

# The Effect of Dynamic Capabilities on MSMEs Digitalization: Exploring the Moderating Role of Firm Age

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## Abstract

This paper examines how digitalization of Micro, Small, and Medium Enterprises (MSMEs) is influenced by their ability to adapt in a turbulent environment. Our goal is to understand the role of dynamic capabilities, specifically sensing and seizing opportunities, in the digital maturity of firms. We employ a structural equation model to analyze the effect of these capabilities on MSMEs' digitalization, taking advantage of a novel data set from the self-assessment tool Chequeo Digital in Ecuador. Our focus on dynamic capabilities in the MSMEs context, represents a significant contribution, enhancing our understanding of the determinants of digitalization. The results show a positive and substantial effect of both capabilities on the digital advance of MSMEs. Moreover, we found a negative and significant moderating effect of firm age, on the relationship between sensing capability and digitalization, suggesting that older firms may face in adopting digital technologies when compared to their younger counterparts.

**Keywords:** MSME's; Digitalization; Dynamic Capabilities

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## 1. Introduction

A firm's capacity to adopt digital technologies is critical to its success and survival nowadays. The digital era is characterized by the abundance of technologies and options that may challenge firms to recognize its benefits and identify the appropriate digital technologies for them. This is particularly relevant for MSMEs, as they suffer from limited access to financial and technological resources, restricting their capacity to learn and to take advantage of digital technologies adoption (Masood & Sonntag, 2020). Despite this, MSMEs have a great advantage, because of their smallness and flexibility they can improve the creation of positive values and norms toward digitalization (Eller et al., 2020).

Until now, the concept of digital transformation (DT) has been considered a black box in MSMEs (Zahoor et al., 2023), principally driven by the wrong idea that DT is an advanced digitization, rather than a continuous process of changes, adaptation, and improvements (Machado et al., 2021; Savastano et al., 2021) that should be built on their existent capabilities. However, before reaching steps such as digital transformation, understanding the conditions to advance digitalization is necessary to support the development of MSMEs (Bouwman et al., 2019), as they are key in the development agenda of developing economies. Furthermore, digitalization is crucial since it has been demonstrated that it significantly improves firms' performance (Zeng et al., 2022).

In the literature, dynamic capabilities (DC) have been recognized as key drivers of survival in crisis and turbulent environments (Weaven et al., 2021, Mansouri et al., 2022), being essential to responding to disruptive technological shifts, integrating e-business transformation, and connecting with customers and suppliers to respond to disruptive

innovations (Karimi & Walter, 2015). In this sense, DC is necessary to implement changes in the value creation processes and in the organizational routines (Ellstrom et al., 2021). At the same time, DC helps the business to be aware of its ecosystem (i.e., competitors, newcomers, and opportunities). To attend these opportunities, organizations must develop new products, services, or processes and further conduct continuous renewals (Teece, 2007).

This study aims to investigate the effect of dynamic capabilities as enabling mechanisms of MSME's digitalization in a developing economy. Specifically, sensing, and seizing DC play a role in raising business awareness of internal and external opportunities of digital technologies adoption. Here, we contribute to Vial's (2021) call, which emphasizes the need to examine DC as a theoretical foundation to analyze mechanisms that enable firms to engage in digitalization and DT. Similarly, we follow the call of Zeng et al. (2022), who demand future research with appropriate measures of firms' DC, to study its role in the digital age. In addition, this study contributes to the growing DC literature by understanding how dynamic managerial capabilities (i.e., sensing and seizing) as determinants may promote digital vision in MSMEs in Ecuador. The findings show the positive effect of sensing and seizing DC on the firm's adoption of digital technologies. In addition, firm age performs a moderator role in the relationship between sensing and seizing capability, and digitalization.

The paper is organized as follows: in the next section, we set out the theoretical background. Section 3 presents hypothesis development. Section 4 details the research design and methodology, while Section 5 outlines the results and Section 6 provides the discussion of their policy implications, conclusions, limitations, and future research opportunities.

