

KEY DIMENSIONS OF DIGITAL MATURITY: A STUDY WITH RETAIL SECTOR COMPANIES IN BRAZIL

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ABSTRACT

Purpose: The objective of this research was to identify which dimensions are related to the establishment of higher levels of digital maturity.

Originality/value: There is little academic scientific literature on digital maturity in Brazil. This research will offer subsidies to companies regarding the different dimensions that need to be emphasized by managers in order to achieve a full and effective digital transformation. This information will be valuable to support the digital transformation process of these companies. The study fills a gap in the academic context related to the lack of more comprehensive empirical studies based on digital maturity.

Design/methodology/approach: This study evaluated the relationship of eight dimensions of capacity (strategy, leadership, market, operational, people, culture, governance, and technology) with the development of digital maturity. This survey applied an electronic questionnaire to directors of the strategic level of Brazilian retail sector companies located in different regions of Brazil. At the end, a total of 260 valid questionnaires were obtained. The responses were analyzed using the Partial Least Squares (PLS) method.

Findings: The research results showed that the strategy, market, operations, culture, and technology dimensions are those that are most related to the development of digital maturity.

KEYWORDS

Digital transformation. Digital maturity. Digital capabilities. Digital orientation. Retail.

1. INTRODUCTION

In recent years, a series of phenomena related to digitalization and new manufacturing technologies have been changing the business environment under the term “Industry 4.0” or the “Fourth Industrial Revolution” ((Schuh, Anderl, Gausemeier, Hompel, & Wahlster, 2017). The concept of digital transformation emerges from a context of new business models, that is, from the need for sustainable and efficient use of limited resources over the production of highly customizable products.

Although digital transformation can be defined as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019, p. 1), it is a concept imbricated by complex issues that affect many or all segments within an organization Hess, Matt, Benlian, & Wiesböck, 2016).

Despite the relevance of digital transformation for the survival of organizations nowadays, it is noteworthy that executives do not have enough clarity about the different elements that need to be considered in their efforts to digitally transform their businesses. As a result, they run the risk of overlooking important elements of digital transformation or disregarding solutions that are more favorable to the specific characteristics of their companies (Hess et al., 2016).

Based on the need to contribute to a successful digital transformation implementation and the achievement of more advanced digital maturity levels, several studies on the subject have been carried out in recent years. Among those studies, it is possible to cite the ones published by Hess et al. (2016), International Data Corporation – IDC (2020), Isaev, Korovkina, and Tabakova (2018), Ivančić, Vukšić, and Spremić (2019), Martins, Dias, Castilho, and Leite (2019), Rossmann (2018), Schuh et al. (2017), Valdez-de-Leon (2016), Vial (2019), and Wade, Macaulay, Noronha e Barbier (2019). Some of the maturity models consist of establishing different dimensions and criteria to achieve digital maturity, while others describe key action dimensions and different stages that indicate the required business evolution in terms of digital maturity.

However, the analysis of the outcomes from previous studies reveals a gap in understanding which elements are related to digital transformation, that is: which criteria, dimensions, elements, characteristics, or directions are allowing an organization to reach an adequate level of digital maturity?



This empirical research aims to identify which elements or dimensions are related to the development of digital maturity.

A literature review carried out by Rossmann (2018) identifies different measurement models for digital maturity. The researcher has found out in his analysis that digital maturity incorporates eight capability dimensions: the strategy, the leadership, the market, the operations/the operational system, the people, the culture, the governance, and the technology. The present study aims to replicate the scale developed by Rossmann (2018) in the Brazilian retail sector. The choice to focus the research on companies in the retail sector was deemed appropriate because it is believed that the sector is very dynamic and competitive. Its characteristics make it eligible for the instrument developed by Rossmann (2018) to be applied. Moreover, retailers continuously innovate to attract more consumers, face competition and take advantage of technology improvements (Miotto & Parente, 2015). Indeed, the retail sector is usually characterized as highly competitive and dynamic in technological advances and innovation (Ghisi, Silveira, Kristensen, Hingley, & Lindgreen, 2008). The questionnaire was sent to professionals situated on strategic levels. We obtained responses from 260 companies and they were analyzed by using the Partial Least Squares (PLS) method.

This study presents contributions to business practitioners and scholars. As for the business context, the research will provide subsidies for companies regarding the various aspects that need to be emphasized by managers to achieve full and effective digital transformation. This basic information will be valuable for Brazilian companies in terms of placing them at the same level of development as their foreign competitors. In addition to that, a better understanding of the dimensions related to digital maturity can make the companies more prepared to face the various challenges brought about by the Fourth Industrial Revolution (Industry 4.0). As for the academic context, the study fills a gap related to the lack of more comprehensive empirical studies regarding the basis for digital maturity. It is noteworthy that Studies on Digital Maturity Transformation, which include studies on maturity, have been conducted mainly by consulting firms in a low volume of academic scientific literature, with little conceptual and empirical research (Dolganova & Deeva, 2019).

