



Digitalization and entrepreneurial firms' resilience to pandemic crises: Evidence from COVID-19 and the German Mittelstand

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ABSTRACT

While stressing the relevance of context, the organizational resilience literature has so far not extensively examined resilience in times of healthcare crises such as the ongoing COVID-19 pandemic. The Parasite Stress Theory of Values suggests that such pandemic crises have detrimental impacts on entrepreneurial activity due to social distancing and its effects on interaction, collaboration, and innovation. However, alternatives to personal contact now available thanks to digitalization, have not yet been examined. We expect entrepreneurial firms with more digitalized business models to show higher resilience to pandemic crises, especially those highly affected by globalization and more for non-family businesses than for family businesses. Based on a survey of German Mittelstand firms in the midst of the crisis induced by COVID-19, our findings broadly support our expectations and thus help qualify the Parasite Stress Theory of Values and contribute to a better understanding of organizational resilience in times of pandemic crises.

1. Introduction

The 20th century and early 21st century have seen an increasing number of crises due to diseases such as Spanish flu, AIDS, SARS, Avian flu, and – most recently – the coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Kraus et al., 2020). These diseases have impacted thousands or even millions of individuals, and have had serious short- and long-term consequences for the economy as a whole and for individual businesses (Donthu and Gustafsson, 2020; García-Carbonell et al., 2021; Mitze and Makkonen, 2022). Since it cannot be ruled out that additional pandemic crises will further affect businesses, it seems relevant to investigate what makes businesses more resilient against such crises.

While research on organizational resilience has grown significantly in recent years (Duchek, 2020; Hillmann, 2021; Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017), this literature still features some important gaps. For instance, Linnenluecke (2017, p. 15) concludes that existing resilience research is highly context-dependent. That is, such research has typically focused on organizations' resilience in specific cultural and sector contexts or in response to exogenous events such as economic crises, disasters and terrorist attacks (Linnenluecke, 2017; Williams et al., 2017). In addition, Linnenluecke (2017)

mentions that “a prominent approach for assessing resilience has been case-based research”. Thus, while insights from the existing literature can be relevant to the specific types of accidents and disasters or similar events, they may not generalize to other kinds of external shocks (Linnenluecke, 2017) such as pandemic crises. Interestingly, in the review papers on organizational resilience by Hillmann and Guenther (2021), Linnenluecke (2017) and Williams et al. (2017), the context of pandemic crises, or healthcare crises more generally, is not mentioned. Hence, we lack a thorough understanding of what makes firms resilient to pandemic crises, which have increased in frequency over the past century (Kraus et al., 2020). Recently, studies have analyzed resilience to pandemic crises in the case of COVID-19, some of which point to digitalization before the crisis as a driver of such resilience (e.g., Beninger and Francis, 2022; Fath et al., 2021). However, these works also rely on qualitative data (Fath et al., 2021) or remain at the conceptual level (Beninger and Francis, 2022). Thus, what a-priori factors make larger populations of firms resilient to pandemic crises remains an open question.

A theory to address this gap and which we draw on in this study is the Parasite Stress Theory of Values (e.g., Thornhill and Fincher, 2014). Generally, this theory assumes that the physiological and psychological immune systems can be mobilized to fight infectious diseases. Earlier

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research on business and human behavior (e.g., Bennett and Nikolaev, 2020; Faulkner et al., 2004; Navarrete and Fessler, 2006; Nørfelt et al., 2020; Park et al., 2007) has mainly added to our understanding of the psychological immune system and our paper follows this tradition. For instance, by drawing on the psychological immune system of the Parasite Stress Theory of Values and focusing on the effects of the Spanish flu, Bennett and Nikolaev (2020) recently found that countries with high historical exposure to pandemic diseases show lower innovativeness today. The Parasite Stress Theory of Values suggests that this observation is due to the phenomenon that in regions with a high disease prevalence, people tend to activate the psychological immune system and thus minimize the risk of contracting diseases by avoiding interactions with other people. In turn, this avoidance of social contact results in less “mutually beneficial economic and social interactions, thus hindering the division of labor, specialization, and gains from trade possible in broader markets” (Bennett and Nikolaev, 2020, p. 2) and in turn limits innovativeness. Adding to this line of thought by investigating the effects of Spanish flu, Rao and Greve (2018) found that pandemic crises lead to less organization building. Likewise, Nørfelt et al. (2020) argue that an openness to foreigners has historically created opportunities for social exchange and gains in technology, shelter and food resources – all of which are endangered in times of pandemic crises when the psychological immune system is activated.

While these dynamics have been at play in historical pandemic crises such as the Spanish flu in the early 20th century, recent business trends may now provide a different environment for entrepreneurs. In particular, digitalization – the “manifold sociotechnical phenomena and processes of adopting and using” digital technologies “in broader individual, organizational, and societal contexts” (Legner et al., 2017, p. 301) – may be seen as a game changer (cf. Dąbrowska et al., 2022; Eller et al., 2020). As indicated by Bennett and Nikolaev (2020), one strategy for curtailing the spread of contagious diseases is avoiding interactions among people. This strategy has been adopted in the COVID-19 crisis under the label of “social distancing”: according to Ferguson et al. (2020), isolation at home, voluntary quarantine, social distancing by at-risk groups, general social distancing, and lockdown including of governmental and entrepreneurial facilities are the five most important non-pharmaceutical interventions to fight the spread of the SARS-CoV-2 virus.

While these social distancing measures hampered business activity during the Spanish flu pandemic (Bennett and Nikolaev, 2020), higher levels of digitalization may have reduced this harmful effect of social distancing on individual businesses during the COVID-19 crisis. Put differently, we could expect that entrepreneurial firms that had a higher

level of digitalization before the COVID-19 crisis show a higher level of resilience to the crisis. As not all firms may benefit from digitalization in the same way (e.g., Dąbrowska et al., 2022; Eller et al., 2020) and organizational resilience is generally found to be context-bound (Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017), we additionally examine whether this general digitalization–crisis resilience relationship is moderated by the respective firms' level of globalization, family firm status, firm size, industry affiliation, strategy, and past performance (see Fig. 1 for a summary of these expectations). To recap, in this paper, we want to answer the following two research questions that have so far remained unanswered:

- 1) Do higher levels of digitalization increase entrepreneurial firms' resilience to pandemic crises?
- 2) How do context characteristics (firms' level of globalization, family firm status, firm size, industry affiliation, strategy, past performance, transformational leadership style, and embedding in subnational regions) impact the digitalization–crisis resilience relationship?

By addressing these questions, we contribute to the organizational resilience literature (Duchek, 2020; Hillmann, 2021; Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017) by being among the first to identify the conditions under which digitalization can make firms resilient to pandemic crises. Moreover, our study adds to the development of the Parasite Stress Theory of Values (Bennett and Nikolaev, 2020; Thornhill and Fincher, 2014) by introducing the notion that measures that can maintain business contacts despite social distancing in times of pandemic crisis (e.g., digital technologies) can help mitigate the detrimental economic impact of such crises, at least in certain contexts (e.g., high levels of globalization and non-family ownership).

The remainder of this paper is organized as follows. The next section positions our research in the existing literature and develops seven hypotheses. Section 3 then describes our methods, the main characteristics of the sampled firms and respondents, and the procedures used to ensure valid data. Section 4 presents our results. Section 5 concludes with a discussion of our findings, their implications, and their main limitations.

2. Literature review, theory, and hypotheses

2.1. Organizational resilience

The organizational resilience literature is rooted in several disciplines (e.g., psychology, ecology, management, organizational studies),

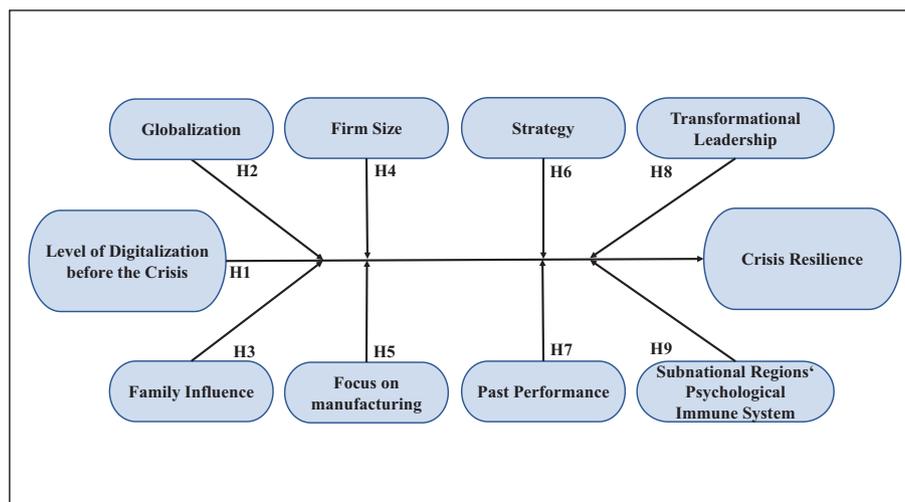


Fig. 1. Research model.

which may help explain why no uniform conceptualization or definition of resilience has emerged (Linnenluecke, 2017; Williams et al., 2017). However, some common threads within the resilience literature can be identified. For instance, much of the research on organizational resilience has focused on how well firms can respond to external threats or even shocks such as natural disasters, terrorist attacks, and financial crises (Hillmann, 2021; Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017). In this literature stream, there is some agreement that such resilience needs to be defined in light of the specific context being analyzed (Hillmann and Guenther, 2021; Parker and Ameen, 2018; Shin and Park, 2021; Linkov et al., 2014).

The context we examine, namely, a pandemic crisis or, more broadly, a healthcare crisis, has so far been overlooked in the organizational resilience literature, as reflected in three recent and well-cited reviews of the topic (Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017). Nevertheless, pandemic crises can be regarded as “inconceivable, unscheduled, and unexpected” (Williams et al., 2017, p. 735) and thus fit the definition of Williams et al. (2017) as a crisis triggered by a specific event. In our empirical setting, this event is the outbreak and worldwide spread of COVID-19. As argued by Hillmann and Guenther (2021, p. 24), in such an event-triggered crisis, organizational resilience is mainly geared toward stability and can be defined as an organization’s ability to “endure or bear the impacts of change or a disruptive event” and to “keep the organization functioning”. Given our research objectives in Section 1, we concentrate on one capability at the organizational level (i.e., digitalization) that was put in place *before* the event-triggered crisis. That is, for the purpose of our study, we view digitalization before the COVID-19 pandemic as a preparation capability that later became “necessary in times of crisis”, even though the respective organizations may have been prepared “without knowing, if, when, or where” this preparation capability would become relevant in the context of the event-triggered crisis studied in this paper (Duchek, 2020, p. 226; see also Giones et al., 2020).