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## 2. Theoretical Background

### 2.1 Digitalization

According to Gartner's IT glossary, Digitalization is "the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business". The previous step of digitalization is digitization, which is a two-sided phenomenon. On the one side, digital technologies are considered a space for new business opportunities and providers of novel ways to value creation (Witschel et al., 2019; Weimman et al., 2020). For example, by digitizing (i.e., analogous conversion to digital form) information-intensive processes, the costs can be cut by 90 percent, moreover, replacing manual processes with software allows businesses to collect data (Parviainen et al., 2017) that can be later analyzed to solve problems efficiently.

On the other hand, digitization is considered a creator of challenges for businesses (Witschel et al., 2019) and a source of enormous disruption (Karimi & Walter, 2015). Digitalization relaxes the entry barriers and fosters new entry of digital entrepreneurs (Fossen & Sorgner, 2021; Woodard et al., 2013). In addition, these technologies move the competition from a physical plane to a virtual plane where information flows freely and the barriers to entry become less significant (Vial, 2021), significantly increasing the competition.

These new technologies imply changes in the way of working (Parviainen et al., 2017). With this radical technological change, capability gaps have emerged due to the introduction of new technological knowledge, alternatives, and new ways of creating value (Karimi & Walter, 2015). These new digital technologies, also, threaten to make obsolete skills and resources thus, firms need to shift their focus to the capability to change (Ellstrom et al., 2021) and need to be open to modifying and transforming their strategies (Rashid & Ratten, 2020). The literature has examined different aspects of the digitalization of MSMEs. Eller et al. (2020), using a sample of 193 SMEs analyzed certain resources that affect digitalization, and the effect of this ultimately on performance, they found that IT adoption, employee skills, and digital strategy drive digitalization, moreover digitalization mediates the relationship of these three resources on performance.

### 2.2 Dynamic Capabilities

According to the Resource Based View (RBV), firms have valuable, rare, inimitable, and non-substitutable resources that lead to gaining competitive advantage (Barney, 1991; Witschel et al., 2019). Among the mainstream firms' resources, we can mention labor, capital, and land; in a more specific view, there are others such as machinery, skilled personnel, trade contacts, technology, and efficient processes (Wernerfelt, 1984). Nevertheless, this theory has been criticized due to its lack of explanation of how firms sustain competitive advantage under turbulent and continuously changing environments (i.e., digitalization and digital transformation). In other words, it has commonly been seen, that firms struggle to derive sustainable competitive advantage from static resources during dynamic environments (Kraaijenbrink, 2009). Therefore, RBV is not the best framework to explain firms' behavior during continuously changing environments.

At this point, the Dynamic Capabilities framework appears as the most suitable theory to explain the capabilities required for firm survival during turbulent environments. Rather than only owning difficult-to-replicate assets, this framework states that firms must develop difficult-to-replicate dynamic capabilities that can be used to create, extend, upgrade, protect, and keep relevant firm's unique asset base (Teece, 2007). Furthermore, the development of dynamic capabilities is the most valuable way to innovate, create, deploy, protect long-run business performance, and sustain competitive advantage (Teece et al., 1997; Teece, 2007).

In this sense, Teece et al. (1997) defined dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal, and external competencies to address rapidly changing environments. With strong dynamic capabilities firms would be able to respond to environmental dynamics (Witschel et al., 2019). These capabilities are commonly divided into three primary clusters (Teece, 2014), sensing, seizing, and transforming capabilities (Teece, 2007; Teece, 2014).

The development of DC helps companies adapt to the waves of technological innovation through environmental scanning, sensing, and integrative stages (Putritamara et al., 2023). By developing sensing and seizing capabilities firms could take advantage of opportunities, and ultimately reconfigure and adapt the business to the future advances of upcoming digital technologies quickly. Therefore, dynamic capabilities are required to be continuously developed to conduct changes in business models (Witschel, 2019).