Digital transformation literature is still incipient in Brazil. A search on the site called Scientific Periodicals Electronic Library (Spell), maintained by the National Association of Graduate Programs in Administration (Anpad), under the label “Digital Transformation”, conducted in March 2021, retrieved only eight papers, which were either dedicated to theoretical discussions on



the subject or had their focus on specific descriptions of case studies. The outcome of this research may serve as a basis for other empirical or comparative studies either in other industries, in other geographical regions, or in other cultural contexts.

2. THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

In order to survive in the current market, many companies have been trying to integrate digital technology into their businesses in an organizational change known as digital transformation (Tekic & Koroteev, 2019). Changes are possible due to access and the use of new technologies to improve organizational performance and achieve sustainable and competitive advantages (Siachou, Vrontis, & Trichina, 2020). A new paradigm represents a shift from tangible to intangible resources focusing on creativity, cooperation, and intellectual property (Melović, Jocović, Dabić, Vulić, & Dudic, 2020). It involves the transformation of core operations, products and business processes, which may generate revised or entirely new business models (Singh, Klarner, & Hess, 2019).

The concept of digital maturity gained relevance in the study performed by Westerman, Bonnet, and McAfee (2014), which presented evidence that companies with greater digital maturity had also achieved higher corporate performance levels. Rossmann (2018) developed a measurement model for digital maturity. The author indicates that digital maturity incorporates eight capability dimensions: the strategy, the leadership, the market, the operations, the people, the culture, the governance, and the technology. Our study and its research hypotheses, as presented below, are based on this model of eight dimensions.

2.1 Strategy capability

The formulation and the implementation of a digital transformation strategy have become key concerns for many organizations, given the impacts of digital technologies on the organizations' environment (Matarazzo, Penco, Profumo, & Quaglia, 2021). Companies typically need a digital strategy to help managers navigate through the transformation process (Hess et al., 2016). A digital business strategy can be seen as an organizational strategy formulated and executed by leveraging digital resources to create differential value (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013).



Digital strategy involves pursuing slightly different goals than a traditional information technology (IT) strategy. Unlike the latter, which hardly considers the business environment, the digital strategy focuses on transforming products, services, processes, and organizational components by introducing technology (Dolganova & Deeva, 2019). In this sense, a digital strategy signals the path to digital transformation, and it guides managers into the transformation process, generating results from the integration and the use of digital technology with a broader impact on companies, as it addresses the potential effects over interactions across company boundaries with customers, competitors, and suppliers. Thus, the following hypothesis is presented:

- H1: Digital maturity is positively manifested in the development of strategic capability.

2.2 Leadership capability

Companies employing a digital strategy can successfully undergo a transformation if strong leadership is demonstrated from the top of the organization (Tekic & Koroteev, 2019). In digitally mature companies, executives have specific competencies to successfully master the challenges related to digitalization. Among these competencies, leadership is indispensable to adapt to new market conditions and maintain their competitive advantage (Klein, 2020). For successful implementation of digital transformation technologies, top management, whose support is vital for making changes into processes and performance, must be inspirational and transformational (Kumar, Singh, & Kumar, 2021). Moreover, managers' leadership and their focus on the companies' missions are crucial to implementing more advanced stages of the digital transformation strategy (Jardim, 2021). Proactive leadership and investment are the key factors that determine a company's potential to become a digital organization (Kontić & Vidicki, 2018). The context leads to the hypothesis:

- H2: Digital maturity is positively manifested in the development of leadership capability.

2.3 Market capability

The impact of the digital age has caused changes in virtually every component of the business strategy. Organizations, in order to remain competitive,



generate positive impacts not only for themselves but also for individuals and society. Those organizations are seeking to change the paths of value creation with respect to value proposition, value networks, digital channels, agility, and ambidexterity through digital technologies. The end-to-end customer's journey is a key guide to digital transformation. Positive outcomes can come from combining customer journey design with implemented technologies (Hess et al., 2016; Ivančić et al., 2019; Matt, Hess, & Benlian, 2015; Vial, 2019). In addition, the incorporation of digital products and services into the business and the impact they have on customer experience and company performance can be seen as a key to achieving higher levels of digital maturity (Rossmann, 2018). From this perspective, the following hypothesis is presented:

- H3: Digital maturity is positively manifested in the development of market capability.

