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## Article

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Digital Business

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*Suggested Citation:* Festing, Christian; Proff, Heike (2025) : Assessing the impact of national culture on digital maturity, Digital Business, ISSN 2666-9544, Elsevier, Amsterdam, Vol. 5, Iss. 2, pp. 1-14, <https://doi.org/10.1016/j.digbus.2025.100121>

This Version is available at:

<https://hdl.handle.net/10419/337995>

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# Assessing the impact of national culture on digital maturity

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## ARTICLE INFO

### Keywords:

Digital transformation  
Digitalization  
National culture  
Cultural dimensions  
Capabilities

## ABSTRACT

Companies are progressing with their digital transformation. However, in order to successfully manage this transition to a high degree of digital maturity, they must not only adopt digital technologies but also use them to optimize their processes, products, services and business models and develop the necessary capabilities. As part of the search for drivers and antecedents, this article sheds light on the influence of national culture on firms' digital maturity. To this end, hypotheses on the effects along Hofstede's six cultural dimensions are derived from the literature and then tested in a quantitative study of 603 companies from the manufacturing industry applying multiple regression analysis. The results confirm that digital maturity is fostered by strong uncertainty avoidance and long-term orientation and hampered by strong individualism and indulgence. In contrast, no significant effects were found for power distance and masculinity. The study thus contributes to research by affirming the culture-bound nature of digital maturity and encouraging companies to incorporate conducive values of national culture into their global strategies for digital transformation.

## 1. Introduction

Digitalization and related digital technologies are advancing and opening up numerous opportunities that companies are trying to exploit as part of their digital transformation (Hanelt et al., 2021; Verhoef et al., 2021). To name just a few examples, digitalization can help to deal with change, optimize processes, reduce costs, create added value for customers and enter into new markets (Autio et al., 2021; Lanzolla et al., 2020; Meyer et al., 2023), enabling it to be a key contributor to firm performance from an economic point of view (Ribeiro-Navarrete et al., 2021). In addition, digital technologies allow for companies to increase their sustainability in terms of social and environmental aspects (George & Schillebeeckx, 2022; Ye et al., 2024).

The successful course of the digital transformation can therefore be crucial for securing competitive advantages (Adner et al., 2019; Porter & Heppelmann, 2014), although barriers need to be overcome (Volberda et al., 2021). For this reason, management research has been concerned with the search for influencing factors, antecedents and drivers of digital transformation, which have been identified in the form of internal factors such as firm size or the characteristics of top management teams as well as external factors such as legal and infrastructural conditions (Balakrishnan & Das, 2020; Yang et al., 2024). For example, large companies are, on average, more digitally mature than SMEs (Eller et al., 2020), while the latest crises, particularly the COVID-19 pandemic, have

accelerated the digital transformation of companies in recent years (Barker et al., 2024; Bürgel et al., 2023).

Moreover, culture is repeatedly emphasized as an influencing factor in this regard (Butt et al., 2024), triggering a discussion about "cracking the culture code for successful digital transformation" (Pedersen, 2022). Unfortunately, previous research has mainly focused on organizational culture in relation to digital transformation (Hanelt et al., 2021; Kane et al., 2015; Plekhanov et al., 2023; Vial, 2019), although culture consists of several layers (Chen & Lin, 2021; Leung et al., 2005). However, national culture is another layer of culture that could play a decisive role in the digitalization process of companies. This is due to the fact that the course of firms' digital transformation depends on the openness to change, behavior and decision-making of their organizational members, which in turn are strongly shaped by a country's national culture (Geletkanycz, 1997; Srivastava et al., 2020; Vaara et al., 2021).

For this reason, the role of national culture should be examined more closely as a possible factor influencing the digital transformation of companies. While the impact of national culture on the adoption of information and communication technologies (ICT) (Erumban & de Jong, 2006) and innovation (Efrat, 2014; Tian et al., 2018), among other things, has already been extensively researched, there is hardly any literature to date that sheds light on the influence of national culture on a firm's digital transformation directly. Rubino et al. (2020) already examined the influence of national culture on digitalization in

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<https://doi.org/10.1016/j.digbus.2025.100121>

Received 18 November 2024; Received in revised form 9 April 2025; Accepted 9 April 2025

Available online 11 April 2025

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companies in Europe but only considered digitalization as the adoption of digital technologies in their study. However, digital transformation “encompasses changes in several spheres” (Cavalcanti & Oliveira, 2022) and therefore much more than the mere integration and adoption of a few technologies in companies. Thus, “technology itself is only part of the complex puzzle” (Vial, 2019) that companies need to put together as a response to digitalization in order to increase their digital maturity (Holopainen et al., 2022; Leso et al., 2024). Beyond just implementing digital technologies, the existing literature also deals with the leveraging of these technologies in order to design new digital offerings and business models (Ancillai et al., 2023; Kraus et al., 2021; Yoo et al., 2012) as well as obtaining required capabilities (Heubeck, 2023; Ostmeier & Strobel, 2022) as part of digital transformation. This article therefore contributes to closing the research gap identified and to understanding the role of national culture in the digital transformation towards comprehensive digital maturity in companies.

## 2. Theoretical background

### 2.1. Digital transformation and digital maturity

Digitalization is changing countless aspects of everyday life and thus has far-reaching significance for individuals, companies and entire societies (Barker et al., 2024). The term digitalization is widely used and describes “the increased generation, analysis, and use of data” (Björkdahl & Holmén, 2019). Although the internet is a key enabler of digitalization in the first place, the great potential of digitalization in recent years has been based in particular on advances in hardware and software technologies (Vadana et al., 2020). In companies, digital technologies such as blockchain, the Internet of Things, big data, cloud computing and artificial intelligence (AI) generate numerous

possibilities (Yang et al., 2024). Accordingly, digitalization is changing firms' processes, products, services and business models discontinuously (Knobbe & Proff, 2020), reshaping global value chains (Ahi et al., 2022) and transforming entire industries (Benner & Waldfogel, 2023). These changes and various effects of digital technologies create a high degree of uncertainty as a result (Bodrožić & Adler, 2022; Kraus et al., 2021). In line with this, management research has also identified a “dark side” of digitalization with obstacles and disadvantages (Lanzolla et al., 2020; Verbeke & Hutzschenreuter, 2021). The exploitation of the potential of digitalization is hampered by barriers such as high investment costs (Gebauer et al., 2020; Hossnofsky & Junge, 2019), the emergence of tensions (George & Schillebeeckx, 2022; Smith & Lewis, 2011), obstacles to acceptance and user privacy (Calderon-Monge & Ribeiro-Soriano, 2024), the enormous complexity of digital technologies (Iansiti & Lakhani, 2017) and lacks of digital know-how (Grimpe et al., 2023).

Despite these barriers, companies are trying to push ahead with their digital transformation, which “describes a company-wide change” (Verhoef et al., 2021) in response to digitalization in order to exploit the emerging advantages. Digital transformation can therefore be understood as a maturation process (Leso et al., 2024). In this context, the term digital maturity is used to indicate how strongly a company has responded to digitalization to date and the extent to which necessary adjustments as part of the digital transformation have already taken place (Kane et al., 2017). The term is often used synonymously with digital readiness (Montero Guerra et al., 2023) or strategic readiness (Holopainen et al., 2022) and thus additionally emphasizes the securing of a preparedness for changes in the context of digitalization (Nasiri et al., 2022). Maturity basically describes a certain state in a process that strives to be completed or perfected, making digital maturity “the result of a continuous and ongoing process of adaptation to a changing digital landscape” (Mettler & Pinto, 2018).

