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DIGITAL ECOSYSTEM: THE MISSING LINK BETWEEN STRATEGY AND FINANCIAL PERFORMANCE FOR DIGITAL BUSINESSES[1]

ECOSSISTEMA DIGITAL: O ELO PERDIDO ENTRE A ESTRATÉGIA E O DESEMPENHO FINANCEIRO DE NEGÓCIOS DIGITAIS

ECOSISTEMA DIGITAL: EL ESLABÓN PERDIDO ENTRE LA ESTRATEGIA Y EL DESEMPEÑO FINANCIERO PARA LAS EMPRESAS DIGITALES

ABSTRACT

Objective: This article aims to answer the following research question: How does the digital connectivity capacity of the digital ecosystem mediate the strategy's impact on digital business performance?

Design / methodology / approach: A survey was applied and for analysis, the modeling of structural equations of partial least squares (PLS-SEM) with the SmartPLS software was used.

Results: The main results indicate that the ability to respond to market and consumer demands is essential for the performance of the digital business, and strategies must be established to increase the product portfolio and increase the speed of decision-making.

Research limitations / implications: The main limitation of the study is due to the fact that the research companies are from the retail sector.

Practical implications: It was found that companies need to consider the ecosystem in their digital transformation strategy, as it allows flexibility in the connection between business actors, positively influencing financial performance.

Theoretical implications: The main theoretical implication is that the study presents a research model that seeks to measure the impact of digital strategies on digital business performance, mediated by the connectivity capacity of the ecosystem.

Originality / value: The value of the study is due to the fact that the model is applied in the context of digital transformation, exploring digital capabilities.

Keywords: Digital business strategy. Digital capabilities. Digital ecosystem. Financial performance.

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RESUMO

Objetivo: O presente artigo tem como objetivo responder à seguinte questão de pesquisa: Como a capacidade digital de conectividade do ecossistema digital media o impacto da estratégia no desempenho de negócio digital?

***Design*/metodologia/abordagem:** Foi aplicada uma Survey e, para análise, utilizou-se a modelagem de equações estruturais de mínimos quadrados parciais (PLS-SEM) com o *software* SmartPLS.

Resultados: Os principais resultados indicam que a capacidade de resposta às demandas do mercado e consumidores é essencial para o desempenho do negócio digital devendo ser estabelecidas estratégias de aumento de portfólio de produtos e aumento na velocidade de tomada de decisões.

Limitações/implicações da pesquisa: A principal limitação do estudo se deve ao fato de que as empresas pesquisadas são do ramo do varejo.

Implicações práticas: Verificou-se que as empresas precisam considerar o ecossistema em sua estratégia de transformação digital, pois ele permite uma flexibilidade na conexão entre os atores do negócio, influenciando positivamente no desempenho financeiro.

Implicações teóricas: A principal implicação teórica é que o estudo apresenta um modelo de pesquisa que busca mensurar o impacto das estratégias digitais no desempenho do negócio digital, mediado pela capacidade de conectividade do ecossistema.

Originalidade/valor: O valor do estudo se deve ao fato da aplicação do modelo no contexto de transformação digital, explorando as capacidades digitais.

Palavras-Chave: Estratégia de negócios digitais. Capacidades digitais. Ecossistema digital. Desempenho financeiro.

RESUMÉN

Objetivo: Este artículo tiene como objetivo responder a la siguiente pregunta de investigación: ¿Cómo media la capacidad de conectividad digital del ecosistema digital el impacto de la estrategia en el desempeño del negocio digital?

Diseño / metodología / enfoque: Se aplicó una encuesta y para el análisis se utilizó el modelado de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM) con el software SmartPLS.

Resultados: Los principales resultados indican que la capacidad de respuesta a las demandas del mercado y de los consumidores es fundamental para el desempeño del negocio digital, debiendo establecerse estrategias para incrementar el portafolio de productos y aumentar la velocidad en la toma de decisiones.

Limitaciones / implicaciones de la investigación: La principal limitación del estudio se debe a que las empresas de investigación son del sector retail.

Implicaciones prácticas: Se encontró que las empresas necesitan considerar el ecosistema en su estrategia de transformación digital, ya que permite flexibilidad en la conexión entre los actores del negocio, influyendo positivamente en el desempeño financiero.

Implicaciones teóricas: La principal implicación teórica es que el estudio presenta un modelo de investigación que busca medir el impacto de las estrategias digitales en el desempeño de los negocios digitales, mediado por la capacidad de conectividad del ecosistema.

Originalidad / valor: El valor del estudio se debe a que el modelo se aplica en el contexto de la transformación digital, explorando las capacidades digitales.

Palabras-clave: Estrategia empresarial digital. Capacidades digitales. Ecosistema digital. Rendimiento financiero.

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INTRODUCTION

The evolution of both the internet and other digital technologies has been leading to growing increase in the use of social media, Internet of Things, among other multimedia that produce great data flow within structured and/or unstructured format (Gielens & Steenkamp, 2019; Mikalef, Pappas, Krogstie, & Pavlou, 2020). Such a growth in data and information amount has been bringing along changes in social relationships, in economy, in the ways to do business and in science (Sehnem *et al*. 2021; Soma, Termeerand, & Opdam, 2016), a fact that implies in having companies developing their digital abilities to be updated and capable of quickly responding to market needs (Von Briel, Davidsson, & Recker, 2018; Park & Mithas, 2020).

Accordingly, it is important understanding the concept of capability referring to the highest ability level to be shown or reached under certain conditions. Moreover, this concept can be applied to organizations and individuals, such as managers (Anim-Yeboah, Boateng, Odoom & Kolog, 2020).

Thus, companies must develop new abilities to face digital transformation (DT), which is a phenomenon assessed by several knowledge fields. Initially, these studies mainly focused on the Information Systems field but, nowadays, they are broader and also cover strategies, people, and education, among other factors, as highlighted by Dąbrowska *et al*. (2022). According to these authors, there are four lenses through which DT can be seen and understood, namely: the individual, organizational, ecosystem and geopolitical ones.

