource configurations and new capabilities. Some dynamic capabilities integrate resources and product development routines by which managers combine their varied skills and functional backgrounds to create revenue-producing products and services.

Kohli and Grover (2008) propose that firms must first discover what capabilities are required and then identify what it takes to build them to improve digital business performance. In the following section, we examine the relationship between digital capabilities and digital business performance (Heredia et al., 2022).

According to Bharadwaj et al. (2013), the post-dotcom decade has seen both established and startup firms take advantage of the decreased prices and computing performance levels (hardware and software) as well as global connectivity through standard protocols (e.g., internet and mobile web) so as to adapt their business infrastructure to the new digital era. Consequently, the new digital business model has appeared as an advantageous way to apply all digital technology possibilities for improving business performance.

Digital capability can be defined as a firm's ability to form and implement strategic responses that aim to improve its value proposition, by integrating resources within and across organizational boundaries and by controlling organizational activities for achieving the desired changes through combinations of digital technologies (Wielgos et al., 2021). Fichman et al. (2014) define a digital business model as a "new way to create and capture business value, which materializes or is enabled by IT" (p. 335). The authors Weill and Woerner (2013) emphasize the need for a digital platform to deliver value and to be incorporated into complex ecosystems (El Sawy et al., 2010; Hanelt et al., 2021).

Digital capabilities can be considered as the set of capabilities that boosts the organization's abilities to effectively develop, mobilize, and utilize organizational resources and consequently improve its processes, like client relationship management, new product development, knowledge management, and collaboration through the use of digital technologies (Nadkarni & Prügl, 2021; Tams et al., 2014). Yu et al. (2022) highlight that enterprises need to focus on building their own digital transformation capabilities to create new enterprise value.

Bharadwaj et al. (2013) affirm that there are no generic metrics for firm performance, and they underscore the importance of researchers to examine the effects of digital business to theorize over and develop metrics. However, the authors maintain that it is necessary to observe both aspects within a company and about the companies and with other agents, like the clients, to verify performance.

Rai et al. (2006) demonstrate that three areas of analysis for measuring performance should be observed in the relationship between a company's performance and its competition: operational excellence, the relationship with clients and other stakeholders involved in business processes, and revenue growth.

Operational excellence is defined as the ability of a company to respond to customers and productivity improvements regarding its competitors (Rai et al., 2006; Li et al., 2020). The relationship with clients and other stakeholders involved in business processes is a consequence of this operational excellence since it is necessary to keep verifying the satisfaction of all the agents involved in both internal and external operations, according to the authors Rai et al. (2006) and Benitez et al. (2022).

In addition to operational excellence and customer relations, financial performance is also a performance indicator. Performance can be analyzed by revenue growth, but it can also be examined through return on investments and its relation to the operating profit, as observed by Chi et al. (2016). In other words, financial performance can be analyzed by one or more of the following indicators: return on investment, profit margin, revenue growth, and operating profit on business assets (Benitez et al., 2022; Power et al., 2010).

Thus, for this study, we consider Power et al.'s (2010) financial performance and customer relationship performance (Benitez et al., 2022; Lin et al., 2010; Rai et al., 2006), as presented in the appendix (https://doi.org/ 10.17632/xyhz8gw5fh.1). In the following items, we illustrate this study's hypotheses.

Ecosystem

In the digital age, businesses must integrate seamlessly with ecosystems to remain competitive and thrive. Digital businesses inherently operate within these ecosystems, leveraging interconnected platforms, technologies, and networks to create and capture value. This integration requires the development of robust digital capabilities that enable businesses to adapt to the dy-

namic and multifaceted nature of digital ecosystems (Nambisan et al., 2017).

Firms within ecosystems are continuously developing new strategies to cater to emerging market dynamics. They engage in both competition and collaboration within these ecosystems to ensure total connectivity. For instance, Apple and Amazon may compete in the hardware market while collaborating through Amazon's reader applications available on Apple devices (Yoo et al., 2010). Total connectivity implies enabling connections at any time, any place, for anyone, and anything within the ecosystem.

Studies in the information systems field have frequently associated ecosystems with the development of digital technologies, products, platforms, and infrastructure (Dąbrowska et al., 2022; Ivarsson & Svahn, 2020; Jacobides et al., 2018). Nambisan et al. (2017) suggest that new digital infrastructures and their associated capabilities can significantly complement a firm's practices, such as collaborating with customers or a broader ecosystem of external partners. Furthermore, the architecture of the ecosystem can be tailored to the company's needs and structure, allowing it to join one or multiple ecosystems.