With this focus on digitalization before the crisis as a preparation capability, we aim to complement earlier research that has examined entrepreneurial firms’ responses to the pandemic crisis caused by COVID-19 (e.g., Bartik et al., 2020; DeJardin et al., 2022; Emami et al., 2021; Giotopoulos et al., 2022; Hadjielias et al., 2022; Hammerschmidt et al., 2021; Kraus et al., 2020; Khurana et al., 2022; Kusa et al., 2022; Schwaiger et al., 2022; Soluk, 2022; Soluk et al., 2021; Wendt et al., 2021; Xie et al., 2022), and thus into coping and adaption forms of organizational resilience (Duchek, 2020). In general, these earlier findings highlighted the significant variance among entrepreneurial firms’ responses to the COVID-19 pandemic crisis (e.g., Hadjielias et al., 2022; Sharma et al., 2022), including their reliance on digital technologies (Giotopoulos et al., 2022; Khurana et al., 2022; Soluk, 2022; Soluk et al., 2021; Wendt et al., 2021). At the same time, these studies highlighted several factors that could have influenced how such firms responded (for a review, see Sharma et al., 2022), including their status as family firms (e.g., Hadjielias et al., 2022; Kraus et al., 2020; Soluk et al., 2021), industry affiliation (Bartik et al., 2020; Giotopoulos et al., 2022), organizational size (Bartik et al., 2020; Kraus et al., 2020; Wendt et al., 2021), involvement in global commerce and supply chains (Wendt et al., 2021), the commandment of dynamic capabilities (DeJardin et al., 2022) and resource allocation skills (Soluk, 2022), the individual entrepreneurial orientation and management style of the firm owners (Emami et al., 2021; Khurana et al., 2022; Kusa et al., 2022), financial resources built on their past financial performance (Bartik et al., 2020), their regional embedding (Hammerschmidt et al., 2021; Wendt et al., 2021), an innovation-friendly culture (Giotopoulos et al., 2022) and inclusion in business networks (Khurana et al., 2022; Xie et al., 2022). While these factors need not function in the same way for preparation forms of organizational resilience as for coping and adaption forms (Duchek, 2020), we build on such prior work and examine these contextual characteristics as potential moderators of the general digitalization–resilience relationship.

Like other event-triggered crises, pandemic crises can come with enormous economic and social costs such as lower productivity, firm closures, and unemployment (Bertschek et al., 2019; Frick, 2019; Landini et al., 2020; Rapaccini et al., 2020; Hammerschmidt et al., 2021). These effects are not only short-term, but may instead have long-term consequences. As indicated above and motivated by the Parasite Stress Theory of Values, Bennett and Nikolaev (2020) showed that countries with high personal and economic exposure to the Spanish flu in the early 20th century are less innovative today. Given this theory’s focus on developing resilience against infectious diseases (Thornhill and Fincher, 2014), it fits our pandemic crisis-context well and we detail the theory’s main tenets next.

2.2. Parasite stress theory of values

According to the Parasite Stress Theory of Values, two main strategies can be deployed to overcome times of infectious diseases and thus develop resilience: (1) adapting the physiological immune system and (2) adapting the psychological (e.g., behavioral) immune system (Schaller, 2011). In this paper, as in other business-related research on this theory (e.g., Bennett and Nikolaev, 2020; Mortensen et al., 2010), we draw on the second strategy – adapting the psychological immune system, which can be described as “a complex suite of cognitive, affective, and behavioral mechanisms that ultimately help prevent pathogen transmission in the face of recurrent infectious disease threats” (Ackerman et al., 2018, p. 2).

The theory predicts that if the parasite stress increases, social groups will adopt their psychological immune system and will become more resilient toward infectious diseases (Thornhill and Fincher, 2014). For instance, the psychological immune system can lead to higher conformity to cultural norms and more social conservatism (Ackerman et al., 2018; Fincher and Thornhill, 2008; Faulkner et al., 2004). Also, the psychological immune system can be reflected in stereotyping, such as aversion toward outgroup members, especially those associated with the pandemic disease, and lead to phenomena such as xenophobia, neophobia, philopatry, and ethnocentrism (Nørfelt et al., 2020; Thornhill and Fincher, 2014). A series of experimental studies has generally confirmed this mechanism of the psychological immune system as predicted by the Parasite Stress Theory of Values (e.g., Faulkner et al., 2004; Navarrete and Fessler, 2006; Park et al., 2007).

At the same time, the theory starts from the assumption that the institutions and values vary between social groups, which is why Thornhill and Fincher (2014) expect to see differences in the psychological immune system between social groups such as continents and countries. In particular, as part of this psychological immune system, the theory suggests that in regions with a high disease prevalence, people tend to minimize the risk of contracting by avoiding interactions with other people. Consequently, people in a closed group, who are confronted with the risk of infection by a disease, tend to be less open to new experiences as well as to economic and social interactions with people in other groups; hence, they are more introverted (Mortensen et al., 2010). Such behavior has been documented not only for Spanish flu (Bennett and Nikolaev, 2020; Rao and Greve, 2018), but also for other infectious diseases such as the plague in medieval Europe (e.g., Linkov et al., 2014; Perciaccante et al., 2021). While not explicitly referring to the Parasite Stress Theory of Values, Linkov et al. (2014) present a case study of how the medieval state of Venice tried to keep the plague off the main islands by stopping incoming ships already at the outer islands and separating their passengers from Venice’s main population until the health of the passengers had been evaluated. While such measures were meant to save the people in a closed social group (e.g., the citizens of medieval Venice) from infection, lowered levels of interactions with other social groups may also jeopardize several of the benefits of cross-cultural interaction such as sharing knowledge, technology or warfare strategies (Nørfelt et al., 2020).

In line with the latter notion, Bennett and Nikolaev (2020) have

investigated the long-term effects of the Spanish flu and found that lower degrees of interaction have historically hindered the division of labor and trade more generally, which in turn may have resulted in lower innovativeness. By contrast, in regions less severely hit by the Spanish flu, [Bennett and Nikolaev \(2020\)](#) found higher levels of innovativeness today. The Parasite Stress Theory of Values suggests that this finding can be explained by the fact that people in less-hit regions can continue to be more open to interact with other people and engage in economic collaboration. Such less hit regions can thus continue to benefit from learning from other and foreign people ([Norfelt et al., 2020](#)). [Rao and Greve \(2018\)](#) add to the detrimental effect on collaborative business activity found by [Bennett and Nikolaev \(2020\)](#) by showing that this effect is more pronounced for disasters that can be attributed to human behavior such as pandemic crises than natural disasters (e.g., caused by weather shocks). [Rao and Greve \(2018\)](#) theorize that this stronger detrimental economic effect of human-made crises such as pandemics is due to the less pronounced feeling of shared fate and need for cooperation than in situations of natural disasters.

Existing research has mostly applied the Parasite Stress Theory of Values at the continent or country level. That is, psychological immune system differences and their effects have been found for comparisons between continents and countries (e.g., [Bennett and Nikolaev, 2020](#); [Thornhill and Fincher, 2014](#)). For this reason, [Bennett and Nikolaev \(2020\)](#) called for further studies of the applicability of the theory not only between countries, but also within countries and thus between subnational regions. Below, we take such reasoning into account, but aim to drill down even further to social groups. As indicated above, we theorize that we may not only see differences between continents, countries and subnational regions when it comes to social groups' psychological immune system. By contrast, we adopt the notion that individual organizations such as entrepreneurial firms can also be viewed as social groups characterized by their idiosyncratic institutions and values (e.g., [Logue et al., 2015](#); [Lounsbury, 2007, 2008](#)). With the following hypotheses, we thus aim to test the applicability of the Parasite Stress Theory of Values for organization-level studies for the specific case of digitalization.

2.3. Digitalization and resilience against pandemic crises

As just discussed, for the Spanish flu, the predictions of the Parasite Stress Theory of Values, especially those of the adaptations of the psychological immune system, seem to hold – at least for between-country comparisons. Existing work on this theory assumes that physical distancing automatically leads to fewer interactions and detrimental long-term economic effects (e.g., [Bennett and Nikolaev, 2020](#); [Thornhill and Fincher, 2014](#)). However, recent economic and technological trends may have created an environment that has spawned different psychological dynamics than those in the early 20th century when the Spanish flu crisis occurred. In particular, the growing digitalization of and interactions among businesses may now provide a vehicle to maintain contacts despite measures of physical social distancing ([Mäntymäki et al., 2022](#)), including business contacts with key external stakeholders such as suppliers and customers ([Qader et al., 2022](#)). Hence, in our contemporary COVID-19 setting and different to the situation during the Spanish flu, the psychological immune system of many individuals and entrepreneurs seems to understand that staying in contact via digital technologies is safe if personal contact and thus the risk of infection are minimized. In this way, as shown by [Mäntymäki et al. \(2022\)](#), higher levels of digitalization can be an effective way to deal with psychological life stressors. For instance, entrepreneurs can stay in contact with their stakeholders despite social distancing measures and thus avoid the additional stressor of fearing business failure.

At the same time, when a pandemic crisis unfolds, digital alternatives to personal communication and business transactions may not immediately be available. That is, like with other kinds of infrastructures, digital infrastructures also need time to build, test, and implement

([Bullini Orlandi et al., 2021](#); [Giotopoulos et al., 2022](#); [Urbinati et al., 2020](#)). Consequently, we expect that businesses that had already built digital infrastructures to a higher degree before a pandemic crisis are better equipped to cope with that crisis. In short, such firms should be more resilient ([Linnenluecke, 2017](#)). Hence, we view digitalization before the crises as a preparation capability ([Duchek, 2020](#); [Giones et al., 2020](#)) to develop resilience to pandemic crises and expect that firms with higher levels of digitalization before a pandemic crisis should be more resilient in the face of such a crisis ([Pedersen et al., 2020](#); [Rapaccini et al., 2020](#); [Belhadi et al., 2021](#)). Consequently, we hypothesize:

Hypothesis 1. (H1). Entrepreneurial firms that had become more digitalized before a pandemic crisis are more resilient to the effects of that crisis.

2.4. Moderating effects

As indicated above and addressed in our second research question, the existing literature on organizational resilience ([Hillmann, 2021](#); [Hillmann and Guenther, 2021](#); [Linnenluecke, 2017](#); [Williams et al., 2017](#)) has highlighted that preparedness to crisis events and thus the development of organizational resilience seems highly context-dependent. Thus, we now turn to the important aspects of context that can be assumed to impact the general digitalization–resilience relationship proposed in H1.