Previous literature has broadly examined the influence of dynamic capabilities on different variables and contexts related to MSMEs. These studies have employed both qualitative and quantitative approaches. Qualitative studies have focused on theory and measurement items development, such as Witschel et al. (2019), who using a qualitative case analysis approach, found that during rapidly changing and turbulent environments (such as digital transformation) German firms need strong dynamic capabilities (i.e., sensing, seizing, and transforming) to overcome challenges in business model development. Moreover, Soluk and Kammerlander (2021) analyze the digital transformation of Germany, Austria, and Switzerland Mittelstand firms from the manufacturing industry. They found that digital transformation entails 3 stages and identified certain dynamic capabilities associated with the stages: process (recognizing, assimilation, and commercialization of new information), products and services (continuous renewal of the firm), and business model digitalization (reorganization of routines).

On the other hand, quantitative studies are relatively scarce due to data availability and measurement problems. Most empirical studies employed an SEM approach. For instance, regarding digitalization, previous studies have found generally positive effects of DC. Karimi and Walter (2015), using a sample of 136 newspaper companies found an association between first-order dynamic capabilities, and digital platform capabilities, and a positive association between these and response to digital disruption (revenue generated from non-core products). Savastano et al. (2022) with a survey sample of 110 managers

of the manufacturing sector, analyzed the influence of high-order DC on firms' performance, with the mediation effect of digital manufacturing capabilities, their findings showed that high-order DC positively affects firm performance, both directly and indirectly through a partial mediation of digital manufacturing capabilities. Witschel et al. (2022), analyzed the role of DC on business model innovation under the context of digitalization, they also added contextual factors, by analyzing a sample of 119 German manufacturing firms their results pointed out that building strong dynamic capabilities is crucial for business model innovation, moreover, they highlighted that an entrepreneurial leadership and good mindset may bring advantages in this process. Li et al. (2022) in a study of 165 Chinese manufacturing firms analyzed some digital-related dynamic capabilities, they found that during the Covid-19 context, market capitalizing agility (seizing) and operational adjustment agility (transforming) mediates the relationship between digitalization capabilities (sensing) and firm performance. Moreover, they found that the size effect of market agility is larger than the operational agility. In a recent study, Putritamara et al. (2023) by using cross-sectional data from beekeeping companies in Indonesia, found that dynamic capabilities play an important role in improving the DT of SMEs.

### 3. Hypotheses Development

#### 3.1 The relationship between sensing dynamic capability and digitalization

The digitalization phenomena start with external triggers, such as disruptive digital competitors, changes in consumer behaviors, and the development of new digital technologies (Warner & Wager, 2019). To respond to this phenomenon, sensing these changes is fundamental. Under this context, the sensing dynamic capability refers to the process of recognizing several changes of possible digital trends that can be applied inside the MSMEs. These new trends manifest in changes in customer requirements, technologies, and market environments (Witschel et al., 2019).

Sensing new trends should occur at all organizational levels, with lower levels providing information to the top management team (Teece & Linden, 2017). It is important to have a digitally oriented culture (Warner & Wager, 2019), where the entire staff (i.e., including workers, and the top management team) should be aware of any digital technological development that could be implemented and benefit the organization. At the higher levels, owner-managers with positive identification with digital technologies can build a digital identity (norms, standards, and values) that can be shared with the employees (Bouncken & Barwinski, 2021; Eller et al., 2020). This organizational embeddedness may help to easily identify potential technologies that can be applied in the business.

Ellstrom et al. (2021) highlight two routines to develop sensing capabilities related to digital technologies such as cross-industrial and inside-out digital infrastructure. The former refers to the pursuit of digital opportunities outside the industry through networking with other firms, it can be possible to identify applications of digital tech-

nologies that could be modified to fit the industry. The latter refers to the recognition of internal systems and infrastructure of the firm and the awareness of which of them are outdated and need improvement. Taking into consideration the routines of Ellstrom et al. (2021), a highly developed sensing capability makes the organization aware of external digital technology improvements and internal opportunities for the actualization of old-time processes.

