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Going digital EMNEs: The role of digital maturity capability

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ABSTRACT

International Business (IB) has increasingly focused on born-digital multinationals, but less attention is being directed to traditional multinationals aiming to remain competitive by digitally transforming themselves (that is, achieving greater digital maturity). This phenomenon cannot be extrapolated from born digitals. This gap is deeper with emerging market multinationals (EMNEs), which find major challenges to joining the digital age. Recalling that strategically located subsidiaries are critical for EMNEs' success, we ask: How do EMNEs pursue digital maturity and how do their subsidiaries contribute to this process? A capability-based view of multinational enterprises and relevant EMNE literature help us to conceptualize Digital Maturity Capability as a complex capability paramount to developing competitiveness in the digital age. Using survey data from 91 Brazilian multinationals, we found that EMNEs build elements of competitive advantage in modern markets through enhanced digital maturity while leveraging foreign subsidiaries for increasing value chain and ecosystem integration.We contribute to making the capabilities framework more relevant within IB and advance the analysis of going digital multinationals with the experience of EMNEs. Such results have practical implications for managers navigating the digital era's choppy waters.

1. Introduction

Competitiveness has become intimately connected with digital technologies, which are mostly virtual and usually not geographically-bounded (Banalieva & Dhanaraj, 2019; Furr et al., 2022; Li et al., 2019; Sturgeon, 2021). This emerging dynamic has important consequences for how we theorize about multinational enterprises, particularly emerging market multinationals (EMNEs) due to their heavy reliance on foreign investments to acquire assets and capabilities abroad (Kumar et al., 2020; Luo & Tung, 2007, 2018). EMNEs are companies that, despite coming from a heterogeneous set of countries that can be called *emerging* or *developing* markets, have successfully expanded and established multinational operations (Cuervo-Cazurra & Genc, 2008; Ramamurti & Singh, 2009). Strategically located subsidiaries have played an important role in upgrading EMNEs' capabilities through local embeddedness and reverse knowledge transfer (Awate et al., 2015; Chidlow et al., 2021). As we enter the digital age, traditional multinationals, in general, and EMNEs, in particular, are urged to become what researchers have called *going digital* multinationals (Eden, 2019, p 19).

Differently from born digital firms which are digital from inception (Monaghan et al., 2020), going digital firms are traditional, offline firms—often referred to as brick-and-mortars (Meyer et al., 2023)—that invest in augmenting their digital capabilities to try to remain competitive (Srinivasan & Eden, 2021). These firms need to integrate digital strategies with their existing systems and processes (Verhoef et al., 2021), despite being less agile than fully digital companies (Furr et al., 2022). That means they have a challenging path that born digitals cannot be expected to experience. That is the case, for instance, of retail companies competing with e-commerce firms (Reinartz et al., 2019), the book publishing industry trying to survive e-books (Jiang & Katsamakas, 2010), and banks disputing markets with fintechs (Liu et al., 2011). Such examples, mostly from outside IB, have shown "the importance of digital transformation for contemporary organizations to survive and achieve competitive advantage in a digital economy" (Liu et al., 2011, p. 1728). In this context, digital transformation can be understood as "organizational change that is triggered and shaped by the widespread diffusion of digital technologies" (Hanelt et al., 2021, p. 1160), through which the firm can develop capabilities relevant to the digital age (e.g., Sousa-Zomer et al., 2020; Warner & Wäger, 2019). The progress that a going digital firm demonstrates on this transformation path corresponds to its

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digital maturity (Chanias & Hess, 2016; Chen & Tian, 2022).

While recent IB studies have focused mostly on the specificities of born digital firms, the same attention has not been directed to going digital multinationals (Batsakis et al., 2023), even less to going digital EMNEs. Some of the recent research on digital transformation has examined Chinese multinationals (for instance, Li et al., 2022; Shamim et al., 2020), but emerging markets are a highly heterogeneous group. Some do not consider China an emerging economy due to its particular development path (Bruton et al., 2021). The lack of attention to EMNEs is problematic, to the extent that these firms can benefit particularly from data management capabilities (Shamim et al., 2020) but find more challenges to joining the digital revolution due to additional difficulties in recruiting skilled people and closing talent gaps (Koch, 2022; Meyer & Xin, 2018). Considering strategically located subsidiaries' role in upgrading EMNEs' capabilities, the challenge for EMNEs competing in the digital era includes the pursuit of greater digital maturity while trying to use their subsidiaries to leverage that process.

Our study addresses the question: *How do EMNEs pursue digital maturity and how do their subsidiaries contribute to this process?* Building on a capability-based view of multinational enterprises (Teece, 2014a) and relevant EMNE literature, we adapt the digital maturity framework proposed by Germany's National Academy of Science and Engineering (ACATECH) (Schuh et al., 2017). ACATECH's framework is one of the most comprehensive models (Gökalp & Martinez, 2022) among more than 20 alternatives available in the literature (Caiado et al., 2021; Gökalp & Martinez, 2022; Mittal et al., 2018). This model is also more specific to address the experience of going digital firms than those related to already-digitalized firms such as International Digital Competence, which focuses on "companies with exclusively digital products" (Cahen & Borini, 2020, p. 1). In the end, we conceptualize *Digital Maturity Capability* (DMC) as a complex, high-level capability embodying a firm's degree of digital maturity. DMC features five dimensions that go from assessing and leveraging technology and data—*Digital technical capability* (DTC) (Warner & Wäger, 2019) and *Data management capability* (DMC) (Bharadwaj et al., 2013; Weichert, 2017)—to preparing people and reengineering the organization and its culture—*People management capability* (PMC) (Bajer, 2017; Vial, 2019), *Organizational design capability* (ODC) (Bennett & Lemoine, 2014; Teece et al., 2016), and *Culture-crafting capability* (CCC) (Karimi & Walter, 2015; Schuh et al., 2017).

We use a partial least squares-structural equation model (PLS-SEM) and survey data on Brazilian multinationals (BrMNEs) to test a formative specification for DMC and its relevance for EMNEs' development of digitally-enabled decision-making processes and value chain and ecosystem integration, as well as the effect of their multinationality. Our findings offer three contributions to the growing debate about digital technologies and related issues within IB (Ahi et al., 2022; Strange et al., 2022). First, we formalize DMC as a higher-order construct composed of complementary capabilities that can be associated with the essential processes—or subcapabilities (Verbeke, 2022)—underpinning dynamic capabilities (Teece, 2014a). In doing so, we contribute to making the capabilities paradigm more relevant in IB research (Verbeke, 2022; Zahra et al., 2022). Second, we develop the discussion of going digital multinationals by exploring the experience of EMNEs and proposing a model that reconciles traditional dimensions of digital maturity with dimensions particularly critical to these companies (Koch, 2022; Meyer & Xin, 2018; Shamim et al., 2020). Third, we find that going digital EMNEs can build elements of competitive advantage in modern digital markets through enhanced digital maturity while still leveraging foreign subsidiaries as a channel for developing value chain and ecosystem integration. This finding widens the discussion on EMNE success, which mostly focuses on their ability to strategically locate asset-seeking investments abroad (Kumar et al., 2020; Luo & Bu, 2018; Luo & Tung, 2018).

The remainder of this text is organized as follows. First, we discuss the capabilities and features that characterize digitally mature organizations. A description of our conceptual model and methodology comes next, followed by our results and a discussion of their implications. We finish with final remarks, limitations of this work, and future research directions.

2. Theoretical background

2.1. A DMC framework for going digital EMNEs

MNEs represent organizations "driven by the opportunity to leverage capabilities and create and capture value from innovation on a global scale" (Teece, 2014a, p 22). In this sense, capability represents "the capacity to utilize resources to perform a task or an activity, against the opposition of circumstance" (Teece, 2014a, p. 14). Consequently, the home country becomes an important context to understand a firm's set of capabilities, affecting the evolution of local industries and the competitiveness of individual firms (Cuervo-Cazurra et al., 2018; Madhok & Osegowitsch, 2000). Still, multinational enterprises from emerging markets have been rapidly building up capabilities and transitioning to competitive positions in the global markets (Petricevic & Teece, 2019). As interest in digital multinationals increases in IB, it can be noted that experts in various fields view digital transformation as a matter of developing strategic resources and capabilities (e.g., Sousa-Zomer et al., 2020; Warner & Wäger, 2019). However, a common maturity model for capabilities relevant in the digital age remains elusive.