**Table 1**  
Components of digital maturity models.

Source	Model	Components			
		Digital activities	Digital business	Operational capabilities	Dynamic capabilities
Berghaus and Back (2016)	Digital maturity model	Information technology, process digitalization	Product innovation, customer experience, collaboration	Organization	Strategy, transformation management
Colli et al. (2019)	Industry 4.0 maturity model	Technology, connectivity	Value creation	Competences	Governance
De Carolis et al. (2017)	Digital readiness model for manufacturing companies	Technology, process, monitoring & control		Organization	
Devi et al. (2022)	Digital capability maturity model		Digital services creation	Individual capability, organizational capability	Alignment strategy
Fleury et al. (2024)	Digital maturity capability model	Digital technical capability, data management capability		People management capability, culture-crafting capability, organizational design capability	
Gökalp and Martinez (2022)	Digital transformation capability maturity model	Information & technology	Digital process transformation	Workforce management	Strategic governance
Holopainen et al. (2022)	Framework for managing digital operations	Supply chain	Customers	Organization & culture	Strategy, management
Hortovanyi et al. (2023)	Digital capability maturity model	Technology, operations	Customers	Organization & culture	Strategy
Pinto et al. (2023)	Digital maturity model	Technology, operations	Market	Culture	Strategy
Rafael et al. (2020)	Industry 4.0 maturity model for machine tool companies	Smart factory, smart operations, data driven	Smart products	Employees	Strategy
Schumacher et al. (2016)	Industry 4.0 maturity model	Technology, operations	Products, customers	People, culture, leadership	Strategy, governance
Sjödín et al. (2018)	Smart factory maturity model	Technology, process		People	
Sommer and Proff (2023)	Digital maturity model	Digital technologies, digital processes	Digital products & services, digital business models	Individual Capabilities, Organizational Capabilities	Sensing, Seizing, Reconfiguring
Valdez-de-Leon (2016)	Digital maturity model for telecommunications service providers	Technology, operations	Innovation, customer, ecosystem	Organization	Strategy
Williams et al. (2019)	Digital maturity model	Technology, processes	Products & services	People & culture	Strategy, management

In recent years, numerous models for assessing digital maturity have therefore emerged (Thordsen & Bick, 2023), differing greatly in their underlying components, as the exemplary overview in Table 1 shows. Strategy features as a component in many models, which primarily refers to a strategy for dealing with changes due to digitalization. In particular, the models for manufacturing companies or Industry 4.0 models of the selection, such as that of Sjödin et al. (2018), strongly emphasize the technologies and associated processes and operations in production as essential components. Although culture is also frequently a representative component, it is again limited to the organizational culture in the models.

This article follows the understanding of digital maturity by Sommer and Proff (2023), as it takes both an operational and a strategic perspective and pays attention to necessary capabilities such as dynamic capabilities. Moreover, digital maturity according to this understanding covers most of the components of other maturity models, which can be summarized on four overarching spheres consisting of digital activities and digital business as well as operational capabilities and dynamic capabilities for digitalization (Table 1).

### 2.1.1. Maturity in digital activities

Companies can optimize structures, processes and activities using digital technologies (Valero-Gil et al., 2024). One goal here is growth, but for most companies, the focus so far has been on increasing efficiency along the value chain (Björkdahl, 2020; Yang et al., 2021). In this respect, the benefits of digitalization for companies can be explained primarily by transaction cost economics (Williamson, 1996). In the course of digital transformation, companies can improve processes in coordination within departments, between departments, with subsidiaries and with external stakeholders such as suppliers by optimizing data transfer, establishing standards, modularizing systems and enhancing communication even in global value chains (Ahi et al., 2022; Meyer et al., 2023). This reduces information asymmetries (Barker et al., 2024) and therefore advances the speed, transparency and efficiency of processes in and between companies (Calderon-Monge & Ribeiro-Soriano, 2024).

For instance, the digital technology of blockchain can raise trust between involved actors (Hanafizadeh & Alipour, 2024; Schmidt & Wagner, 2019), while AI enables automated decision-making (Raisch & Krakowski, 2021). In terms of Industry 4.0, factories can be completely modernized and their production efficiency can be increased by digitizing manufacturing procedures (Delke et al., 2023). With regard to internationalization processes, digitalization has the potential to bridge distances and barriers to entry (Cassetta et al., 2020; Verbeke & Hutzschenreuter, 2021). In general, digital technologies can lower the effort required for searching for information, monitoring activities and exchanging data (Autio et al., 2021; Loebbecke & Picot, 2015). The result of all these mechanisms is a sharp reduction in internal and external coordination costs and thus in transaction costs (Chen & Kamal, 2016; Iansiti & Lakhani, 2017).

### 2.1.2. Maturity in digital business

With regard to the customer, digitalization enables companies to modify their products, services and business models (Calderon-Monge & Ribeiro-Soriano, 2024; Kraus et al., 2021). This helps to create and appropriate more value for the firm and is necessary due to continuously varying customer needs (Verhoef et al., 2021). Digital technologies can “radically change the nature” of firms’ offerings (Yoo et al., 2012) and enable disruptive customer solutions this way (Llopis-Albert et al., 2021). For example, physical products can be supported by intelligent functions and services through connection to the internet, thus enriching their benefits for the customer and creating an added value (Porter & Heppelmann, 2014). This is often observed in manufacturing companies under the term “digital servitization” (Shen et al., 2023). In this context, some industries are revealing a complete dematerialization of originally physical products, now being substituted by digital means (Miller &

Wang, 2024).

Besides, a more pronounced relationship with customers is often sought (Matarazzo et al., 2021), in which customers become co-creators of value through increased interaction (Plekhanov et al., 2023). In terms of co-creation, companies can furthermore collaborate with other firms in ecosystems to establish an integrated value proposition in the market (Stonig et al., 2022). Thus, services based on collaboration with complementary partners in ecosystems (Adner, 2017; Jacobides et al., 2018) can meet the needs of customers and often of multiple stakeholders in a new way (Snihur et al., 2021). These ecosystems are usually enabled by digital platforms (Kapoor et al., 2021), which have the potential to achieve strong dominance in the market (Birkinshaw, 2022; Khanagha et al., 2022).

Digitally enabled forms of collaboration lead to new business models (Foss & Saebi, 2017; Snihur & Markman, 2023; Volberda et al., 2021). Business models consist of different components as part of value creation and delivery, value proposition and finally value capture (Clauss, 2017), which can be enhanced, extended or redesigned in terms of digitalization (Berman, 2012). Among other things, the possibilities of personalization and digitalizing the customer experience can be exploited (Ancillai et al., 2023; Lanzolla et al., 2020; Li, 2020). As part of the digital transformation, business models are thus incrementally expanded and adapted by potentials based on digitalization, while existing, inefficient ones are replaced by new business models (Loebbecke & Picot, 2015).

### 2.1.3. Maturity through digital operational capabilities

Operational capabilities, also referred to as ordinary capabilities, are crucial for firm performance, as they determine the basis for “how firms create economic rents” (Makadok, 2001). From a resource-based view (Helfat et al., 2023), new digital operational capabilities are therefore needed, including both organizational and individual capabilities in times of digitalization (Ritter & Pedersen, 2020). Accordingly, the development of those capabilities is seen as an antecedent for a successful digital transformation (Konopik et al., 2022; Piwowar-Sulej et al., 2024).

On the one hand, organizational capabilities in particular are based on the working atmosphere, the organizational structure as well as company-specific routines (Csaszar, 2012; Teece, 2012), which evolve over the course of time through complex interactions (Amit & Schoemaker, 1993). To cope with the dynamics of digitalization, the need for organizational agility, by means of flat hierarchies and decentralized decision-making, is increasingly discussed in the literature (Teece et al., 2016; Verhoef et al., 2021; Walter, 2021). Moreover, cross-functional teams can support the development of a common digital understanding, coordination and the diffusion of information and digital knowledge between departments (Singh et al., 2020).