Therefore, digital businesses must reconsider how to standardize infrastructures and business processes around them, which also requires agility to respond to rapidly changing ecosystem conditions. It also calls for the orchestration of more multifaceted, data-rich, and dynamic digital resources (Bharadwaj et al., 2013). Nambisan et al. (2017) have also suggested the concept of orchestration "wherein one or more firms (or entities) assume the responsibility for coordinating value co-creation and value appropriation" (p. 230). It becomes necessary to orchestrate the digital ecosystem to monitor the environment and assess the digital process among the ecosystem's agents and consequently connect them. Therefore, we divided the ecosystem approach into ecosystem orchestration and ecosystem connectivity.

In this way, Gupta et al. (2019) affirm that digital ecosystems can semantically and intuitively even be interpreted as a context or application or a mode of technological execution of both innovation and business ecosystems. The authors suggest that digital ecosystems play a fundamental role in the execution of innovation and business ecosystems, promoting the understanding of their interrelationships among all stakeholders, so it is necessary to orchestrate the ecosystem.

Ecosystem orchestration

Orchestration capability is crucial for managing the complex network of relationships within a digital ecosystem. Companies must coordinate interactions not only with customers and suppliers but also with other organizations and partners, such as producers of complementary products and services, logistics providers, outsourcers, and financiers (Markus & Loebbecke, 2013; Nambisan et al., 2017). This role of an orchestrator involves setting internal and external rules and procedures for the ecosystem (Nambisan & Baron, 2021). Nambisan et al. (2017) have theorized about digital business strategy and taken the perspective of ecosystem orchestrators, whose position in the ecosystem gives them the substantial power to dictate terms to more dependent companies (Nambisan & Baron, 2021; Wamba et al., 2017). That way, the owner can establish internal and external rules and procedures across their partners and other agents within the ecosystem.

Markus and Loebbecke (2013) provide some examples that can help illustrate the orchestrator's role in the ecosystem, such as the original equipment manufacturers (OEMs) in the automotive and high-tech industries and leading consumer product retailers. However, partners in an orchestrator's ecosystem might also be members of additional ecosystems (Linde et al., 2021). For example, a supplier of a particular automobile component or subassembly may supply all US OEMs; therefore, the respective OEMs' ecosystems would be at least partially overlapping. The broader the concept of the ecosystem, the more likely it is to include organizations belonging to multiple overlapping ecosystems.

Kazan and Damsgaard (2016) and Linde et al. (2021) developed a study on the ecosystem and added another idea of orchestration that complements the example above. According to these authors, most payment services are based on a four-party scheme (i.e., payer, payee, acquirer, card issuer), where these agents process payment transactions through orchestrated business models.

In the case of information products, the concept of orchestration is also applicable. For instance, the two-sided newspaper market with its two customer groups, readers, and advertisers, is changing due to digitalization. Therefore, the following hypotheses are proposed:

H1 — Ecosystem orchestration is positively related to the ecosystem connectivity capability.

H2 — Ecosystem orchestration is positively related to the sensing capability.

H3 — Ecosystem orchestration is positively related to the process digitization capability.

Ecosystem connectivity

Ecosystem connectivity refers to the socio-technical environment of individuals, organizations, and digital technologies that maintain collaborative and competitive relationships to co-create value on shared digital platforms (Senyo et al., 2019). Barenfänger and Otto (2015) argue that ecosystem connectivity is a crucial digital capability. Nambisan and Baron (2021) note that digital ecosystems aim to improve communication efficiency among internal agents and to structure the existing business ecosystem. Additionally, this ecosystem allows for condensing information from all corners of the IT organization (Wamba et al., 2017). According to Yoo et al. (2012), ecosystem capabilities enable a firm to search, explore, acquire, assimilate, and apply knowledge about resources, opportunities, and how resources can be configured to exploit opportunities.

H4 — Ecosystem connectivity is positively related to responsiveness capability.

Sensing

The sensing capability is defined as the ability to spot, interpret, and pursue opportunities in the environment (Pavlou & El Sawy, 2011). Digital technologies employed by digital businesses allow them to better sense and respond to customer needs (Setia et al., 2013). Continental Airlines, for example, "has adopted a data warehousing platform to gain access to real-time customer and flight information that helps them better understand and meet their passengers' needs and wants" (Setia et al., 2013, p. 566).

The sensing capability enables digital businesses to face some challenges, such as the difficulty in identifying new business opportunities (Kohli & Grover, 2008). This capability also helps companies to deal with a multitude of new channels such as social media, artificial intelligence, blockchain, IoT, and digital platforms (Industry 4.0 technologies), etc. (Benitez et al., 2022; Chellappa et al., 2010; Chen et al., 2023).