Previous literature reviews found between 15 and 25 models (Caiado et al., 2021; Gökalp & Martinez, 2022; Mittal et al., 2018). ACATECH's digital maturity framework (Schuh et al., 2017) is one of the most comprehensive alternatives (Gökalp & Martinez, 2022), measuring digital maturity through four dimensions: Resources, Information Systems, Organizational Structure, and Culture (Schuh et al., 2017). Such a structure aligns with the available definitions of digital transformation as a phenomenon that is not only about digital technologies but also has a social aspect (Furr et al., 2022; Matt et al., 2015; Vial, 2019). It is also more specific to address the experience of going digital firms than models focusing on already-digitalized ones (for instance, Cahen & Borini, 2020). The ACATECH framework covers aspects where traditional firms may experience challenges when going digital due to the legacy (Verhoef et al., 2021) and inertia (Furr et al., 2022) of existing processes, cultural norms, and investments. Nevertheless, we must consider its appropriateness in framing digital transformation in our empirical context (Furr et al., 2022).

In particular, the way the ACATECH framework addresses resources relevant to digital maturity has two drawbacks in a study focused on EMNEs. First, it pays little attention to the digital requirements of people management by placing it as a subcomponent within the wider dimension of *resources*. In the digital economy, digital maturity associated with people management is critical because companies need to recruit, develop, and motivate highly skilled workers capable of working collaboratively and tackling complex problems (Vial, 2019). People-related resources thus represent one of the major resources for a multinational enterprise to develop the capabilities required for going digital (Gong & Ribiere, 2021).

However, recruiting the right employees with the most suitable skills can be particularly troublesome for firms dealing with human resource bottlenecks, such as EMNEs (Meyer & Xin, 2018). Emerging markets suffer from an oversupply of unskilled labor and struggle with local weak educational and knowledge infrastructure, like training schools, research institutes, universities, and standards-setting organizations (Cuervo-Cazurra et al., 2019; Khanna et al., 2005). Poor employee mobility in these locations worsens this absence of trained and motivated people, which specialists have called a *talent gap* (Koch, 2022). Consequently, developing human capital is challenging for EMNEs (Narula & Kodiyat, 2016).

Besides people management, the ACATECH framework underestimates the requirements associated with data management as well. Those are necessary capabilities for firms to capture, acquire, store, process, and protect digital information (Bharadwaj et al., 2013). Data management has been deemed a major value-creation lever as companies make decisions in an increasingly data-driven economy (Janssen et al., 2017). The relevance of data management for contemporary businesses is such that it can challenge existing business models and management approaches (Shams & Solima, 2019).

Despite that, the ACATECH framework merely suggests that digital maturity can be measured by the extent of *data analysis*, *data acquisition through sensors and actuators*, and *contextualized data delivery*. It does not mention the capture of structured and unstructured data from diverse sources, including markets, clients, and consumers (Wedel & Kannan, 2020). Good data management capabilities generally reduce internal and external coordination costs (Chen & Kamal, 2016), and improve intra-organizational interactions (Dosi et al., 2008). This can be vital for EMNEs to explore and exploit opportunities (Shamim et al., 2020), an essential aspect of their internationalization (Khan et al., 2022; Luo & Rui, 2009).

By adapting the ACATECH framework with more explicit references to human resources and data management as relevant dimensions of digital maturity, we seek to provide those topics with the attention they deserve instead of only addressing them in general terms as *resources*. The other three dimensions of the ACATECH framework are well defined, and thus, can be incorporated as dimensions in our framework.

First, going digital firms need to scout digital technologies, plan digital scenarios, and support the digital infrastructure from digital databases and metadata to digital mindsets (Warner & Wäger, 2019). In this domain, governance policies and information security have become strategic aspects of data infrastructure as data breaches have become a public concern (Kshetri, 2005; Luo, 2022). Second, going digital firms' organizational structure needs to be built to jointly orchestrate agility and ambidexterity so that firms can flexibly and promptly react to their turbulent markets (Teece, 2007, 2014b). That includes applying modern management techniques, such as agile management (Giacosa et al., 2022), and others that have proved their relevance over time, such as lean practices (Buer et al., 2018). Finally, organizational culture is essential to the response to technological change, fostering openness to new technologies and processes and tolerance to failure (Leonard-Barton, 1992; Tripsas & Gavetti, 2000). Ensuring employee commitment to the new ways of working and aligning the leadership style are also part of these efforts (AlNuaimi et al., 2022; Weber et al., 2022).

After revisiting the ACATECH model, we call the resulting framework Digital Maturity Capability (DMC) and understand it as embodying a firm's ability to go digital despite its contextual challenges (particularly in the home country). Drawing from previous literature, Teece (2014a, p. 23) differentiates between dynamic and ordinary capabilities by indicating that the former type is more critical for competitive differentiation because it is "hard to develop, and difficult to transfer across borders", being embedded in a unique set of relationships and events featured in the history of an organization. Ordinary capabilities, in turn, are mostly about developing proficiency with routines.

Based on the challenges that going digital firms face in reconciling digital-related efforts with existing ways of doing things (Furr et al., 2022; Verhoef et al., 2021), it is reasonable to consider that the capabilities that they develop in this process, although reflecting the dimensions outlined here, are likely to be unique to their paths and can thus be important assets for developing competitiveness in the digital age. Hence, we contend that DMC qualifies for a dynamic capability.

2.2. *The relevance of multinationality*

Nowadays, expanding abroad often involves investing in capabilities relevant to the digital age as the firm leverages the benefits of digital tools to operate across borders (Meyer et al., 2023; Strange et al., 2022). Yet, the advent of the digital age does not automatically rule out conventional mechanisms deemed especially important for EMNEs' growth. For instance, a common topic in EMNE internationalization theories is how strategically located foreign operations can help the firm acquire competitive assets and knowledge (Luo & Tung, 2007, 2018; Mathews, 2006). Foreign subsidiaries remain useful as EMNEs need to navigate the digital environment, facilitating learning and upgrading their digital capabilities (Ghorbani et al., 2023). Therefore, EMNEs must consider the geographical and digital dimensions in their internationalization strategies (Vadana et al., 2019).

As EMNEs' foreign expansion evolves, they tend to exhibit an increased multinationality given by higher degrees of internationalization (Sullivan, 1994). However, the extensive literature on the connection between multinationality and competitiveness provides conflicting evidence and requires more contextualized research (Pisani et al., 2020). Research focusing on EMNEs has found an overall positive relationship between the degree of internationalization and performance (Wu et al., 2022), as well as a positive effect on innovation outcomes (Elia et al., 2020) and more general attributes such as corporate governance (Popli et al., 2021).

For EMNEs, the relevance of setting up foreign subsidiaries can be tied particularly to mechanisms involving reverse knowledge transfer and local institutional embeddedness. While it is generally assumed that knowledge flows from headquarters to subsidiaries in multinational enterprises (Ambos et al., 2006), the opposite is often true for EMNEs. For instance, they frequently establish subsidiaries in more advanced nations, and/or acquire superior assets and capabilities through foreign investments (Kumar et al., 2020; Luo & Tung, 2007, 2018). With the headquarters in a lower knowledge position concerning the subsidiary, there is a learning opportunity (Awate et al., 2015).

Besides knowledge transfer mechanisms, foreign subsidiaries provide EMNEs with opportunities to engage with host market institutions and innovation networks to contribute to local market needs (Giuliani et al., 2014). Furthermore, they can challenge existing norms and arrangements to improve their operational conditions and legitimacy (Chidlow et al., 2021). That dynamic allows EMNEs to assimilate advanced processes and incorporate technological skills, knowledge, and managerial best practices (Elia et al., 2020).

2.3. *Key enablers of competitiveness in the digital era*

In the digital world, EMNEs' portfolio of foreign subsidiaries can be a source of knowledge and innovation (Elia et al., 2020) as they acquire mature operations abroad (Luo & Tung, 2007) or use their foreign footprint to hire specialized professionals (Kafouros et al., 2018) and absorb technology from collaborators (Srinivasan et al., 2007). Nevertheless, they must know specific dynamics to thrive in such a context. Chikán (2008, p. 25), states that "achieving competitiveness requires the firm's continuing adaptation to changing social and economic norms and conditions."

In the digital age, this will require the development of key enabling features both internal and external to the firm. Internally, firms need to leverage available data from various sources (Wedel & Kannan, 2020) into improved decision-making processes (Janssen et al., 2017). Externally, they need to get integrated into value chains and business ecosystems (Nambisan et al., 2019) that are increasingly digital. In other words, it is necessary to consider data and business ecosystems as key enablers of competitiveness in the context of this study.

Firms need to pay attention to the role of data in decision-making as flows that used to be mostly physical are now becoming largely intangible (Luo, 2021; Nambisan et al., 2019). The new data-dependent approach in the digital age challenges the old ways of decision-making, essentially based on "data from a limited range of traditional sources such as production records, internal accounts and market research reports" (Strange & Zucchella, 2017, p. 176). The conventional way of making decisions tended to be essentially backward-looking and focused on monitoring tasks and processes. The new approach encourages the combination of existing and new data sources to identify patterns and opportunities (Davenport et al., 2012).