On the other hand, individual capabilities refer to the resources that can be provided by individual organizational members (Sommer & Proff, 2023). With regard to the exploitation of digital options, this particularly includes the know-how of employees and leadership competencies (Ostmeier & Strobel, 2022; Saarikko et al., 2020; Schiuma et al., 2024). Digital skills ranging from basic knowledge of ICT to advanced programming skills are essential at employee-level for a successful digital transformation in the company (Grimpe et al., 2023; Scuotto et al., 2021). In order to be able to use the growing amount of data in the company to its advantage, strong analytical expertise is also required within the company's workforce (Lanzolla et al., 2020). Training to improve the necessary digital capabilities of employees can therefore increase the performance of companies (Ribeiro-Navarrete et al., 2021). Conversely, digital technologies have the potential to support employees' capabilities and improve their operational performance (Schafheite et al., 2020).

### 2.1.4. Maturity through dynamic capabilities

From a strategic perspective, companies need certain capabilities to

adapt and benefit from technological changes (Barreto, 2010; Leso et al., 2024). In this context, the dynamic capabilities approach has progressed and become established in management research (Peteraf et al., 2013; Schilke et al., 2018). Dynamic capabilities are thus considered particularly important as part of the digital transformation (Chirumalla, 2021; Warner & Wäger, 2019). According to the approach, companies need capabilities of sensing in order to recognize changes caused by digitalization and the associated opportunities and risks, capabilities to seize resulting potentials and, finally, capabilities to adapt accordingly by expanding, combining or, if necessary, reconfiguring (Teece, 2007). Thus, dynamic capabilities can adapt the operational capabilities, including the organizational capabilities, in order to master the digital transformation in companies (Konopik et al., 2022).

The capabilities of sensing, seizing and reconfiguring are subjected to varying degrees of stress in an exploratory, a building and an expanding phase of adjustment triggered by digitalization (Yeow et al., 2018). For instance, in the exploratory phase, these capabilities may take the form of continuous but sequential cross-industry digital monitoring (Ellström et al., 2022). While they were originally mainly considered important for upper management decision making, research has shown that processes at almost all levels of a company can be facilitated by dynamic capabilities (Schilke et al., 2018). In this way, dynamic capabilities can frequently contribute to value creation and firm performance in a highly dynamic environment affected by digital technologies (Drnevich & Kriauciunas, 2011; Sjödin et al., 2023), therefore ensuring the necessary governance and strategic readiness (Holopainen et al., 2022).

## 2.2. National culture and intercultural differences

A country's culture has long been ascribed the role of one of its most significant environmental features (Steenkamp, 2001). Alongside individual, group and organizational layers, national or country culture can be regarded as one layer of the multi-level or multi-layer construct of culture (Chen & Lin, 2021; Leung et al., 2005). Being understood as something that people who live in a country have (Moore, 2020), national culture can be "broadly defined as values, beliefs, norms and behavioral patterns of a national group" (Leung et al., 2005). These values and patterns are seen as relatively stable (Taras et al., 2023) and affect people's perceptions (Engelen & Brettel, 2011).

While culture plays a major role in society, it also has a significant impact on companies and organizations in general, since the actions of organizational members are significantly determined by cultural imprints (Vaara et al., 2021). For instance, Li et al. (2013) were able to prove in this respect that imprints of national culture affect managerial decision-making. For decades, culture has been a central research topic in international management and in international business for this reason (Tung & Verbeke, 2010). In these fields, culture has been linked to topics such as forms and modes of entry, transnational cooperation, resources and knowledge transfer, expatriate and international expansion (Caprar et al., 2015). Additionally, a large number of studies have been conducted on the influence of cultural values and intercultural differences on various variables at firm-level (Kirkman et al., 2017; Srivastava et al., 2020).

Intercultural or cross-cultural differences refer to the deviations between different cultures and are usually related to the differences between national cultures (Richter et al., 2016; Taras et al., 2016), between which the construct of cultural distance arises (Kogut & Singh, 1988). Awareness of intercultural differences is considered to be of great importance, which can be explained by the fact that taking such intercultural differences into account can significantly improve the quality of decisions under uncertainty in organizations (Csaszar & Eggers, 2013). Therefore, it is necessary to be able to grasp and quantify cultural distances between nations. Since culture is a latent variable, it must be made tangible in the form of manifestations (Javidan et al., 2006). Researchers introduced different dimensions of culture in order to measure and aggregate the huge amount of these manifestations and provide

simplified overviews of the different national cultures (Kaasa, 2021). In doing so, researchers usually utilize cultural distance measures (Tung & Stahl, 2018). These refer to operational variables that form proxies for these dimensions, allowing estimates of the magnitude of differences between countries within these cultural dimensions (Tung & Verbeke, 2010). Today, more than a hundred sets of cultural dimensions exist as a result (Taras et al., 2009).

Hofstede (1980) is regarded as the first to have established a meaningful framework to evaluating national culture. His dimensions were originally based on a survey of over 100,000 IBM employees, resulting in cultural dimensions conceptualized as bipolar factors. This has led to discussions about the extent to which the aggregation of individual values provides reliable values at country-level, especially when samples are based only on specific groups or companies (Schwartz, 2014). In this context, for example, it is criticized that national borders are not always ideal for representing culturally homogeneous areas due to the presence of subcultures in some cases (Minkov & Kaasa, 2021), meaning that cultural differences within a country can be just as pronounced as cultural differences across countries (Beugelsdijk et al., 2017). Indeed, cultural dimensions are often seen as overly generalized and devalued as subjective creations (Minkov & Kaasa, 2022). However, despite this criticism, those cultural dimensions still provide the most established way of measuring intercultural differences and their effects in research (Jackson, 2020). In line with this, publications such as Schwartz (2014) confirm that methods for deriving cultural values for countries from aggregated individual values are reliable and that aggregated individual values can indeed explain differences in attitudes and behavior at country-level if suitable samples are selected.

Accordingly, after revising and addressing earlier issues (Hofstede et al., 2010), Hofstede's framework has become the basis for numerous cross-cultural studies. It comprises the six dimensions of power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, long-term vs. short-term orientation and finally indulgence vs. restraint. Other well-known cultural dimensions stem, for example, from Schwartz (2008) and from the GLOBE (Global Leadership and Organizational Behavior Effectiveness) study (House et al., 2004), as shown in Table 2.

The dimensions introduced by Schwartz are also aligned in opposite directions. The GLOBE study shows strong similarities with the terms from Hofstede's framework but expands it with additional dimensions. In any case, many overlaps exist between the cultural dimensions of the various frameworks (Kaasa, 2021). Accordingly, "each of these frameworks partly captures the same variation in cross-cultural values and partly some unique variation not picked by any of the other frameworks" (Beugelsdijk et al., 2017). However, Hofstede's dimensions are considered comprehensive enough to capture the influence of the most important facets of national culture without becoming too complex, underlining their clarity, simplicity and high resonance with managers (Kirkman et al., 2006). This is why they are most frequently used in cross-cultural studies compared to other frameworks (Engelen & Brettel, 2011). Their suitability is also confirmed by the continuous updating of the values for Hofstede's cultural dimensions in countries worldwide. Thus, for the purpose of the analysis in the context of digital maturity, Hofstede's cultural dimensions are also used in the further course of this study.

## 3. Hypotheses development

Since the essential actions and decisions in the context of the digital transformation of companies depend on their organizational members and these are shaped by values of national culture (Vaara et al., 2021), it can be assumed that digital maturity is influenced by national culture along its various dimensions. Below, the extent to which Hofstede's six cultural dimensions have a positive or negative impact on digital maturity is therefore examined.