Thus, this digital capability plays an essential role in gathering data from the environment by producing useful information, as organizational value is extracted when the collected data is analyzed through data mining, leading to a meaningful difference in operational excellence and competitive market response (Kohli & Grover, 2008).

Moreover, digital businesses depend on sensing capability for subjective evaluation and decision-making. Whenever these firms sense a need to search outside for such solutions, they tend to seek support through their established relationships to be able to respond to demands (Lin et al., 2016).

Mikalef and Pateli (2017) corroborate this idea by denoting that the sensing capability can help ensure that a competitor's motions are closely monitored and that sufficient feedback by customers is received and analyzed for informing management decisions to respond to possible shifts in the business environment. Therefore, the following hypothesis is proposed:

H5 — The sensing capability is positively related to the responsiveness capability.

Process digitization

Process digitization is the transition from running a traditional business to a digital one, according to Barnir et al. (2023). These authors also affirm that digital resources obtained through the internet, though available to all firms, often require unique capabilities that are more present in some firms than in others and that offer benefits that are more important to some firms than to others. Bealiaeva et al. (2019) distinguish between different levels of business digitalization and prescribe them different enablers and sets of relationships.

Kohli and Grover (2008) add that firms should develop the ability to gain insight into their processes so that they can react and respond to problems or changes as fast as possible. In this sense, process digitization is a digital capability that can be developed for digital businesses.

Grover and Kohli (2013) offer some examples of process digitization, thereby demonstrating that there are currently many applications that perform various functions ranging from data retrieval (e.g., UPS package tracking) to data integration to disparate services (e.g., Kayak's airfare comparison) to more complex applications that create a business process (e.g., Auto Slash, a car rental monitoring application that rebooks a rental when cheaper options become available).

Lyytinen et al. (2016) affirm that "increasing the level of digitization in our everyday socioeconomic system involves representing, processing, storing, and communicating the widest possible range of matter, energy, and information comprising our world" (p. 49).

Täuscher and Laudien (2017) reinforce the crucial role of the digitization process capability by emphasizing that digital business interactions go beyond highly automated processes in electronic commodity trading or stock markets. They illustrate the example of marketplaces that use a digital platform to develop many digitized processes to integrate clients and stores but do not substantially produce or trade goods or services itself.

This digitization may be related, for instance, to the development/launch of electronic businesses, such as

the e-marketplace, e-commerce, among others (Koch, 2010). Furthermore, according to Bamir et al. (2023), process digitization benefits informational flow in several business sectors, such as marketing and IT, which implies good responsiveness.

Therefore, this digital capability enables speed to the processes and is linked to responsiveness. Once the process is digitized, the response can be instantaneous (Mishra et al., 2007). As a result, the reach of digitized processes ensures more agility and responsiveness in accessing information for the customers and within the firm (Setia et al., 2013). Thus, the following hypothesis is proposed:

H6 — The process digitization capability is positively related to the responsiveness capability.

Responsiveness

Digital technologies are known to be key enablers of digital capabilities that allow digital businesses to respond to clients' needs and desires quickly and efficiently, leading to improvements in the company's performance (Setia et al., 2013). Kohli and Grover (2008) argue that responsiveness is a required capability for responding to market competition.

Responsiveness leads digital business to face some challenges, such as the need for developing new insights and knowledge in order to cope with market demands (Barrett et al., 2015), and difficulties in responding quickly to market changes and in satisfying consumer desires (Kohli & Grover, 2008; Tams et al., 2014). Responsiveness also helps companies understand changes in consumers' behavior so as to satisfy them (Hylving et al., 2012).

Responsiveness improves customer satisfaction, which brings several benefits, such as good recommendations from social media and fewer complaints, attracting more consumers and, consequently, more sales or services. In other words, customer satisfaction is related to business performance (Tarafdar & Ragu-Nathan, 2010).

Setia et al. (2013) stress that performance may be related to the customer response capability, thereby representing a culture characterized by continuous monitoring of customer needs and improved customer value. Hence, responsiveness is a capability that companies can have for monitoring and leveraging digital business strategies, such as focusing actions on customer needs and customizing information according to the purchasing profile. Because of improvements in agility and responsiveness, firms can achieve a higher level of performance and competitive advantage (Teece, 2007; Tams et al., 2014).

Therefore, the improved response speed, effectiveness, and efficiency in coping with environmental changes can positively affect competitive performance by enabling firms to take advantage of market capitalizing motions and operational adjustments for reducing costs (Mikalef & Pateli, 2017).