However, not all data is equally relevant or ready to be used for decision-making. Digitally-enabled decisions rely on the proper use of data from structured and non-structured sources (Janssen et al., 2017; Wedel & Kannan, 2020). The data is processed using techniques such as big data analytics. Besides enhancing the firm's decision-making processes (Bharadwaj et al., 2013; Vial, 2019), this approach offers opportunities for better and faster coordination across the organization (Schuh et al., 2017; Vial, 2019) and improves the firm's capacity to sense opportunities and mobilize resources (Teece, 2007, 2014b). That is particularly important for EMNEs since they may face considerable challenges managing their operations abroad (Cuervo-Cazurra, 2016).

Furthermore, the integration of contemporary firms into business ecosystems indicates that managing operations and innovations has radically changed in the hyper-competitive, digital world (Nambisan et al., 2019). In an international context, a business ecosystem can be defined as "the organisms of the business world (…) involved in exchanges, production, business functions, and cross-border trade through both marketplace competition and cooperation" (Hult et al., 2020, p. 44). Within these ecosystems, firms increasingly operate and innovate, particularly in the digitally-enabled ones (Nambisan et al., 2019).

That aligns with the growing demand for knowledge partners and the spread of platforms designed to bring them together into innovation ecosystems, encompassing research institutes, universities, governments, and businesses (Petricevic & Teece, 2019). Such a scenario contrasts with the image of innovation as something essentially allocated to R&D departments, a reality of just a few decades ago especially in large organizations. Hence, going digital organizations must integrate their capabilities with partners along their value chains and develop business ecosystems (Nambisan et al., 2019).

Relationships nurtured in this way create mutual growth opportunities and foster win-win situations that can help businesses handle uncertain and complex situations while operating in foreign markets (Rong et al., 2015). In particular, these relationships can offer EMNEs the opportunity to transfer innovation across units and geographies (Borini et al., 2012), and create higher-quality products (Ishida et al., 2013). Whereas digital connectivity brings down the cost of international interactions and transactions (Luo, 2021), the organization of such ecosystems provides firms with new ways of dealing with turbulence, more fluid value propositions and cross-border organization, and new ways of recognizing and pursuing opportunities (Li et al., 2019; Nambisan et al., 2019).

These ideas highlight the crucial importance of data-driven decision-making and integration into value chains and business ecosystems for EMNEs' competitiveness in the digital era. To do so, EMNEs need to nurture and enhance a set of capabilities to harness digital technologies' potential. Moreover, EMNEs must adeptly leverage their multinationality, utilizing their network of foreign subsidiaries as strategic conduits for acquiring invaluable organizational knowledge and experiential insights, which can fuel their innovation endeavors.

3. Hypotheses development

Our conceptual model (Fig. 1) connects EMNEs' DMC with the development of digitally-enabled decision-making processes and value chain and ecosystem integration while assessing the effects of their multinationality on DMC.

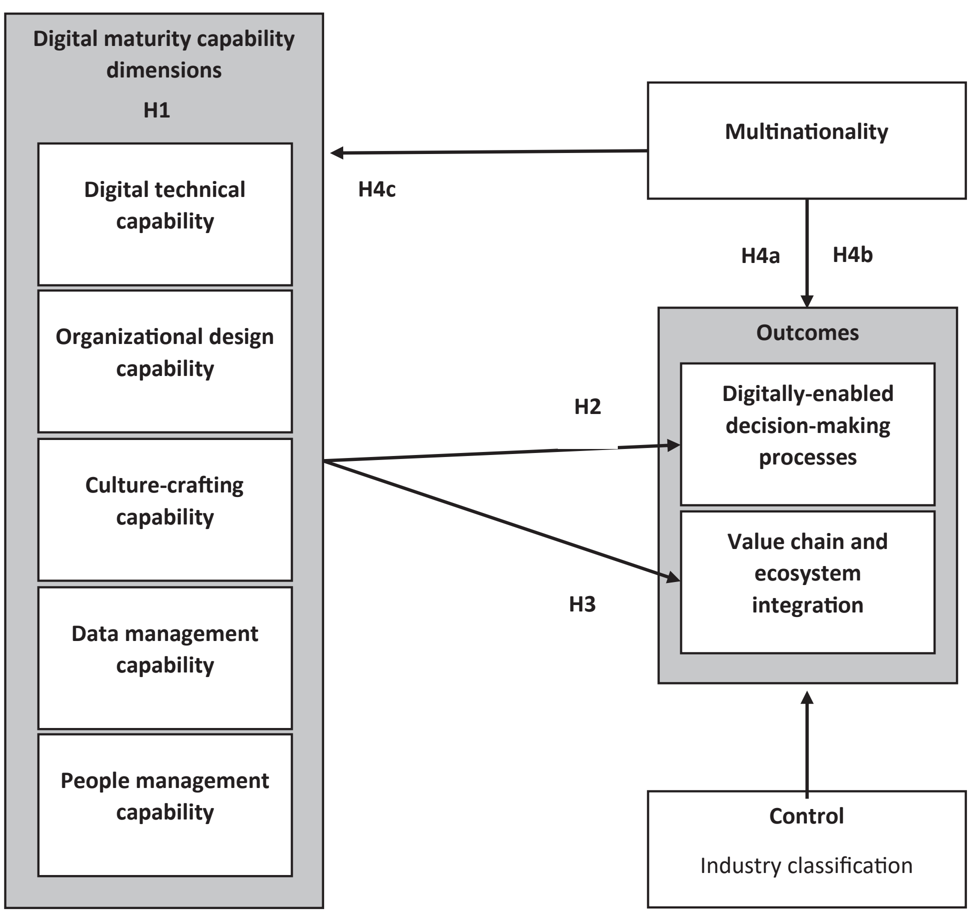

Fig. 1. The Digital Maturity Capability conceptual model.

3.1. DMC and its outcomes for EMNEs

As noted before, applying the ACATECH model to EMNEs requires a greater emphasis on people and data management. Hence, we use a digital maturity model with five dimensions: (a) knowing how to select the technologies best suited to their business models (Warner & Wäger, 2019), (b) learning how to handle and leverage flows of structured and unstructured data (Bharadwaj et al., 2013; Weichert, 2017), (c) preparing human resources to operate and make decisions in a digital context (Bajer, 2017; Vial, 2019), (d) designing and implementing an organizational structure that enables employees to work digitally (Bennett & Lemoine, 2014; Teece et al., 2016), and (e) crafting a digital culture that ensure the long-term sustainability of these changes (Karimi & Walter, 2015; Schuh et al., 2017).

These processes can be associated with a set of distinct capabilities (Ghosh et al., 2022; Gökalp & Martinez, 2022; Warner & Wäger, 2019): i) *Digital technical capability*, the ability to scout digital technologies, plan digital scenarios, and support the creation of digital infrastructure; ii) *Data management capability*, the ability to manage data sources, and information and communication technologies; iii) *People management capability*, the ability to recruit, develop, and motivate highly skilled workers who are capable of working collaboratively and tackling complex problems by relying on data as much as possible; iv) *Organizational design capability*, the ability to re-engineer the firm and transform units, subsidiaries, and business functions according to the possibilities unveiled by digital technologies; and v) *Culture-crafting capability*, the ability to establish an organizational culture that appreciates and promotes decisions relying on sound data and informed interpretation. These capabilities materialize the complexity that authors have acknowledged in digital transformation, reflecting processes with both technology and human aspects (Furr et al., 2022; Matt et al., 2015; Vial, 2019).

As the listed dimensions guide the firm from selecting technologies (Warner & Wäger, 2019) and data flows (Bharadwaj et al., 2013; Weichert, 2017) to preparing its human resources (Bajer, 2017; Vial, 2019) and organizational structure (Bennett & Lemoine, 2014; Teece et al., 2016), and up to crafting a digital culture to ensure long-term change (Karimi & Walter, 2015; Schuh et al., 2017), they can be compared with the three essential processes—or *subcapabilities* (Verbeke, 2022)—underpinning dynamic capabilities: *sensing*, *seizing*, and *transforming* (Teece, 2014a). Sensing concerns the firm's capacity to identify and assess opportunities, while seizing refers to mobilizing resources to address those opportunities and capturing value from them, and transforming translates into continued renewal. The parallel between these processes and the scope of DMC's dimensions reinforces both the view of DMC as a dynamic capability and the understanding of the mentioned dimensions as its components.

Nevertheless, the convergence of the dimensions mentioned above is not necessarily free of issues. For instance, a potential trade-off between people and tools represents a core tension of going digital, including considering whether people and technology are complements or substitutes for each other (Furr et al., 2022). The proper control over technology infrastructure and data-related policies may also require a level of bureaucracy that may not be compatible with the more agile mindset that characterizes the organizational structure and culture of an aspiring digital enterprise (Agrawal et al., 2018). These potential trade-offs are closely related to issues we have made explicit in the ACATECH framework and can influence how we see the relationships between the DMC dimensions. Hence, we test the existence of DMC as our first hypothesis:

H1. . EMNE's digital maturity encompasses five dimensions: digital technical capability, data management capability, people management capability, organizational design capability, and culture-crafting capability.