Among these context factors is globalization. In particular, we expect the relationship between digitalization and resilience to pandemic crises to be more pronounced for globalized firms. Globalization can be understood as the increasing interdependence of and connectivity between national economies including suppliers, governments, and consumers in various countries ([Devezas, 2020](#); [Knight, 2000](#)). Entrepreneurial firms that are strongly affected by globalization usually have a supplier and customer base spread across several countries or even continents (e.g., [Belhadi et al., 2021](#); [Ekinci et al., 2022](#); [Hiebl and Pielsticker, 2022](#); [Laanti et al., 2007](#)). If social distancing measures are introduced in response to a pandemic crisis, then personal contacts between entrepreneurs and their international partners would be hit hard due to travel restrictions and outright travel bans ([Brem et al., 2021](#); [Nummela et al., 2020](#)). That is, close personal contacts between global parties may be more difficult to maintain without the extensive use of digital technologies. Consequently, for entrepreneurial firms with a global orientation, higher levels of digitalization before a pandemic crisis seem to be particularly relevant to provide higher resilience to the crisis. By contrast, less globalized entrepreneurial firms, which are mainly active at the local or regional level, may find it easier to maintain personal contacts without increased levels of digitalization. Their business contacts may be predominantly found in the same region or country and thus less affected by travel bans and closed borders. Hence, we hypothesize:

Hypothesis 2. (H2). The relationship described in H1 is more pronounced if the respective firm is more affected by globalization.

Also, the relationship between digitalization and resilience to pandemic crises as proposed in H1 can be expected to be more pronounced for non-family firms than for family firms. According to the literature, in the large group of entrepreneurial firms, family firms comprise an important subgroup that differs from non-family entrepreneurial firms in several ways (e.g. [Zahra et al., 2004](#)). For instance, family businesses are characterized by a built-in focus on resilience against crises, which helps them to survive crises and quickly regain their performance afterwards ([Amann and Jaussaud, 2012](#); [Calabrò et al., 2021](#)).

A prime reason for such resilience can be found in family businesses' usual long-term orientation ([Clauß et al., 2022](#); [Le Breton-Miller and Miller, 2022](#); [De Groote et al., 2022](#)). That is, many family firms tend to

strive for long-term business stability and, therefore, show higher levels of risk aversion (De Massis et al., 2015; Hiebl, 2013; Soluk, 2022; Soluk et al., 2021). For instance, such risk aversion is reflected in the finding that family firms are often reluctant to leave traditionally stable and attractive markets and are slow to react to disruptive technological change (De Groot et al., 2022). For instance, Ceipek et al. (2021) recently found that family firms are less open than non-family firms to exploratory innovation related to the Internet of Things. In addition, family firms' typical risk aversion is reflected in their lower levels of debt and higher levels of equity (e.g., González et al., 2013). While these different forms of risk aversion may hamper family business development in times of strong economic growth, they may also prevent family firms from severe economic downsides in times of crisis (Calabrò et al., 2021; Le Breton-Miller and Miller, 2022). A potential mechanism behind this relationship was recently highlighted by Leppäaho and Ritala (2022). Based on a single case study of a Finnish family business, these authors highlighted that family businesses may accumulate slack resources during economically calm periods, which they then use in times of crisis not only to ensure their survival, but also to potentially mobilize renewal and innovation endeavors when other firms such as non-family firms cannot afford to do so. Interestingly, Leppäaho and Ritala (2022, p. 6) referred to this behavior of retaining earnings and creating slack resources as providing “psychological and emotional safety” to the family business and controlling family. Relatedly, Calabrò et al. (2021, p. 5) referred to the psychological phenomenon that a controlling family's “conviction in its capability to find solutions and resources to cope with challenges as a group can be considered as a cornerstone of resilience”, highlighting another psychological source of the higher built-in resilience of family firms. That is, family businesses' long-term orientation, retained earnings during good or calm economic times and the controlling family's cohesion may enable them to ride out economically rough times such as those during a pandemic with less psychological stress.

However, if we assume that due to the just described behavior, family firms and their managers on average experience less stress during pandemic crises than their non-family counterparts, we can infer that the psychological benefits of higher levels of digitalization before a pandemic crisis are less valuable to family firms than to non-family firms. That is, non-family firms do not usually feature an equally strong and built-in long-term orientation and crisis resilience as that of family firms (Amann and Jaussaud, 2012). Therefore, they may not command the same level of slack resources and psychological resilience and generally be more vulnerable to crises. It can thus be expected that higher levels of digitalization are more important for non-family firms to develop resilience against pandemic crises. That is, the above-described notion that higher levels of digitalization before the crisis may work against entrepreneurial firms' psychological stressors should be more pronounced for non-family firms, as, on average, they cannot be expected to have an equally strong psychological safety net as family firms. Hence, we hypothesize:

Hypothesis 3. (H3). The relationship described in H1 is more pronounced for non-family businesses than for family businesses.

Besides, the relationship between digitalization and resilience to pandemic crises can be expected to be more pronounced for smaller entrepreneurial firms than for their larger counterparts. Compared with smaller firms, larger ones usually enjoy more and better access to resources (Spithoven et al., 2013) such as access to finance (Bartik et al., 2020; Cowling et al., 2015; Wendt et al., 2021). Due to this higher level of resources, larger entrepreneurial firms usually have a more stable basis when entering crises, which makes them more likely to be resilient to such crises. In contrast, for smaller entrepreneurial firms, crises such as pandemics can be expected to threaten their existence, as they usually do not have the resources to weather extended periods with fewer sales, lower earnings, and associated liquidity problems (Eggers, 2020). Consequently, we expect that for smaller firms, higher levels of

digitalization before the crises are even more important to develop resilience against a pandemic crisis than for larger firms. Hence, we hypothesize:

Hypothesis 4. (H4). The relationship described in H1 is more pronounced for smaller entrepreneurial firms than for larger entrepreneurial firms.

In addition, for firms that are mainly active in the manufacturing industry, it can be expected that the relationship between digitalization and resilience to pandemic crises is less pronounced. For other industries such as retail, lockdowns during the COVID-19 pandemic have made in-person retail business difficult or non-existent in many countries worldwide (Pantano et al., 2020). That is, for such non-manufacturing industries, higher levels of digitalization before a crisis – such as e-commerce in the case of retail firms – can be expected to be a more important driver of the resilience against pandemic crises as compared with manufacturing firms. In contrast, for manufacturing firms, even higher levels of digitalization might not significantly affect their resilience against pandemic crises. First, several parts of the manufacturing industry such as producers of medical ventilators, N95 masks, and hand sanitizers experienced increased demand during the COVID-19 pandemic (Brem et al., 2021) – irrespective of these businesses' level of digitalization. Second, due to social-distancing measures during pandemic crises and the current inability to apply remote work to shopfloor levels, other manufacturing firms tend to be either shut down completely or have their operations upheld thanks to protective measures (Cai and Luo, 2020). On both options, the level of digitalization can be expected to have little impact on their resilience against pandemic crises. Hence:

Hypothesis 5. (H5). The relationship described in H1 is less pronounced if the respective firm is primarily focused on manufacturing activities.

Also, it can be expected that the relationship between digitalization and resilience to pandemic crises is more pronounced for prospector firms and less pronounced for defender firms. The latter firms primarily occupy niches in markets where relatively stable ranges of products or services are offered. Such defender firms are usually not at the forefront of market developments related to new products or services and tend to ignore changes that have no immediate impact on current activity areas (Miles and Snow, 1978). In contrast, prospector firms usually make changes to products or services frequently, are generally more open to radical innovation, and are thus more used to translating such innovation into their operations than defender firms (e.g., Laforet, 2008). Given their higher familiarity in dealing with innovation such as digitalization, we expect that prospector firms are able to “make more out of higher levels of digitalization” in terms of developing resilience to pandemic crises in the short term. Hence:

Hypothesis 6. (H6). The relationship described in H1 is more pronounced for prospector firms and less pronounced for defender firms.

As discussed above, it needs significant resources to not only build digital infrastructures, but also put them in place. Not least, such resources could be available due to superior past performance, which is why past performance can be expected to moderate the relationship proposed in H1, too. That is, we expect the relationship between digitalization and resilience to pandemic crises to be more pronounced for firms with high levels of past performance. Such high-performing firms are likely to have retained some of their high recent earnings and thus created reserve funds that can be drawn upon in times of pandemic crisis. While we have theorized above that high levels of digitalization are per se a driver of such resilience (see H1), we assume that the impact of this driver can even be enhanced by quick and bold measures to draw on and extend digitalization endeavors already started before the crisis (Rapaccini et al., 2020). Such measures are likely to require the short-term availability of financial resources. Such resources are more likely

to be found in firms with recent outperformance and sufficient reserve funds than in firms which show recent underperformance (Pal et al., 2014). That is, we expect high-performing firms to be able to use their reserve funds to develop more quickly and effectively high levels of digitalization before a crisis into crises resilience than low-performing firms. Hence, we assume:

Hypothesis 7. (H7). The relationship described in H1 is more pronounced for firms with high levels of past performance than for firms with low levels of past performance.

Similar to the abundant resources created by past performance, apt leadership personnel can be expected to be crucial when trying to transfer higher levels of digitalization into resilience to a pandemic crisis. For many firms, a pandemic crisis represents a state of upheaval and transformation, which is why we examine transformational leadership (e.g., Bass, 1999; Bass and Riggio, 2006), which we expect to moderate the relationship proposed in H1. That is, we expect the relationship between digitalization and resilience to pandemic crises to be more pronounced for firms with high levels of transformational leadership. Prior research has found that building and introducing digital infrastructures is an important first step, but that making the most of these infrastructures is an equally important second step that relies heavily on apt managerial skills (Dong et al., 2009; Jafari-Sadeghi et al., 2023; Zangiacomì et al., 2020). During business transformations, it may be necessary to deal with continuously changing environments, especially during times of pandemic crises (Kusa et al., 2022; Li et al., 2022). To make the most of technological innovation such as new digital infrastructures, managers with a transformational leadership style may thus be specifically valuable (Birasnav, 2013; Zoltners et al., 2021). Managers who have such a transformational leadership style serve as a transformation role model to an organization's employees by having a charismatic personality and motivating and inspiring employees to give their best to make the transformation a success (Bass, 1999; Bass and Riggio, 2006; Farrukh et al., 2022; Gerards et al., 2021; Hiebl and Pielsticker, 2022). We thus suspect that if firms feature managers with such a transformational leadership style, such firms can better translate their high levels of digitalization before the crisis into higher levels of resilience to pandemic crises. Therefore:

Hypothesis 8. (H8). The relationship described in H1 is more pronounced for firms featuring high levels of transformational leadership than for firms featuring low levels of transformational leadership.