According to Ernst and Young, approximately 90% of companies take digital transformation as priority in their strategic planning for the next two years. Based on research carried out by Forrester, 85% of companies "are investing in digital transformation in 2018; 50% [of them] feel that it is too late, already" (Sia, Weill, & Zhang, 2021, p. 35). However, companies do their best effort to develop an effective strategy to favor digital transformation, and it might require reassessing processes, services and company functions from the perspective made feasible by technology (Gupta & Bose, 2019).

Bharadwaj *et al.* (2013) corroborated the previous statement and highlighted that several organizations are starting to realize about the benefits of digital resources and to understand the need of new capabilities broader than IT. Simultaneously, they are developing or reconfiguring a strategy to their businesses. Thus, in order to become faster and to quickly adjust to technological evolutions, it is essential developing new capabilities, mainly the digital ones, the so-called CDig. They form a set of capabilities that potentiate organizations' ability to develop, mobilize and efficiently use organization resources and improve their processes, such as the case of managing relationship with customers, developing new products, knowledge management and collaboration based on using digital technologies. It is so, because, nowadays, digital businesses are part of digital ecosystems (Tams, Grover, & Thatcher, 2014).

The concept of ecosystem in Information Systems (IS) research is recent and its use has been growing. Most studies in this field had started after 2010, and they were boosted by the development of digital technologies, of digital products, platforms and infrastructure (Dąbrowska *et al*., 2022; Yeow, Soh, & Hansen, 2018; Ivarsson & Svahn, 2020).

Therefore, Bärenfänger and Otto (2015) point out the need of CDig for ecosystem connectivity to allow data and information connection in a digital ecosystem. It would fully connect the company to its external partners, as shown by Tan *et al.* (2015). This integration, along with digital technologies, such as social media, mobile technologies, data-analysis technologies, have broadened organizations' information potential (Westerman, Bonnet, & Mcafee, 2014). Dong, Hussain and Chang (2007) added that the target of digital ecosystems is to improve communication efficiency between internal agents and the business' ecosystem structure.

With respect to strategy, Margiono (2020) and Kane (2015) agree with Bharadwaj *et al*. (2013), by highlighting that, in order to improve their performance, digital businesses must reevaluate and adjust their strategies to new changes in the environment. They must focus on the needs of new customers who, nowadays, are much more demanding and better informed.

Thus, it is possible observing the changes brought by digital technologies combined to increase in information speed and amount. It shows fast evolution in the market and points

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out that organizations need faster strategies capable of reconfiguring their resources and capabilities (Daniel, Ward, & Franken, 2014). Such a need meets the theory of Dynamic Capabilities (DC), according to which, whenever the competition scenario evolves quickly and in an unpredictable way, it is necessary adjusting itself to it by combining the existing resources and capabilities, as well as by developing new capabilities, if necessary (Teece, Pisano, & Schuen, 1997; Eisenhardt & Martin, 2000).

Therefore, assumingly, the strategy of a digital business must allow it to boost the ecosystem's connectivity ability to enhance the organization's performance by delivering a quality product or service to its customers. The company must be able to manage relationships among the multiple actors involved in the business, such as the company's suppliers and employees; thus, it needs a Digital Business strategy (Granados & Gupta, 2013; Bharadwaj *et al*., 2013; Yeow, Soh, & Hansen, 2018; Mikalef *et al*., 2020).

The contribution of the current research lies on broadening the understanding of strategies for digital businesses. Furthermore, it theoretically helps introducing the concepts of digital ecosystem, as well as the theoretical updates on digital capabilities and strategies topics, with emphasis on their association with digital business performance, since it regards a recent and yet little assessed topic. Other contribution by the present study is the development of a research model that allows better understating the influence of strategy on the development of digital businesses. In order to do so, the research question will be herein introduced to guide the current study: how does the digital ecosystem's digital connectivity ability mediates strategy impact on digital business performance?

The present article is divided into six sections. Subsequently, the theoretical reference and hypothesis are introduced. The third section highlights the adopted research method, and it is followed by the results, in the fourth section. Section number five discusses the results, and the sixth one points out the study conclusions.

THEORETICAL REFERENCE

Studies focused on combining topics, digital business strategy and digital ability are quite recent. Initially, some fundamental concepts are introduced and, then, the hypotheses are developed.

DIGITAL BUSINESS STRATEGY

According to Dabroswska *et al*. (2022), changes at organizational level gather four fields: a) strategy and strategic response to digital transformation, which demands exploring possibilities linked to work practices and organizational routines; b) design and organizational change, according to which, new organizational structures must have mechanisms that make collaboration, interaction and coordination for digital innovation easier; c) creation of new digital capacities to help decision making whose analysis dynamics and the understanding of managers' trends are affected by the generation of, and learning with, accumulated data, such as the case of artificial intelligence; d) changes in value creation, if they are capable of reformulating their relationships and interdependences, as well as of embodying the transformation of new and more flexible business models.

Accordingly, the digital business defined by Setia, Venkatesh and Joglekara (2013) as companies that use digital technologies to better perceive and respond to customers' needs are one of the main company types using such technologies. Fichman *et al*. (2014, p. 335) define digital businesses as a "new way to create and capture business' value, and they point out that this business type needs a digital platform to provide value that materializes itself or that is enabled by IT". Weill and Woerner (2013) add to this idea by highlighting that this business type needs a digital platform to provide value and to be incorporated to complex digital ecosystems.

Similarly, Bharadwaj *et al*. (2013) highlight that digital businesses present a series of internal and external emerging organizational challenges that must be assessed and understood, such as new information flow configuration, transparency, digital ecosystems and people's behavior, be it for entirely new business models - since they rise along with a digital strategy – or businesses that followed a traditional strategy and that had to make adjustments in their strategy.