The volatility, uncertainty, complexity, and ambiguity (VUCA) characteristics of existing business environments challenge how firms make decisions, while the number of variables related to a single decision grows exponentially. Dealing with this can be especially difficult for EMNEs as they typically lack institutional support and traditional resources (Elia & Santangelo, 2017; Kaynak et al., 2005; Sheng et al., 2013). However, some EMNEs can be as digitally competitive as developed country multinationals (Bloom et al., 2010). Hence, EMNEs with higher digital maturity can mobilize their capabilities to evolve their decision-making process in a digital world.

For instance, consider the application of Artificial Intelligence and the modeling of decisions. For this to be functional, the firm must build a dataset that is timely, accurate, clean, unbiased, and trustworthy (Sivarajah et al., 2017). Researchers continue to debate intensely about transforming data lakes (that is, sets of heterogeneous data) into inputs for big data analysis (Ahi et al., 2022; Wamba et al., 2017). Data capture, storage, and retrieval, associated with computing power for processing, feed decision models that aid accurate decision-making (Janssen et al., 2017). Therefore, both *data management capability* and *digital technical capability* are fundamental for firms, including EMNEs, who want to make their decision-making data-driven.

Anderson, (2015) warning regarding the exaggeration implicit in the ideal of "data-driven" asks for a balance between the reliance on data processing versus experience and intuition. This type of balance is particularly critical in Latin countries, especially the emerging ones where cultural norms and social capital remain very influential (Park, Nunes, Muratbekova-Touron, & Moatti, 2018). *Culture crafting capability* is usually considered the most important tool to handle this kind of issue. Firms intending to become more data-driven need to change values, leadership styles, and policies, which are the foundations of organizational culture (Chaudhuri et al., 2021). Besides establishing an environment where rational thinking prevails over opinions, change in values also includes openness and trust, the promotion of broad data literacy, and a cooperative and learning culture (Schuh et al., 2017).

Designing an appropriate organizational structure that will support the above-mentioned changes is daunting, requiring a proper application of *organizational design capability*. Specifically, it must consider individuals and groups of individuals as decision-makers (Blanka et al., 2022). These decision-makers are configured in mutable structures, processing different types and volumes of data and information channeled for the appropriate decision points (Hanelt et al., 2021; Schwer & Hitz, 2018). According to Pereira et al. (2021), high-performing EMNEs can solve the tensions surrounding them by creating an agile and ambidextrous environment across various organizational levels. These organizational designs promote accelerated learning at all levels, where "test fast–fail fast–learn fast" is the rule (Guinan et al., 2019). Further, they create engagement and initiative concomitantly with professional challenges and cooperation.

Finally, an excellent *people management capability* enables the firm to establish a digital workforce that is capable of solving complex problems using analytical skills (Dremel et al., 2017) and making data-driven decisions (Åberg & Torchia, 2020). For EMNEs, this can be helpful when the alternative is competing for skilled talents with established firms (Koch, 2022; Meyer & Xin, 2018). It concerns the reskilling process, the incorporation of new types of professionals, such as data scientists, and the structuring of a new C-suite, comprising the Chief Data Officer, Chief Technology Officer, and Chief Digital Officer (Davison et al., 2023).

Altogether, the set of capabilities accompanying digital maturity can help EMNEs overcome their technology constraints, and equip them to handle the technical and people-related challenges of establishing digitally-enabled decision-making processes. Based on this discussion, we propose our second hypothesis:

H2. EMNEs with higher digital maturity adopt digitally-enabled decision-making processes to a greater extent.

DMC-related digital capabilities can also help EMNEs overcome their unfavorable origins and enable them to operate in a world marked by business networks and ecosystems. From a business network perspective, a firm's reputation and power in a business network coevolve with the activities that it conducts within the network and its relationships with other network actors (Forsgren et al., 2005). Contemporary business networks have tightly embedded business relationships when it comes to technology. That is especially true regarding the platforms and complementarity logic of the technology assets firms bring (Nambisan et al., 2019). These aspects directly affect the paths available for building reputation and power in a technology-enabled value chain or business ecosystem.

Digital technical capability facilitates the firm in entering and assessing relevant positions in digitally-enabled networks, allowing firms to acquire the required infrastructure and assimilate the rules that align actors in the ecosystem (Li et al., 2019). For example, joining a network with high levels of digital infrastructure may require certifications and specific protocols (Verbeke & Hutzschenreuter, 2021). The power a firm holds in the network may expand when it can influence the technology that other firms adopt in the same network (Baraldi & Nadin, 2006). These dynamics are relevant for EMNEs because they can change the basis of interfirm relationships. With proper infrastructure, *data management capability* enables firms to improve their collaboration with other network actors. Data exchange and processing helps them integrate their processes with those of their business partners (Kache & Seuring, 2017) and better understand and connect with other markets (Alcácer et al., 2016).

People management capability helps firms ensure that their employees can leverage the technology assets relevant to the firms' participation in the business network and operationalize collaboration with other network actors. Together, these aspects form the basic logic of value creation in digital business ecosystems (Jacobides et al., 2018; Li et al., 2019). If an organization needs to overcome a weak institutional heritage, skilled employees may be its primary asset when developing business relationships within an ecosystem (Schaefer, 2020). Finally, *organizational design* and *culture-crafting* capabilities promote the structural and cultural foundations upon which people and technology can converge. That happens as organizational forms and cultures encounter additional challenges when firms operate in a business ecosystem (Autio et al., 2018; Baldwin, 2012; Möller & Halinen, 2017).

Therefore, DMC-related capabilities can help EMNEs access and act in business networks and ecosystems with embedded digital technologies. We thus propose our third hypothesis:

H3. EMNEs with a higher level of digital maturity have a higher degree of integration within their value chains and business ecosystems.

3.2. Effects of multinationality on the variables of interest

Although multinationality's relevance for EMNEs in digital markets remains unclear, it can still be considered critical for developing competitiveness in a more digital world as geography remains a relevant dimension of internationalization (Ghorbani et al., 2023). That means the existence of potential mechanisms through which multinationality could promote the key enablers of competitiveness in such a context—that is, digitally-enabled decision-making and value chain and ecosystem integration. These mechanisms can be anticipated as one acknowledges how multinationality not only promotes EMNEs' performance (Wu et al., 2022) but also their innovation outcomes (Elia et al., 2020) and corporate governance (Popli et al., 2021).

In fact, multinationality can affect innovation outcomes by providing mechanisms for developing digitally-enabled decision-making processes. For instance, digital technologies can be introduced through digital process innovation, representing "the creation of new ways of operating in organizations with the support of digital technologies" (Trocin et al., 2021). Drawing on IB and innovation research, Elia et al. (2020) argued that a portfolio of foreign subsidiaries can become a strategic channel for an EMNE to acquire organizational and experiential knowledge, which can help its innovation efforts (Guillén & García-Canal, 2009; Piperopoulos et al., 2018). Firms that incorporate digital technologies in their processes often transform their ways of operating and making decisions because of such a technology (Pietronudo et al., 2022; Trocin et al., 2021).

EMNEs can also access complementary assets as they increase their multinationality, which further enhances their innovation outcomes and could contribute to the internalization of digital technologies that can transform the firms' decision-making processes. This happens when EMNEs acquire mature operations abroad (Luo & Tung, 2007) or simply use their foreign footprint to hire specialized professionals (Kafouros et al., 2018) and absorb technology from collaborators (Srinivasan et al., 2007). As Elia et al. (2020) indicate, this process can help EMNEs assimilate advanced processes by incorporating technological skills, knowledge, and managerial best practices.

Thus, as EMNEs expand their multinationality, introducing digital technologies can advance their decision processes. Based on this, we propose the hypothesis:

H4a. Multinationality positively affects the development of digitally-enabled decision-making processes.

Besides potentially leading to the development of digitally-enabled decision-making processes, multinationality also exhibits effects that can be connected to the development of value chain and ecosystem integration. That is an important point regarding EMNEs, which, despite their multinational nature, are often characterized by a lack of relevant connections with global networks (Li & Fleury, 2020; Zhou, 2022). As mentioned above, the impacts of multinationality on EMNEs' innovation outcomes can also happen through partners from whom these firms can learn and incorporate advanced practices and technologies. As Elia et al. (2020) noted, such cooperation can contribute to a firm's innovation efforts. That includes collaboration with foreign universities and laboratories (Kafouros et al., 2015) and other organizations (Laursen & Salter, 2006). Such dynamics have become an increasingly important aspect of navigating in a world where competition moves from the firm-level to the ecosystem-level (Hult et al., 2020; Nambisan et al., 2019).