Finally, as suggested by Bennett and Nikolaev (2020), we anticipate that entrepreneurial firms' embedding in different subnational regions moderates the relationship proposed in H1. Just like for continents and countries (Thornhill and Fincher, 2014), the values and institutions of subnational regions may vary, as might their psychological immune system when facing an infectious disease (Bennett and Nikolaev, 2020). In particular, it can be expected that some subnational regions put in place more rigid measures than others. For instance, more rigid regions may be characterized by more rigidly restrictive opening hours as well as more social distancing and exit prohibition measures during pandemic crises (Behnke, 2021). By contrast, in subnational regions with a less rigid psychological immune system, organizations have more room for maneuver. We thus assume that in such regions with less rigid restrictions, the level of digitalization before the crisis has a stronger effect on organizational resilience than in regions in which firms have less discretion. Hence, we assume:

Hypothesis 9. (H9). The relationship described in H1 is more pronounced for firms located in subnational regions with less rigid psychological immune system reactions than for firms located in subnational regions with more rigid psychological immune system reactions.

3. Methods

3.1. Sampling, data, and tests for potential biases

3.1.1. Sampling procedures

To test our hypotheses, we conducted an online survey targeting German Mittelstand firms since they have been depicted as usually showing high levels of entrepreneurship (De Massis et al., 2018; Heider et al., 2021; Logue et al., 2015). Such high levels of entrepreneurship are often due to the need for German Mittelstand firms to innovate despite their scarce financial and human resources (De Massis et al., 2018; Weigel et al., 2022). This high level of innovation efficiency is usually found to be rooted in German Mittelstand firms' pronounced entrepreneurial mindset (Heider et al., 2021), which makes them a useful sample to study entrepreneurial firms. In line with De Massis et al. (2018), we follow the German Mittelstand definition of Becker et al. (2008) and define Mittelstand firms as those with a maximum of 3000 employees.

Most of the survey questions were based on established constructs from the English-language literature. We translated these questions into German – the language of our questionnaire. Our questionnaire was then retranslated into English by a fellow researcher who was not involved in the rest of the research process. This retranslated version allowed us to check potential translation errors by comparing the original English-language survey items with those in the retranslated version (cf. Brislin, 1970; Maneesriwongul and Dixon, 2004). In addition, we invited 10 pretesters (five academics, five practitioners) to provide feedback on the comprehensibility and flow of the questionnaire (cf. Hunt et al., 1982). Based on our language comparisons and the pretest feedback, we slightly amended the German-language questionnaire.

From the Amadeus database, we extracted a sample of 1118 Mittelstand firms, which had a maximum of 3000 employees and were situated in the same federal state or a federal state close to our university (i.e., those situated in Hesse, North Rhine-Westphalia, or Rhineland Palatinate) since past research has shown that geographic proximity between survey authors and addressees results in higher response rates (Bartholomew and Smith, 2006). This data set exclusively comprised non-listed firms that were not part of the financial services industry. The Amadeus data included the firms' industry affiliation, their numbers of employees, and the contact information of each firm. We then manually searched for the firms' top managers' e-mail addresses. We specifically targeted CEOs and other members of the top management team, since these top managers usually have an excellent and wide-ranging overview of their firms' activities (Zahra, 1991).

The survey invitations that clearly indicated the university sponsorship of our survey (cf. Mellahi and Harris, 2016) were sent out to these top managers by e-mail in early July 2020 and reminders were sent through the middle of August 2020. The timeframe of the survey was in the midst of the COVID-19 crisis, which enabled us to capture the perceived impact of the crisis on the surveyed firms at that time without involving potential issues of recall bias, which could have materialized if we conducted our survey several months or years later. To facilitate responses, we assured participants of their anonymity (cf. Mellahi and Harris, 2016). In addition, since past research has found that incentives usually lead to higher response rates (Singer and Ye, 2013), we offered our survey addressees two kinds of incentives upon the completion of the survey: (1) an executive research report and (2) a donation of EUR 10 to a charity of their choice. Survey respondents could choose between receiving none, one, or both incentives.

In total, 156 complete or partially complete questionnaires were obtained. This resulted in a response rate of 13.95 %. In general, response rates in management and entrepreneurship research have been declining in recent decades (e.g., Chidlow et al., 2015; Pielsticker and Hiebl, 2020), especially those targeting top executives (Cycyota and Harrison, 2006). However, our achieved response rate seems

satisfactory, as it is in line with those of comparable recent and well-published survey studies (e.g., Rodil et al., 2016; Förster, 2015; Popa et al., 2017; Xie et al., 2022). Of the 156 cases, 23 had to be removed due to missing information on the variables of interest in this study. We thus used the remaining 133 cases with full information on the measures discussed below.

3.1.2. Potential biases

In times of decreasing response rates (Chidlow et al., 2015; Pielsticker and Hiebl, 2020), surveys addressing individual top managers offer a pragmatic approach to realizing sufficiently large sample sizes (Montabon et al., 2018) and drawing on respondents' knowledge about their firms. At the same time, the results of such surveys may be susceptible to common method bias (Podsakoff et al., 2003; Montabon et al., 2018). Although we include archival data on the varying levels of COVID-19-related restrictions in the subnational regions we cover, most of the data we analyze below were generated by a single respondent in each firm. Consequently, and in line with prior research (e.g., Podsakoff et al., 2003), we took several established measures to avoid common method bias from arising. First, as indicated above, we ensured our respondents full anonymity. Second, we implemented a lag between the independent and dependent variables in the flow of our questionnaire to avoid respondents building their own mental models, which may bias our results. Third, we drew on pretested questions from the research literature and conducted extensive pretests. This way, we wanted to ensure that our questions were, for instance, simple, concise, specific, and did not feature complicated syntax (Podsakoff et al., 2003). Fourth, we integrated a marker variable in our questionnaire. As suggested by Lindell and Whitney (2001), we used a highly reliable multi-item construct that is theoretically unrelated to our variables – *Executive Job Demands* (see below for measurement). We computed correlations between this variable and all other variables in our study (see Table 4) (Calic and Ghasemaghahi, 2021; Lindell and Whitney, 2001). These correlations provide no signals of a common method bias as the maximum significant correlation value was rather low (i.e., -0.268 ; see Cohen, 1988 on correlation effect sizes). Finally, we conducted a Harman's one-factor test. The basic assumption of this test is that common method variance is present when a single factor explains much of the covariance between the variables (Podsakoff et al., 2003; Podsakoff and Organ, 1986). Our exploratory factor analysis on all the survey-generated variables included in this study shows that no single factor explains most of the covariance between these variables (the largest factor accounts for only 16.77 % of the covariance). Therefore, our survey data seem unlikely to suffer from common method variance.

Another bias potentially affecting survey studies is non-response bias (Van Loon, 2003), which arises if the percentage of non-respondents is high (Frohlich, 2002). A common type of non-response analysis is a comparison of late and early respondents since non-respondents are viewed as similar to late respondents (e.g., Van der Stede et al., 2005). In line with the approach suggested by Armstrong and Overton (1977), Table 1 compares the mean values between early (25th quantile) and late respondents (75th quantile) for all the variables involved in our study. To use the correct tests for analyzing the differences between early and late respondents, we tested all the variables in our sample using a Kolmogorov–Smirnov test and Shapiro–Wilk test, finding that none of the variables were normally distributed, excluding *Past Performance*. Consequently, we used the non-parametric Mann–Whitney *U* test to check for significant differences between early and late respondents for non-normally distributed variables except the dichotomous variables *Industry*, *Family Business*, *Firm Size*, and *Strategy*. For these latter variables, we used the chi-square test to check for significant differences, and we used the *t*-test for the normally distributed variable *Past Performance*. We found no significant difference between early and late respondents and thus no signals of non-response bias.

Table 1

Comparison of the variables involved in this study for late respondents and early respondents.

Variable	Early respondents	Late respondents	p-Value
	Mean	Mean	
Crisis Resilience	3.73	4.12	0.332
Family Business	0.58	0.61	0.802
Firm Size 250–499	0.21	0.18	0.757
Manufacturing	0.52	0.64	0.319
Strategy	0.30	0.42	0.306
Past Performance	4.65	4.54	0.654
Level of Digitalization before the Crisis	43.88	35.39	0.135
Globalization	3.82	3.84	0.995
Transformational Leadership	5.83	5.83	1.000
Subnational Region North Rhine-Westphalia	0.67	0.76	0.415
Subnational Region Hesse	0.12	0.21	0.322

3.2. Measures

3.2.1. Independent variable

As suggested by prior literature (Bergkvist and Rossiter, 2007; Niemand et al., 2021), the *Level of Digitalization before the Crisis* was measured by a single item indicating the firm's level of digitalization. In line with Niemand et al. (2021), respondents were asked to indicate the digitalization of their firm's business model before the COVID-19 crisis from 0 % to 100 %.

3.2.2. Dependent variable

Crisis Resilience was measured using a reverse-coded scale adapted from Becker et al. (2016). Becker et al. (2016) established a construct to measure the impact of the global financial crisis in 2008. We slightly adapted the questions for our specific empirical setting and the COVID-19 crisis. Respondents were asked to indicate the extent to which their firm was impacted by the COVID-19 crisis along six dimensions on a seven-point Likert scale (from “not at all” to “very strongly”). We acknowledge that the various instruments used to measure organizational resilience in survey studies lack agreement on a generally accepted survey construct (for reviews, see Duchek, 2020; Linnenluecke, 2017). We opted for the scale developed by Becker et al. (2016) since this scale, too, was designed to measure the impact of a crisis at the organizational level (and not the individual level such as the frequently applied PsyCap measure introduced by Luthans et al., 2007). In addition, the Becker et al. (2016) scale had already been applied in a similar fashion in our country of data collection (Germany), which lowered potential biases due to cultural differences in interpreting and answering our questionnaire.

3.2.3. Moderator variables

3.2.3.1. Globalization. Based on the scale presented by Knight (2000), we asked respondents to indicate their agreement on six dimensions (see Table 2) of the globalization of their firm on a seven-point Likert scale (from “completely disagree” to “completely agree”).

3.2.3.2. Family business. Family business research has not agreed on a generally accepted definition of family firms, but many empirical studies rely on survey respondents' self-assessment of their firms as family or non-family firms (Steiger et al., 2015). We followed this approach and coded this variable as “1” (yes) if the respondent considered his or her firm as a family firm and “0” if otherwise.

3.2.3.3. Firm Size. We operationalized *Firm Size* based on the number of employees (e.g., Speckbacher and Wentges, 2012; Tocher and

Table 2

Construct validity of Crisis Resilience, Globalization, Past Performance, Transformational Leadership, and Executive Job Demands (marker variable).