According to the second presented case - traditional businesses that started acting in the digital world -, companies must reanalyze their organization logics and the use of their

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IT infrastructure, since new strategies and capabilities are needed (Sehnem *et al*. 2021; Yoo, Henfridsson, & Lyytinen, 2010), like digital ecosystem's digital connectivity ability.

Margiono (2020), Grover and Kohli (2013) state that digital business strategies open significant room for companies to increase competitiveness, to improve customers' experience and their financial performance. Different from the large property systems from the 1980s, nowadays "micro-applications" allow companies to create and reconfigure digital capacity in order to hold short-term competition advantage.

Thus, several organizations are turning their traditional business strategies into a new modular form, which is distributed, inter-functional and presents global business processes that allow work to be done without time, distance and functional barriers (Pavlou & El Sawy, 2010). This business type requires capabilities that lead to digital ecosystem connectivity, and that contribute to improve its performance (Yeow, Soh, & Hansen, 2018).

Xu, Hou and Zhang (2022), Weill and Woerner (2013) highlight that digital businesses must invest in competitive advantage sources, such as digital platforms and other resources. However, they also suggest that these businesses must develop digital capacities to stand out in front of their customers and to improve their own performance.

Therefore, it is also taken into account that actors' connectivity with the ecosystem is the very basis to improve information flow (Westerman, Bonnet, & Mcafee, 2014). It is necessary understanding the association between ecosystem connectivity – which is further highlighted in the current article – and digital business strategy so that one can assess this association impact on these businesses' performance.

DIGITAL ECOSYSTEM CONNECTIVITY

The concept of Business Digital Ecosystem was herein used as individuals, organizations and digital technologies' socio-technical environment that has collaborative and competitive relationships to co-create value in shared digital platforms (Senyo, Liu, & Effah, 2019). The integration of these abilities enables the participation of multiple actors and the potentiation of digital capabilities' skills and resources, a fact that improves processes and information flow. This process leads to instantaneous responses to information environment and visualization (Dąbrowska *et al*., 2022; Tams, Grover, & Thatcher, 2014; Westerman, Bonnet, & Mcafee, 2014; Bärenfänger & Otto, 2015).

Ecosystem connectivity - that, according to Tan *et al*. (2015) and Yoo *et al*. (2012), allows a company to make research; explorations to acquire, assimilate and apply knowledge on research, opportunities and on how resources can be configured in order to use opportunities to improve their financial performance - has stood out among digital capacities.

Companies develop new strategies in digital ecosystem to fulfil the dynamics of emerging markets by competing face-to-face at some front (for example, Apple and Amazon sell hardware) and by collaborating at other fronts (for example, Amazon provide apps to readers) (Mas & Gómez, 2021; Yoo, Henfridsson, & Lyytinen, 2010).

This ability can support companies and help them deal with digital economy challenges, such as developing a digital ecosystem to integrate and coordinate new agents (costumes, suppliers, crews, stakeholders and other actors) internally, externally and in the company as a whole (Nambisan *et al*., 2017). Furthermore, ecosystem connectivity ability enables collaboration and communication among companies (Hylving, Henfridsson, & Selander, 2012; Barret *et al*., 2015) and working in digital platforms in an innovative way, like through crowdsourcing and crowdfunding (Nambisan *et al*., 2017; Alam & Campbell, 2016).

Digital infrastructures also allow the generalization of the digital platform where several organizations can innovate on (Barret *et al*., 2015). Tan *et al*. (2015) presented the innovation example of a digital multi-lateral platform ecosystem that consists either in the platform or in its specific constituents. This multi-faceted platform ecosystem attracts a good number of customers, either from paying groups or from the subsidized ones; they also provide these customers with the adequate value to reach sustainable growth in their ecosystem.

Kazan and Damsgaard (2016, p. 477)

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reinforce the idea that "companies project their offers in such a way to create reciprocal businesses value between different user types (for example, payer and beneficiary) that, in their turn, create self-reinforcement and expand network effects". Besides the ecosystem's connectivity ability, it can add value to the business. The next section presents the hypotheses' development.

HYPOTHESES DEVELOPMENT AND RESEARCH MODEL

Bharadwaj *et al.* (2013) highlight three constructs that form the digital business strategy, namely: decision-making, scope, scale and speed. According to these authors, these elements boost responsiveness to customers by improving their experiences and digital business performance.

With respect to performance factors, Rai, Patnayakuni and Seth (2006) point out that, in order to measure performance, it is necessary observing a company's performance in comparison to its competitors. It is possible seeing revenue growth and the relationship with both customers and other actors involved in business processes.

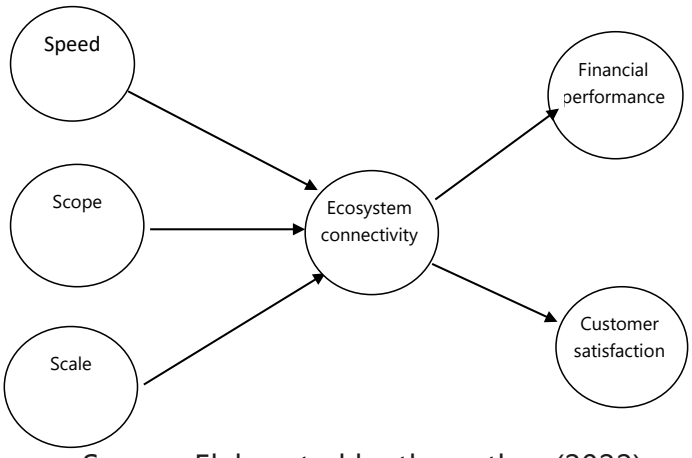
Setia, Venkatesh and Joglekar (2013) stress that performance can be related to orientation to customers. According to them, this process is a culture featured by continuous follow-up of customers' needs and by improvement in customer value.

Therefore, by analyzing the herein referenced studies, which aim at measuring performance, it is possible observing that there are several forms and indicators of digital business performance. The following indicators were adopted for the present research:

- Financial performance;
- Relationship with customers and other actors involved in business processes.