Other authors have also stressed that an increased multinationality can help EMNEs by signaling better corporate governance practices, which contributes to developing connections within the business ecosystem. As Popli et al. (2021) remarked, EMNEs often try to overcome the weak reputation of their home country institutions and their trust deficit with foreign stakeholders by implementing "better corporate governance and auditing mechanisms to demonstrate their credibility" (Deng et al., 2020, p. 62). Improving board independence and reducing family ownership are some of the initiatives that represent "significant objective evidence" that "enable value-chain stakeholders in host nations to alter and reconstruct their beliefs regarding EMNEs' trustworthiness and integrity" (Popli et al., 2021, p. 701). Thus, EMNEs may improve their governance attributes as they increase their multinationality. This dynamic is likely to add to the effect of innovation collaborations and contribute to integrating the EMNE into its value chain and ecosystems. Therefore, we propose the hypothesis:

H4b. Multinationality positively affects the development of the value chain and ecosystem integration.

Besides improving the key enablers of digital competitiveness, we should also consider whether multinationality can directly promote an EMNE's digital maturity. The causality in this relationship is not trivial, since digital technologies tend to reduce the costs and barriers to internationalization (Autio & Zander, 2016). Therefore, a firm may increase its multinational presence *because* of digital maturity. When it comes to incumbent EMNEs, however, one can expect that these firms already have a preestablished multinational footprint when they start investing more seriously in going digital.

Mechanisms similar to those that foster innovation based on multinationality apply to the development of the technical dimensions of DMC. EMNEs can learn about such issues during foreign expansion as they learn through network partners or by internalizing knowledge as they hire new employees or acquire other firms (Bilgili et al., 2016). As EMNEs experience the competitiveness of contemporary markets in different countries, they may acquire knowledge relevant to scouting digital technologies and plan their digital infrastructure accordingly (Munjal et al., 2022). That can improve their *digital technical capability*. Further, they can assimilate knowledge about managing data sources and information and communication technologies, thereby advancing their *data management capability*.

The remaining dimensions of going digital involve knowing how to manage people, design the organization, and craft a proper culture. These aspects may evolve together with multinationality since an increased multinational expansion tends to potentialize the social and organizational challenges faced by firms. EMNEs live with a well-known gap of talents at home and their foreign expansion is usually accompanied by a search for both managerial and technical people abroad (Meyer & Xin, 2018). As they expand, EMNEs thus must become better at recruiting and managing people in different countries. Organizational design is also fostered in this process as EMNEs now operate in different regulatory environments and accommodate tensions such as those between efficiency and innovation (Khan et al., 2022; Pereira et al., 2021). Finally, the development of an EMNE's multinationality naturally brings complexity that cannot be managed without crafting a culture that is fit for the new challenges, empowers decision-making, and fosters learning in diverse contexts (Jonsson & Vahlne, 2021; Wang et al., 2014).

Altogether, the multinational expansion of EMNEs reflects pressures that require them to develop multiple capabilities. Some of these capabilities relate to the DMC dimensions and can, in principle, also contribute toward that. In this vein, we propose the hypothesis:

H4c. Multinationality positively affects the development of DMC.

In summary, the model depicted in Fig. 1 and our hypotheses propose that EMNEs' shift toward digitally-driven decision-making and value chain and business ecosystem integrations are associated with their digital maturity. Furthermore, we postulate that multinationality can affect value chain integration, digitally enabled decision-making processes, and the growth of digital maturity capability. Our empirical investigation into the complex interrelationships among digital maturity, multinationality, decision-making procedures, and ecosystem integration in EMNEs is grounded in these ideas.

4. Methodology

4.1. Sample and data collection

Studies on digital maturity in emerging countries are still limited, with most cases focusing on China and its multinationals (for instance, Li et al., 2022; Shamim et al., 2020). While China's trajectory increasingly sets it apart from other emerging economies (Paul & Benito, 2018), Brazil remains a modest producer of digital technology (UNIDO, 2019). For instance, the country ranks 52nd among 63 countries on the digital competitiveness ranking compiled by the International Institute for Management Development (IMD, 2022). The country's firms also lag behind those of countries in the Organization for Economic Co-operation and Development (OECD) in adopting digital technologies (OECD, 2020). Considering these issues, we tested our hypotheses with data surveyed from Brazilian multinationals (BrMNEs).

Given the lack of official data on BrMNEs, we used different sources to sample the firms. First, we rely on information from a Brazilian research center on international competitiveness that has followed Brazilian Multinationals since 2008 and developed a list of BrMNEs. This list of companies has been used in different surveys in the past, and its information is updated yearly based on data from third-party databases and rankings published by specialized media and business schools (such as Exame Magazine and Fundação Dom Cabral). For instance, Exame Magazine is well known in Brazil for its annual ranking, featuring information on the 1000 biggest companies in the country, including several multinationals. In comparison, Fundação Dom Cabral (FDC) uses the Transnationality Index to collect information on selected Brazilian Multinationals. Although it is trustworthy, FDC's ranking is incomplete. Hence, there is a need to triangulate the information from different data sources. We limited our dataset to Brazilian firms that maintain value-adding activities in foreign countries, excluding those with only a postal address abroad or subsidiaries in tax havens. To guarantee that the list of BrMNEs follows these criteria, we also collected information on their subsidiaries from the Oribs database and the companies' websites and, for those publicly listed, their annual report as well. In total, we identified 228 multinationals of various sizes.

Our survey instrument was adapted from ACATECH's digital maturity framework (Schuh et al., 2017). This framework was initially prepared by researchers from Aachen University, together with companies such as Infosys (India) and PTC Inc (USA). Our questionnaire was developed in Brazilian Portuguese and pre-tested before data collection. For each of the 228 companies that we identified, we made a preliminary phone call to check the name and contact details of the manager responsible for decisions related to digitalization—usually the Chief Technology Officer (CTO), Chief Information Officer (CIO), or Chief Digital Officer (CDO). As the status and position of these individuals made them best placed to address our research objectives, we assumed that single-respondent bias was limited (Kumar et al., 1993). In the end, 91 valid questionnaires were obtained (one per company).

4.2. Questionnaire development

We based our approach on the ACATECH model, acknowledged as one of the most comprehensive frameworks to assessing digital maturity (Gökalp & Martinez, 2022), and took various steps to ensure the validity and reliability of our research instrument. Since the report does not detail its methodology and we were not able to access the original questionnaire even after direct contact with Prof. Schuh, the ACATECH report coordinator, we developed our own items based on the structure of that report. The questionnaire was developed directly in Portuguese, with the assistance from a professor who had followed the development process leading to ACATECH's framework.

Based on the dimensions proposed by ACATECH, with the modification introduced in the Resources block, we created a first set of questions. Drawing inspiration from the logic adopted by the ACATECH framework, we assumed that companies at level 1 of each item would correspond to Industry 2.0 stages, characterized by Taylorist-Fordist approaches. Level 3 items described companies that would have implemented the Lean production organization and management model, integrating mechanical and electronic systems. Companies at level 5 would be advanced in adopting and utilizing digital technologies. We carefully aligned all questionnaire choices with the specialized literature. Levels 2 and 4 were interpreted as indicative of transitional processes.

To reduce the risk of misinterpretation during the interviews, we crafted a defining statement for each level of each question. Respondents were asked to identify the statement that best characterized their company for each question. The questionnaire thus constructed was tested in two Brazilian EMNEs, in manufacturing and services. It was also discussed with managers from five subsidiaries of European multinationals operating in Brazil. Finally, the questionnaire was also reviewed by the aforementioned professor, who had strong ties to German research groups and, at the time, was a visiting researcher at the University of Aachen.

4.3. Construct operationalization

We assume that the five capabilities of digital maturity constitute a second-order, formative construct called *Digital Maturity Capability (DMC)*. While reflective measurement assesses constructs through their observed effects, formative specification is applied when the measures capture independent causes or dimensions of the construct (Coltman et al., 2008; Finn & Wang, 2014). We operationalized each DMC capability as a multi-item construct with reflective measurement items. We assessed these items using five-level scales composed of short statements reflecting progression over a given aspect of the corresponding capability.

Three out of the DMC's five capabilities are closely related to dimensions of the ACATECH framework. First, we have Digital Technical Capability (DTC), which we operationalized after ACATECH's Information Systems dimension by asking interviewees: i) How are the needs and capacity planning of your IT systems infrastructure built? (DTC1); ii) How does your company work with metadata? (DTC2); iii) Does your company have data governance policies? (DTC3); and iv) What measures does your company take to prevent attacks on its information systems? (DTC4). The measurement scales across these items indicated that the most advanced companies have medium to long-term plans for their digital infrastructure, feature structured and unified metadata, systematically develop and maintain data governance policies, and keep security and compliance measures in place. That is enabled by redundant systems, cloud computing (Benlian et al., 2018), explicit data governance policies, and compliance with international standards for data protection (Haggerty, 2017).