Crisis Resilience		Factor loadings (CFA)
Composite reliability = 0.88	AVE = 0.66	
To what extent is your firm impacted by the current COVID-19-crisis?		0.712
Was there a decline in orders?		0.872
Was there a decline in your turnover?		0.995
Has the availability of capital decreased?		0.608
Globalization		Factor loadings (CFA)
Composite reliability = 0.90	AVE = 0.59	
To what extent do the following statements apply to your firm?		
Many of our most important competitors' headquarters are abroad.		0.648
Most of our main competitors have distribution channels in Asia and Europe.		0.756
Cross-border flow of goods and capital normally happens in our industry without problems.		0.628
Within the last ten years, trade with foreign countries has increased enormously.		0.929
Within the last ten years, competition with overseas firms has increased enormously.		0.784
Within the last ten years, we came to the conclusion in our firm that international sales are an important source for additional revenue.		0.825
Past Performance		Factor loadings (CFA)
Composite reliability = 0.90	AVE = 0.54	
How would you rate your firm's current performance as compared to your competitors?		
Sales growth		0.475
Growth in market share		0.461
Growth in number of employees		0.432
Increase in profitability		0.822
Return on equity		0.959
Return on assets		0.958
Profit margin on sales		0.861
Ability to fund growth from profits		0.680
Transformational Leadership		Factor loadings (CFA)
Innovation (Formative weight (path coefficient) = 0.156***; VIF = 1.340) (CR = 0.77; AVE = 0.53)		
I communicate the meaning and background of upcoming tasks and goals.		0.704
I show new ways of understanding tasks and goals.		0.746
I encourage my employees to question their own approaches and ways of thinking.		0.722
Team spirit (Formative weight (path coefficient) = 0.261***; VIF = 2.089) (CR = 0.82; AVE = 0.54)		
I ensure that team members work well together.		0.820
I ensure that employees see themselves as team members rather than individuals.		0.825
I appeal to the sense of community or togetherness.		0.605
I manage to get employees to work together to achieve goals and tasks.		0.653
Performance development (Formative weight (path coefficient) = 0.218***; VIF = 1.394) (CR = 0.86; AVE = 0.60)		
I demand justified best performance from employees.		0.808
I explain why top performance is required.		0.879
I communicate transparently and comprehensibly that high performance is important.		0.784
I communicate my confidence in the ability of the respective employee when defining performance goals.		0.610
Individuality focus (Formative weight (path coefficient) = 0.220***; VIF = 1.564) (CR = 0.81; AVE = 0.54)		
I know how my employees are doing personally.		0.921
I know my employees' individual interests and personal goals.		0.857
I support my employees in their professional performance and development.		0.586
I express my appreciation to my employees.		0.461
Vision (Formative weight (path coefficient) = 0.249***; VIF = 1.953) (CR = 0.82; AVE = 0.54)		
I inspire through a vision of the future.		0.786
I communicate a clear and attractive vision of the future for my team.		0.978
I enthusiastically communicate my vision of long-term opportunities, tasks and goals.		0.592
I make my employees understand the meaning and value of their work.		0.490

(continued on next page)

Table 2 (continued)

Transformational Leadership		Factor loadings (CFA)
To set an example of something to somebody (in the way one lives) (Formative weight (path coefficient) = 0.250***; VIF = 1.772) (CR = 0.82; AVE = 0.54)		
I exemplify what is important to me.		0.785
I am aware of my role as a role model.		0.758
I am a credible role model as a leader.		0.673
I am myself a good example of how members of my organization (or firm) should behave.		0.716
Executive Job Demands (marker variable)		
Composite reliability = 0.84	AVE = 0.52	Factor loadings (CFA)
To what extent do the following statements apply to your current position in your firm?		
I have to work fast.		0.683
I have too much work to do.		0.733
I have to work extra to finish a task.		0.835
I work under time pressure.		0.826
I have to deal with backlog at work.		0.612

Rutherford, 2009) and created two size classes: *Firm Size 250–499* is coded as “1” if the firm has more than 249 and fewer than 500 employees, and coded as “0” if otherwise.

3.2.3.4. Manufacturing. This dichotomous variable is coded as “1” if the firm primarily belongs to the manufacturing industry in the respondents' view, and “0” if otherwise.

3.2.3.5. Strategy. We operationalized this variable using two of Miles and Snow's (1978) strategic archetypes: prospectors and defenders. After reading a short description of two types of firms, one reflecting a prospector strategy and the other a defender strategy, respondents had to rate which of the two descriptions fits their firms best. The resulting *Strategy* variable was coded “1” for prospectors and “0” for defenders.

3.2.3.6. Past performance. We measure *Past Performance* based on the subjective performance measurement suggested by Eddleston and Kellermanns (2007) consisting of eight items. For all items, our survey respondents were asked to indicate on a seven-point Likert scale whether they performed better or worse than their competitors in the three years before our survey.

3.2.3.7. Transformational Leadership. We measured the *Transformational Leadership* style as suggested by Rowold and Poethke (2017). Their measurement includes 24 items along the following six dimensions: vision, team spirit, innovation, focus on individuality, performance development and setting an example to somebody. We used a seven-point Likert scale from “completely disagree” to “completely agree” and asked our participants the extent to which they agree with the 24 items regarding their behavior toward their employees in the labor context. In line with the literature, we operationalized *Transformational Leadership* as a second-order construct¹ and a metrically scaled variable (e.g., MacKenzie et al., 2005; Tyssen et al., 2014).

3.2.3.8. Subnational Regions. To measure *Subnational Regions*, we used the restrictiveness index developed by Behnke (2021). This index

¹ After having conducted confirmatory factors analyses to create the first-order constructs, we also calculated the significance of the formative weights (path coefficients) and VIFs to address potential multicollinearity problems (Hair et al., 2019). In line with the literature (e.g., Braumann et al., 2020; van Riel et al., 2017), we used the repeated indicator approach. No VIF value was above three; hence, the results indicated no multicollinearity problems and all the formative weights were significant (Hair et al., 2019).

measures the restrictiveness of the measures introduced by the 16 federal states (*Bundesländer*) in Germany in response to the COVID-19 pandemic during our period of data collection (i.e., mid-2020, “KW 33” as per Behnke, 2021). In Germany, federal states have autonomy and a high degree of discretion, and therefore they respond to pandemic crises differently (Büthe et al., 2020; Karaulova and Kroll, 2021). The degree of restrictions in response to the COVID-19 pandemic thus greatly differed across federal states (Büthe et al., 2020), which allowed us to distinguish the influence of more or less rigid subnational regions. According to Behnke (2021), the federal state of North Rhine-Westphalia featured much more rigid restrictions in mid-2020 than the federal state of Hesse, which scored very low on the scale presented by Behnke (2021). We thus viewed North Rhine-Westphalia as a subnational region with a more rigid psychological immune system and Hesse as a subnational region with a less rigid psychological immune system. To incorporate these subnational regions into our analyses, we created two dummy variables. For firms that have their headquarters in North Rhine-Westphalia, we coded *Subnational Region North Rhine-Westphalia* “1” and “0” otherwise. Likewise, we coded *Subnational Region Hesse* “1” if the firm is located in Hesse and “0” otherwise. The federal state of Rhineland Palatinate thus served as the reference group; firms located in this federal state were coded “0” for both dummy variables.

3.2.4. Marker variable

The multi-item construct *Executive Job Demands* is based on the job demands measurement suggested by Janssen (2000). For all eight items by Janssen (2000), we asked our survey participants to indicate on a seven-point Likert scale how often the statements applied to their current organizational role (from “never” to “always”).

3.3. Reliability and validity of multi-item constructs

For the multi-item constructs used in our study, we conducted confirmatory factor analyses (CFA) to establish construct validity (see Table 2). As proposed by the literature, we suppressed factor loadings smaller than 0.40 (Field, 2018; Hair et al., 2011, 2019) and conducted empirical tests to establish content and construct validity (Nunnally, 1978). According to Hair et al. (2019), composite reliability (CR) values should be at least 0.7 and average variance extracted (AVE) values should be at least 0.5 for all multi-item constructs. For two of our multi-item constructs (i.e., *Crisis Resilience*, *Executive Job Demands*), some individual items showed loadings below 0.4 or that had a detrimental effect on reaching the suggested AVE threshold. In line with methodological advice (Fornell and Larcker, 1981; Hair et al., 2017, 2019) and similar survey-based studies (e.g., Mariani et al., 2021; Naatu et al.,

2022; Popa et al., 2017), we removed such items from further analysis to ensure that all the items show loadings of at least 0.4 and that the above CR and AVE thresholds are reached. To construct *Crisis Resilience*, we therefore removed the initial items four and six; to construct *Executive Job Demands*, we excluded the original items five, seven and eight.² For the remaining two multi-item constructs in our study (i.e., *Globalization*, *Past Performance*), the CFA results indicated sufficient reliability and that all the measured items loaded onto a single factor and could thus be retained. After having confirmed that all the multi-item constructs had convergent and discriminant validity, we averaged the responses across the remaining items of the respective constructs to arrive at the final scores for our variables (see Table 2).

4. Results

4.1. Descriptive results and correlations

Table 3 contains the descriptive statistics of our variables (e.g., N, Mean, Median, SD) and Table 4 presents the correlation matrix. Due to the various scale levels of our variables, we used different measures of associations (e.g., Pearson, Phi; see the notes in Table 4). There are several significant associations between the variables. However, there is no indication of multicollinearity issues since all the correlations are below the threshold of 0.7 (Dormann et al., 2013).

4.2. Multiple regression analyses

We used a hierarchical regression analysis to test our hypotheses (see Table 5). Model 1 includes the main effects suggested in H1 and Model 2 adds the interaction terms as proposed in H2 through H7. Before creating the interaction terms, we mean-centered the involved variables (Cronbach, 1987; Field, 2018) and calculated their cross products. For all the models, we display the variance inflation factors (VIFs) to further assess potential multicollinearity issues. There are several guidelines for VIFs; however, as a general rule of thumb, they should not exceed 10 (e.g., Dormann et al., 2013; Hair et al., 2011). Our VIFs in Table 5 are all well below this threshold: the maximum VIF value was 2.939. Conse-

Table 3
Descriptives.