Assumingly, if a company has connectivity with the ecosystem it is inserted in, this system can improve the company's performance, even more (Barret *et al.*, 2015). Thus, based on these concepts, the hypotheses illustrated in the research are introduced below.

Figure 1
Research Model



Source: Elaborated by the author (2022)

DECISION-MAKING SPEED AND DIGITAL ECOSYSTEM CONNECTIVITY

Although time was acknowledged in the strategic management literature as important competition-advantage factor for companies (Hao & Song, 2016), it embodies a core part in digital business environments. The digital business strategy speeds up product launching; thus, when traditional companies add digital dimensions to their business strategy, time speed at product launching is recalibrated based on the velocity set by companies depending on new technologies and on the velocity of their competitors (Matt, Hess, & Benlian, 2015).

Thus, product-launching speed, within a digital business context, also highlights the relevance of planned obsolescence, such as the case of Apple's iPod that gives room to iPod Touch and to iPhone (and even to iPad). Organizational ability to both recognize the accelerated nature of innovation and its implementation, based on planned obsolescence, is essential for a company's competition success and survival under digital commercial conditions (Bharadwaj *et al.*, 2013).

Accordingly, there is consensus that technology has allowed companies to speed up their decision making process, which, otherwise, could be reduced due to information flow going up and down in hierarchy through multiple management layers (Setia, Venkatesh, & Joglekara. 2013, Fan, 2018).

DOI: https://doi.org/10.14210/alcance.v30n1(jan/abr).p73-89

Orchestration speed in supply chain, on global base, is becoming an important competition advantage factor. Therefore, it is necessary connecting actions in the digital ecosystem. It is much more than staff outsourcing non-valuable activities, but working in a collaborative way from the conceptual project to products' recycling (Nambisan *et al*., 2017).

It is worth highlighting that supply chain orchestration does not mean managing the current portfolio of products, but also innovating in tomorrow's portfolio. This process demands the dynamic relining of partners and suppliers, and it takes us to the final speed dimension of network formation and adaptation pace (Kane, 2015).

Thus, one of the main requirements of digital business strategy lies on a new organizational ability to design, develop and manage networks that reinforce complementary resources to those the company have inside its own hierarchy. It is done by establishing an effective connection among actors in the digital ecosystem (Bharadwaj *et al.*, 2013). Therefore, the following hypothesis is introduced:

H1 – Speed is positively correlated to ecosystem connectivity.

DIGITAL ECOSYSTEM SCOPE AND CONNECTIVITY

Scope refers to variety in products' portfolio and in companies, as well as activities carried out under control and straight property of a company. Scope exceeds traditional functional fields, such as marketing, sales, logistics, operations, among others, and several business processes made feasible by IT, such as managing orders, customers service, among others. Therefore, digital business strategy can be seen as intrinsically trans-functional (Bharadwaj *et al.*, 2013).

As for the digital strategies' context, it is important pointing out that the proliferation of social media, cloud computing and of mobile phones improved the quality and amount of data generated on a daily basis. This scenario opens a new products and services' portfolio related to the business scope (Kane, 2015). Thus, these strategies focus on products transformation, processes and organization aspects, due to the new technologies.

Accordingly, scope is more broadly designed; it explicitly includes digital activities, the interface with customers, such as digital technologies as part of final users' products. Therefore, it is necessary having connection inside digital ecosystems (Matt, Hess, & Benlian, 2015).

Although implementing the work capacities of the model confirms the ability to expand the scope of digital innovation benefits, it is essential emphasizing the need of planning, of proper preparation and connections inside digital ecosystems. This process can boost business outcomes and improve responsiveness to customers, a fact that will make them happy (Nylén & Holmström, 2015). Thus, Kane (2015) highlights that the final power of a digital strategy lies on its scope.

In light of the foregoing, it is likely stating that the digital business strategy cannot be conceived in separate from the business, alliance, partnership and competitors' ecosystem. Expanding the reach of the digital business strategy to levels beyond limited supply chains with partners in traditional industries and to weakly coupled dynamic ecosystems that have not emerged, is a much more complex task (Bharadwaj *et al.*, 2013). Thus, the following hypothesis was proposed:

H2 – Scope is positively correlated to ecosystem connectivity.

DIGITAL ECOSYSTEM SCALE AND CONNECTIVITY

With respect to scale, it is necessary thinking in physical and digital terms. Increase in the availability of, and dependence on, cloud computing services provides a new strategic dynamic ability for companies to broaden or reduce their infrastructure (Mithas, Tafti, & Mitchell, 2013; Setia, Venkatesh, & Joglekara, 2013).

When digital infrastructure and business strategy are entangled to each other and

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connected through a digital ecosystem, this ability to fast expand becomes a strategic dynamic skill for companies to adjust to the dynamic requirements of the digital market (Nylén & Holmström, 2015). Network effects become the main differential and booster of value creation, as more products and services become digital and connected (Bharadwaj *et al.*, 2013).

Dimensioning based on digital business strategy demands understanding how to develop organizational capacities to use the huge amounts of data, information and heterogeneous knowledge systematically generated, as well as to be connected to other ecosystem actors. This process makes this digital strategy aspect easier (Fan, 2018).

Whenever digital intensity increases and digital business strategy takes over, it is more likely that dimensioning options will be based on alliances and partnerships, through digital assets shared with other companies in the business ecosystem, at different limits of the traditional industry (Bharadwaj *et al.*, 2013). This scenario forces the strategic scale association related to digital ecosystem connectivity. Thus, it is possible to introduce hypothesis number three:

H3 – Scale is positively correlated to ecosystem connectivity.

ECOSYSTEM CONNECTIVITY AND DIGITAL BUSINESS PERFORMANCE

The evolution of digital infrastructure or platform can be broadly understood as a gradual process, through which an analog infrastructure turns into a more complex form by integrating several actors (Henfridsson & Bygstad, 2013). These platforms are connected to ecosystems, and it allows the interaction of several system users, as highlighted by Karimi and Walter (2015). It improves financial performance and fastens response to customers, a fact that makes them happier (Kane, 2015).