2.4 Operations capability

Recent research has shown that innovative technologies are complex phenomena and require new intellectual resources, which are often beyond the capabilities of any organization. Therefore, in addition to significant changes in companies' internal capabilities, digital transformation also pushes innovation into external innovation networks (Saarikko, Westergren, & Blomquist, 2020). Since digital technologies are interactive technologies that establish connections to other organizations, they also allow companies to improve their innovation capacity by integrating partners and even competitors in their creative and experimental processes (Hervé, Schmitt, & Baldegger, 2020). It is necessary to build up or join a digital ecosystem to work with new partners in co-creation and cooperation activities that help redefine the speed of collaborative behaviors and recreate new business models (Warner & Wäger, 2019). Most studies on digital transformation recognize the relationship between the engagement of companies with other parties and digital innovation (Vial, 2019). In this sense, integration with other parties must be embedded in the company's operations. That leads to the following hypothesis:

- H4: Digital maturity is positively manifested in the development of operations capability.



2.5 Culture capability

Culture is considered a driver for digital transformation, since it cannot be scaled as a top-down initiative and it depends on the organization's ability to promote new behaviors. In a cultural context, transformation is a core principle and a strategy for the entire company (IDC, 2020). Digital transformation requires instilling a culture that encourages experimentation, tolerates failure, and supports change, which, in a traditional culture, based on hierarchical power and teams or business units competing for resources, does not seem to occur (Hemerling, Kilmann, Danoesastro, Stutts, & Ahern, 2018). The digital culture prepares people to deliver fast results based on delegation, collaboration, agility, and learning by accelerating decision making and value creation, which could not be achieved simply by introducing new technologies (Schuh et al., 2017). As a result, higher levels of digital maturity seem to influence the organization's culture, which leads to the formulation of the following hypothesis:

- H5: Digital maturity is positively manifested in the development of cultural capability.

2.6 People capability

Fostering a digital culture accelerates the digital transformation process of an organization. However, this process needs to be supported by developing people's skills (Warner & Wäger, 2019). To accomplish the transition, it is necessary to reassess existing skills and capabilities and to make sure how they can be combined to accommodate the interdisciplinary nature of innovative products and services (Saarikko et al., 2020). Managers must have a good knowledge of digital tools and a clear vision for digital transformation (Ukko, Nasiri, Saunila, & Rantala, 2019). Other researchers suggest involving younger "digital natives" in the capacity of building upon the process of traditional organizations by making a balance between improving the digital maturity of the internal workforce and hiring new talents (Warner & Wäger, 2019). In any case, previous research has pointed to the relationship between development of people's skills and the digital transformation process, which leads us to the formulation of the following hypothesis:

- H6: Digital maturity is positively manifested in the development of people's capability.



2.7 Governance capability

The development of a digital transformation strategy also requires specific governance structures, for example, boards and panels (Matarazzo et al., 2021). In addition, intangible resources, such as governance practices, can assist managers in formulating strategies. For the successful implementation of digital transformation processes, governance policies and procedures need to be developed and applied (Omar & Almaghthawi, 2020). Besides, governance is a means to improve data quality and acceptance of the use of data for decision-making (Brous & Janssen, 2020). The formulation leads us to the following hypothesis:

- H7: Digital maturity is positively manifested in the development of governance capability.

2.8 Technology capability

Digital technologies transform the way companies compete with each other, as they increasingly compete not only with rival companies in their industry but also with businesses in other industries that attract customers through new digital offerings. The use of technology addresses a company's attitudes toward new technologies and its ability to exploit technologies across borders by impacting products, business processes, sales channels, and supply chains (Matt et al., 2015). New digital technologies, especially those called SMACIT3 – social, mobile, analytics, cloud and internet of things (IoT) – or social, mobile, analytics, cloud technologies and internet of things – present opportunities, but also existential threats for companies already established. Thus, technology emerges as a set of fundamental capabilities that enable the planning, deployment, and integration of effective solutions capable of supporting a digital business (Valdez-de-Leon, 2016). The following hypothesis is, thus, presented:

- H8: Digital maturity is positively manifested in the development of technology capability.

3. METHODOLOGY

The empirical phase of this study included a survey distributed through a site called SurveyMonkey to leaders in strategic levels of Brazilian companies



of the retail sector located in different regions of the country. The questionnaire form was available to the participants from February 5th to February 18th, 2021.

In order to identify the necessary sample size (n) to perform the structural equation analysis, we used the formula proposed by Westland (2010):

$$n \geq 50r^2 - 450r + 1.100$$

in which:

p = manifest variables = 32;

f = number of latent variables = 9;

$$r = \frac{p}{f} = \frac{32}{9} \approx 3,6.$$

Therefore, for this study, n should be greater than 128, a value exceeded by the number of valid questionnaires (260). The sample was composed of higher hierarchical level professionals (executives, presidents, vice-presidents, directors) and managers, coordinators, supervisors, and specialists.

The questionnaire was organized into two sections. The first section contained questions related to the retail sector company: its location, area of operation, number of employees, annual revenues and, the company's age. The second section, in turn, consisted of 32 questions related to the digital maturity scale, developed by Rossmann (2018). In this scale, respondents were asked to declare how much they agreed or disagreed with the statements on digital maturity by using an 11-point Likert-type scale, ranging from 0 (strongly disagree) to 10 (strongly agree). The scale items are shown in Appendix 1.