**Table 2**  
Cultural dimensions.

Framework	Hofstede (2011)	Schwartz (2008)	GLOBE (House et al., 2004)
Cultural dimensions	Power distance	Hierarchy vs. egalitarianism	Power distance
	Individualism vs. collectivism		In-group collectivism Institutional collectivism Gender egalitarianism
Cultural dimensions	Masculinity vs. femininity	Mastery vs. harmony	Assertiveness
	Uncertainty avoidance		Performance orientation
	Long-term vs. short-term orientation	(Affective and intellectual) autonomy vs. embeddedness	Humane orientation
	Indulgence vs. restraint		Uncertainty avoidance Future orientation

### 3.1. Influence of power distance (PDI) on digital maturity

The first dimension of PDI describes how much people accept hierarchies. In cultures with high PDI values, hierarchy, subordination and the authority of a few over the many are common (Beugelsdijk & Welzel, 2018). In contrast, a low PDI expresses that inequality of power is more strongly rejected within a culture. Accordingly, a low PDI is associated with egalitarianism and supports autonomy and independence within an organization, potentially fostering employee motivation under transformative conditions (Kirkman et al., 2009). A reason for this is that in countries with a small PDI and a corresponding tendency towards less authoritarian leadership, companies tend to create an organizational environment in which employees generally feel more comfortable (Huang et al., 2017). This can lead to employees showing more initiative and making suggestions for the conversion to new digital processes and products, thus strengthening capabilities such as sensing of digital options. While a low PDI usually results in individuals of an organization acting as a team and sharing resources (Boone et al., 2019), a high PDI can lead to critical information, access to resources and decision-making rights being further restricted to people at higher hierarchical levels (Bogatyeva et al., 2019). The introduction of changes as part of the digital transformation is also less likely in companies in countries with a high PDI, as changes are partly avoided here by decision-makers in order not to endanger existing power structures (Leung et al., 2005). In addition, companies in countries with a high PDI often have hierarchical structures that make bottom-up communication from technical employees to top management difficult (Qu et al., 2011). However, this type of communication is crucial for efficient adjustments in companies in the context of digitalization. It can therefore be assumed that a large PDI is an obstacle to the implementation of digital processes and technologies, to the establishment of digital offerings as well as to necessary capabilities. This leads to the first hypothesis:

**H1.** A high PDI has a negative impact on the digital maturity of companies in a country.

### 3.2. Influence of individualism (IDV) on digital maturity

The one pole of this dimension, with the expression IDV, describes countries in which people care almost exclusively for themselves and their families (Brewer & Venaik, 2011). That is why a high IDV is associated with self-orientation. Collectivism, by contrast, is characterized by an individual's sense of responsibility towards a group or organization. As a result, collectivist cultures therefore attach great importance to group membership and are marked by tightly-knit social structures (Handley & Angst, 2015). On the one hand, people in cultures with high IDV are less oriented towards shared values and the previous norms of the group than more collectivistic cultures. Previous studies have demonstrated a positive influence of IDV on, for example, ICT adoption (Erumban & de Jong, 2006) or innovation (Efrat, 2014). However, the results from prior studies on the impact of IDV are partly contradictory (Tian et al., 2018) and digital maturity needs certain

organizational capabilities (Sommer & Proff, 2023) that thrive collectively in the group and require joint coordination between individuals in the organization. In this context, cross-cultural research has often emphasized the positive effects of collectivism based on its focus on group work and team spirit (Knein et al., 2020). Moreover, collectivism might have a positive effect on digital business. This can be explained by the fact that many new digital offerings and business models are based on a joint orientation of a multilateral set of partners with complementary resources in ecosystems based on digital platforms (Adner, 2017; Jacobides et al., 2018; Kapoor et al., 2021), but also on value co-creation with customers (Plekhanov et al., 2023). In this sense, a high IDV poses barriers to new forms of joint value creation in times of digitalization. Accordingly, the following hypothesis emerges:

**H2.** A high IDV has a negative impact on the digital maturity of companies in a country.

### 3.3. Influence of masculinity (MAS) on digital maturity

Hofstede's most controversial dimension includes the social distribution of roles between the genders (Sent & Kroese, 2022). The dimension presents income and recognition as typically masculine traits, whereas a good relationship with superiors and colleagues is considered a feminine goal. Although the study of Rubino et al. (2020) has demonstrated a negative correlation between MAS and the use of digital technologies in companies, most of the literature sees a positive influence of MAS on variables such as innovativeness (Tian et al., 2018) and ICT adoption (Erumban & de Jong, 2006). The reason for this is that masculine cultures emphasize values such as wealth, success, ambition, materialism and achievement (Hofstede et al., 2010). Therefore, individuals in these cultures are more eager to seek and exploit digital opportunities and to acquire skills or improve existing skills that can enhance their success, especially digital operational capabilities, which tend to be promising and are increasingly demanded (Scuotto et al., 2021). In this context, companies in cultures with a high MAS are also more likely to be able to develop the required dynamic capabilities for the digital transformation (Ellström et al., 2022) in addition to the individual digital capabilities of their employees (Ritter & Pedersen, 2020). From this follows:

**H3.** A high MAS has a positive impact on the digital maturity of companies in a country.

### 3.4. Influence of uncertainty avoidance (UAI) on digital maturity

The dimension of UAI describes the degree to which people get stressed in situations that they perceive as unclear, unforeseeable or unstructured (Hofstede, 2011). A high degree of UAI is therefore accompanied by a need for rules, standards and laws. However, it should be noted that UAI should not be equated with risk avoidance. The main aim of avoiding uncertainty is to reduce ambiguity, not to reduce risks in the first place. Cultures with a high degree of UAI are often even willing

to take risks in order to contain ambiguous situations and strive for structure in their organizations (Hofstede et al., 2010).

As the high speed of technological progress leads to complex and dynamic circumstances, changes brought about by new digital technologies are often perceived as uncertain and ambiguous (Bodrožić & Adler, 2022). For this reason, cultures with a high level of UAI in particular may find the changes in their environment resulting from digitalization uncomfortable and may be more likely to try to control them (Taras et al., 2016). Anyway, there is evidence in the literature that digital, computer-based control systems can limit uncertainty (Björkdahl & Holmén, 2019). In this sense, digitalization can be used to track processes such as deliveries or production steps, keep an eye on the market and competitors, automatically evaluate data about customers and even monitor the skills and performance of a company's own employees (Schafheitle et al., 2020). A high level of UAI is therefore accompanied by better sensing of the environment for observing risks and potentials through digitalization (Yeow et al., 2018) as well as by sensing capabilities, which are optimized through digital technologies. Since companies are subject to the consequences of ambiguity and uncertainty in the context of external technological development anyway, it can be assumed that companies in countries with high UAI use the control options of digitalization to the best of their ability to monitor and reduce uncertainty. The following hypothesis on UAI is formulated accordingly:

**H4.** A high UAI has a positive impact on the digital maturity of companies in a country.

### 3.5. Influence of long-term orientation (LTO) on digital maturity

The dimension focusing on time describes the extent to which cultures orient their actions and behaviors towards the short-term or the long-term. This dimension thus shows whether within a nation the tendency is to strive for short-term results or sustainable success. A high degree of LTO is associated with perseverance, thrift, persistence and a view of the future (Hofstede et al., 2010). The arguments on the influence of LTO are somewhat divergent in the literature. On the one hand, some arguments indicate that a high LTO is a hindrance to digital maturity in companies. In order to drive digital transformation and implement changes quickly, companies generally have to act fast and agile at short notice. Digital opportunities do not only have to be recognized but also have to be seized promptly and resulting changes have to be implemented quickly in the company by adapting existing resources and processes (Teece et al., 2016). The rationale for this is that in fast-changing digital environments, a low response speed is not sufficiently effective (Verhoef et al., 2021). Organizational agility, which goes hand in hand with a certain short-termism (Walter, 2021), is necessary for companies in this context. On the other hand, cultures with a high degree of LTO think beyond current conditions and attach greater importance to situations in the distant future than to immediate outcomes (Sent & Kroese, 2022). Since the positive effects and financial benefits of implementing digital technologies in companies usually only arise in the distant future (Hossnofsky & Junge, 2019), a high LTO could increase the likelihood of investment decisions being made in digital technologies. Moreover, while short-term oriented societies regard traditions as sacrosanct, long-term oriented cultures place greater emphasis on adaptation to changed circumstances (Hofstede, 2011) and are therefore more willing to embark on new paths in the context of digitalization. In accordance with the second line of reasoning, the hypothesis on the effect of LTO is as follows:

**H5.** A high LTO has a positive impact on the digital maturity of companies in a country.

### 3.6. Influence of indulgence (IVR) on digital maturity

The final dimension encompasses the two opposing poles of

indulgence and restraint. While indulgence is represented by a high happiness, high optimism, having many friends and a sense of high control over one's own life, restraint is associated with a lower sense of happiness, more pessimism, a perception of helplessness and stricter norms (Hofstede, 2011). Accordingly, this dimension can be described "as the extent to which members of society enjoy pleasures and express emotions" (Sent & Kroese, 2022). Following the study of Alipour and Yaprak (2022), companies in societies with a high degree of IVR are more willing to take risks, increasing the likelihood of risky investments in digitalization in these societies. Due to the sense of freedom associated with indulgence, employees in such companies are additionally more likely to take action (Bogatyeva et al., 2019). However, employees are often uncomfortable with changes to the familiar due to ingrained habits. This means that adjustments as part of the digital transformation could be at odds with employees' preferences, leading to resistance to change (Hon et al., 2014). Since employees in cultures with a high indulgence are more focused on their interests and the pursuit of their own happiness, they are therefore more likely to refuse necessary changes (Warner & Wäger, 2019). In contrast, in cultures where the values of the restraint side are more pronounced, members of the organization are more likely to accept undesirable adjustments in the context of digitalization, partially because they see themselves as less empowered to prevent changes (Hofstede et al., 2010). This results in the final hypothesis:

**H6.** A high IVR has a negative impact on the digital maturity of companies in a country.

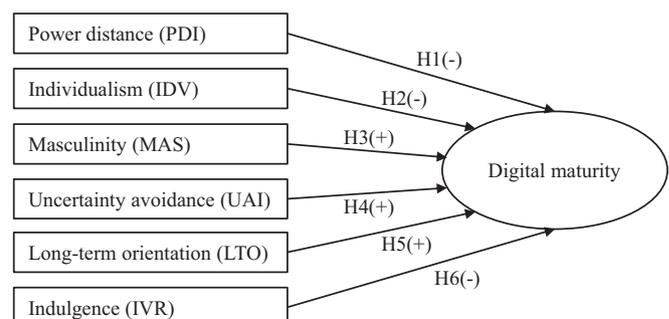
An overview of the six hypotheses and assumed effects on digital maturity is given in Fig. 1.

## 4. Methodology and data

This study attempts to examine the influence of intercultural differences on digital maturity in companies. A quantitative analysis is therefore carried out to test the hypotheses put forward. Regression analyses have proven their worth in management research for examining influences of this kind (Weaver & Wuensch, 2013). Since an influence of national culture on digital maturity is to be expected, but national culture as a stable variable at country-level cannot be influenced by the endogenous variable of digital maturity at firm-level, the methodology of ordinary least squares (OLS) is used for this study. OLS estimation is the most commonly used form of regression analysis and is considered a suitable method for assessing influences between variables if, as shown, an endogeneity problem can be ruled out (Bascle, 2008).

### 4.1. Data collections

For the purpose of the study, various cultural characteristics were made tangible using Hofstede's cultural dimensions. In order to contrast the influence of different cultural values, the countries Germany, Japan and the USA were considered for the study. These countries were chosen



**Fig. 1.** Impact of the cultural dimensions on digital maturity.

since they are located in different global regions. Moreover, all three countries play a significant role in the global economy and are therefore subject to relatively similar macroeconomic factors compared to developing or emerging countries, minimizing distorting factors at country-level (Engelen & Brettel, 2011). Finally, the three countries were also selected for the study because, as often recommended, they differ relatively strongly from one another in terms of the values within the cultural dimensions (Kirkman & Shapiro, 2001). In this context, the scores from Hofstede et al. (2010) were used to determine the values of the variables for the six cultural dimensions PDI, IDV, MAS, UAI, LTO and IVR, as their validity and reliability have been repeatedly confirmed in tests (Kogut & Singh, 1988). These scores range from 0 to 100 for each of these bipolar cultural dimensions in Germany, Japan and the USA, reflecting the distribution of the different cultural values in these countries (Table 3).

The data on digital maturity was collected in a survey of companies in Germany, Japan and the USA in 2023 using an online questionnaire. The companies were predominantly from the manufacturing industry in order to ensure comparability of the transformation process, as born-digital firms “simply started with a different set of management principles” (Birkinshaw, 2022). In order to reduce distortions of a possibly existing industry culture, data was obtained from companies of different sub-industries of the manufacturing sector, such as the automotive industry, the chemical industry or other mechanical engineering industries. Only participants from top management or middle management were surveyed in order to obtain the most reliable feedback possible on the digital transformation in these companies.

#### 4.2. Variable construction

To examine digital maturity, a measurement model is necessary to assess the quality of the digital transformation process of the companies in different countries. This article therefore follows the common approach of using an index (Kromann et al., 2019) in the sense of a digital maturity index (Montero Guerra et al., 2023). The digital maturity index was derived via the four sub-indices of digital activity, digital business, digital operational capabilities and dynamic capabilities (Fig. 2). To this end, the indices were collected using a total of 41 items, which were operationalized as variables in response to digitalization extended to Sommer and Proff (2023). The operationalization takes into account frequently represented items from other maturity models (Table 1) and is also based on a theoretical foundation (see Sections 2.1.1 To 2.1.4). A Likert scale with options ranging from 1 (no digital maturity) to 7 (full digital maturity) was used to obtain data in this context (Dolnicar & Grün, 2013). From the responses received, a mean value was calculated for each of the four sub-indices, assuming an equal weighting for all items. An overall value for digital maturity was then calculated as the average of the mean values of the sub-indices.

The digital activity index contains 16 items (A1-A16) for altering processes and technologies to improve coordination and interaction. Based on the value chain according to Porter (1985), components for the optimization of processes and reduction of costs are included in different areas of the company. Further items focus on shortening product development times and the time between order and delivery, the use of digital technologies for data analytics, data generation in real-time, central integrated IT systems and the digitalization of the supply chain, even beyond company boundaries (Adner et al., 2019; Plekhanov et al., 2023).

**Table 3**  
Scores of Hofstede's cultural dimensions.

Country	PDI	IDV	MAS	UAI	LTO	IVR
Germany	35	67	66	65	83	40
Japan	54	46	95	92	88	42
USA	40	91	62	46	26	68

Consisting of 10 items (B1-B10), the digital business index focuses on the digitalization of products, services and business models. These items comprise software-enabled offerings, intelligent connected offerings, an individual and specific approach to the customer, proactive actions in the competition, change in the use of resources, flexible value architecture and partner network in the course of digitalization (Ancillai et al., 2023; Li, 2020). To consider platform-based ecosystems, questions were developed on multilateral partnerships, joint value co-creation with multiple companies and the creation of a focal value proposition for customers in times of digitalization (Adner, 2017; Jacobides et al., 2018).