By using this capability, MSMEs can identify digital technologies that can be quickly implemented and thus ultimately contribute to the digitalization process. Based on this, we hypothesize that:

**Hypothesis H1:** *Sensing dynamic capability has a positive effect on the digitalization of firms.*

#### 3.2 The relationship between seizing dynamic capability and digitalization

According to Li et al. (2022), it is not sufficient to sense the new trends, and to obtain data, firms must convert these data into meaningful market insights and decide which information has potential value (Kump et al., 2019). Subsequently, seizing means that firms need to deploy resources to address these opportunities, and capture value (Teece, 2014) with the development of new products processes, and services (Teece, 2007). Under this logic, for example, given the mobility restrictions due to Covid-19, TikTok identified the demand for public spaces such as museums and movie theaters, developing new services to cope with this necessity, such as online exhibits, and movie playback (Wang et al., 2020; Li et al., 2022).

Another aspect of the seizing dynamic capability is the organization of the development team in a multidisciplinary way (Witschel et al., 2022). To do that, it is necessary the participation of different areas such as legal, audit, and controlling staff to implement new digital solutions (Witschel et al., 2019). In other words, multidisciplinary teams may contribute with different perspectives, opinions, and experiences in the process of digitalization. An adequate seizing capability contributes to converting ideal opportunities into meaningful processes, products, and services, avoiding inefficiencies that take a long time to materialize. Based on this, the following hypothesis is stated:

**Hypothesis H2:** *Seizing dynamic capability has a positive effect on the digitalization of firms.*

#### 3.3 The Moderating Effect of Firm Age

Previous literature has found mixed effects on the influence of the firm age on innovation outcomes (Coad et al., 2016). However, we especially focus on the aspect where firm age may hurt digitalization. When firm age increases, internal processes and routines get formalized, thus increasing organizational rigidity (Barnir et al., 2003). In other words, when firms become older, they are less likely to engage in changes or adaptation processes (Guillén, 2002; Zhou et al., 2021). This may produce the loss of learning effects and obsolescence (Coad et al., 2016; Sørensen & Stuart, 2000), especially in processes related to technology actualization. As a result, this effect may keep away the integration of new digital technologies.

In emerging economies, firm age has a deeper effect on decisions regarding innovation or technological actualization. When firms have established strong organization values (especially those settled by the founder), creating a strong culture and employee identification with the organization's vision. This may generate some resistance to changes, and as a result, new attractive ideas would be taken with caution and suspicion (Roessl et al., 2010). Moreover, it can be perceived that when a firm age increases, the firm's culture possibly exhibits paternalistic behavior where the first generations are still involved in the decision-making processes, exhibiting limited freedom concerning identifying new opportunities (Chirico et al., 2012). Thus, top managers may illustrate an attitude toward not making changes, thereby showing no links with the development of sensing dynamic capabilities.

In the same line, given that firm age is correlated with the years of experience of the top-management team (i.e., including the CEO), a young firm may have a top management team that shows receptiveness to change and willingness to take more risks influencing the identification of applicable digital technologies (sensing) (Wiersema & Bantel, 1992), and afterward their subsequent adoption (seizing), thus, influencing the performance of digitized firms (Ribeiro-Navarrete, 2021).

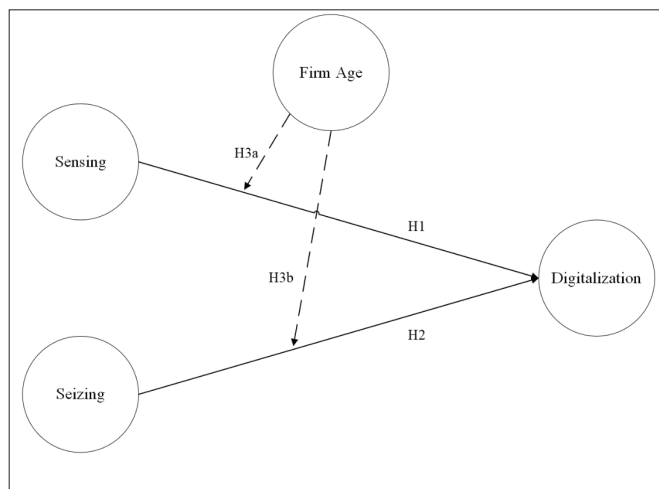
Based on these explanations, the following hypotheses are presented:

**Hypothesis H3a:** The positive influence of sensing dynamic capabilities on digitalization will be weakened when the firm's age is greater.