The scales were adapted and validated by applying the parallel translation technique (Malhotra, 2001). Through that technique, a committee of translators discusses alternative versions of questionnaire items, and this committee of translators changes items until a consensus is reached. Each member of the committee of translators is fluent in at least two languages. Four translators were used in this process, including two professionals of digital transformation and two professors, one with an IT background and the other with a Marketing background. All of them are fluent in English.

The questionnaire pre-test was applied to a sample of five retail executives in order to verify their understanding of the survey questions. The interviewees were asked to present their suggestions to improve items' readability and comprehension. The team duly discussed suggestions, and necessary modifications were made to the survey questions.



For data analysis, it was deemed appropriate to use structural equation modeling (Hair et al., 2017) due to the characteristics and the objective of this study. Based on the study performed by Rossmann (2018), all eight dimensions were treated as reflective, and the model was classified as a second-order molar model. Initially, the second-order digital maturity dimension was assigned to 32 indicators linked to *strategy*, *leadership*, *market*, *operations*, *people*, *culture*, *governance*, and *technology*. The PLS estimation was used to operationalize the structural equation analysis (Wong, 2011). Data analysis was carried out using R software (version 4.0.4) and Minitab (version 17.1.0).

In the structural equation analysis, the evaluation of the measurement model and the evaluation of the structural model were performed. The former was done according to criteria established by Hair et al. (2017) and by Fornell and Larcker (1981): convergent validity, discriminant validity, and internal consistency. The latter was performed based on the criteria established by Hair et al. (2017): size and significance of the path coefficients, multicollinearity, *Goodness of Fit* (GoF), and *Stone-Geisser's* (Q²). The bootstrapping procedure was performed by a thousand resamples in order to evaluate the statistical significance of the estimated coefficients.

In order to assess the adequate assumptions of distribution for the use of a regression analysis technique, multicollinearity and the presence of outliers were analyzed. Multicollinearity was not detected in the relationship between the indicators, since all correlation coefficients presented by them were lower than 0.80. Regarding outliers, they were present in 14 indicators: EST3, LID1, LID3, LID4, MER1, MER2, OPE2, OPE4, PES4, CULT1, CULT2, CULT4, GOV1, and TEC3. They were listed in a quantity that varied, for each of the manifest variables previously mentioned, between one and three cases. These discrepant values were not excluded from the analysis by considering the following arguments: 1. they refer to legitimate values of the population (they are not typing errors); 2. the number of outliers in each variable (from one to three) is small in relation to the sample size (260 cases); and 3. despite being classified as outliers, they are not very distant from the other values present in the sample, since the research was done with the use of a scale composed of pre-fixed values (from 0 to 10). Considering these justifications, we concluded that the few outliers presented in the sample would not be able to generate relevant disturbances in the results of the structural equation analysis.

The next section outlines the main results of this study.

4. RESULTS

4.1 Sample description

The final sample was composed of 2.3% of small companies, 38.9% of medium-sized companies, and 58.8% of large companies. In terms of the hierarchical positions of the survey participants, 116 respondents (44.6%) are CEOs, vice presidents, board members, business owners, or directors, while 106 respondents (40.8%) are managers. The other respondents are coordinators, supervisors, specialists, analysts (14.6%). Figure 4.1.1 presents the characteristics of the participating companies.

(Figure 4.1.1)

COMPANIES' CHARACTERISTICS

		Number of respondents	Frequency (%)
Area of operation	Retail	128	49.2%
	Distribution	72	27.7%
	Wholesale	17	6.5%
	Wholesale and distribution	9	3.5%
	Wholesale and retail	8	3.1%
	Distribution and retail	15	5.8%
	Wholesale, distribution, and retail	11	4.2%
Company size	Small company	6	2.30%
	Medium-sized company	101	38.80%
	Large company	153	58.80%
Number of employees	Less than 99	48	18.40%
	From 100 to 499	99	38.10%
	From 500 to 999	46	17.70%
	More than 1,000	67	25.80%
Company age	Less than 10 years	10	3.80%
	More than 10 years	250	96.20%

Source: Elaborated by the authors.

4.2 Model evaluation

The evaluation of the measurement model comprises a unidimensional analysis, a convergent validity analysis, and a discriminant validity analysis. Appendix 1 shows the results of the unidimensionality tests, which use the composite reliability indicator. It can be seen that the composite reliability values for all indicators are greater than the threshold of 0.700, and they are defined as satisfactory (Hair et al., 2017). A convergent validity has been observed in all dimensions, since all indicators show statistical significance (p -value < 0.001) and loadings are greater than 0.708. Exceptions were observed in the Leadership capability. It manifests not only with the variable LID2i, but it also shows a load of 0.128. That indicator was then eliminated from the Leadership capability construct.