Organizational Design Capability (ODC) is derived from ACATECH's Organizational Structure dimension. To measure this construct, we asked interviewees: i) Does your company adopt flexible organization and administration principles to allocate employees? (ODC1); ii) How long does it take for your company to validate assumptions and hypotheses about possible products and services under real market conditions? (ODC2); and iii) How does your company approach integrating processes with stakeholders along the value chain? (ODC3). Companies with the most advanced levels across these items feature multidisciplinary working groups that collaborate across strategic themes (Dremel et al., 2017), with organizational processes following agile principles (Bennett & Lemoine, 2014) and value chains relying on digitalized routines (Becker & Schmid, 2020).

Finally, we derived Culture-Crafting Capability (CCC) from ACATECH's Culture dimension by asking interviewees: i) Is your company open to new technologies? (CCC1); ii) How does your company handle errors? (CCC2); iii) To what extent do people in your company understand that they are responsible for changing the company? (CCC3); and iv) How do you characterize the leadership style adopted by your company? (CCC4). For these items, the most advanced companies continuously and systematically test new technologies, develop partnerships, and invest in start-ups. They prioritize agility and learning, promote mutual trust, empower employees, and tolerate errors (Karimi & Walter, 2015; Schuh et al., 2017).

Data Management Capability (DMC) and People Management Capability (PMC) relate to issues that, as we discussed earlier, are ill-defined in ACATECH's framework yet are relevant to our empirical problem. To evaluate DMC, we asked interviewees: i) How does your company capture and organize data so that it feeds decision-making processes at different levels? (DMC1); and ii) What is the best characterization of your company's existing capacity for automatic data analysis? (DMC2). The measurement scales across these items revealed that the most advanced firms can manage and capture structured and non-structured data in ways that guarantee their accuracy, coherence, and compatibility. Similarly, they can develop algorithms that perform predictive and prescriptive analyses based on Artificial Intelligence (Arbatani et al., 2019; Warner & Wäger, 2019).

When assessing PMC, we asked interviewees: i) What skills do your employees have that enable them to use digital technologies? (PMC1); ii) How does your company establish people management policies to motivate employees to use and explore the potential of digital technologies to help them achieve their goals? (PMC2); and iii) How does your company deal with the need for professional development? (PMC3). The most advanced companies' workforce includes specialists with different backgrounds collaborating closely. They feature policies prioritizing talent-based recruiting, empowering people to execute and create new business opportunities, and proactively identifying and incorporating innovative learning and development practices (Adner et al., 2019; Singh & Hess, 2017).

Considering the increasing importance of data and digital technologies for managing modern firms (Janssen et al., 2017; Wieringa et al., 2021), we define Digitally-enabled Decision-making Processes (DDP) as the use of digital technologies to support decision-making routines and information flows within firms. To assess DDP, we asked interviewees: i) Does digital infrastructure improve communication in your company? (DDP1); ii) What is the estimated share of operational decisions in your company that are already automated with digital technologies? (DDP2); and iii) How does your company benefit from the potential of digital technologies in its decision-making processes? (DDP3). The most advanced companies identified here offer stakeholders access to optimized information according to specific needs and permissions, thus reducing redundancy and enhancing traceability (Correani et al., 2020; Molloy & Schwenk, 1995). Their decision-making processes have higher automation levels and use digital technologies to balance centralization and decentralization, with information available to all organizational levels (Dremel et al., 2017; Sebastian et al., 2017).

As a second enabler of firm success in the digital era (Gawer & Cusumano, 2014; Li et al., 2019), we considered Value Chain and Ecosystem Integration (VCEI). We define VCEI as using digital technologies to support business relationships within innovation ecosystems. We assessed VCEI by asking respondents: i) To what extent does adopting digital technologies help your company serve your customers/consumers better? (VCEI1); ii) Does your company cooperate within the value chain to increase its competitiveness? (VCEI2); iii) Does your company participate in networks which collaborate on innovation? (VCEI3); and iv) Do your company's new product and service projects require inputs/parts/components developed in collaboration with other companies in the network? (VCEI4). The measurement scales of these indicators were aimed at capturing the level of investment in partnering (Lee et al., 2020), and the level of collaboration and trust among partners, research institutions, and the government (Autio et al., 2018; Warner & Wäger, 2019).

In line with the literature, we assessed whether the sampled multinationals benefit from multinationality-related phenomena, like reverse knowledge transfer (Ambos et al., 2006). We assessed this effect by looking at the sampled firms' degree of internationalization, which was measured by the number of countries in which they have subsidiaries (NSub) based on data from the companies' websites and the Orbis database.

Finally, we used the Eurostat industry classification (Eurostat, 2020) to control for the technology intensiveness of each firm's industry. This assessment is important because digital transformation, representing a phenomenon observed across industries (Strange et al., 2022), can be experienced differently by firms in low and high-technology industries. Some aspects in this regard include different adoption levels of digital technologies and distinct trends toward technology convergence over time (Plekhanov et al., 2022). We implemented this control using two binary variables to identify whether each firm belonged to a low- (LTech) or high-tech (HTech) manufacturing industry, using services as the reference category.

Table 1 summarizes the items used to operationalize our constructs.

Table 1
Construct operationalization.

Constructs	Questions
Digital Technical Capability (DTC)	How are the needs and capacity planning of your IT systems infrastructure built? (DTC1); How does your company work with metadata? (DTC2) Does your company have data governance policies? (DTC3); What measures does your company take to prevent attacks on its information systems? (DTC4);
Organizational Design Capability (ODC)	Does your company adopt flexible organization and administration principles to allocate employees? (ODC1) How long does it take for your company to validate assumptions and hypotheses about possible products and services under real market conditions? (ODC2) How does your company approach integrating processes with stakeholders along the value chain? (ODC3)
Culture-Crafting Capability (CCC)	Is your company open to new technologies? (CCC1) How does your company handle errors? (CCC2) To what extent do people in your company understand that they are responsible for changing the company? (CCC3) How do you characterize the leadership style adopted by your company? (CCC4)
Data Management Capability (DMC)	How does your company capture and organize data so that it feeds decision-making processes at different levels? (DMC1) What is the best characterization of your company's existing capacity for automatic data analysis? (DMC2)
People Management Capability (PMC)	What skills do your employees have that enable them to use digital technologies? (PMC1) How does your company establish people management policies so that employees are motivated to use and explore the potential of digital technologies to help them achieve their goals? (PMC2) How does your company deal with the need for professional development? (PMC3)
Digitally-enabled Decision-making Processes (DDP)	Does digital infrastructure improve communication in your company? (DDP1); What is the estimated share of operational decisions in your company that are already automated with digital technologies? (DDP2); How does your company benefit from the potential of digital technologies in its decision-making processes? (DDP3)
Value Chain and Ecosystem Integration (VCEI)	To what extent does the adoption of digital technologies help your company serve your customers/consumers better? (VCEI1) Does your company cooperate within the value chain to increase its competitiveness? (VCEI2) Does your company participate in networks which collaborate on innovation? (VCEI3) Do your company's new product and service projects require inputs/parts/components developed in collaboration with other companies in the network? (VCEI4)
Multinationality	Number of countries in which they have subsidiaries (NSub)
Industry (control)	Binary variables to identify whether each firm belonged to a low- (LTech) or high-tech (HTech) manufacturing industry

4.4. Common method bias

To minimize the risks of common method bias (CMB), we adopted both procedural and statistical approaches recommended in the literature (Chang et al., 2010; Podsakoff et al., 2003; Tehseen et al., 2017). For instance, the implementation of interviews by different members of our research team (following the same protocol) contributed to reducing the influence of individual particularities and expectations. As we ensured anonymity to respondents, we also aimed to remedy any evaluation expectations that could interfere with their scores. The combination of primary and secondary data sources additionally attenuates potential CMB problems. After data collection, we first conducted a Harman's one-factor test and verified that the largest factor in the un-rotated solution accounted for only 38.2% of the total variance in the sample. Applying a full collinearity test that has been recommended for assessing CMB in structural equation modeling based on partial least squares (Kock, 2015), we obtained variance inflation factors (VIFs) that are limited to the range between 1.063 and 2.105 and, therefore, satisfy the suggested threshold of 3.3. Finally, the fact that the correlation between our main constructs is not substantially large (see Table 3 in the results section) corroborates for considering that CMB is not a major concern in our study (Tehseen et al., 2017).

4.5. Data analysis

We processed our survey data using structural equation modeling based on partial least squares (PLS-SEM), which is a variance-based technique that emerged more strongly in recent years as an alternative to the traditional SEM models based on covariance (CB-SEM) and gained popularity rapidly in various fields (Guenther et al., 2023; Hair et al., 2017; Richter et al., 2016, 2022). While CB-SEM seeks to estimate how much a theoretical model is close to the covariance matrix observed in a given sample, PLS-SEM operates similarly to multiple regression analyses, selecting regression parameters that maximize the variance explained in the endogenous variables (Hair, Hult, et al., 2014). This scenario makes CB-SEM better for theory confirmation whereas PLS finds its main applications in prediction and theory development (Henseler et al., 2014; Sarstedt et al., 2016). The latter situation more closely describes the context of our research—that is, a lack of consensus around theoretical explanations of digital transformation and reduced attention to issues relevant to our empirical context.