**Hypothesis H3b:** The positive influence of seizing dynamic capabilities on digitalization will be weakened when the firm's age is greater.

Taking into consideration the hypotheses set out above, a research framework is proposed for further empirical validation, as illustrated in Figure 1.

Figure 1. Research framework.



In addition, we control certain observable variables such as the firm sector, and the CEO tenure.

## 4. Research Design and Methodology

### 4.1 Sampling and data collection

This study attempted to collect data from 280 MSMEs, based on the Chequeo Digital questionnaire, which is an online self-assessment tool developed by Inter-American Development Bank (IDB) and Fundación Pais Digital, to help Latin American MSMEs to assess their level of digital maturity and to improve their digitalization.

Chequeo Digital questionnaire includes a maximum of 62 questions about 8 dimensions and 3 conditions. The dimensions assessed are Technologies and digital abilities; Culture and leadership; People and organization; Communications; Products and innovations; Processes; Data and Analytics; and Strategy and digital transformation. The conditions are Attitude, Preparation, and Knowledge. At the end of the questionnaire, each firm receives a report with personalized recommendations about how to improve their digital maturity.

Our sample contains 280 firms, it is composed of 50% Microbusinesses, 30% small businesses, and 20% median businesses. Firms in the sample operate mainly in the Service (47%) and Commerce sectors (35%), with 18% belonging to the Industrial sector. See Appendix B for a detailed description of the sectors. They have operated for 10 years on average, 50% have 7.5 years in the market, the youngest firm in the sample has less than 1 year of operation, and the oldest has remained in the market for 62 years. Regarding CEO tenure, the sample is mainly composed of executives with relatively low experience, with an average of nearly 6 years in charge, moreover, half of the CEOs have 4 or fewer years of experience as shown in Appendix A.

### 4.2 Measurement items

The research constructs used in this study were gauged by measurement items provided by the Chequeo Digital questionnaire. All questions were measured using a semantic differential scale of 7 points, in this scale the higher the value, the higher the level of the measured characteristic. We measured dynamic capabilities as a first-order reflective construct of the sensing and seizing dimensions: sensing (three-item) and seizing (five-item) adapted from, Mikalef and Patafeli (2017), Hussain and Malik (2022), Witschel et al. (2019), Putritamara et al. (2023). The digitalization construct was assessed by five items adapted from Nwankpa and Roumani (2016), Chu et al. (2019), and Putritamara et al. (2023). Appendix B presents the constructs-related questions and similar metrics or studies on which we are based.

Additionally, we collected data from the web page and the Directory of Companies of the Superintendencia de Compañías, Valores y Seguros to obtain data about the CEO tenure, and firm foundation date to construct the firm age variable.

### 4.3 Assessment for potential common method bias

Due to this study collected data from a single respondent from each firm, there is the possibility that common method bias represents a potential issue. Following the guidelines of Podsakoff et al. (2003), this study carried out the following steps to analyze the impacts of common method variance (CMV). First, a systematic process was employed to confirm the simplicity of the measurement items. Second,



the responses obtained would remain anonymous and examined in aggregate. In doing so, we increased the motivation of the informants to collaborate with the survey without fear of potential retaliation. Third, the Harmon one-factor method was employed to examine the possible impact of common method bias. By putting the five research constructs into an unrotated principal components analysis proved that no factor was reported for all the variances. Specifically, the highest single variance obtained was 38.12%, and thus this factor did not report for more than 50% of the variance (Podsakoff & Organ, 1986).