Another common measure for establishing convergent validity at the construct level is the average variance extracted (AVE). The results of the convergent validity analysis are presented in Appendix 1, and they seem to be satisfactory. The data obtained from the divergent validity analysis allow us to conclude that not all dimensions present such validity. The result indicates that the latent variables of some constructs do not measure different aspects related to the constructs and, therefore, are redundant, and some of them should be eliminated from the analysis. Thus, the constructs leadership capability, people capability, and governance capability are excluded on Figure 4.2.1, which shows the results of this analysis after the removal of those constructs.

(Figure 4.2.1)

DISCRIMINANT VALIDITY

	Strategy	Market	Operations	Culture	Technology	Digital maturity
Strategy	0.765					
Market	0.745	0.783				
Operations	0.743	0.638	0.757			
Culture	0.671	0.593	0.637	0.690		
Technology	0.711	0.669	0.719	0.632	0.720	
Digital maturity	-	-	-	-	-	0.597

Source: Elaborated by the authors.

The modified structural models were evaluated based on the following criteria: a path of a coefficient analysis, a variance of an inflation factor (VIF), GOF, Q², and a correlation between exogenous constructs in the structural model. Figure 4.2.2 shows the results of the verification of these criteria.

(Figure 4.2.2)

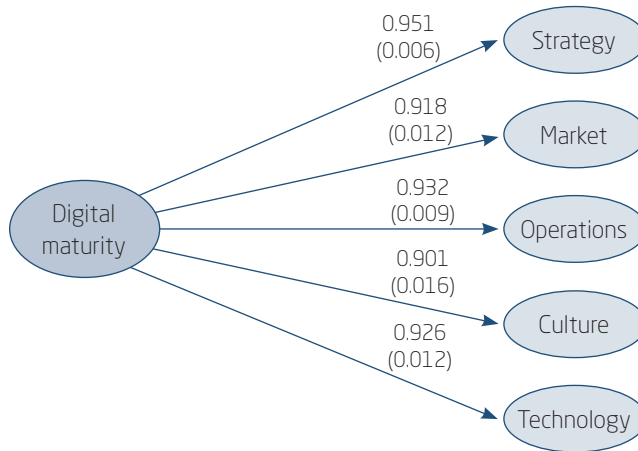
**EVALUATION OF THE MODIFIED STRUCTURAL MODEL -
COEFFICIENT PATHS, VIF, GOF, AND Q²**

Construct	Standardized estimation	Standardized error	p-value	VIF	R ²	GoF	Q ²
Strategy	0.951	0.006	0.007	6.485	0.905		
Market	0.918	0.012	0.013	4.486	0.842		
Operations	0.932	0.009	0.010	5.055	0.869	0.745	0.294
Culture	0.901	0.016	0.018	3.616	0.813		
Technology	0.926	0.012	0.012	4.844	0.857		

Source: Elaborated by the authors.

The data shown in Figure 4.2.2 demonstrates that all the paths proposed in the structural model are significant (p-values < 0.001). They indicate that maturity positively manifests itself in the capabilities of the strategy, the market, the operations, the culture, and the technology. The dimensions that are mostly manifested by digital maturity are in that order: the strategy (0.951), the operations (0.932), the technology (0.926), the market (0.918), and the culture (0.901). The GoF value is acceptable, and it indicates that the overall predictive performance of the model is adequate. The final model is represented in Figure 4.2.3.

(Figure 4.2.3)
MODIFIED STRUCTURAL MODEL



Source: Elaborated by the authors.

The results of the evaluation of the proposed hypotheses are shown in Figure 4.2.4.

(Figure 4.2.4)
HYPOTHESES EVALUATION - STRUCTURAL EQUATION ANALYSIS

Hypothesis	Hypothesis supported?
H1. <i>Digital maturity is positively manifested in strategy capability</i>	Hypothesis supported
H2. <i>Digital maturity is positively manifested in leadership capability</i>	Hypothesis not supported
H3. <i>Digital maturity is positively manifested in market capability</i>	Hypothesis supported
H4. <i>Digital maturity is positively manifested in operations capability</i>	Hypothesis supported
H5. <i>Digital maturity is positively manifested in people capability</i>	Hypothesis not supported
H6. <i>Digital maturity is positively manifested in cultural capability</i>	Hypothesis supported
H7. <i>Digital maturity is positively manifested in governance capability</i>	Hypothesis not supported
H8. <i>Digital maturity is positively manifested in technology capability</i>	Hypothesis supported

Source: Elaborated by the authors.