Accordingly, responsiveness can be defined as an ability that requires speed and flexibility in an organization's processes and that responds quickly to a new customer need to improve business performance (Barenfänger & Otto, 2015; Setia et al., 2013; Tams et al., 2014). Therefore, the following hypothesis is proposed:

H7 — The responsiveness capability is positively related to digital business performance.

Based on the stated goals of this research, Figure 1 presents the proposed model for the study concerning digital business performance.

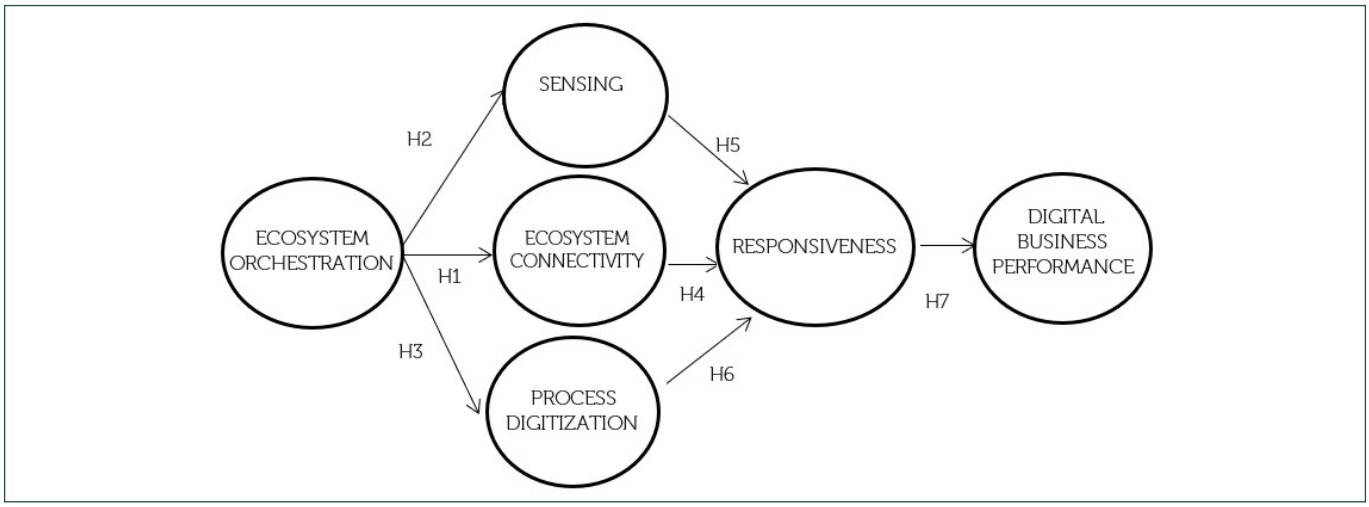

Figure 1: Research model.

METHODOLOGY

A survey was developed and applied to respondents within the digital business to collect data and measure the constructs in the research model (Figure 1). We adopted the definition of survey research by Pinsonneault and Kraemer (1993), which focuses on the survey's purpose to produce quantitative descriptions of some aspect of the populations studied by asking people structured and pre-defined questions through a sample.

Measurement and data collection

We collected data from a diverse range of digital businesses, including both pure digital companies (e.g., digital-native e-commerce and e-services) and traditional brick-and-mortar organizations with significant digital operations (e.g., companies with e-commerce websites). This comprehensive approach allows for a robust analysis of digital capabilities across different business models. We contacted companies belonging to two national associations that integrate digital businesses, the Brazilian E-commerce Association and the Brazilian Association of Digital Agents. It is important to mention that the characteristics of the participating companies suggest their involvement in digital ecosystems. An electronic survey instrument was used (https://doi.org/10.17632/xyhz8gw5fh.1).

We made preliminary contact and followed up with the return of the electronic surveys to improve the response rate, as indicated by Cooper and Schindler (2003). The respondents were IT managers who manage the digital area. Following the initial invitation to participate in the survey, three e-mail reminders were sent out with a three-week interval between them.

We contacted 994 companies from the abovementioned associations, and the return rate was approximately 33%, with a total of 328 responses. The sample's purification was performed, and incomplete questionnaires were excluded, as well as outliers. Questionnaires that contained 90% or more of the answers in one same item were removed, as well as those that had answers in only two items, as suggested by Hair et al. (2022). Therefore, 20 questionnaires were excluded.

Concerning the sample size requirements, the 308 responses received exceeded both the specifications of (1) ten times the largest number of formative indicators used to measure one construct and (2) ten times the largest number of structural paths directed at a particular latent construct in the structural model (Hair et al., 2022).

Table 1. Description of the companies.