Variables	N	Mean	Min	Max	Median	SD
Crisis Resilience	133	4.00	1.00	7.00	4.00	1.64
Family Business	133	0.68	0.00	1.00	1.00	0.47
Firm Size 250–499	133	0.26	0.00	1.00	0.00	0.44
Manufacturing	133	0.61	0.00	1.00	1.00	0.49
Strategy	133	0.44	0.00	1.00	0.00	0.50
Past Performance	133	4.53	1.63	7.00	4.50	1.03
Level of Digitalization before the Crisis	133	38.05	0.00	90.00	39.00	21.62
Globalization	133	3.77	1.00	6.83	4.17	1.80
Transformational Leadership	133	5.82	2.88	6.91	5.89	0.53
Subnational Region North Rhine-Westphalia	133	0.68	0.00	1.00	1.00	0.47
Subnational Region Hesse	133	0.20	0.00	1.00	0.00	0.40

² To assess whether the removal of individual items due to low factor loadings or low AVE values for the full constructs affected our results, we also calculated all the regression models without dropping any items when constructing the dependent variable *Crisis Resilience* (albeit, of course, with lower resulting AVE values). The significant findings shown in our regression analyses remained the same (untabulated). We also performed the same exercise for the marker variable *Executive Job Demands*. Again, the inclusion of all the items did not materially change our results for this marker variable.

quently, from the VIFs and the above correlation matrix, we have no indications of multicollinearity issues that may threaten the validity of our results.

All the models show sufficient predictive validity as measured by R^2 . Our full model (Model 2) features a higher R^2 (0.308) than Model 1, which supports our hierarchical regression setup. The F statistics indicate that both models are significant at $p < .01$. In addition, the two models should hold sufficient statistical power, as the 19 independent variables in Model 2 would require a minimum number of 95 ($19 * 5$) observations as of Hair et al. (2019) or 115 ($20 + 19 * 5$) as of Khamis and Kepler (2010). Our number of observations (133) is well above these thresholds.

Model 1 tests the direct effect proposed in H1. Besides *Past Performance* ($b = 0.299$, $p < .01$) and *Globalization* ($b = -0.285$, $p < .01$), no further significant direct effect on *Crisis Resilience* can be found. In particular, Model 1 shows no direct positive effect of the *Level of Digitalization before the Crisis* on *Crisis Resilience*, which is why H1 cannot be confirmed.

The significant predictors *Past Performance* ($b = 0.273$, $p < .01$) and *Globalization* ($b = -0.263$, $p < .05$) are also confirmed by Model 2. In addition, two interaction effects turn out to be significant. First, the interaction between the *Level of Digitalization before the Crisis* and *Globalization* ($b = 0.249$, $p < .10$), and second, the interaction between the *Level of Digitalization before the Crisis* and *Family Business* ($b = -0.202$, $p < .05$) are associated with *Crisis Resilience*, which supports H2 and H3.

Figs. 2 and 3 plot the variables involved in our significant interaction effects. For plotting these effects, we categorizing the respective variables into two groups using a median split each. Fig. 2 indicates that firms barely affected by globalization that show a low level of digitalization feature the highest level of *Crisis Resilience* (i.e., 4.66). By contrast, and in line with H2, firms highly affected by globalization with a more digitalized business model emerge from our analyses as more resilient to pandemic crises than their less digitalized counterparts (see the solid slope in Fig. 2). In summary, as the solid slope is steeper than the dotted slope in Fig. 2, it seems as if the hypothesized relationship between the *Level of Digitalization before the Crisis* and *Crisis Resilience* holds better for firms highly affected by globalization.

Fig. 3 indicates that non-family businesses with a little digitalized business model show the lowest level of *Crisis Resilience* (i.e., 3.63). By contrast, and in line with H3, non-family businesses with a more digitalized business model emerge from our analyses as more resilient to pandemic crises than their less digitalized counterparts and family businesses (see Fig. 3). Therefore, it seems as if the hypothesized relationship between the *Level of Digitalization before the Crisis* and *Crisis Resilience* holds better for non-family businesses.

4.3. Robustness check

As a robustness check of our results, we tested an alternative measurement of the level of digitalization – that is, the level of digitalization during the crisis. We did so as our data indicated that during the COVID-19 crisis, the average level of digitalization increased from 38.05 % before the crisis to 47.20 % during the crisis. Consequently, it could be argued that higher levels of digitalization during the crisis would affect *Crisis Resilience*, perhaps even more so than those levels before the crisis. We thus computed another battery of regression models, where the *Level of Digitalization During the Crisis* acts as the independent variable and as part of our interaction terms. Just as the variable *Level of Digitalization Before the Crisis*, the variable *Level of Digitalization During the Crisis* was constructed by asking the respondents to indicate the digitalization of their firm's business model at the moment of answering our survey and thus during the COVID-19 crisis from 0 % to 100 % (cf. Niemand et al., 2021). The results of this exercise are reported in Table 6 and confirm the significant moderator *Family Business*. However, the interaction term between *Digitalization During the Crisis* and *Globalization* is not significantly related to *Crisis Resilience* in the final model in Table 6. Only our

Table 4
Correlation matrix.

Variables	N	1	2	3	4	5	6	7	8	9	10	11	12
1 Crisis Resilience	133	1											
2 Family Business	133	0.026	1										
3 Firm Size 250–499	133	−0.128	−0.221	1									
4 Manufacturing	133	−0.251	0.369	−0.060	1								
5 Strategy	133	0.054	0.197	0.136	0.033	1							
6 Past Performance	133	0.260	0.194	−0.120	0.104	0.308	1						
7 Level of Digitalization before the Crisis	133	0.011	0.058	−0.097	−0.080	−0.030	0.115	1					
8 Globalization	133	−0.340	0.159	0.082	0.607	0.094	0.117	0.052	1				
9 Transformational Leadership	133	−0.056	−0.057	−0.009	0.031	0.075	0.177	0.222	0.160	1			
10 Subnational Region North Rhine-Westphalia	133	−0.115	0.038	0.110	0.072	−0.062	−0.069	−0.003	0.101	−0.060	1		
11 Subnational Region Hesse	133	0.057	−0.051	−0.124	−0.017	0.076	0.019	−0.144	−0.063	−0.029	−0.730	1	
12 Executive Job Demands (marker variable)	133	−0.105	−0.004	0.135	0.153	−0.135	−0.268	−0.024	0.141	−0.077	0.028	0.000	1

Correlations significant at $p \leq .1$ are indicated in bold; *Point-biserial* correlation coefficients are used for correlations between metric and dichotomous variables; *Pearson* correlation coefficients are used for correlations between metric variables; *Phi* values are used between dichotomous variables (for further information see Field, 2018).

Table 5
Hierarchical regression analysis (main analysis).

Dependent variable	Crisis Resilience							
	Main effects only (Model 1)				Interaction effects added (Model 2)			
Independent variables	Stand. beta	t value	p value	VIF	Stand. beta	t value	p value	VIF
Constant		2.726	0.007***			2.340	0.021**	
Level of Digitalization before the Crisis	−0.020	−0.237	0.813	1.148	−0.019	−0.226	0.822	1.200
Globalization	−0.285	−2.727	0.007***	1.724	−0.263	−2.447	0.016**	1.884
Family Business	0.045	0.485	0.628	1.341	0.067	0.719	0.474	1.434
Firm Size 250–499	−0.064	−0.741	0.460	1.170	−0.050	−0.577	0.565	1.250
Manufacturing	−0.124	−1.129	0.261	1.886	−0.142	−1.265	0.208	2.042
Strategy	−0.005	−0.062	0.950	1.221	−0.083	−0.912	0.364	1.360
Past Performance	0.299	3.424	0.001***	1.202	0.273	2.996	0.003***	1.353
Subnational Region North Rhine-Westphalia	−0.086	−0.718	0.474	2.249	−0.035	−0.270	0.788	2.695
Subnational Region Hesse	−0.041	−0.343	0.732	2.301	0.041	0.316	0.752	2.693
Transformational Leadership	−0.058	−0.691	0.491	1.130	−0.033	−0.378	0.706	1.219
Level of Digitalization before the Crisis * Globalization					0.249	1.952	0.053*	2.648
Level of Digitalization before the Crisis * Family Business					−0.202	−2.222	0.028**	1.348
Level of Digitalization before the Crisis * Firm Size 250–499					−0.020	−0.222	0.825	1.342
Level of Digitalization before the Crisis * Manufacturing					−0.106	−0.876	0.383	2.403
Level of Digitalization before the Crisis * Strategy					−0.025	−0.262	0.794	1.523
Level of Digitalization before the Crisis * Past Performance					0.011	0.105	0.916	1.678
Level of Digitalization before the Crisis * Transformational Leadership					0.015	0.170	0.865	1.308
Level of Digitalization before the Crisis * Subnational Region North Rhine-Westphalia					−0.156	−1.162	0.248	2.939
Level of Digitalization before the Crisis * Subnational Region Hesse					−0.028	−0.230	0.818	2.468
R ²	0.226				0.308			
Adjusted R ²	0.162				0.191			
F	3.553***				2.643***			
N	133				133			

* $p < .10$.
 ** $p < .05$.
 *** $p < .01$.

results on *Family Business* can thus be considered robust against potential differences between the levels of digitalization before and during the crisis, which reinforces our focus on *Digitalization Before the Crisis* as an even more important source of resilience than *Digitalization During the Crisis*.

5. Discussion, implications and limitations

5.1. Summary of hypotheses tests

Our main results do not imply a universal impact of digitalization on crisis resilience as proposed in H1, but rather an effect contingent on the

extent to which entrepreneurial firms are affected by globalization (as proposed in H2) and family influence (see H3). That is, our data lends support to hypotheses H2 and H3, but hypotheses H4, H5, H6, H7, H8 and H9 on additional moderating effects could not be supported. At the same time, our main findings can be considered to control for the potential influence of these non-significant moderator variables and thus incorporate the potential effect of firm size, industry affiliation, strategy, past performance, leadership style and regional embedding.

Overall, these findings imply that higher levels of digitalization do not serve all types of firms equally well as a preparation capability to develop resilience to pandemic crises. In Sections 5.2 and 5.3, we thus first focus on the two hypotheses and moderating effects that could be

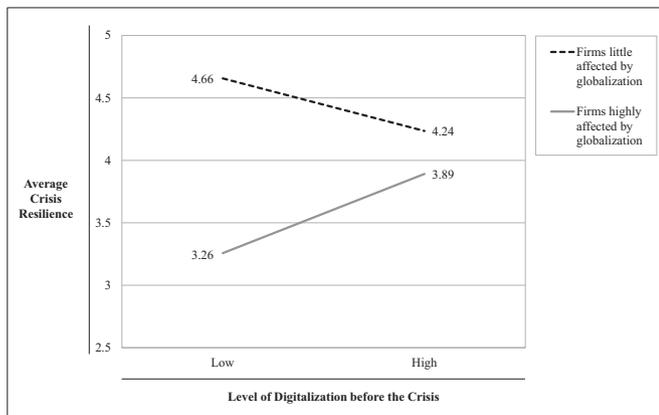


Fig. 2. Interaction between *Level of Digitalization before the Crisis* and *Globalization*.