The operational capability index reflects the operational capabilities for digitalization and includes 5 items (C1-C5). This encompasses a roadmap for the digitalization initiatives, support from top management in the implementation of the digital transformation, a digital mindset in the organization and the number of digital talents (Grimpe et al., 2023; Scuotto et al., 2021; Volberda et al., 2021).

Finally, the dynamic capability index comprises 10 items (D1-D10) and reflects the extent of capabilities to adapt in the era of digitalization. The operationalization was carried out on the basis of Teece (2007) and Warner and Wäger (2019). Concerning the sensing of companies, it has been taken into account the identification of new technologies, observation of new technologies of competitors and suppliers, monitoring of technology outside of the own industry and target market analyses. The items decision development for digital solutions, structured decision-making, investment decisions in new assets and decisions involving stakeholders were used in view of the seizing of digital opportunities in companies. Finally, the reconfiguring of capabilities due to digitalization was operationalized by changes in knowledge management and corporate governance.

In addition, control variables were included at firm-level. As the size of companies is seen as a factor influencing their digital transformation (Eller et al., 2020), the number of employees is used as a control variable. Alongside this, the duration of a firm's digital transformation to date was subsumed on the basis of its starting year.

## 5. Results

### 5.1. Descriptive statistics

603 companies took part in the survey on digital maturity, with almost equal numbers headquartered in Germany, Japan and the USA. All of them have yearly revenues of at least 80 million US dollars. Of these organizations, just 13.1 % of them have fewer than 1000 employees, around 31.5 % employ between 1000 and 10,000 and the rest, that is, more than half of the companies surveyed, have 10,000 or more employees. The number of small, medium-sized and larger companies, as well as the number of companies from the sub-segments of the manufacturing industry, are distributed evenly across the three countries in order to minimize distortions regarding the analysis of the influence of national culture.

The descriptive statistics of the 41 items surveyed are summarized in Table 4.

Sub-indices were calculated from the surveyed items, which were then used to form a digital maturity index assuming equal weighting (Table 5). In order to test the reliability of the items used to form the sub-indices for digital activity, digital business, digital operational capabilities and dynamic capabilities, the values for Cronbach's alpha were determined (Bonett & Wright, 2015). They lie between 0.866 and 0.939 for all four sub-indices and are therefore well above the generally recommended guideline values of 0.7 for acceptable or 0.8 for high internal consistency of the items (Cho & Kim, 2015).

With an average value of 4.248, the digital activity index is markedly lower than the values of the three other sub-indices, which are around 5. This results in an overall digital maturity index with a value of 4.851 (out of a maximum of 7). When viewed at country-level, the results show

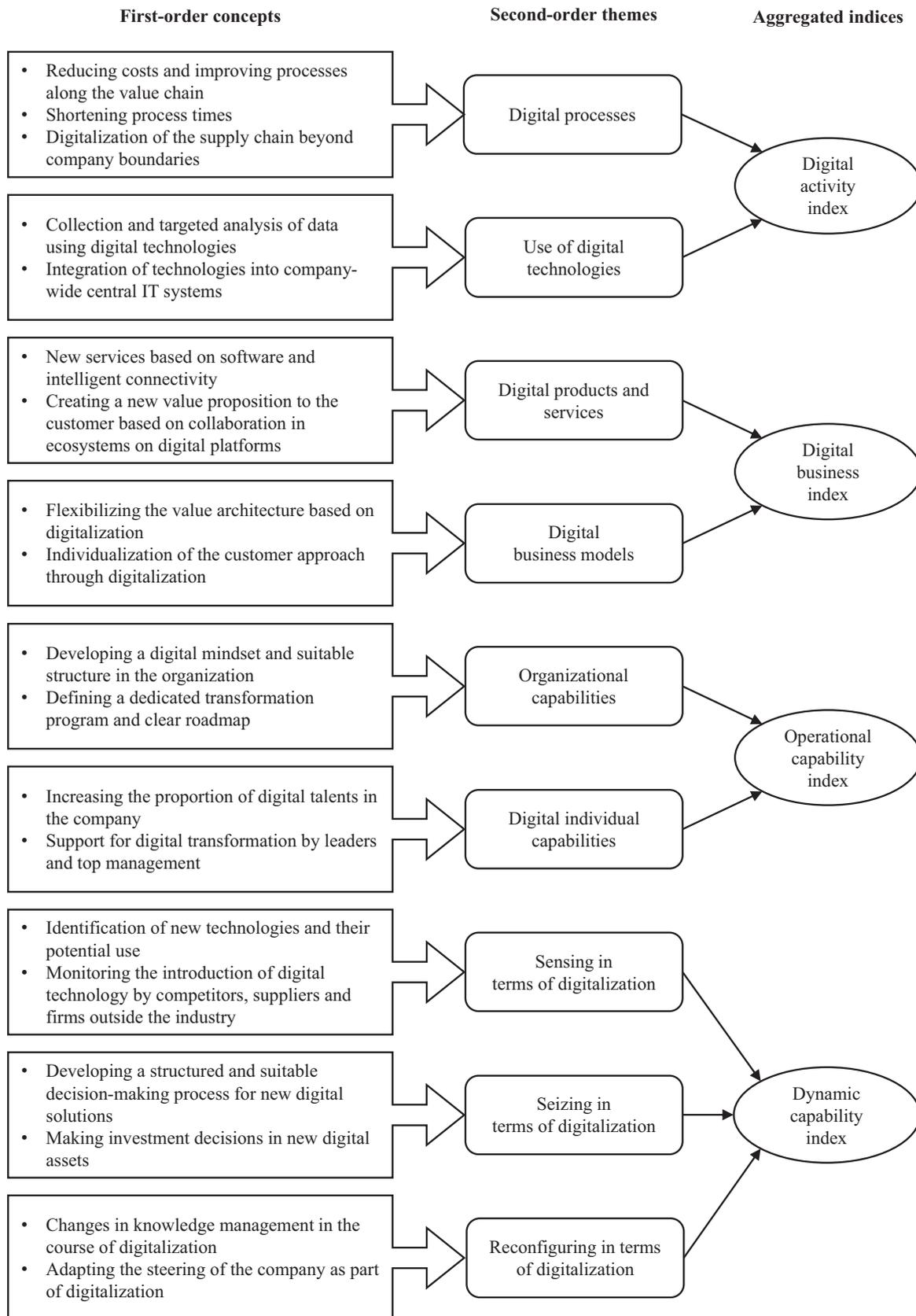


Fig. 2. Data structure.

**Table 4**  
Descriptive statistics of the surveyed items.

Item	Mean	SD
A1	4.254	1.545
A2	4.360	1.689
A3	4.347	1.607
A4	4.337	1.609
A5	4.300	1.677
A6	5.164	1.454
A7	5.113	1.478
A8	5.028	1.484
A9	5.290	1.375
A10	3.698	1.277
A11	3.352	1.256
A12	3.700	1.267
A13	3.768	1.391
A14	3.773	1.293
A15	3.720	1.305
A16	3.758	1.270
B1	5.431	1.289
B2	5.184	1.534
B3	5.109	1.474
B4	5.139	1.474
B5	5.191	1.464
B6	5.088	1.510
B7	5.050	1.522
B8	5.078	1.333
B9	5.187	1.375
B10	5.013	1.425
C1	5.184	1.464
C2	5.315	1.394
C3	5.158	1.410
C4	5.222	1.465
C5	3.446	1.274
D1	4.949	1.433
D2	5.217	1.460
D3	5.085	1.462
D4	5.186	1.478
D5	4.985	1.453
D6	5.420	1.385
D7	5.177	1.429
D8	5.093	1.486
D9	5.028	1.461
D10	5.292	1.556

Notes: SD = Standard deviation; N = 603; scale from 1 to 7.