Therefore, connection capacity through a digital platform enables instantaneous and continuous contact with all corporation partners, at levels beyond the traditional supply chain, including customers (consumers) (Karimi & Walter, 2015; Barenfanger & Otto, 2015).

Companies must revisit their organization logics and the use of their infrastructure, so traditional businesses can start acting in the digital world. It is necessary to acquire new abilities, mainly ecosystem connectivity (Yoo, Henfridsson, & Lyytinen, 2010; Nambisan *et al.*, 2017).

However, according to Setia, Venkatesh and Joglekara (2013), little is known about effective digital business strategies; moreover, several big organizations still cannot use the digital technologies available to improve their performance, such as the case of customer services. Barret *et al*. (2015) add to this topic by highlighting the relevance of connectivity among digital ecosystem actors in order to enhance financial performance.

Saarikko (2016) points out the association between ecosystem connectivity and digital business performance, and it meets Bharadwaj *et al*. (2013), who highlights that digital ecosystems get connected to each other and coordinate all actors in it; this connection can influence digital business performance. Therefore, it must take into account financial performance measures and relationship with customers, as pointed out by Rai, Patnayakuni and Seth (2006), Setia, Venkatesh and Joglekar (2013). Thus, the next hypotheses can be introduced:

H4 – Ecosystem connectivity is positively correlated to financial performance.

H5 – Ecosystem connectivity is positively correlated to relationship with customers.

Subsequently, the research methodology used to measure the herein highlighted hypotheses is introduced.

METHOD

The present research was developed and managed by the main respondents within digital business. It was done for data collection purpose and to measure the constructs in the research model (Fig. 1). The study follows the Survey design by Pinsonneault and Kraemer (1993), which focuses on quantitative description production of some aspects of the assessed population by making structured and prep-defined questions to people, by using a sample.

Data were collected in e-commerce and e-service digital companies to test the herein

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advocated hypotheses. These companies belong to two national associations that participate in the digital business sector, namely: Associação Brasileira de Comércio Eletrônico (ABComm) and Associação Brasileira de Agentes Digitais (ABRADi).

In order to do so, an electronic search instrument comprising the questions was used based on measures available in the existing literature. A previous contact was made with the interested company to request clearance, name and function of respondents for questionnaire sending.

Respondents were IT managers in the digital field. After the initial invitation to join the survey was made, three reminders were sent by e-mail, one every three weeks. Data collection process lasted approximately four months (from November 2017 to April 2018) and mean conclusion time to fulfil the questionnaire was 18 minutes.

Contact was made with 994 companies that are members of the aforementioned associations; approximately 33% of the sent-out questionnaires were replied – total of 328 replies. Sample purification was carried out and incomplete questionnaires were excluded from the sample, just as outliers. Questionnaires that recorded 90%, or more, of their questions at the lower scale value were removed from the sample, as well as those that only had responses in two items, as suggested by Hair et al. (2014). Therefore, 20 questionnaires were excluded from the sample.

With respect to sample-size requirements, the 308 replies exceed the requirement of 1) ten times the largest number of formative indicators used to measure a construct and 2) of ten times the largest number of structural paths oriented to a certain construct that is latent to the structural model (Hair et al., 2014).

Data collection instrument (Appendix A) is a questionnaire with 21 structured and pre-defined questions based on the literature in Information Systems. It was done by using agreement Likert scale with seven scores. Instrument validation was carried out according to validation stages suggested by Koufteros (1999): development of the study's theoretical references, face and content validity and pre-test. Thus, apparent and instrument contents validity was carried out by three PhD professors and by three IT field managers. Appraisers analyzed the instrument, made recommendation during the trails and described some items, which were taken into consideration. Subsequently, the pre-test was run.

The pre-test was performed with 53 IT managers, with students in the MBA course, with emphasis on Information Systems. The survey was applied by the researchers in printed format, in the classroom, with institutions and respondents' consent. All comments were recorded for further discussions, and the final writing of the items was adjusted to the final text of the questionnaire.

STATISTICAL TECHNIQUES

The collected data were tabulated and subsequently analyzed in SPSS software (*Statistical Package for the Social Sciences*), version 21, which was used for reliability analysis, descriptive statistics and data exploratory statistics. The hypotheses were tested through partial least squares structural equation modeling (PLS-SEM) in SmartPLS software (Hair, Ringle, & Sarstedt, 2011).

PLS-SEM is mainly seen as appropriate to this study type, since it allows the simultaneous estimate of multiple causal relationships between one, or more, independent variables and one, or more, dependent variables (Hair *et al*., 2014). According to these authors, researchers appreciate SEM's ability to assess latent variables at observation level (external model or measurement model) and to test associations among latent variables at theoretical level (internal or structural model).

Besides, there was caution in developing the research in order to control *common method variance* (CMV), i.e., variance in the common method that, as highlighted by Podsakoff *et al*. (2003), is oftentimes a problem; therefore, researchers need to make whatever is possible to control it. According to them, this variance refers to the spurious relationship that can take place among indicators and even among constructs, given the common data collection procedure

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applied to all indicators.

The aim of the present study was to reduce the probability of inserting this systemic error type, according to suggestion by Malhotra *et al.* (2006), by counter-balancing the order of questions, using instruments broadly validated in the literature, applying different scales to measure the constructs and, finally, making sure of respondents' reliability and secrecy by informing them that there are no right or wrong answers, i.e., each item must be honestly answered to represent reality.

Secondly, based on suggestion by Podsakoff *et al.* (2003), scale items were improved by consulting experts and scholars from the herein approached field. Finally, the test of a Harman factor was run after data collection in order to assess the common-method bias. Six factors were extracted, and it represented 45.96% of the explained variance – this rate was lower than 50%, which is a satisfactory level, according to Podsakoff *et al.* (2003).