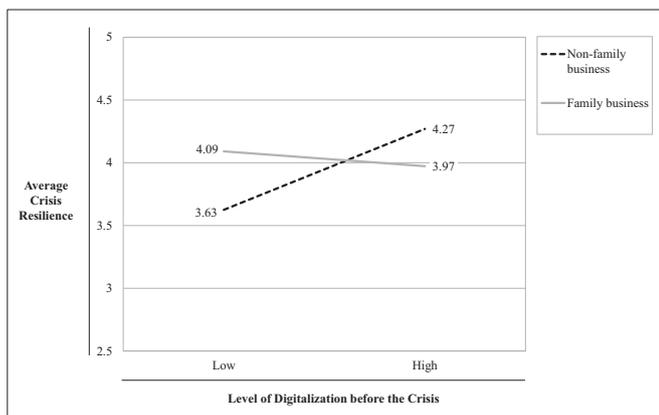


Fig. 3. Interaction between *Level of Digitalization before the Crisis* and *Family Business*.

confirmed by our main results. We then turn to the theoretical implications of our results in Section 5.4, where we incorporate our significant and non-significant hypotheses tests and explain what they mean for the development of the Parasite Stress Theory of Values and literature on organizational resilience. In Section 5.5, we discuss the practical implications of our study, while Section 5.6 concludes the paper by describing its most important limitations and resulting avenues for further research.

5.2. The moderating effect of globalization

As shown in Fig. 2, the positive impact of digitalization on crisis resilience can only be found for entrepreneurial firms highly affected by globalization. This finding indicates that in pandemic crises, globalized firms are specifically reliant on digital technologies to continue their relationships with stakeholders worldwide. In turn, globalized entrepreneurial firms that have only a relatively low level of digitalization before a pandemic crisis emerge from our study as those most affected by the COVID-19 pandemic and thus show the lowest resilience to this crisis.

In turn, for entrepreneurial firms less affected by globalization, Fig. 2 suggests that higher levels of digitalization before the crisis do not increase their crisis resilience. This goes directly against our first hypothesis. A potential explanation of this finding is that entrepreneurial firms hardly affected by globalization are mostly active locally or regionally. Historically, such firms, at least German Mittelstand firms, have been highly embedded in their local communities (De Massis et al.,

2018; Pahnke and Welter, 2019). However, as suggested by recent evidence on remote work (Soroui, 2021), a growing reliance on digital technologies may lead to disembedding dynamics. In our case, this could mean that Mittelstand firms, which were once locally embedded but now increasingly rely on digital technologies, may have lost some of this embeddedness due to their lower levels of personal contact and interaction (cf. Soroui, 2021). In times of crisis, the loss of local embeddedness may then come with lower levels of reciprocal support between locally or regionally active firms with higher levels of embeddedness, and this could explain the lower levels of crisis resilience for more digitalized entrepreneurial firms that are not globalized.

5.3. The moderating effect of family business

As shown in Fig. 3, the positive impact of digitalization on crisis resilience can be found for both family and non-family entrepreneurial firms. Fig. 3 also shows that the positive effect is particularly evident for non-family businesses (see the solid lines' steeper slope), which confirms our H3. This finding indicates that non-family firms are more reliant on digitalization to create resilience against pandemic crises than family firms. In turn, non-family entrepreneurial firms with a more digitalized business model emerge from our analyses as more resilient to pandemic crises than their similarly digitalized family entrepreneurial counterparts.

As indicated in Section 2, we suppose that this finding is due to family firms having a higher level of built-in crisis resilience (Amann and Jaussaud, 2012; Calabrò et al., 2021) and psychological safety net (Leppäaho and Ritala, 2022) due to their usual long-term orientation (Clauß et al., 2022; De Massis et al., 2015), their risk aversion (Hiebl, 2013) and slack resources built up during economically calm times (Leppäaho and Ritala, 2022). As shown by our findings, particularly those from our simple slope analysis, family firms may gain less from digitalization than their non-family counterparts, indicating that they may feature a higher level of built-in crisis resilience—irrespective of their level of digitalization before the crisis. Viewed through the lens of the Parasite Stress Theory of Values, we can conclude that the psychological immune system of family firms seems to differ from those of non-family firms. In particular, it may be that family firms are less reliant on technological drivers of resilience such as their level of digitalization because they are typically more prone than non-family firms to create an emotional and psychological safety net during good economic times than can be accessed during times of crises (Leppäaho and Ritala, 2022). In addition, family firms may benefit from the controlling family's commitment to the firm and strong willingness to find resources and solutions to cope with crises (Calabrò et al., 2021). All these psychological features of family firms and controlling families seem to make them less reliant on other tools that may relieve psychological stress during pandemic crises such as higher levels of digitalization (Mäntymäki et al., 2022). By contrast, non-family firms, which may lack the above-noted psychological features, seem to be more reliant on higher levels of digitalization before the crisis to reach higher levels of resilience.

These results add to the growing literature on the digitalization of family firms (Batt et al., 2020; Löhde et al., 2020; Škare and Soriano, 2021; Soluk, 2022; Soluk and Kammerlander, 2021; Soluk et al., 2021). In particular, our findings on preparation capabilities complement earlier work that examined the other forms of organizational resilience adopted by family firms in response to the COVID-19 pandemic crisis (e. g., Calabrò et al., 2021; Giotopoulos et al., 2022; Hadjielias et al., 2022; Le Breton-Miller and Miller, 2022; Schwaiger et al., 2022; Soluk, 2022; Soluk et al., 2021). Most directly related to our research, Soluk et al. (2021) focused on family firms' coping and adaptation capabilities as part of organizational resilience (cf. Duchek, 2020). They found that the creation of adaptive capacity and adoption of digital technologies to deal with the exogenous shock caused by COVID-19 depend on several antecedents including resource constraints, the fear of losing the socio-

Table 6
Hierarchical regression analysis (robustness check).

Dependent variable	Crisis Resilience							
	Main effects only (Model 3)				Interaction effects added (Model 4)			
	Stand. beta	t value	p value	VIF	Stand. beta	t value	p value	VIF
Constant		2.731	0.007***			2.401	0.018**	
Level of Digitalization during the Crisis	0.010	0.122	0.903	1.142	0.002	0.025	0.980	1.249
Globalization	-0.290	-2.768	0.007***	1.724	-0.254	-2.344	0.021**	1.885
Family Business	0.042	0.460	0.646	1.334	0.061	0.639	0.524	1.458
Firm Size 250–499	-0.060	-0.694	0.489	1.190	-0.040	-0.449	0.654	1.276
Manufacturing Strategy	-0.118	-1.085	0.280	1.858	-0.140	-1.239	0.218	2.071
Past Performance	-0.004	-0.044	0.965	1.216	-0.084	-0.906	0.367	1.368
Subnational Region North Rhine-Westphalia	0.296	3.382	0.001***	1.210	0.262	2.885	0.005***	1.331
Subnational Region Hesse	-0.081	-0.686	0.494	2.219	-0.060	-0.477	0.634	2.589
Transformational Leadership	-0.034	-0.281	0.780	2.276	0.004	0.035	0.972	2.584
Level of Digitalization during the Crisis * Globalization	-0.064	-0.757	0.450	1.118	-0.035	-0.401	0.689	1.227
Level of Digitalization during the Crisis * Family Business					0.169	1.388	0.168	2.402
Level of Digitalization during the Crisis * Firm Size 250–499					-0.200	-2.284	0.024**	1.241
Level of Digitalization during the Crisis * Manufacturing Strategy					0.016	0.178	0.859	1.362
Level of Digitalization during the Crisis * Past Performance					-0.018	-0.149	0.882	2.345
Level of Digitalization before the Crisis * Transformational Leadership					-0.019	-0.205	0.838	1.407
Level of Digitalization before the Crisis * Subnational Region North Rhine-Westphalia					0.027	0.294	0.770	1.333
Level of Digitalization before the Crisis * Subnational Region Hesse					0.026	0.289	0.773	1.257
R ²	0.225				-0.145	-1.070	0.287	2.948
Adjusted R ²	0.162				-0.030	-0.226	0.821	2.757
F	3.547***				0.299			
N	133				0.181			

* $p < .10$.
 ** $p < .05$.
 *** $p < .01$.

emotional wealth associated with the controlling family's status as business owners and the presence of non-family managers. Combining our findings with those of Soluk et al. (2021) indicates that family firms' long-term orientation and the associated built-in organizational resilience tend to make them less reliant on digitalization to be prepared for the impact of such crises (as found in our study); however, in terms of their adaptive capacity, family firms differ widely due to their idiosyncratic resource sets and other antecedents (Soluk et al., 2021; see also Hadjielias et al., 2022; Schwaiger et al., 2022).

5.4. Theoretical implications and contributions

As summarized in Table 7, our study adds to the literature on the effects of pandemic crises on entrepreneurship. Two prominent recent additions to this literature (Bennett and Nikolaev, 2020; Rao and Greve, 2018) focus on the short- and long-term effects of Spanish flu and find the detrimental effects of this pandemic on entrepreneurial activities such as innovation (Bennett and Nikolaev, 2020) and organization building (Rao and Greve, 2018). Both studies explain this relationship using the Parasite Stress Theory of Values that suggests that “social distancing” leads to less collaboration, interaction, and, as a consequence, entrepreneurial activity.

At the time of last submitting this manuscript (October 2022), the COVID-19 crisis has not been fully resolved and we cannot yet foresee the long-term effects of this pandemic. However, our data suggest that in the short run, more globalized entrepreneurial firms and non-family entrepreneurial firms have been more resilient to the crisis in case they had the necessary preparation capabilities analyzed in this paper: higher degrees of digitalization in their business model before the crisis. That is, our findings qualify the Parasite Stress Theory of Values, which has thus far focused on the reduction of personal contact but overlooked digital technologies that may provide an alternative to such contact. The reduction of personal contact can also be seen in the COVID-19 crisis (e.

g., Lewnard and Lo, 2020). According to our findings, more intensive reliance on modern digital technologies seems to reduce the detrimental impact of social distancing for more globalized entrepreneurial firms and for non-family entrepreneurial firms. That is, despite social distancing measures introduced during a pandemic, higher levels of digitalization seem to help such firms in retaining cross-cultural interaction including its benefits such as transfers of technology and knowledge and keeping up intercultural trade (Norfelt et al., 2020). As severe economic downturns are observed in most countries worldwide as a consequence of the outbreak of the COVID-19 pandemic (e.g., Fernandes, 2020; Mitze and Makkonen, 2022), our findings imply that the extent to which globalized and non-family entrepreneurial firms are affected by such crises can be reduced by higher levels of digitalization. However, they do not imply that digitalization protects globalized and non-family entrepreneurial firms from pandemic crises perfectly. Hence, theoretically, our findings imply that the relationship between contagious diseases and entrepreneurship suggested by the Parasite Stress Theory of Values is moderated by the use of digital technologies or, more broadly, ways that support humans in maintaining interaction despite the reduction of personal contact.