5. DISCUSSIONS

The findings of this study provide strong evidence that digital maturity manifests itself positively in the digital strategy, as we observed that it was the dimension that had manifested itself the most (0.951). Previous research assumes that higher levels of digital maturity denote the presence of a specific set of dimensions. Among them, we identify the digital strategy and the business model (Isaev et al., 2018; Ivančić et al., 2019; Rossmann, 2018; Sebastian et al., 2017; Valdez-de-Leon, 2016; Westerman et al., 2014). By considering this context, the study carried out by Kane, Palmer, Phillips, Kiron, and Buckley (2015) points out that more than 80% of the companies in more advanced stages of digital maturity have clear and coherent digital strategies. On the other hand, only 15% of those at early stages have them, demonstrating that digital maturity translates into superior strategy capabilities. Sebastian et al. (2017) punctuates that the ability to digitally reimagine the business comes largely determined by a clear digital strategy supported by leaders who foster a changing and innovative culture. Ivančić et al. (2019) conducted a case study with three companies from different industries and in different stages of digital transformation, and they demonstrate that sharing a common digital vision is understood as an important factor for the successful outcome of digital transformation efforts. So, each company develops its strategy according to its needs and the stage of its digital transformation process (Hess et al., 2016; Ivančić et al., 2019).

The present study indicates that the second dimension (the operations) has the greatest impact in the development of digital maturity, focused on inter-organizational collaboration and integration. The result corroborates previous studies, which point out that digitally mature organizations must support a collaborative development approach to be innovative and responsive to the ever-increasing and accelerating changes in customer needs (Mugge, Abbu, Michaelis, Kwiatkowski, & Gudergan, 2020). Smart manufacturing enterprises, for instance, are organized into multiple layers of networked collaborative subsystems, and collaboration between these layers constitutes a requirement to support agile and resilient processes (Camarinha-Matos, Fornasiero, Ramezani, & Ferrada, 2019). Collaboration is essential to respond to rapid technological changes, an intense global competition and short product life-cycles because it helps reduce costs and risks and enables companies to access unavailable knowledge, assets, and resources (Barrane, Ndubisi, Kamble, Karuranga, & Poulin, 2020).

The market capability seems to be manifested through digital maturity. This result corroborates the findings of Vial (2019), who states that digital technologies leverage disruption regarding customer's behavior and needs. More digitally mature businesses, i.e., those that adopt the digital transformation path, have more advanced market capability. Hess et al. (2016) propose that organizations working on value creation alternatives for their customers tend to be positioned at higher levels of digital maturity. Value creation can be realized, for example, through the combination of personalized data and mobile technologies, which is leveraged by companies to better tailor their products, their communications, and their interactions to meet specific customer needs. Thus, the value created enables differentiation from competitors, consolidation of customer relationships, and achievement of competitive advantage (Schallmo, Williams, & Boardman, 2017).

The implementation of digital transformation impacts corporate culture as well. The results also showed that digital maturity manifests itself positively in the performance of the culture capability. Rossmann (2018) defines culture as the set of behaviors that involve the transparency of the company's decisions to the collaborators, agility in decision making, and openness to change continuously. Ananyin, Zimin, Lugachev, Gimranov, and Skripkin (2018) state that a digital organization has a change-oriented culture, in which rapid change and leadership are the most important values. Some characteristics of corporate culture, in this context, are: high level of willingness to learn, openness to innovations, promotion of creativity, and generation of ideas, entrepreneurial mentality, and democratic leadership (Veile, Kiel, Müller, & Voigt, 2019). Cultural factors can greatly influence the way new digital business models are developed and evolved within an organization (Mugge et al., 2020). Several studies point out that it is not enough for organizations in more advanced stages of digital transformation to use and to adopt digital technologies; these studies have also treated culture as a fundamental dimension for driving this process (Hemerling et al., 2018; IDC, 2020; Martins et al., 2019; Salviotti, Gaur, & Pennarola, 2019; Schuh et al., 2017; Westerman et al., 2014).

This study also investigates the relationship between digital maturity and technology capability, and it has found a positive influence of the former on the latter. The results indicate that, out of the five dimensions that remained in the model, technology comes in third place in terms of being affected by digital maturity (0.926). Despite the position of the technology dimension, it is clear that higher levels of digital maturity denote the implementation of digital assets. Westerman et al. (2014) say that digital trans-



formation is the use of technology to radically improve the performance or reach of businesses.

It was also observed that some of the assessed dimensions presented problems of discriminant validity – leadership capability, governance capability, and people capability. It means that the constructs are not unique and they failed to capture phenomena not represented by other constructs in the model. Thus, there seems to be an overlap between these constructs and the others, inasmuch as on other constructs in the model, such as culture or strategy, or when they capture aspects related to leadership, governance, and people as well. The literature shows evidence of the relationship between these constructs. Andriole (2020) states that corporate culture in digital transformation is as important as leadership support and that both “go hand in hand”. Digital leadership is an important factor in managing current challenges, and it has become a key concept in the discussion about what kinds of skills managers need for digital transformation (Zeike, Bradbury, Lindert, & Pfaff, 2019). Leadership promotes dynamic capabilities with the objective of renewing products and business models (Peter, Kraft, & Lindeque, 2020). Digitally mature leaders are well-informed and exhibit entrepreneurial behaviors. Thus, the implementation of digital transformation strategies manifests itself in the behavior of executives or leaders, in general by directly impacting the performance of employees (Mugge et al., 2020).