**Table 5**  
Indices of digital maturity.

Indices	Cronbach's alpha	Mean	SD
Digital activity index	0.895	4.248	0.899
Digital business index	0.928	5.147	1.124
Digital capability index	0.866	4.865	1.132
Operational capability index	0.939	5.143	1.172
Digital maturity index	-	4.851	1.001

Notes: SD = Standard deviation; N = 603.

that there are country-specific differences in terms of the digital maturity of the surveyed companies. Of the three countries considered, the companies headquartered in Germany have the highest digital maturity with an average value of 5.040. The average digital maturity index of the companies with headquarter in Japan is 4.900, compared to only 4.610 in the USA.

5.2. Hypotheses testing

To test the hypotheses, the influence of Hofstede's scores for the dimensions on the digital maturity index of the companies was analyzed by applying multiple regression in the form of an OLS estimation. As there are high intercorrelations between Hofstede's cultural dimensions (Hofstede et al., 2010), the six dimensions were each tested separately in six models together with the control variables as dependent variables, as

is usual for cross-cultural research with this methodology (cf. Geletkanycz, 1997). The results of the OLS estimation are presented in Table 6.

Starting with the control variables, the results confirm the positive influence of both variables. In all six multiple regression models, the company size in the form of the number of employees is significant at a 1 % level, while the duration with which the digital transformation has already been implemented in the company is even significant at a 0.1 % level.

Continuing with the test of hypotheses, the multiple regression models reveal that PDI and MAS have no significant influence on digital maturity. Although the calculated directions of effect of these dimensions correspond to the expected directions of effect in the hypotheses, the standardized regression coefficients, especially for PDI with  $\beta = -0.005$ , but also for MAS with  $\beta = 0.070$ , are too low. Hypothesis 1 and hypothesis 3 must therefore be rejected.

However, the four other cultural dimensions show a stronger effect on digital maturity. IDV with a coefficient of  $\beta = -0.150$  as well as IVR with a coefficient of  $\beta = -0.173$  show a significant negative influence (both  $p$ -values  $<0.001$ ) on digital maturity and thus prove the effect derived from the literature. Accordingly, hypothesis 2 and hypothesis 6 can be accepted. Finally, UAI and LTO both have a significant positive influence on digital maturity. Model 4 and model 5 result in coefficients of  $\beta = 0.128$  ( $p$ -value  $<0.01$ ) for UAI and a coefficient of  $\beta = 0.197$  ( $p$ -value  $<0.001$ ) for LTO, thereby also confirming hypothesis 4 and hypothesis 5.

6. Discussion and implications

6.1. Discussion

The findings of the study demonstrate that national culture has a significant impact on digital maturity. However, only four of the six hypotheses along the cultural dimensions can be confirmed. Although various indications from the literature suggested a negative effect of PDI on the degree of digitalization of companies, no significant impact of this dimension can be revealed on the basis of the statistical analysis. In line with the argumentation of Kirkman et al. (2009) on the influence of the PDI, this result might be explained by the fact that in times of transformation, employees partly expect and need clear instructions and solutions along the hierarchy. In this context, such employees are often more likely to accept solutions from leaders and not from colleagues at the same hierarchical level. Accordingly, for this type of employee, an appropriate environment with a high PDI and clear instructions can be advantageous in terms of digital transformation. Besides, radical strategic actions initiated by managers or leaders as a result of digitalization are much more likely to be implemented without resistance or questioning in cultures with a high PDI (Crossland & Hambrick, 2011). Because even if these radical changes contradict their own preferences or mean personal sacrifice, employees in cultures with a high PDI want to prove themselves to their superiors and follow instructions (Jiang et al., 2022), counteracting the presented arguments that see a high PDI as a barrier to digital maturity.

As part of hypothesis 3, the results of the study provide a positive correlation coefficient, which, however, is not significant and therefore does not significantly prove the expected positive effect of MAS on digital maturity. This could be due to the fact that the values assigned to the female side can also be partly conducive in this respect, with their emphasis on human relationships helping to create a favorable trust-based and conflict-free climate for the implementation of digital technologies (Rubino et al., 2020). The impacts of masculine and feminine values therefore seem to neutralize each other with regard to digital maturity. This is in line with the results of previous studies on the influence of culture on change processes in companies, concluding "that values attributed to gender fail to substantively contribute" (Geletkanycz, 1997).

Although four of the six dimensions have a statistically significant

**Table 6**  
Multiple regression results: Standardized beta coefficients (standard error).

Variable	Digital maturity index					
	Model 1 (R <sup>2</sup> = 0.042)	Model 2 (R <sup>2</sup> = 0.064)	Model 3 (R <sup>2</sup> = 0.047)	Model 4 (R <sup>2</sup> = 0.059)	Model 5 (R <sup>2</sup> = 0.076)	Model 6 (R <sup>2</sup> = 0.083)
Firm size	0.110** (0.013)	0.105** (0.013)	0.107** (0.013)	0.105** (0.013)	0.107** (0.013)	0.108** (0.013)
Duration	0.152*** (0.016)	0.174*** (0.016)	0.160*** (0.016)	0.170*** (0.016)	0.183*** (0.016)	0.184*** (0.016)
PDI	-0.005 (0.005)					
IDV		-0.150*** (0.002)				
MAS			0.070 (0.003)			
UAI				0.128** (0.002)		
LTO					0.197*** (0.003)	
IVR						-0.204*** (0.003)

Notes: \* $p < 0,05$ ; \*\* $p < 0,01$ ; \*\*\* $p < 0,001$ ;  $N = 603$ .

impact, the relatively small R<sup>2</sup> values in the regression models show that only a small proportion of the variance in digital maturity can be explained by national culture. However, this is not surprising, as digital maturity is dependent on several other factors (Balakrishnan & Das, 2020; Yang et al., 2024).

## 6.2. Theoretical implications

The findings contribute to research that focuses on drivers and influences in the context of digital transformation. In doing so, they expand the findings of research on culture, which have so far been predominantly limited to organizational culture (Hanelt et al., 2021; Vial, 2019). The study therefore sheds more light on the impact of the layer of national culture in this respect.

It has been shown that digitalization in companies is bound up with national culture, which, according to the available results, exerts significant influences on their digital maturity apart from the PDI and MAS dimensions. By demonstrating in this context, for example, a low IDV and a high UAI as drivers of digital maturity, the study complements and refutes other cross-cultural studies, such as the work of Erumban and de Jong (2006) and Rubino et al. (2020), which assume and partially prove reverse effects in these two dimensions on the adoption of technologies. Moreover, the results on the positive impact of collectivism underline that intercultural differences between countries should not only be seen as a disadvantage, but as an opportunity by taking “cultural attractiveness” into account in firms’ international strategies. Following Li et al. (2017), it is possible this way to improve global collaboration by considering which cultural values complement one’s own values in the pursuit of digital maturity or which cultures the employees of one’s own company enjoy working with. In this sense, the study by Boone et al. (2019), for example, was further able to prove the positive effect of national diversity in the top management teams of companies.

Finally, this study contributes to research as it considers multiple dimensions of digital transformation in addition to the dimensions of national culture (Plekhanov et al., 2023), by holistically capturing the response of companies in terms of their digital maturity (Kane et al., 2017; Leso et al., 2024). Accordingly, the results imply that national culture influences factors of organizational capabilities that are relevant for digital transformation. In this context, previous studies such as those by Eisend et al. (2016) or Knein et al. (2020) have already been able to demonstrate a moderating effect of national culture on the impact of organizational culture on third variables, which would also be conceivable in the case of digital maturity. Besides, the holistic view of digital maturity in this study provides a tool for better understanding and tackling the emergence of the digitalization paradox often discussed

in research (Gebauer et al., 2020). This arises when companies do not achieve the expected results from their investments in digital technologies and therefore “struggle with capturing value from digitalization” (Kohtamäki et al., 2020).