Activity type	Number	Percentage
E-commerce	215	69.8%
E-service	67	21.8 %
Others	26	8.4 %
Total	308	100%
Business source	**Number**	**Percentage**
Digital native	194	63%
Became a digital business	87	28.2%
In the digital transformation process	27	8.8%
Total	308	100%

Note. Developed by the authors.

The data collection instrument was a questionnaire with 31 questions based on the information systems (IS) literature. The seven-point Likert scale of the agreement was used. The instrument's validation was performed according to the steps in the validation process, as proposed by MacKenzie et al. (2011), the development of the study's theoretical basis, definition of the variables, face and content validities, and the pre-test. The pre-test was applied to 53 IT managers, MBA students in programs focused on information systems. The research was applied by the paper in the classroom by the researchers, with the consent of the institutions and respondents.

Data analysis

The data collected were tabulated and then analyzed with the help of the SPSS software (Statistical Package for the Social Sciences), version 21, used to analyze reliability and descriptive and exploratory statistical data. The hypotheses were then tested using partial least squares structural equation modeling (PLS-SEM), and precisely through the SmartPLS software package (Ringle et al., 2005). PLS-SEM is deemed particularly appropriate for this study since it permits the simultaneous estimation of multiple causal relationships between one or more independent variables and one or more dependent variables (Hair et al., 2022).

Moreover, care was taken in developing the study in order to control common method variance (CMV), as emphasized by MacKenzie et al. (2011). If systematic method variance is not controlled, this variance will be lumped together with systematic trait variance in the construct. This is a problem since it can lead to erroneous perceptions about the appropriateness of a scale's reliability and convergent validity.

In addition, Harman's one-factor test was conducted to assess common method bias. Six factors were extracted, accounting for 45.96% of the variance explained, less than 50%, which is the satisfactory level

according to MacKenzie et al. (2011). Next, we present the results based on the data collected.

RESULTS

We analyzed the proposed model using PLS, a predictive modeling technique that performs bootstrap re-sampling as a non-parametric means of drawing statistical inferences based on the sample provided by Hair et al. (2019).

Measurement model

The measurement model estimation provides information about internal consistency (reliability) and discriminant validity. We assessed reliability and validity for scales with multiple, reflective items, following along with criteria presented by Hair et al. (2019) and Hair et al. (2022). According to these authors, all multi-item scales are reliable, with internal consistency reliability (ICR) scores being well above the recommended level of 0.70. Internal consistency is also established when scales have an average variance extracted (AVE) of at least 0.50 (Hair et al., 2019).

The internal consistency reliability measurements of Cronbach's alpha are also above the recommended level of 0.7 for all constructs, indicating that for this population of participants, the scales exhibited an acceptable level of reliability. Discriminant validity was assessed by using the Fornell-Larker criterion, where each construct's square root of AVE exceeded their correlations with all other constructs. The results in Table 2 depict discriminant validity (Hair et al., 2019).

Table 2. Reliability and discriminant validity.

	A	ICR	AVE	ECO_O	ECO_C	PERF	PRD	RESP	SNS
ECO_O	0.846	0.897	0.621	**0.863**					
ECO_C	0.776	0.845	0.510	0.824	**0.781**				
DBS	0.912	0.930	0.690	0.604	0.560	**0.831**			
PRD	0.912	0.938	0.792	0.603	0.548	0.519	**0.890**		
RESP	0.899	0.929	0.767	0.628	0.580	0.541	0.874	**0.876**	
SNS	0.877	0.912	0.678	0.502	0.465	0.492	0.840	0.870	**0.823**

Note. Developed by the authors. ECOC = Ecosystem connectivity; ECOO = Ecosystem orchestration; PRD = Process digitization; RSP = Responsiveness; SNS = Sensing; DBS = Digital business performance.

Structural model

We used the coefficient of determination (R^2), which represents the amount of explained variance of each endogenous latent variable (Hair et al., 2022), to assess the model's quality. As we can see in Figure 2, the proportion of the total variance of each endogenous construct explained by the model is 68% for ecosystem connectivity, 36.8% for process digitization, 84% for responsiveness, 26.2% for sensing, and 29.3% for digital business performance. Accordingly, the R^2 values are satisfactory since the exogenous digital capabilities (sensing, responsiveness, and ecosystem connectivity) explain 84% of the variance in the dependent variable 'responsiveness.' Also, the 'responsiveness' variable explains 29.3% of the variance in the dependent variable 'performance.'