When there is digital maturity, it is assumed that a combination of digital and transformational capabilities is manifested, which involve managerial aspects such as leadership, culture, change management, and governance (Cichosz, Wallenburg, & Knemeyer, 2020). Governance and leadership play an important role, as business leaders must provide guidance along the transformation journey; they must communicate the vision throughout the organization; and they have to attempt to reduce employee’s resistance, which often occurs in organizations that simultaneously start adopting a new strategy and a different culture (Mugge et al., 2020). It is understood that the culture and strategy constructs may have been able to represent at least part of the leadership and governance dimensions.

Finally, the people capability dimension also seems to have been incorporated by other dimensions of the model. Despite the results, it is observed that organizations with higher maturity levels tend to have employees capable of driving the digital transformation process. It is very important to train employees to accept and to use new digital technologies. Individual characteristics such as curiosity, desire to progress, need for personal development and even confidence in using technology are very important because innovative personal capacity makes it easier for employees to develop their digital



capabilities (González-Varona, López-Paredes, Poza, & Acebes, 2021). With digital maturity, individuals develop digital competencies, which involve the confident, critical, and creative use of information, communication and technology (ICT) to achieve certain goals. Those competencies include people's knowledge of digital business models and digital technologies, as well as their abilities to embrace and use new digital technologies in their jobs (Gfrerer, Hutter, Füller, & Ströhle, 2020). Lack of digital skills is often cited as a major obstacle to a successful digital transformation (Baumeister, Barbosa, & Gomes, 2020). Concerning personality traits, employees must be open to change. In addition, tolerance for failure, willingness to learn from mistakes, and creativity are essential. So, to sum up, social and communication skills facilitate interdisciplinary collaboration, teamwork, and information exchange (Veile et al., 2019).

6. CONCLUSIONS

The initiative to undertake the study was to identify which elements or dimensions would lead to the development of digital maturity. In other words, we sought to examine the relationship between digital maturity and a set of capabilities from a survey conducted in over two hundred retail companies in Brazil. The results of the research led to the conclusion that the dimensions strategy, market, operations, culture, and technology are the ones that are statistically significant in the proposed model, which make us assume that those dimensions are the most impacted ones by the digital maturity construct. Thus, the stated objective has been achieved because, in addition to testing the model, the relationship between digital maturity and key dimensions was also examined when considering assessing to what extent digital transformation efforts manifest themselves in the development of these dimensions in organizations in the retail industry in Brazil.

Beyond these findings, the results of this research led us to an important question: why were not the hypotheses related to leadership, people, and governance capabilities supported by the analyses conducted? We believe that, due to the complexity and breadth of the concept of digital maturity, there are points of intersection between the dimensions not supported in the hypotheses and the dimensions of strategy, market, operations, culture, and technology.

This study's findings explore an uncovered research gap and contribute to distinct stakeholders when we consider that studies focused on a portrait of the digital maturity of specific economic sectors in Brazil are still incipient.



Thus, researchers in the field of digital transformation and related areas, as well as in the retail area, can use the data exposed here to improve general discussions on the subject. To practitioners, this study also sheds light to outcomes that can stimulate organizations, especially retail ones, to develop capabilities related to digital transformation.

This study has some limitations that open up interesting opportunities for future research. First, it was conducted with a cross-sectional research design, in which all measurement items were collected at the same point in time. A longitudinal study could extend the current research by capturing the dynamics of the investigated relationships over time. Second, it employed only a quantitative method for data collection and analysis. Examining these relationships through qualitative methods, such as focus groups and interviews, may allow a deeper understanding of how these phenomena actually occur in organizations. It is also possible to expand this investigation by including a broader sample of companies operating in different locations around the world. As the retail sector is a context-driven field, its characteristics may vary across regions, considering local economic, social, and institutional conditions.

There are other possibilities for future studies as well. It would be an interesting initiative to determine the order in which the capabilities studied in this work should be developed. In this sense, studies about the precedence of relations among the constructs assessed in this study would be useful in order to guide organizations in the gradual development of these capabilities.

DIMENSÕES-CHAVE DA MATURIDADE DIGITAL: UM ESTUDO COM EMPRESAS DO SETOR DE VAREJO NO BRASIL

RESUMO

Objetivo: O objetivo desta pesquisa foi identificar quais dimensões estão relacionadas ao estabelecimento de maiores níveis de maturidade digital.