## 6.3. Managerial implications

Companies can benefit from the approach presented as a tool for monitoring and measuring their digitalization activities. The results on the digital maturity index and the sub-indices show that, on average, the companies surveyed are already advanced with the digital transformation and have a medium to middle-high level of digital maturity, though they are neither fully exploiting the opportunities of digitalization nor possessing complete strategic readiness (Holopainen et al., 2022). They must therefore continue to tackle digital transformation in all its facets and, in addition to the use of technologies, build up the necessary capabilities in their organizations and among their workforces. The responses from the companies surveyed showed that the digitalization of their activities is still the least advanced part of their digital maturity. Companies should therefore examine the extent to which improvements can still be made at this point, both within the company and beyond its boundaries. The suitable implementation of Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) systems can be an important step towards optimizing processes in this regard. This is demonstrated, for example, by Hendricks et al. (2007), whose study shows that investments in such systems in most cases lead to increased profitability in companies.

Moreover, companies should also consider the findings on the influence of the various cultural dimensions. While the layer of national culture is virtually unchangeable (Taras et al., 2023), companies should try to transfer the conducive cultural values that can be derived from the dimensions of national culture into the organizational culture. Accordingly, companies should, for example, align their organizational structure in a collectivist manner in order to optimize processes, their business and the resource base in the context of digitalization. For this purpose, companies could, among other things, encourage teamwork and trust within the organization (Eisend et al., 2016). Since the results do not confirm PDI as an inhibitor, companies should also consider having their digital transformation more strongly guided by leaders (Schiuma et al., 2024; Volberda et al., 2021), especially in countries with high PDI, where clear instructions are expected from employees at lower hierarchical levels (Kirkman et al., 2009). To this end, companies could introduce new positions such as Chief Digital Officers (Singh et al., 2020). These recommendations are also founded on the study by Schaubroeck et al. (2007), in which organizations with a higher PDI as

well as higher collectivism benefited more from such transformational leadership and demonstrated higher team performance.

Finally, Hofstede's scores provide managers with guidance that applies not only to the three countries examined in this study. On this basis, multinational companies should take the various cultural influences into account in terms of their global transformation programs, including with regard to their globally distributed locations and subsidiaries. For example, multinational companies should target nations with supportive prevailing cultural values for the location of their IT headquarters and digital transformation offices. Managers should take these and further aspects to heart and thereby strive for a "strategic design of culture for digital transformation" (Butt et al., 2024).

## 7. Conclusions and future research

The study reveals important findings in relation to the cultural bond of digital maturity, however, it is not exempt from limitations. While the data on digital maturity was collected from a sufficiently large number of companies, these companies were only headquartered in three highly industrialized countries. Although Engelen and Brettel (2011) show in their content analysis of 99 cross-cultural studies that 65 % of these articles even only consider two countries, the quality of the results could be improved by including additional national cultures in future research. This also encompasses consideration of emerging and developing countries for which the findings of this study cannot be generalized. Indeed, strong deviations in macroeconomic factors lead to different conditions for the digital transformation of companies (Bodrožić & Adler, 2022). For example, outside of industrialized countries, capital and highly skilled labor are generally less available, creating barriers to investing in digital technologies or building the necessary operational capabilities.

In this context, limitations arise from the fact that the results on the influence of national culture might be affected by other country-level effects such as the macroeconomic conditions mentioned above, even within the research sample focused on high-income nations. Future research could validate the results of this study by applying statistical methods of hierarchical linear modeling or multilevel analysis (Peterson et al., 2012), which can be used to partially rule out distorting effects at country-level. Multilevel analysis provides a useful methodology when the underlying variables and data have a nested hierarchical structure (Hitt et al., 2007), for example, with country-level and firm-level variables. Although Tung and Stahl (2018) also recommend multilevel analyses in principle, they primarily point to the need "to explore other national differentiators" in addition to national culture. This appeal is underlined by the low  $R^2$  values in the regression models of this study, which illustrate that alongside to national culture, various other potential factors such as the technological infrastructure or institutional environments must be taken into account in order to fully explain the degree of digital maturity in companies.

Despite their widespread use, Hofstede's cultural dimensions are further subject to criticism, such as for aggregating data from individuals to the higher country-level and neglecting intranational cultural differences (Beugelsdijk et al., 2017). In this context, the quality of the results is limited by the fact that the study does not take into account cultural diversity within countries, nor interrelationships between various cultural dimensions (Richter et al., 2016). Future research should therefore validate the results of this study by means of investigations based on alternative cultural dimensions, for example, according to Schwartz (2008) or the GLOBE study (House et al., 2004).

A further important aspect for future research relates to the need for a dynamic view of national culture, digital maturity and their interactions, as this study was conducted at one point in time. Although national culture is considered relatively stable (Taras et al., 2023), it is not entirely devoid of dynamics, especially as recent geopolitical and societal shifts have led to an increased rate of cultural change (Tung & Stahl, 2018). However, the dynamic is much stronger on the

digitalization side. Since digital technologies are constantly evolving, the requirements for perfect digital maturity are also continuously shifting (Nasiri et al., 2022). In particular, the rapid technological advances in the field of AI are currently creating entirely new possibilities that did not exist a few years ago (Helfat et al., 2023; Raisch & Krakowski, 2021; Sjödin et al., 2023). Accordingly, "digital maturity is a relative and subjective construct that either improves or worsens over time" (Mettler & Pinto, 2018). Digital transformation, which is already defined as a dynamic process, therefore requires different capabilities in companies at different times during this process (Konopik et al., 2022; Schilke et al., 2018; Yeow et al., 2018). Longitudinal studies could contribute to a better understanding of the temporal development of digital maturity, its requirements and the role of culture as an influencing factor in this respect.

In addition to the potential that arises over time, the dangers and side effects of digitalization for companies need to be noted and should not be underestimated (Lanzolla et al., 2020; Verbeke & Hutzschenreuter, 2021). For example, enormous productivity losses result from frequent interruptions due to "digital distraction" (Jarrahi et al., 2023), the erosion of competencies is accelerating in the digital age (Meyer et al., 2023) and great risks of being hacked exist if cybersecurity is inadequate (Ribeiro-Navarrete et al., 2021). These side effects can ultimately lead to companies not achieving the expected economic success through their digital transformation (Kohtamäki et al., 2020). Apart from economic performance, companies should also pay attention to adverse effects such as electronic waste and increased energy consumption in terms of their ecological and social performance in order to increase their sustainability through digital technologies (Valero-Gil et al., 2024; Ye et al., 2024).

Finally, although the study has contributed to a better understanding of the influence of national culture on digitalization in firms, it does not yet provide any insights into the extent to which there is a reverse effect of these variables in the long term. The question of whether the effect of culture on digitalization or whether the effect of digitalization on culture prevails has long been the subject of research in this regard (Kane et al., 2015). However, this is important to clarify, as digital technologies have simultaneous impacts on the growth of cultural divergence and convergence (Leung et al., 2005). Considering that culture as a multi-layer construct has several levels with diverse interactions between them (Chen & Lin, 2021), research has already identified new cultural layers as a result of digital technologies and included, for example, "platform culture" in its discussions (Alt, 2022). Thus, research needs to further address the impact of digitalization and the associated globalization on culture, but also "the interplay of organizational and national culture" (Knein et al., 2020). This is important to provide even sharper insights for digital transformation in the future.

## CRedit authorship contribution statement

**Christian Festing:** Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization, Writing – review & editing. **Heike Proff:** Data curation, Conceptualization, Supervision.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The authors do not have permission to share data.

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