### 5. Results

Partial least squares (PLS) analysis was employed using SmartPLS Software (Ringle et al., 2024) to examine the measurement and structural model. Compared with normal variance-based structural equation modeling, PLS is more suitable when the focus of this work is on theory development, specifically due to the Latin American context. As such, PLS was considered good enough to employ in this context. Moreover, the moderating effect of Firms age was calculated using the two-stage approach. We used this approach since it has been proved that it outperforms other approaches regarding parameter recovery (Becker et al., 2018).

#### 5.1 Evaluation of the measurement model

After the collection procedure, the data went through a refining process to analyze its reliability and discriminant validity (Fornell & Larcker, 1981). A confirmatory factor analysis (CFA) was performed to determine the measurement items loaded on the proposed latent research constructs. Table 1 showed that all the factor loadings in all constructs surpassed the conventional 0.500 criteria, providing support for convergent validity.

**Table 1.** Factor Loadings

	Sensing	Seizing	Digitalization
SEN1	0.754		
SEN2	0.850		
SEN3	0.844		
SEI1		0.653	
SEI2		0.733	
SEI3		0.680	
SEI4		0.761	
SEI5		0.786	
DIG1			0.804
DIG2			0.717
DIG3			0.641
DIG4			0.784
DIG5			0.841

**Table 2.** Construct Reliability and Convergent Validity

	CR	AVE	Cronbach
Sensing	0.857	0.668	0.762
Seizing	0.846	0.524	0.773
Digitalization	0.872	0.578	0.815

Additionally, internal consistency was examined by using the traditional Cronbach's alpha and Composite Reliability, as results shown in Table 2, Composite Reliability and Cronbach alpha's values exceed the recommended values of 0.60 and 0.70 respectively.

On the other hand, convergent validity is examined by assessing the average variance extracted (AVE), as can be seen in column 2 of Table 2, the rule of thumb is satisfied since all constructs exceeded the cut-off criterion of 0.5, this is a signal that more than a half of the indicator variance is included in the construct score (Hair et al., 2022). Moreover, by applying Fornell and Larcker's guideline (1981), discriminant validity was estimated by testing whether the square roots of the AVE were greater than the correlations between the focal construct and the other study construct.

Finally, we used the HTMT ratio to analyze whether a construct reflects stronger relationships with its indicators than with other constructs (Hair et al., 2022). Table 3 reflects that the relationship between item constructs does not exceed the critical value of 0.90, except for the HTMT ratio of seizing and sensing, which slightly exceeds this value. Taken together, these results proved the discriminant validity of the constructs.

**Table 3.** Assessment of Discriminant Validity

Constructs	DIGI	SEIZ	SEN
Digitalización (DIGI)	<b>0.902</b>		
Seizing (SEIZ)	0.693	<b>0.879</b>	
Sensing (SEN)	0.622	0.796	<b>0.817</b>

\*The highlighted diagonal values are the square root of the average variance extracted (AVE) for each construct; the other values are the correlations among constructs.

**Table 3.** Assessment of Discriminant Validity – HTMT ratio

	HTMT ratio
Seizing <-> Digitalización	0.854
Sensing <-> Digitalización	0.739
Sensing <-> Seizing	1.013

In Table 4, we analyze whether the structural model shows collinearity problems between the endogenous construct (digitalization) and the predictors (i.e., sensing, seizing, and other variables). For this, we examine the VIF values, here the values should not exceed the critical value of 5 (Hair et al., 2006). As can be seen, all values are below 5, suggesting that our model does not have problems of collinearity.

**Table 4.** VIF values in the Structural Model

Constructs	Digitalization
Sensing	2.799
Seizing	2.743

Table 5 shows the results of the f-squared effect sizes. These values demonstrate that the sensing construct has a small effect size of 0.022 on Digitalization, although, seizing depicts a medium effect size of 0.241.