Originalidade/valor: Há um volume pequeno de literatura científico-acadêmica, com poucas pesquisas conceituais e empíricas sobre o tema de maturidade digital no Brasil. Esta pesquisa oferecerá subsídios para as empresas no tocante às diversas dimensões que precisam ser enfati-



zadas pelos gestores, a fim de se atingir uma transformação digital plena e eficaz. Essas informações serão valiosas para apoiar o processo de transformação digital dessas empresas. No contexto acadêmico, o estudo supre uma lacuna relacionada à falta de estudos empíricos mais abrangentes quanto às bases da maturidade digital.

Design/metodologia/abordagem: Este estudo avaliou a relação de oito dimensões de capacidade (estratégia, liderança, mercado, operacional, pessoas, cultura, governança e tecnologia) com o desenvolvimento da maturidade digital. Aplicou-se um questionário eletrônico a dirigentes de nível estratégico de empresas brasileiras do setor varejista, situadas em diferentes regiões do Brasil. Obteve-se, ao final, um total de 260 questionários válidos. As respostas foram analisadas com o método de *Partial Least Squares* (PLS).

Resultados: Os resultados da pesquisa mostraram que as dimensões estratégia, mercado, operações, cultura e tecnologia são aquelas que estão mais relacionadas ao desenvolvimento da maturidade digital.

PALAVRAS-CHAVE

Transformação digital. Maturidade digital. Capacidades digitais. Orientação digital. Varejo.

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Appendix 1**UNIDIMENSIONALITY AND CONVERGENT VALIDITY**

Item	Item description	Composite reliability	Loading	AVE
Strategy	EST1 Our company has implemented a digital strategy.	0.929	0.897	0.765
	EST2 Our company's digital strategy is documented and communicated.		0.863	
	EST3 Our company's digital strategy has a significant influence on its business model and operations.		0.862	
	EST4 The digital strategy is continuously under evaluation and adaptation.		0.877	
Leadership	LID1 Our executives support the implementation of the digital strategy.	0.803	0.872	0.553
	LID2i Digital strategy is only implemented in isolated functional areas.		0.128	
	LID3 The leadership culture in our company is based on transparency, cooperation, and decentralization of the decision-making processes.		0.844	
Market	LID4 Our company's digital strategy has an influence on the tasks and profiles of executives.		0.849	
	MER1 Digital products and services are integrated into our interfaces and business processes and create a noticeable impact on the customer experience.	0.896	0.878	0.783
	MER2 In our company, there is a direct creation of added value through the progressive digitalization of products and services (e.g., cost reduction, increased productivity, improved customer experience, customer differentiation).		0.815	
	MER3 Digital products and services have a broad impact on our company's overall performance.		0.832	
MER4 Our company is creating a significant sales volume through digital channels.		0.778		

(continue)

Appendix 1 (continuation)

UNIDIMENSIONALITY AND CONVERGENT VALIDITY

Item	Item description	Composite reliability	Loading	AVE
Operations				
OPE1	There are sufficient resources (time, people, budget) available to implement the digital strategy within our company.	0.914	0.828	0.757
OPE2	We establish a strong multidisciplinary cooperation and co-creation between stakeholders across our value chain.		0.866	
OPE3	Physical and digital processes are fully integrated through holistic process models.		0.844	
OPE4	The strength of our digital strategy is driven by innovations in operations.		0.872	
People				
PES1	Within our company, there are specialists in core issues related to digital transformation.	0.904	0.834	0.702
PES2	Within our company, future education opportunities for core topics of digital transformation are available.		0.831	
PES3	Within our company, comprehensive measures to strengthen digital literacy are implemented.		0.867	
PES4	Within our company, new job profiles have been created for employees with expertise in core topics of digital transformation.		0.818	
Culture				
CULT1	Decisions within our company are transparent to our own employees.	0.899	0.808	0.690
CULT2	Digitalization impacts the agility of our company's decision-making.		0.801	
CULT3	In the daily business routine, employees and executives exchange information about our company's digital transformation.		0.874	
CULT4	Continuous change is part of our corporate culture.		0.837	

(continue)

(Appendix 1 (conclusion))

UNIDIMENSIONALITY AND CONVERGENT VALIDITY

Item	Item description	Composite reliability	Loading	AVE
Governance				
GOV1	Guidelines for the use of digital technologies are communicated to and used by employees.	0.924	0.858	0.752
GOV2	Our company implements a holistic management model for digital strategy and the corresponding key metrics.		0.891	
GOV3	Key metrics for digital strategy are fully integrated into the control.		0.849	
GOV4	Corporate strategy and digital strategy are intensely connected and complement each other.		0.872	
Technology				
TEC1	Our company uses big data to optimize strategies, processes, and products.	0.866	0.812	0.720
TEC2	Within our company, we use tools for digital modeling, automation, and control of business processes.		0.829	
TEC3	Our company has implemented company-wide digital workplace concepts. Digital platforms are used for daily collaboration.		0.780	
TEC4	Digital technologies are the mainspring for future product and service developments.		0.721	
Digital maturity		0.978		0.584

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