Moreover, PLS-SEM combines robust estimation with a soft approach to modeling that translates into minimal demands in terms of measurement scales, sample sizes, and residual distributions. In line with that, PLS-SEM appropriately handles model estimation using relatively small sample sizes like ours (Hair et al., 2019). Our sample size is inherently limited by our research context, given the small size of the population of Brazilian multinationals. Nevertheless, our sample is larger than that required to detect R^2 values of at least 0.25 in PLS (considering our model's complexity), a 5% confidence level, and a statistical power of 80% (Hair, Blacket al., 2014).

Besides sample size, PLS-SEM is superior to CB-SEM when estimating formative models (Hair et al., 2019; Hair et al., 2012). Available alternatives to implement formative models with CB-SEM either underrepresent the variance in the constructs by focusing on common variance (when using causal indicators) or require specific model constraints to overcome identification issues (when using composite indicators) (Sarstedt et al., 2016). The logic of PLS-SEM, in turn, includes the total variance shared between exogenous and endogenous variables and considers that weighted linear combinations of indicators are valid proxies of the conceptual variables investigated (Guenther et al., 2023; Sarstedt et al., 2016). Due to those reasons, we adopted PLS-SEM and implemented our analysis using the software SmartPLS (Ringle et al., 2015).

5. Results

First, we evaluate the PLS model's measured constructs and then the structural paths between them (Hair, Black et al., 2014). Table 2 shows that all indicators in our measurement model had standardized loadings above 0.7, except for one item in Digital Technical Capability (DTC4), two in Culture-Crafting Capability (CCC2 and CCC3), and one in

Table 2
Reliability and convergent validity of first-order constructs.

Construct	Item	Standardized loadings	Composite reliability	Average variance extracted
DMC	DMC1	0.817	0.802	0.670
	DMC2	0.820		
PMC	PMC1	0.746	0.790	0.556
	PMC2	0.759		
	PMC3	0.732		
DTC	DTC1	0.739	0.823	0.539
	DTC2	0.805		
	DTC3	0.757		
	DTC4	0.624		
ODC	ODC1	0.821	0.800	0.572
	ODC2	0.715		
	ODC3	0.730		
CCC	CCC1	0.783	0.807	0.513
	CCC2	0.654		
	CCC3	0.621		
	CCC4	0.790		
DDP	DDP1	0.749	0.773	0.532
	DDP2	0.678		
	DDP3	0.759		
VCEI	VCEI1	0.746	0.832	0.554
	VCEI2	0.743		
	VCEI3	0.758		
	VCEI4	0.730		

Digitally-enabled Decision-making Processes (DDP2). We decided to keep these two indicators because their loadings were still higher than the 0.6 thresholds accepted by some authors (Hair, Black et al., 2014). Further, their respective constructs satisfied the suggested benchmarks for construct reliability (0.7) and average variance extracted (AVE) (0.5). In addition, discriminant validity was also respected as the square root of the variance shared between reflective constructs (bold diagonal values in Table 3) were higher than their associations with other constructs (Fornell & Larcker, 1981).

Next, we use reflective measurement to undertake redundancy analysis to test the validity of the second-order formative construct (DMC) by comparing its correlation with an alternative construct (Chin, 1998). The correlation between the formative and reflective constructs was 0.687, below the ideal value of 0.8. Nevertheless, given the exploratory context of this research and the complexity of assessing a second-order construct with few reflective items, we proceed with the analysis. All five dimensions of DMC had significant outer weights and their variance inflation factors varied between 2.196 (CCC) and 3.170 (ODC). Hence, at the very least, DMC can be considered a formative construct with the five listed dimensions, as anticipated in H1.

Building on a 5,000-sample bootstrap, the assessment of the structural model showed that DMC was positively associated with both DDP ($\beta = 0.728$, $p = 0.000$) and VCEI ($\beta = 0.684$, $p = 0.000$), thereby supporting H2 and H3, respectively (Table 4). The number of subsidiaries has a statistically significant relationship only with VCEI, indicating support for H4b ($\beta = 0.164$, $p = 0.036$). The Stone-Geisser Q^2 statistic

Table 4
Estimation of the structural model.

Effect	Path coefficient	p-value	R^2	Adjusted R^2	Stone-Geisser Q^2
Effects on DMC			1.000	1.000	0.387
DMC	0.169	0.000			
PMC	0.221	0.000			
DTC	0.296	0.000			
ODC	0.222	0.000			
CCC	0.257	0.000			
NSub	0.003	0.297			
HTech	0.001	0.833			
LTech	-0.000	0.900			
Effects on DDP			0.535	0.513	0.244
DMC	0.728	0.000			
NSub	0.011	0.895			
HTech	-0.020	0.824			
LTech	-0.011	0.895			
Effects on VCEI			0.562	0.541	0.282
DMC	0.684	0.000			
NSub	0.164	0.036			
HTech	0.050	0.523			
LTech	-0.089	0.263			

produced a value greater than zero for DMC, DDP, and VCEI, which signals predictive validity (Henseler et al., 2009).

6. Discussion

Our results provide a contextually informed understanding of digital maturity's relevance. They reveal two major lines of discussion with implications for EMNEs in general: 1) the structure of DMC and 2) the role of multinationality.

6.1. The structure of DMC

DMC's formative specification implies that its dimensions represent independent causes whose relevance can be understood from their path coefficients. We find that Digital Technical Capability has the highest path coefficient, followed by Culture Crafting Capability, Organizational Design, and People Management Capabilities, and finally, Data Management Capability. This order is supported by an ANOVA test of the results of the bootstrap samples ($F = 448.856$, $p = 0.000$).

Together, this shows the traditional behavior of EMNEs, or at least BrMNEs, of investing more in hard assets than soft ones, especially people (Fleury et al., 2012). Besides some influence of its colonial legacy, people management in Brazil is an extremely complex regulatory issue (Geary & Aguzzoli, 2016). Consequently, companies prefer to invest in tangible resources rather than human capital (Fleury & Fleury, 2014). Notably, the second highest path coefficient is for culture crafting. This finding is in line with the great attention that culture receives

Table 3
Discriminant validity of first-order constructs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) DMC	**0.819**									
(2) PMC	0.626**	**0.746**								
(3) DTC	0.684**	0.671**	**0.734**							
(4) ODC	0.707**	0.725**	0.722**	**0.757**						
(5) CCC	0.581**	0.670**	0.661**	0.610**	**0.716**					
(6) DDP	0.633**	0.596**	0.693**	0.618**	0.576**	**0.729**				
(7) VCEI	0.610**	0.669**	0.611**	0.612**	0.590**	0.541**	**0.744**			
(8) NSub	0.145	0.122	0.245*	0.143	0.171	0.156	0.303**	**1.000**		
(9) HTech	-0.035	-0.074	0.073	-0.092	0.020	-0.024	0.105	0.093	**1.000**	
(10) LTech	-0.098	-0.002	-0.009	-0.070	-0.084	-0.041	-0.149	0.045	-0.554**	**1.000**

* $p < 0.05$, ** $p < 0.01$

in consultancies and practitioner-focused debates (Bughin, 2017; English, 2023; Hyatt, 2019). Further, executives see culture-related investments as an umbrella for all human-related needs of their organizations (Alvesson & Sveningsson, 2015) and, thus, may even focus on them at the expense of more specific issues, such as those that had the lowest path coefficients.

Data management, in turn, had the lowest path coefficient. By contrast, we had argued for its inclusion in the ACATECH model given its potential relevance for EMNEs. That may be a consequence of the challenges these firms face while reconciling the data coming from their legacy systems and manual processes with the more modern and abundant data from machine sensors and social networks (Verhoef et al., 2021). Overcoming this issue is very difficult as making a convincing business case for data-related investments, especially in conventional, non-digital firms, remains challenging (Burden et al., 2018). That can become another driver that makes EMNEs—particularly BrMNEs—focus on adding new technology infrastructure even as they continue working with the hard-to-change data flows, low-skilled people, and outdated organizational designs required to keep those flows alive.

Note that our analysis does not intend to normatively indicate that the DMC dimensions should be ordered or prioritized in any specific way. Rather, it simply shows us what going digital looks like for BrMNEs, and acknowledges the need for a more contextualized understanding of this phenomenon (Furr et al., 2022). Our results also show that the DMC dimensions form a coherent whole, with each dimension responsible for a part of the overall high-level, complex capability that is DMC. Therefore, these dimensions provide a useful frame that can be applied to other emerging market contexts to assess how firms from these countries are facing the challenges of the digital economy.