**Table 5.** f-squared effect sizes

	Digitalization
Sensing	0.022
Seizing	0.241

**5.2 Evaluation of the structural model**

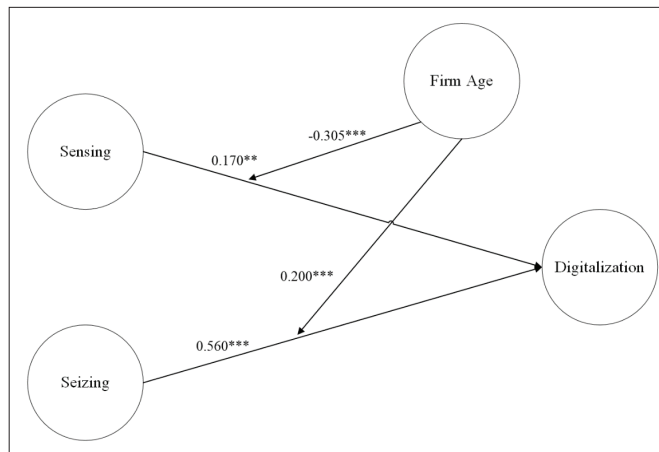
Following the guidelines provided by Ringle et al., (2024). We calculated the traditional determination coefficient R<sup>2</sup> to analyze the models’ predictive capabilities (Hair et al., 2017), our model displays an R<sup>2</sup> value of 0.527 denoting good predictive power.

As specified by the path loadings in Figure 2, the direct effect of sensing dynamic capabilities on digitalization does show a significant effect ( $\beta=0.170, p<.05$ ), thus supporting hypothesis 1. Furthermore, for seizing dynamic capability, the results show that it has a significant and positive effect on digitalization ( $\beta=0.560, p<0.01$ ), and hypothesis 2 is therefore supported.

**5.3 Evaluation of the moderation effects**

Hypothesis 3a and 3b propose that the age of the firm has a negative moderating effect on the association between sensing/seizing dynamic capabilities and digitalization, respectively. As presented in Figure 2, hypothesis 3a is supported ( $\beta = -0.305, p<0.01$ ) while hypothesis 3b is not supported, because it has the opposite effect ( $b = 0.200, p<0.01$ ). A firm’s age negatively impacts the influence of sensing dynamic capabilities on digitalization. In other words, given that sensing dynamic capabilities can result in a higher level of digitalization, the older the firm can significantly reduce this influence. Whereas the opposite occurs with seizing: a firm’s age positively affects the seizing dynamic capability.

**Figure 2.** Structural Equation Modelling Results



**6. Discussion and Conclusion**

The primary contribution of this paper is to assess the links between sensing and seizing dynamic capabilities and the digitalization of MSMEs in the context of a developing economy. This is particularly relevant, as the knowledge of the determinants of digitalization is still limited, especially regarding idiosyncratic processes. Also, the understanding of dynamic capabilities in MSMEs is important, due to their unique nature, as these firms usually have less opportunities and access to resources, reduced capacities and are more vulnerable to the environment.

We measure sensing as the acknowledgment by the firm of the benefits of digitalization as well as the firm having a notion of the digital technologies available. Our results highly support the proposition that the sensing capability positively affects digitalization in the business (H1). Understanding the benefits of adopting digital technologies is a basic condition for the advancement of the firm into the next steps of digital transformation. Furthermore, without an adequate process of identification of digital opportunities or technologies, the consequent appropriation in the form of seizing and transforming would not be possible (Witschel et al., 2022). We also find a positive contribution of seizing, measured as the likelihood of investment, the intention to implement changes towards a digital transformation, the occurrence of digital training, to the MSME digital adoption, and the extent of data collection in the business (H2). Acting in such ways, the firms seem to exhibit increased performance in digital endeavors.

The role of firm age in studying dynamic capabilities becomes more relevant as DC are unique to each firm and to some extent, built on the firms’ DNA. We test for the moderating of firm age, this variable has a negative moderating effect on the relationship of sensing (H3a) and digitalization, while for the impact of seizing (H3b), this effect is positive and significant. Again, the positive impact of the ability to identify and assess opportunities in MSME digitalization is reduced for firms with more time in business, this could be a signal that over time, firms may tend to accommodate to the context, with more rigid organizational structures and mental structures. However, the positive moderating effect could be a signal that, once the firm has passed the hard stage of identifying appropriate digital technologies or digital solutions, the long experience in the market gave the advantage of easily interiorizing these changes, and the consequent translation into value-added products and services. That is, the age of firms will enhance the actions of seizing to facilitate more experience, thus leading to a higher level of digitalization.