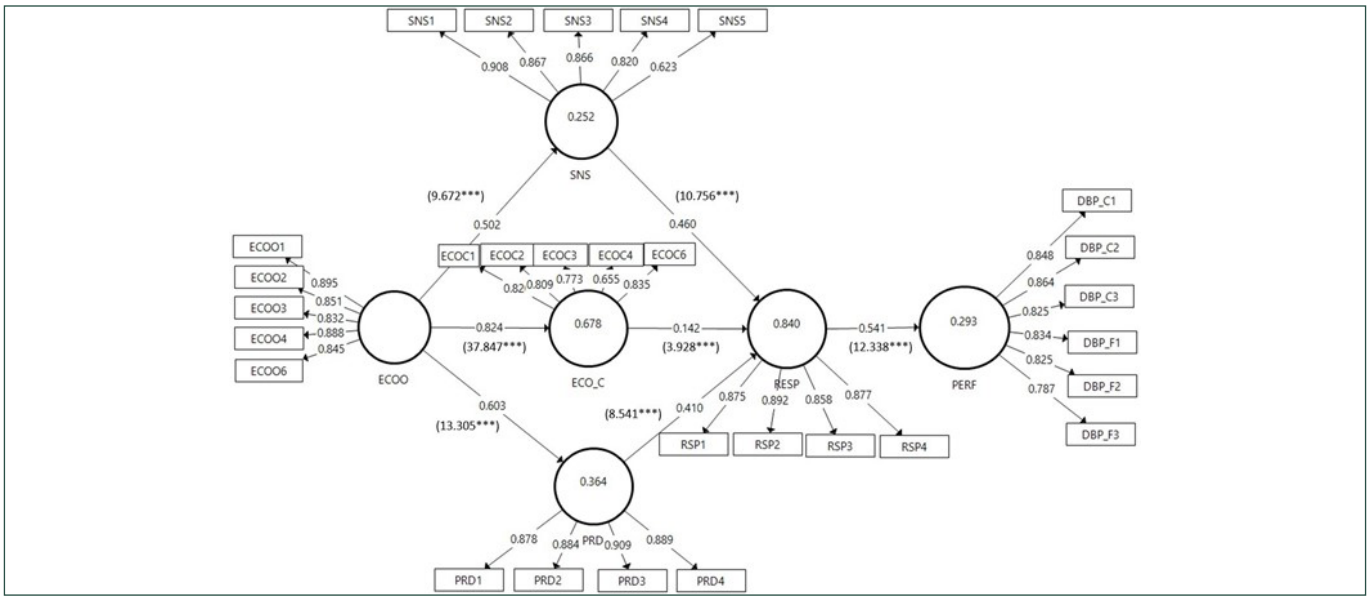

Figure 2. PLS structural model.

The hypotheses were tested by examining the structural model results; a bootstrapping approach was employed through 5,000 re-samples (Hair et al., 2022). We then utilized bootstrap re-sampling to determine t-statistics and significance values. Figure 2 shows the results of the predictive model analysis, including path β coefficients, associated ρ values for each dependent variable performed in SmartPLS.

Following the parameters of Sarstedt et al. (2020) for using bootstrapping to assess the path coefficients' significance, the minimum number of bootstrap samples is 5,000, and the number of cases should be equal to the number of observations in the original sample. Critical t-values for a two-tailed test are 1.65 (significance level = 10 percent), 1.96 (significance level = 5 percent), and 2.58 (significance level = 1 percent). Results indicate that all seven hypotheses in the model were supported, as shown in Table 3.

Table 3. Effects on endogenous variables (direct effects).

	Paths (hypotheses)	(β)	t-statistics (a)	p-value	Status
H1	ECOO -> ECO_C	0.824	37.847***	0.000	Supported
H2	ECOO -> SNS	0.502	9.672***	0.000	Supported
H3	ECOO -> PRD	0.603	13.305***	0.000	Supported
H4	ECO_C -> RESP	0.142	3.928***	0.000	Supported
H5	SNS -> RESP	0.460	10.756***	0.000	Supported
H6	PRD -> RESP	0.410	8.541***	0.000	Supported
H7	RESP -> PERF	0.541	12.338***	0.000	Supported

Note. Developed by the authors based on Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). (3rd ed). Sage. (a) t-values for a two-tailed test: *** t-value 2.58 (significance level = 1%).

The structural model's predictive relevance was assessed by Stone-Geisser's Q^2 measure. The results confirm that the structural model has satisfactory predictive relevance with a value of 1.936 for Q^2, since, according to Chin (1998), a Q^2 value greater than 0 implies that the model has predictive relevance.

It was also used the fit the criterion for PLS path modeling, i.e., the standardized root means square residual (SRMR). This criterion represents the root of the square discrepancy between the observed correlations matrix and the model implied, i.e., the Euclidian distance between two matrices. Assuming a cut-off value of 0.08, as proposed by Hu and Bentler (1999), the model presented in this study shows an acceptable fit of SRMR = 0.060.