6.2. Multinationality and DMC outcomes

The significant effect of multinationality on the development of value chain and ecosystem integration shows that both conventional and digitally-enabled mechanisms can help EMNEs be competitive in the digital era. The simultaneity of these effects can be interpreted by looking at differences in the implications of expanding abroad by leveraging multinationality and digital maturity.

Greater multinationality implies setting up operations in multiple countries, making commitments that are mostly market- and relationship-specific (Johanson & Vahlne, 2009). Such a process involves adaptation costs and efforts due to the limited re-deployability of knowledge and resources across markets (Rugman & Verbeke, 2005). This makes multinationality an external driver of value chain and ecosystem integration, and is necessary for its association with performance improvements (Wu et al., 2022), innovation outcomes (Elia et al., 2020), and corporate governance (Popli et al., 2021). A company that expands by leveraging its high digital maturity, in turn, may be more reliant on the virtual environment, such as running value chain activities on the Internet (Vadana et al., 2019). Digital technologies tend to attenuate foreign expansion's location- and asset-specificity, allowing the firm to focus on replicating its business model and value proposition to its various business partners (Autio & Zander, 2016; Brouthers et al., 2016). Thus, as digital maturity creates room for implementing the firm's strategy, it can be an internal integration driver. That could be a source of advantage for EMNEs by offering them a channel for escaping the constraints imposed by the conventional dominance of international networks by developed market multinationals.

However, the lack of significant effects of multinationality on DMC and the development of digitally-enabled decision-making processes may be a limitation of the role of knowledge transfer processes for EMNEs. Even though multinationality positively affects performance and innovation outcomes (Elia et al., 2020; Wu et al., 2022), the dynamics of the digital era may mean that firms need to engage in new learning mechanisms (Hanelt et al., 2021). Alternatively, EMNEs—particularly BrMNEs—may not have leveraged their multinationality to accelerate their digitalization process. This may be due to two issues, starting with BrMNEs' headquarters (HQ)-centered view and their preference for a centralized management model. BrMNEs have expanded abroad by leveraging their strong home market position and slack resources at their headquarters (Carneiro et al., 2018), replicating practices tested in their home market (Williamson et al., 2013). That prioritizes the HQ, reducing the potential for BrMNEs to benefit from a robust international presence to develop DMC. Second, BrMNEs' subsidiaries tend to operate independently from their headquarters. That is often the case with EMNEs (Wang et al., 2014) and represents the autonomy that foreign units have to handle local operations. Altogether, these effects can inhibit any knowledge transfer necessary for developing DMC in BrMNEs.

7. Final remarks

This study investigated how EMNEs pursue digital maturity and how their subsidiaries contribute to this process. Drawing on the experience of BrMNEs, our results make both theoretical and practical contributions.

7.1. Theoretical contributions

Our study offers three contributions to the growing theoretical discussion of digital technologies and related issues within IB (Ahi et al., 2022; Strange et al., 2022). First, we formalize DMC as a complex, higher-order construct composed of five complementary capabilities related to upgrading a firm's technical and social dimensions. Like we mentioned before, the dimensions of DMC can be compared with the three essential processes or subcapabilities (Verbeke, 2022) underpinning dynamic capabilities: *sensing*, *seizing*, and *transforming* (Teece, 2014a). As indicated by Verbeke (2022), these three processes are often described on a high level of abstraction and credible measurement is required to make the capabilities paradigm more relevant in IB research. In this vein, we contribute to making the capability-based view of multinational enterprises more actionable in the case of multinationals' going digital efforts by operationalizing specific measurements for theoretically and empirically relevant dimensions of capabilities relevant in this process.

Second, we develop the discussion of going digital multinationals by exploring the experience of EMNEs. The recent interest in digital transformation within IB has only produced scarce investigation of brick-and-mortar companies that embrace the digital age, despite researchers acknowledging that these firms are fundamentally different form better-known phenomena such as born digitals (Monaghan et al., 2020). Departing from the ACATECH framework (Schuh et al., 2017), we developed a model that reconciles traditional dimensions of digital maturity (digital infrastructure, organizational design, and organizational culture) with dimensions that are particularly critical to EMNEs—data management (Shamim et al., 2020) and people management (Koch, 2022; Meyer & Xin, 2018). DMC is thus especially relevant for EMNEs, who tend to be late movers in international markets and find difficult obstacles in the institutional conditions typical of their home markets (Doh et al., 2004; Elia & Santangelo, 2017; Kaynak et al., 2005; Sheng et al., 2013). Without proper attention to the dimensions of DMC, researchers may overlook the precise mechanisms behind EMNEs' going digital journey.

Third, we find that going digital EMNEs can build elements of competitive advantage in modern digital markets through enhanced digital maturity while still leveraging foreign subsidiaries as a channel for developing value chain and ecosystem integration. This finding widens the discussion on EMNE success, which still mostly focuses on their ability to locate asset-seeking investments abroad strategically (Kumar et al., 2020; Luo & Bu, 2018; Luo & Tung, 2018). Specifically, we find that DMC enables BrMNEs' internal decision-making processes. It helps them use the potential delivered by structured and unstructured data so that decision-making becomes objective and fast. That is increasingly required for operations in today's complex and dynamic environment (Gölzer & Fritzsche, 2017; Janssen et al., 2017).

Further, we find that DMC allows BrMNEs to create or enhance their position in the networks and platforms that rule the functioning of business and innovation ecosystems, thus allowing them to reposition themselves strategically (Adner, 2017). Therefore, multinationality and digital maturity can work as complimentary mechanisms for supporting EMNEs' foreign expansion. Even if EMNEs are unable to catch up with conventional incumbent multinationals, the presence of DMC allows them to leverage digital technology in their operations to become more competitive.

7.2. Managerial contributions

For EMNE managers who need to navigate the digital era, our study shows that the phenomenon of digital maturity and its expected outcomes is pervasive and goes beyond technological inputs. To thrive in the digital era, companies must combine technical and social capabilities that reflect several dimensions, such as those included in our framework. Thus, being aware of the larger scope of DMC can help managers reconfigure EMNEs' operations to compete in the digital context. For instance, digital technical capability can help deal with the tremendous challenge of assembling and continuously upgrading efficient hardware/software systems that produce coherent technical choices. With data increasingly relevant for business decision-making, any enhancement of data management capability will enable a firm to identify and shape opportunities from structured and unstructured data, filter and absorb the most relevant information, and generate data supporting its development.

Most importantly, managers must prepare an appropriate and competent workforce that can work with structured and non-structured data. Then, improvements in people management capability will empower employees to act and perform effectively in the new environment and become more digitally savvy. Next, better organizational design capability will help create an internal environment that will enable employees to be more sensitive to valuable data. Moreover, a greater culture-crafting capability will stimulate and reinforce the values, attitudes, and behaviors necessary for the new business environment. The absence of any of these dimensions may undermine and even threaten EMNEs' efforts to survive and grow in the digital era.

7.3. Limitations and future research directions

Considering the limitations of our investigation, the small size of our sample should not be a significant concern since the population of Brazilian multinationals is not large (Fleury et al., 2015) and allows for reasonable inferences with a research design like ours. Nevertheless, the applicability of our findings to other emerging markets needs to be tested, preferably using multi-country data.

Similarly, it would also be interesting to test this model with MNEs from developed markets. Our results are bound to the EMNE context, given their unique characteristics and process in developing "going digital" capabilities. This limitation and the related opportunities for future research resonate with recent calls for context relevance in IB (Welch et al., 2022). We believe that is equally critical when analyzing the digitalization process of MNEs. For multinationals in developed country contexts, for instance, a different set of capabilities could be considered or found more pressing given their particular environment. Studies exploring such reasoning could indicate if the digitalization of EMNEs and MNEs should be approached as distinct or similar phenomena.

Moreover, we rely on one among several frameworks on digital maturity. Although we thoroughly explain the relevance and choice of this framework, future studies can explore other possibilities and compare the outcomes. Such an analysis should be performed with a proper contextualization of the frameworks, as we discussed above, since the relevance of a framework's components could differ according to the companies approached. Future studies can also include longitudinal panel data or case studies to provide more robust evidence on the causality between DMC and outcome variables. Moreover, researchers can consider a broader view of how DMC's component capabilities combine with strategic capabilities to regenerate operational capabilities that improve firm competitiveness.

Our study is also limited by its focus on capabilities and processes at the firm level. This focus was necessary for identifying the relationships outlined in our model but it does not rule out dynamics at other scales. For instance, managers can be critical drivers of firms' capability development and strategy implementation processes (Grant, 1991; Teece et al., 1997). Thus, future research could explore the managerial role and their cognitive processes supporting firms' digital transformation. Understanding this aspect can offer important insights to advance the field.

Data Availability

Data will be made available on request.

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