Among the limitations, we cannot conclude that the findings have external validity, that is results do not necessarily apply for all MSMEs in Ecuador. Hence, we are not able to make inferences with this study, as it corresponds to a sample with self-selection bias, and the tool Chequeo Digital is open for all firms, but those who choose to take advantage of it are the ones already signaling certain interest in their digital technologies’ adoption. Also, dynamic capabilities are measured at the organizational level with questions that collect the respondent’s perception, but we acknowledge that the individual (manager) level

plays a key role. The tool requests that the respondent should be the most knowledgeable person in the business; however, this might not be the case for some firms.

According to our findings, there are several managerial activities that can turn into dynamic capabilities, such as sensing and seizing. We focus on these two DC as the first steps that a firm need to follow to enable them to take advantage of digital opportunities, for instance, to increase their sales by reaching existent and new customers using digital technologies. Also, in the context of developing economies, which is volatile and uncertain, MSMEs face unique challenges and the call for policy makers intervention is evident. First, to help firms recognize the benefits of digitalization, and next, to provide incentives and even assign government resources to aid the firm to activate and capture value. This could become a critical factor in the competitiveness and economic development of the country.

Future research on DC and digitalization should focus on a global and standardized definition of DC that would also include the transforming dimension. Additionally, it would be useful to conduct research with a representative sample of developing countries, to draw conclusions at the national level.

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## Appendix A – Sector Classification

Sectors	ISIC	Sub-Sector	# firms
Industries	C	Manufacturing industries	36
	F	Construction	14
	E	Water supply; sewerage, waste management and remediation activities	1
Commerce	G	Wholesale and retail trade; repair of motor vehicles and motorcycles	98
Services	M	Professional, scientific, and technical activities	50
	J	Information and communication	27
	N	Administrative and support service activities	12
	H	Transportation and storage	10
	I	Accommodation and food service activities	8
	L	Real estate activities	7
	P	Education	7
	K	Financial and insurance activities	5
	Q	Human health and social work activities	3
	R	Arts, entertainment and recreation	1
	S	Other service activities	1
<b>TOTAL</b>			<b>280</b>

## Appendix B – Constructs and related literature

The items were measured using a semantic differential scale of 7 points. The questions are presented in the following table.

The questions have the following initial statement:

*“In the range from 1 to 7, how do you describe the following situations regarding your MSME?”*

With 1 representing full disagreement and 7 representing full agreement with the statement.

Construct	Question	Related literature
Sensing	I recognize the benefits that digital technologies can offer to my MSME	Hussain & Malik (2022)
	I have a notion about what digital technologies would be implemented in my MSME	Putritamara et al. (2023) Mikalef & Patateli (2017) (2022) Witschel et al.
	The use of digital technologies has allowed me to identify who my clients are, and what they are looking for.	Kump et al. (2019) Witschel et al (2019) Witschel et al (2022)
Seizing	My MSME’s needs and objectives are aligned with investing in digital technologies	Putritamara et al. (2023)
	I have trained or educated my personnel on digital issues.	Putritamara et al. (2023)
	I am open to making the changes necessary for digital transformation	Witschel et al. (2022)
	I collect data about the activities of my MSME.	Kump et al. (2019) Witschel et al (2019)
	My MSME consults external data to know about the characteristics of our customers.	Kump et al. (2019) Witschel et al (2019) Witschel et al (2022)
Digitalization	I have an online presence	Putritamara et al. (2023)
	I frequently actualize my websites and social media	Chu et al. (2019) Nkanpa & Roumani (2016)
	I use digital tools to attract new customers and retain the existing ones	Putritamara et al. (2023)
	I manage contact with my clients through digital channels	Chu et al. (2019)
	I have implemented some degree of automatization in my MSME	Chu et al. (2019) Nkanpa & Roumani (2016)