RESULTS

SmartPLS software was used to analyze the proposed model in order to validate the items and the predictive analysis. Thus, the predictive modeling technique to carry out resampling, known as Bootstrapping, was used as non-parametric means to design statistical inferences based on the provided sample. PLS is robust for small samples and it is not based on normality assumptions demanded for parametric inferential analysis (Sharma & Kim, 2013).

MEASUREMENT MODEL

Measurement model estimates provide information about internal consistence (reliability) and discriminant validity. Reliability and the validity of scales with multiple reflexive items were assessed based on criteria presented by Hair, Ringle and Sarstedt (2011).

The scales of all items were reliable based on their parameters, as shown in Table 1. They recorded internal consistency reliability (ICR) scores much higher than the recommended level (0.70). Internal consistency was also set when scales registered average variance extracted (AVE) of, at least, 0.50 and for satisfactory discriminant validity (Hair, Ringle, & Sarstedt, 2011; Hair *et al.*, 2014).

Table 1

Reliability and Discriminant Analysis

	AC	CR	AVE	Est1 Speed	Est2 Scope	Est3 Scale	Fin performance	Connect Eco	RC Performance
Est1_Speed	0.927	0.948	0.821	0.906					
Est2_ Scope	0.895	0.927	0.760	0.876	0.872				
Est3_Scale	0.909	0.936	0.786	0.914	0.871	0.886			
Fin performance	0.929	0.954	0.875	0.458	0.450	0.448	0.935		
Conect_eco	0.914	0.936	0.744	0.652	0.523	0.601	0.463	0.863	
Performance RC	0.902	0.938	0.836	0.589	0.521	0.549	0.620	0.612	0.914

Note: **Est1_Speed** = decision-making speed; **Est2_ Scope** = scope; **Est3_scale** = scale; **Fin performance =** Financial performance; **Connect_eco = ecosystem connectivity; RC performance** = performance of relationship with customers.

Source: Elaborated by the authors (2019).

Mean internal consistency reliability of Cronbach Alpha was also higher than the recommended level (0.7) in all constructs. Results in Table 1 showed that the square root of each AVE construct exceeded its correlation to all other constructs. Reliability was assessed by using composite reliability scores. All indices were higher than 0.70, and it pointed out that scales showed acceptable reliability level for this particular population of participants (Hair; Ringle; Sarstedt, 2011; Hair *et al.*, 2014).

STRUCTURAL MODEL

The coefficient of determination (R2), which represents the amount of variance in each endogenous latent variable was calculated (Hair, Risher, Sarstedt, & Ringle, 2019), as depicted in Figure 2, below.

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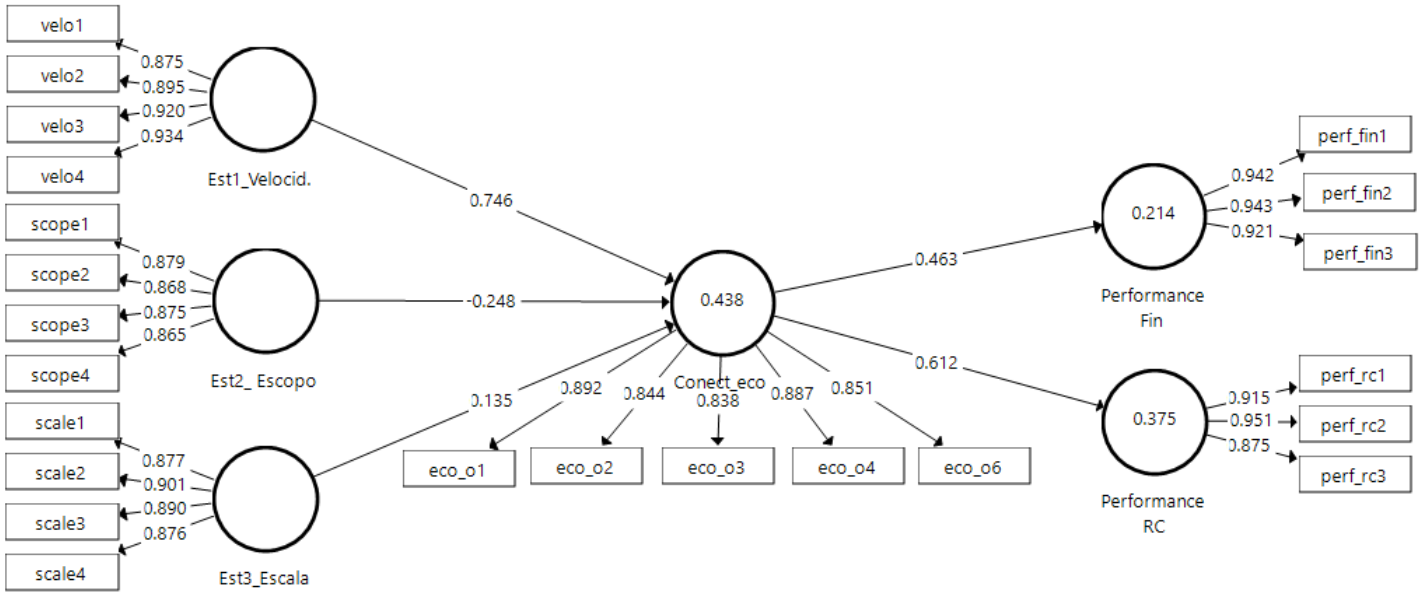
Figure 2
Structural Model



Source: elaborated by the authors (2020).

As shown in Figure 2, the total variance ratio of each endogenous construction explained by the model reached 43.8% for ecosystem connectivity, 21.4% for financial performance and 37.5% for performance of relationship with customers.

Therefore, R2 values were satisfactiory, since the strategy's exogenous variables (speed, scope and scale) explained 43.8% of the dependent variable variance (ecosystem connectivity).