While earlier research on the Parasite Stress Theory of Values focused on its application at the country or continent level (e.g., Bennett and Nikolaev, 2020; Thornhill and Fincher, 2014), we responded to the call by Bennett and Nikolaev (2020) to examine its applicability at the subnational level, too. Despite finding no differences between subnational regions with a more or less rigid psychological immune system, we further extended the application of this theory to individual organizations. Similar to countries and subnational regions, organizations also have idiosyncratic values and traditions (Logue et al., 2015; Lounsbury, 2007, 2008). However, their characteristics, although important, have thus far been overlooked sources of the variance in organizations' psychological immune systems. Although only two of the eight tested organizational characteristics turned out to significantly

Table 7
Summary of theoretical implications and contributions.

Theme	Implications and contributions of the present study	Selected references to which the present study contributes
Parasite Stress Theory of Values	<ul style="list-style-type: none"> In case of pandemic crises, the Parasite Stress Theory of Values has so far assumed a negative impact of the psychological immune system and social distancing on entrepreneurial activities such as innovation. Our study qualifies the theory by showing that this impact of the psychological immune system is less pronounced if entrepreneurial firms exhibit preparation resilience – such as higher levels of digitalization before the pandemic crisis – that enables social contact despite parasite stress. While the Parasite Stress Theory of Values has previously been applied at the country or continent level, our study shows that the theory can also be applied at the subnational and organizational levels. According to our results, specific characteristics such as family involvement and globalization impact an organization's development of the psychological immune system in the event of a pandemic crisis. 	Bennett and Nikolaev (2020), Rao and Greve (2018), Thornhill and Fincher (2014)
Organizational resilience	<ul style="list-style-type: none"> Previous studies on the COVID-19 crisis have mainly analyzed coping and adaption forms of organizational resilience. Our study extends this literature by analyzing preparation resilience in a healthcare crisis in terms of higher levels of digitalization before the crisis. Our study provides evidence of the context-dependency of organizational resilience by showing that higher levels of digitalization before a pandemic crisis do not universally contribute to the development of preparation resilience in all types of organizations. 	Calabrò et al. (2021), Duchek (2020), Hadjielias et al. (2022), Hillmann (2021), Hillmann and Guenther (2021), Khurana et al. (2022), Leppäaho and Ritala (2022), Linnenluecke (2017), Schwaiger et al. (2022), Soluk et al. (2021), Williams et al. (2017)

affect the digitalization–resilience relationship, our two significant moderation results generally confirm the idea that some organization-level characteristics drive the variance in organizations' development of their psychological immune system against pandemic crises. In particular, our results indicate that non-family firms and more globalized firms benefitted more from their digitalization before the crises in developing preparation resilience to the pandemic crises caused by COVID-19. In particular, it is the above-noted psychological specifics of family firms (Calabrò et al., 2021; Leppäaho and Ritala, 2022) that point to their psychological immune system working differently than the ones in non-family firms.

To summarize, as of our best knowledge, our paper is the first to highlight the applicability of the Parasite Stress Theory of Values to individual organizations. At the same time, to corroborate our results, we call for further research to test the predictions of Thornhill and Fincher (2014) at the organizational level, while controlling for the potential differences among subnational regions, countries and continents.

Besides these theoretical contributions to the Parasite Stress Theory of Values, our findings contribute to the literature on organizational resilience (Duchek, 2020; Hillmann, 2021; Hillmann and Guenther, 2021; Linnenluecke, 2017; Williams et al., 2017). This literature highlights that organizational resilience is context-dependent, but has so far mostly overlooked what makes firms resilient in healthcare crises such as a pandemic. Considering that such pandemic crises have increased in frequency in the last century (Kraus et al., 2020), our study is among the first to deliver evidence on developing preparation resilience to this important type of crisis and thus moves beyond existing qualitative evidence (Fath et al., 2021) and conceptual pieces (Beninger and Francis, 2022) on preparation resilience in light of the COVID-19 crisis. We thus extend empirical research that has focused on coping and adaption resilience in response to COVID-19 (Bartik et al., 2020; Dejardin et al.,

2022; Emami et al., 2021; Giotopoulos et al., 2022; Hadjielias et al., 2022; Hammerschmidt et al., 2021; Kraus et al., 2020; Khurana et al., 2022; Kusa et al., 2022; Schwaiger et al., 2022; Soluk et al., 2021; Wendt et al., 2021; Xie et al., 2022) by adding the notion that digitalization can be considered to be a preparation form of organizational resilience (Duchek, 2020), but does not equip all types of organizations equally well to withstand the impact of pandemic crises. That is, different to some of these recently published papers (e.g., Giotopoulos et al., 2022; Schwaiger et al., 2022; Wendt et al., 2021), we did not find that organizational size, strategy, industry affiliation, or past performance materially affect the resilience emanating from the preparation capability of digitalization. A potential reason for such differing findings may lie in that earlier studies focused on coping and adaption forms of resilience. Hence, while, for instance, larger firms and those with better past performance have not benefitted from the preparation capability of digitalization according to our results, they may be better equipped to cope with and adapt to pandemic crises due to their higher average resource bases (Schwaiger et al., 2022; Wendt et al., 2021).

More generally, our findings thus confirm the context dependency of organizational resilience (Linnenluecke, 2017) by showing that digitalization does not universally contribute to developing preparation resilience to pandemic crises, but particularly so in non-family firms and firms more affected by globalization.

5.5. Practical implications

As summarized in Table 8, our findings imply that the value of digitalization as a protector against pandemic crises depends on the extent to which entrepreneurial firms are affected by globalization and the level of family influence they experience. Their resilience to pandemic crises seems to rise if they are globally active or controlled by non-family shareholders and invest in the digitalization of their

Table 8
Summary of practical implications.

Overarching implication	More detailed practical implications
A higher level of digitalization before a pandemic crisis serves as a source of resilience against the crisis	<ul style="list-style-type: none"> Entrepreneurial firms that have a more digitalized business model before a pandemic crisis are less affected by the impact of this crisis, but the effectiveness of this source of resilience depends on some firm characteristics. Our study shows that family firms benefit less from digitalization than non-family firms in terms of their resilience to pandemic crises. We attribute this result to the long-term orientation and built-in resilience of family businesses. Globally active entrepreneurial firms benefit more from digitalization before a pandemic crisis than less globally active entrepreneurial firms.

business. In turn, for entrepreneurial firms that are not globally active, our results suggest that higher levels of digitalization are associated with less resilience to pandemic crises. As discussed above, this dynamic may be because of the lowering of local embeddedness due to digitalization and thus less reciprocal support from the local community. Furthermore, for family entrepreneurial firms, our results suggest that higher levels of digitalization are associated with an increased crisis resilience, but lower in contrast with their non-family counterparts. As discussed above, this dynamic may be because of the family firms' long-term orientation and built-in crisis resilience, which makes digitalization less important for them. However, we can only theorize about these dynamics, and a closer examination is warranted. While these practical implications focus on increasing the resilience of entrepreneurial firms to pandemic crises, we do not rule out that higher levels of digitalization may still help fight the ongoing COVID-19 crisis (cf. Hadjielias et al., 2022; Sharma et al., 2022; Soluk et al., 2021; Wendt et al., 2021; Xie et al., 2022). However, as we specifically measured the level of digitalization before the crisis, we cannot provide evidence for this assumption.

5.6. Limitations

Our findings are not free from limitations. First, our study used empirical data from a specific geographical region – Germany. In particular, we draw on data on Mittelstand firms, which have been shown to feature different dynamics than other entrepreneurial firms (e.g., those situated in Australia or the Silicon Valley; Logue et al., 2015; Pahnke and Welter, 2019). We do not think that this affects the generalizability of our findings to other countries with heavily globalized economies, as the findings on firms highly affected by globalization appear to be the strongest in our analyses. Nevertheless, this limitation must be kept in mind, and the corroboration of our results using data from other regions of the world is needed. Second, the data collection period represents a possible limitation. The data on the various constructs were collected during a global pandemic crisis. According to Podsakoff et al. (2003), respondents' answers depend strongly on their mood states, especially on relatively recent mood-forming events as well as on the way they see themselves and the world around them. Answering a survey at the time of a pandemic crisis may have resulted in different responses than in "normal" times. However, the focus of our survey necessitated this timing, and this limitation could not have been prevented; nevertheless, it must be kept in mind. Third, respondents' answers are, in most cases, subjectively measured. That is, these answers depend strongly on their perception and, therefore, could deviate from firms' objective situation (Podsakoff et al., 2003). At the same time, we aimed to address top managers, who usually have a good overview of their firms, which helps mitigate this limitation. Fourth, while we have analyzed several potential moderators of the relationship between the level of digitalization before the COVID-19 crisis and the resilience of entrepreneurial firms in that crisis, there may be other factors that increase or decrease the impact of digitalization on such preparation resilience. Consequently, future research is needed to test other potential moderating factors, including actor-level factors such as managerial and employee skills (cf. Jafari-Sadeghi et al., 2023; Soluk, 2022), organizational-level factors such as an innovation-friendly culture (cf. Giotopoulos et al., 2022), and industry- and economy-level factors such as regulation and funding for research, development, and innovation (cf. Mitze and Makkonen, 2022; Sharma et al., 2022). Relatedly, we cannot rule out that the driver of our significant findings on the moderating impact of family firm status on the digitalization–resilience relationship may be driven by family firms' underlying risk aversion. Therefore, risk aversion and the associated resilience-enhancing practices such as risk management may drive our findings, especially since we did not measure risk aversion or similar constructs due to the typical space limitations of questionnaire surveys (e.g., Deutskens et al., 2004). However, family firms typically show low adoption rates of risk management

practices (e.g., Glowka et al., 2021; Henschel and Durst, 2016; Hiebl et al., 2019; Mitter et al., 2022a,b), suggesting that our results are not exclusively driven by risk aversion and risk management practices. Nevertheless, to rule out this alternative reasoning, we call for future research to delve into the dynamics among family firms, risk aversion, risk management practices and their organizational resilience to event-triggered crises.

CRedit authorship contribution statement

Tobias R. Bürgel: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Martin R.W. Hiebl:** Conceptualization, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition. **David I. Pielsticker:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Project administration.

Data availability

The data that has been used is confidential.

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