DISCUSSION

Our objective was to measure the impact of digital capabilities on digital business performance. To do so, we presented a research model that aims to measure its impact. We developed the study based on digital businesses, e-commerce, and e-services in South America, with such companies based in Brazil. Our findings verify that the ecosystem orchestration capability serves as an antecedent to other digital capabilities. Additionally, the sensing capability, process digitization capability, and ecosystem connectivity capability significantly impact the responsiveness capability. Consequently, responsiveness is a result of these capabilities, which collectively enhance digital business performance (Verhoef et al., 2021). Thus, this study brings theoretical and practical implications, as presented in the following section.

Theoretical implications

Our study makes several contributions to IS research. These findings align with the dynamic capabilities' framework, which suggests that firms must integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Teece et al., 1997). For instance, Pavlou and El Sawy (2011) emphasized the role of sensing capability in achieving market responsiveness, consistent with our observation that sensing positively impacts responsiveness. Similarly, Setia et al. (2013) highlighted how process digitization enhances a firm's ability to respond to customer needs, supporting our findings on the relationship between process digitization and responsiveness (Hanelt et al., 2021). Likewise, it theoretically advances studies on the ecosystem by indicating the importance of the digital ecosystem in digital transformation. Ecosystem orchestration and ecosystem connectivity are analyzed as two different factors, with orchestration being an antecedent capability. This maintains the relationship of the role of orchestrators within ecosystems, as highlighted by Kazan and Damsgaard (2016) and Markus and Loebbecke (2013).

Moreover, our results underscore the importance of ecosystem orchestration in digital business performance. This is consistent with studies by Nambisan et

al. (2017) and Jacobides et al. (2018), which highlight the critical role of orchestrators in coordinating value creation and appropriation within digital ecosystems. Ecosystem connectivity also emerged as a significant factor, echoing the findings of Senyo et al. (2019), who identified connectivity as crucial for co-creating value in digital platforms (Wamba et al., 2017). Consequently, the company that manages the ecosystem must establish internal and external rules and procedures with its partners and other ecosystem agents to monitor, connect agents, communicate, and develop their operations.

To further develop this discussion, we compare our findings with recent literature on digital transformation. For example, Hanelt et al. (2021) discuss the necessity for firms to adapt their digital capabilities continuously to remain competitive. These studies reinforce our conclusion that a digital business's critical point is its responsiveness, enabling speed in responding to market changes and customer needs (Vial, 2021; Warner & Wäger, 2019).

Furthermore, the model reveals responsiveness to be a consistent capability, reinforcing the importance of agility and responsiveness for a digital business. It was possible to observe that other digital capabilities (sensing, process digitization, and ecosystem connectivity) affect responsiveness capability, leading to better business performance.

To illustrate, digital processes directly influence responsiveness since they improve responsiveness to information accessed by customers and within the company, as already emphasized by Setia et al. (2013). It was also possible to verify that the sensing capability is positively related to responsiveness, according to Pavlou and El Sawy (2011).

We can, therefore, conclude that a digital business's critical point is its responsiveness. It takes speed to respond to the market, to customers, and to stakeholders because competitiveness is very high, thus making it possible to improve performance, particularly in customer satisfaction and, consequently, in improving financial performance.

In conclusion, our research underscores that the linchpin of a digital business's success lies in its responsiveness. Swift responses to market dynamics, customer needs, and stakeholder expectations are crucial for enhancing overall performance, particularly in terms of customer satisfaction and financial outcomes. The digital technologies we explored, including artificial intelligence, blockchain, IoT, and digital platforms, play a pivotal role in enabling and enhancing these digital capabilities, further emphasizing their significance in the contemporary business context. Our study advances the theoretical discourse by highlighting the essential roles of ecosystem orchestration and connectivity within the dynamic capabilities' framework, providing a comprehensive understanding of how digital capabilities drive business performance in a rapidly evolving digital landscape (Nambisan & Baron, 2021; Wamba et al., 2017). These insights underscore the critical connection between digital entrepreneurship, innovation, and positive social change. For policymakers, business leaders, and aspiring entrepreneurs, our research serves as a valuable resource for understanding how digital capabilities can be leveraged to promote innovation and entrepreneurship, ultimately contributing to economic development, job creation, and enhanced well-being.