Hypotheses in the current study were tested by assessing the structural model results based on bootstrapping with 5,000 resamplings. It also allowed determining the t statistics and P significance values (Hair, Ringle, & Sarstedt, 2011; Hair *et al.*, 2014). Figure 2 shows the results recorded for the analysis applied to the predictive model, including the β coefficients of the pathway, associated ρ values for each dependent variable carried out in SmartPLS.

The t values critical to a two-tailed test are 1.65 (significance level = 10%), 1.96 (significance level = 5%) and 2.57 (significance level = 1%). Thus, based on the results, hypotheses H1 and H4 were nor confirmed, as presented in Table 2.

Table 2

Results of Pathway Analysis and Test of Hypotheses

Hypotheses	Structural pathways	Pathway coefficient (β)	T value	P value	Result
H1	**Est1_Speed** -> **Connect_eco**	0,746	9260***	0.000	Confirmed
H2	**Est2_ Scope** -> **Connect_eco**	0,248	15798***	0.000	Confirmed
H3	**Est3_Scale** -> **Connect_eco**	0,135	6207***	0.000	Confirmed
H4	**Connect_eco** -> **Fin performance**	0,463	2293***	0.022	Confirmed
H5	**Connect_eco** -> **RC performance**	0,612	1014***	0.311	Not confirmed

Note: (a) t value for two-tailed test: *** t value 2.58 (significance level – 1%) (Hair *et al.*, 2014).

Source: Elaborated by the authors (2020).

The Q^2 measurement by Stone-Geisser was calculated to assess the predictive relevance of the model, which recorded value of 1,936. According to Chin (1998), Q^2 measurement value higher than 0 implies that the model has predictive relevance. Furthermore, *Standardized Root Mean Square Residual* (SRMR), which is a criterion to represent the root of the square discrepancy between the observed correlations matrix and the implicit correlations in the model,

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was assessed; in other words, the Euclidean distance between two matrices. If one assumes the cut-off value of 0.08, as suggested by Hu and Bentler (1999), the herein presented model shows acceptable adjustment of 0.060.

RESULTS ANALYSIS AND DISCUSSION

The aim of the present study was to assess how digital ecosystem connectivity ability would measure strategy impact on digital business performance. In order to do so, a research model aimed at measuring such an impact was represented; it was mediated by the digital ability of digital ecosystem connectivity in digital business performance. The research was carried out in e-commerce and e-service digital companies in Brazil, as highlighted in the previous section.

It was possible observing that, by developing its strategy, the digital business must have connectivity ability in the ecosystem to improve its performance, because the analysis of hypotheses allows observing that the business strategy has positive impact on financial performance.

As for relationship with customers, hypothesis H5 was not confirmed, and it is justified by statements by Bharadwaj *et al.* (2013), who highlight that the strategy leads to customers' satisfaction, a fact that is linked to the company's relationship with customers, and even closer related to responsiveness to digital ability, as pointed out by Venkatesh and Joglekara (2013). Furthermore, it is necessary combining these digital capacities for the companies to be able to quickly respond to customer and market demands. In other words, only having an ecosystem is not enough, but it is essential developing other capacities, as highlighted by Zouari and Abdelhedi (2021).

Next, implications of results in the present study are analyzed and discussed from two different viewpoints: theory and practice.

THEORETICAL IMPLICATIONS

The study makes contributions for the IS research field by expanding the understanding of digital capacities, because it shows its association with digital business performance. Furthermore, it brings theoretical updates to the study on digital transformations and digital ecosystems, with emphasis on the relevance of strategy to likely improve financial performance and to connect authors within the digital ecosystem.

Result analysis allows observing that constructs stressed by Bharadwaj *et al.* (2013) as components of digital strategy, scope, scale and decision-making speed are positively correlated to ecosystem connectivity. All hypotheses that relate the strategy to ecosystem connectivity were confirmed, and it reinforces the need of having such an ability to improve business' financial performance.

Similarly, Nambisan *et al.* (2017) suggest that the new digital infrastructures and their associated capacities can critically complete a company's practices by, for instance, collaborating to customers or to a broader ecosystem of external partners. Besides, ecosystem architecture can be built according to the company's demand, because it is the combination of one, or more elements, of the same architecture. Thus, ecosystem connectivity ability association with financial performance and with relationship with customers showed that, as stated by Setia, Venkatesh and Joglekara (2013), little is known about the effective digital business strategies. Moreover, only few big organizations can use the digital technologies available to improve their performance, such as the case of customer services; consequently, hypothesis H5 was not confirmed. Zouari and Abdelhedi (2021) corroborated this idea and pointed out the need of developing new capacities in order to fulfil customers' needs, such as speed and responsivity. Furthermore, system and data reliability are factors contributing to customers' satisfaction.

Hypothesis H4, which regards financial performance, was confirmed, and it corroborated the statements by Barret *et al.* (2015), who highlighted that the development of a better ecosystem connectivity will imply in financial performance, because the actors will be connected to each other and it could reduce costs. These authors also highlight that the ecosystem can enable actors to share resources, to offer marketing actions and logistics, among other actions that can contribute to cost reduction (Margiono, 2020).

Accordingly, response speed can differentiate digital businesses (Fan, 2018)

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because it makes customers happier and makes companies capable of standing out among its competitors. However, it does not happen only through connectivity, so, it is necessary developing other digital capacities (Tams, Grover, & Thatcher, 2014), as well as responsive digital processes to improve performance, as already pointed out by Setia, Venkatesh and Joglekara (2013).

Therefore, it can be concluded that the development of digital strategies will lead to improved financial performance, but it is essential focusing on response to the market, to customers and to interested parts, because competition in this business type is essential, and it demands new digital capacities to improve performance, mainly customers' satisfaction.

PRACTICAL IMPLICATIONS

The present study pinpoints digital resources, as well as emphasizes that digital businesses must develop strategies through scope, scale and decision-making speed, as highlighted by Bharadwaj *et al.* (2013). Accordingly, the need of digital business managers to prioritize their investments in an effective strategy, as well as to follow indicators, is the first implication (Westerman, Bonnet, & Mcafee, 2014). However, two main points deserve particular care by managers: ecosystem connectivity ability and response ability.