So, in terms of theoretical advancement, this study extends the dynamic capabilities framework by empirically validating the specific roles of ecosystem orchestration and connectivity in driving digital business performance. Our findings contribute to the existing body of knowledge by elucidating how these capabilities interact to enhance responsiveness and, ultimately, business performance. This research underscores the multifaceted nature of digital capabilities and provides a nuanced understanding of their impact in the context of digital ecosystems (Malchenko et al., 2020; Kastelli et al., 2022).

Practical implications

This paper stresses that digital businesses must develop digital capabilities so that managers can prioritize their investments. However, two main points deserve the managers' particular attention — the orchestration and responsiveness capabilities. Although the literature has already argued that companies participate in several ecosystems, the research model evidences the impact of the orchestration capability on others and, consequently, on performance.

In developing or investing in technologies, digital businesses must be capable of monitoring, being agile, and belonging to other ecosystems that can help improve performance. E-commerce, for example, can have its own ecosystem and still be integrated with others through its customers and suppliers, which will incorporate the ecosystem and thus require a greater need for orchestration. Another example is the e-marketplace that increasingly integrates more agents, also requiring more orchestration and connectivity.

Responsiveness is important for managers to direct their investments in digital technologies that lead companies to respond quickly and efficiently to customer demands and wishes and, therefore, improve their performance (Setia et al., 2013). Thus, to improve responsiveness, companies can develop an interface with

customers with more responsive sites, using APIs, IoT, BI tools, applications, etc.

In other words, they must monitor the market and incorporate the use of digital technologies that can increase their responsiveness. Accordingly, responsiveness increases the speed in response to market changes and in satisfying consumer desires (Kohli & Grover, 2008; Tams et al., 2014). Also, managers will be able to decipher changes in consumer behavior (Hylving et al., 2012).

Besides, developing the digital ecosystem can help foster interdisciplinary collaboration and overcome geographic barriers, since the interconnected nature of the digital ecosystem encourages collaboration between different disciplines and sectors while simultaneously eliminating geographic barriers. Innovation often arises from the interaction of various areas of knowledge, and the digital environment facilitates this collaboration on a global scale.

Furthermore, our research emphasizes the centrality of responsiveness as a core capability for digital businesses. Speed and agility in responding to market, customer, and stakeholder demands are paramount. As such, organizations should focus on strengthening their responsiveness capabilities to enhance customer satisfaction and financial performance.

In conclusion, organizations must recognize the strategic significance of digital capabilities and ecosystem orchestration in the digital era. By embracing and optimizing these digital technologies and capabilities, they can drive innovation, stay competitive, and achieve better business performance. This understanding is pivotal for managers and leaders seeking to navigate the evolving digital landscape successfully.

From the results relating digital capabilities to performance, other practical implementations emerge. The main point is that the widespread application of digital capabilities can certainly contribute to digital business performance.

CONCLUSION

This study aimed to measure the impact of digital capabilities on digital business performance. It was possible to verify the direct and indirect effects of the digital capabilities (ecosystem orchestration, ecosystem connectivity, sensing, and process digitization) on responsiveness and this capability on digital business performance.

The research considered digital businesses, such as e-commerce and e-service, in Brazil. Thus, this study presents a research model that measures the impact of digital capabilities on digital business performance, as highlighted in the results. The study also introduces theoretical and practical implications that may contribute to studies about digital transformation, with the main results pointing to the importance of the companies' capacity to respond to this new scenario brought on by the digital era and the ecosystem's orchestration capacity.

This paper makes several contributions to the field by exploring the impact of digital capabilities on digital business performance. It offers a detailed empirical analysis and provides new insights into the dynamic capabilities theory in the context of digital businesses. Digital businesses leverage technologies such as the internet, mobile applications, and digital platforms to deliver products and services. Digital capabilities, encompassing the necessary skills and processes, enable these businesses to effectively use digital technologies to achieve their objectives. Moreover, by understanding how these capabilities can be orchestrated and integrated within business operations, organizations can better navigate the complexities of digital transformation.

The findings from this study align with and expand upon existing literature, corroborating the significance of digital capabilities in achieving market responsiveness and overall performance. Our results demonstrate how process digitization directly influences a firm's responsiveness, highlighting the critical role of digital capabilities in enhancing business performance. By providing a comprehensive understanding of how these capabilities drive business performance in the rapidly evolving digital landscape, this study advances the theoretical discourse. It underscores the multifaceted nature of digital capabilities and their crucial impact on the success of digital businesses.

A limitation of this study is the number of respondents. Therefore, a suggestion for future research is to extend the analysis to other countries to theoretically advance on this topic. It is also recommended to evaluate the possibility of expanding the sample size and presenting modeling for subgroups of companies categorized by sector or size, as well as the use of control variables, such as the types of digital businesses.

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