Besides, it is possible noticing that digital businesses must seek to develop and invest in digital technologies to be able to monitor the market, to be fast and responsive, and to be capable of acting in different ecosystems, as stated by Setia, Venkatesh and Joglekara (2013), in order to improve their performance.

The present research was carried out in *e-commerce* and e-service companies; it was observed that these digital business types must have connectivity capacity in their ecosystem. They may have their own ecosystem or join ecosystems of other customers and suppliers. This process demands a strategy that leads to the development of a dynamic ability so that companies can broaden or reduce their infrastructure (Mithas, Tafti, & Mitchell, 2013), change their portfolio of services and/or products (Kane, 2015), and make their decision-making process faster (Bharadwaj *et al.,* 2013).

As previously highlighted, response ability is essential; thus, it must be the very focus of managers, since this ability has straight impact on business performance. In order to do so, it is also important emphasizing the need of having managers capable of understanding changes in customers' behavior (Hylving, Henfridsson, & Selander, 2012).

Consequently, companies must be aware that by driving their investments towards digital technologies, they will force companies to respond fast and efficiently to customers' demands. Thus, they will have to improve their performance, as pointed out by Setia, Venkatesh and Joglekara (2013).

Furthermore, companies can develop the interface with customers, through more-responsive websites, by using APIs, IOT, BI tools, apps, among others. Therefore, they will be able to monitor the marketing and to incorporate the use of digital technologies so they can improve their response ability to increase companies' speed in responding to market changes and to meet consumers' desires (Tams, Grover, & Thatcher, 2014).

CONCLUSION

The aim of the present study was to assess how digital ecosystem connectivity ability mediates strategy impact on digital business performance. In order to do so, a research was carried out based on the research model (Figure 1) aimed at measuring the impact of digital business mediated by the digital ability of digital ecosystem connectivity in digital business performance.

Thus, five hypotheses were advocated; they related digital business strategy, construct medium, speed, scope and scale to the digital ability of ecosystem connectivity (H1, H2 and H3), as well as two hypotheses that have related this ability to financial performance (H4) and to relationship with customers (H5).

It was possible observing that all hypotheses related to digital business strategies (H1, H2 and H3) were confirmed, and this finding points towards the need of digital businesses to prioritize their investments in an effective strategy and in indicators' follow-up. Besides, this strategy will allow ecosystem architecture to be

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built based on the company's demand, because it is the combination of one, or more, elements of the same architecture.

With respect to the association of ecosystem connectivity with performance, it was observed that hypothesis H4 was confirmed and H5 was not. This finding points out that ecosystem connectivity can ensure actions capable of improving its financial return or to reduce costs; however, it does not ensure customers' satisfaction because it is closely linked to other capacities, such as responsiveness.

The current article presents the theoretical and practical implications that can contribute to updates in studies about digital transformation. The main emphasized aspects were the need of digital businesses to develop strategies and digital capacities that lead to companies' response ability in this new digital-era scenario, as well as in investing in digital technologies that allow connectivity in the digital ecosystem.

Some of the study's limitations were number of respondents and companies; therefore, future research must analyze this scenario in other countries, so that new theoretical advancements in this field can be achieved. It is also recommended to use control variables, such as digital business type.

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Appendix A - Items for measuring digital capabilities.

Digital Capabilities	Measurement Items
Ecosystem Connectivity	Please rate ecosystem connectivity – the skill that assesses internal and external connections via the digital platform – using a scale of 1 to 7, where 1 means "completely disagree" and 7 means "completely agree".
	1. It is possible to capture and exchange information easily with the following parties, using our platform and digital tools: a. The Suppliers b. Partners c. Employees from different areas d. consumers e. Public sector
	2. We can orchestrate internally and externally the following parts, using our platform and digital tools: a. The Suppliers b. Partners c. Employees from different areas d. consumers e. Public sector
	3. We can easily convey our business needs (eg product or service development) in the form of open calls to the public or external groups of people (eg self-employed) using our digital platform.
"Drivers" for digital business strategy	The following questions are related to the performance "drivers" of the digital business strategy.
Scope of Digital Business Strategy	4. Our IT strategy is well integrated with our business strategy.
	5. Our business strategy facilitates the digitalization of products and/or services.
	6. Our business strategy exploits information about these digital products or services.
	7. Our digital business strategy transcends functional sectors (eg finance, HR, etc.) and traditional processes across our organization.

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Digital Business Strategy Scale	8. Our digital infrastructure can quickly and efficiently adapt to the dynamics of our company's digital strategy.
	9. Our digital infrastructure can be quickly adjusted in response to strategic business needs.
	10. Our digital business strategy can effectively leverage effects on business networks and multifaceted platforms.
	11. Our digital strategy allows us to easily move forward in partnerships and alliances.
Digital Business Strategy Velocity	12. Our digital business strategy accelerates the launch of new products/services.
	13. Our digital business strategy drives learning for operational and strategic decision-making.
	14. Our digital business strategy accelerates the supply chain harmonization process.
	15. Our digital business strategy enables the formation of new business networks that help develop complementary capabilities.
Performance	The next questions are related to digital business performance. Please rate the next three items using the scale between "Strongly Disagree" (1) and "Strongly Agree" (7).
Customer relationship performance	16.We maintain a strong and ongoing relationship with our consumers.
	17.We have precise knowledge about the purchasing patterns (demands) of our consumers.
	18. We have a high rate of recommendations from our consumers.
Performance financial	Rate your financial performance against your competitors' performance on a number of dimensions, using a scale from "much worse" (1) to "much better" (7). 19. Profit in the last 5 years. 20. Revenue over the last 5 years. 21. Return on investments over the last 5 years.

Endnotes

1 The translation of the article is the responsibility of the authors.