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Technological orientation and organizational resilience to Covid-19: The mediating role of strategy's digital maturity

Canio Forliano [a,b], Ludovico Bullini Orlandi [c,*], Alessandro Zardini [d], Cecilia Rossignoli [d]

[a] Department of Political Sciences and International Relations, University of Palermo, Via Amico Ugo Antonio, 90134 Palermo, Italy
[b] Department of Management, University of Turin, Corso Unione Sovietica 218/bis, 10134 Turin, Italy
[c] Department of Management, University of Bologna, Via Capo di Lucca 34, 40126 Bologna, Italy
[d] Department of Business Administration, University of Verona, Via Cantarane 24, 37129 Verona, Italy

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ABSTRACT

Grounded in dynamic capabilities theory, this study investigates the impact of firms' technological orientation (TO) on their resilience to the coronavirus disease (Covid-19) pandemic (RTC). The mediating role of the maturity of their digital strategy (MDS) to this relationship is also considered. To do this, we conducted an online survey of 186 firms that operate in Germany and Italy and tested the study's hypotheses by applying the covariance-based structural equation modeling (CB-SEM) and bootstrapped regression analysis. The results indicate that TO positively affects MDS, leading to higher RTC, whereas the relationship between TO and RTC is not significant. This study extends the knowledge about dynamic capabilities theory by providing empirical support for developing a mature digital strategy. Further, it highlights the importance for managers and policy makers to proactively respond to disruptive changes, such as those caused by the Covid-19 pandemic, thus contributing to organizational resilience literature that stresses the importance of ex ante initiatives to improve resiliency.

1. Introduction

Modern, highly turbulent environments have increasingly pushed firms to cope with crises and changes in order to thrive and gain competitive advantages (Degbey et al., 2021; Li and Liu, 2014; Santoro et al., 2018). This increased dynamism has generally been driven by institutional changes, market volatility, quick shifts in customer needs, and rapid technological advancements, which have provided companies with entrepreneurial challenges at the individual and organizational levels of analysis (Bullini Orlandi et al., 2020; Chung et al., 2021; Ferraris et al., 2019). Initially, it seemed that those changes affected only large businesses and high-tech start-ups. However, the increasing unpredictability and the volatility of modern business environments have pressured every company to improve its technological capabilities and orientation (Del Giudice et al., 2019; OECD, 2020). It is estimated that more than half of the enterprises in the global economy will adopt digital technologies by 2023. Moreover, they have been urged to "get ready for the digitized economy by accelerating investments in key technologies and new operating models to become hyperspeed, hyperscaled, and hyperconnected" (International Data Corporation, 2019, p. 3).

Two years of efforts in response to the effect of Covid-19 have revealed that digitization and solutions based on information and communication technology (ICT) have been critical in driving companies' innovativeness and success. The findings of a McKinsey and Company (2020) survey suggest that after a few months of Covid-19 the digitalization of customer interactions at the global level increased: from 36 % in December 2019 to 58 % in July 2020. Moreover, in the same period, the percentage of fully digitalized products at the global level increased from 35 % to 55 % (McKinsey and Company, 2020). The United Nations Conference on Trade and Development (2020) highlighted that the pandemic generated an increase to e-commerce's share of global retail trade from 14 % in 2019 to about 17 % in 2020. Furthermore, prior studies have emphasized that ICT has played a key role in supporting resilience during Covid-19 at the individual level (e.g., Mäntymäki et al., 2022; Xie et al., 2020) and at the firm level (e.g., Giotopoulos et al., 2022; Heredia et al., 2022), which suggests a direct relationship between them. In one study of the Columbia University research project *ICT and Covid-19*, it is stated that "ICT has also shown itself to be essential both to bolstering long-term resiliency against

* Corresponding author.
E-mail address: ludovico.bullini2@unibo.it (L. Bullini Orlandi).

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future pandemics" (Bajpai et al., 2020, p. 2). In addition, Abidi et al. (2022, pp. 1–3), in their empirical analysis of Covid-19 economic consequences, stated that "digitalization acted as a hedge during the pandemic" because "firms using Information and Communication Technologies (ICT) may be able to cope with economic shocks more flexibly through easier reorganization of their production processes." Lastly, Giotopoulos et al. (2022) suggested that ICT investments and innovations have enhanced firms' responses to the pandemic.

However, is having a strong technological orientation (TO) sufficient to ensure positive performances and organizational responses in fast-changing environments and crises?

The Covid-19 pandemic represents the latest and the most extreme case of disruptive change, which, tragically, emphasizes the urgency of implementing efficient and effective strategies to deal with these challenges on a global scale. Indeed, having profoundly affected the behaviors of companies and consumers (Rehman et al., 2021; Sheth, 2020), the pandemic highlights the critical need for transversal resilience-based capabilities for managing disruptive changes (Al-Omoush et al., 2020; Floetgen et al., 2021; Sakurai and Chughtai, 2020). Borrowing from the social-ecological literature (e.g., Holling, 2001; Plummer and Armitage, 2007), studies in the strategic and organizational management field have investigated the concept of resilience as a company's ability to effectively overcome external shocks and to quickly adapt to changes in the business environment (Kantur and Say, 2015; Linnenluecke, 2017). By empowering companies with agile solutions and by helping managers to make more informed decisions, several studies have found that digital technologies, such as the internet of things and big data, are positively affecting firms' innovations (Blazquez and Domenech, 2018; Bresciani et al., 2018).

However, several studies have suggested that most of the digital transformation projects do not achieve their desired outcomes (Abood et al., 2017; Tabrizi et al., 2019). Indeed, managers often struggle to fully comprehend the impact of digitization because of the lack of a clear strategy for their changed company (Kiron et al., 2016). Thus, if struggling organizations prioritize the short-term adoption of various technologies, digitally mature firms have a precise and gradually implemented strategy that guides their transformation (Kane, 2017; Kane et al., 2015).

Given this, if the initial studies mainly investigated the concept of resilience as a way of reacting to external threats and shocks that enforce adaptive responses, in more recent studies, the emphasis has shifted toward analyzing it from an internal perspective as a way to prevent those shocks (Khlystova et al., 2022; Linnenluecke, 2017). Resilience can thus be leveraged *ex post* or *ex ante*. *Ex post* resilience suggests applying adaptive backward-oriented initiatives to return to previously established structures and processes (Plummer and Armitage, 2007), whereas *ex ante* resilience requires a continual process of sensing changes and initiating organizational reactions beforehand to take advantage of them (Burnard and Bhamra, 2011). This perspective contrasts with reverting to an initial condition that is unable to cope with the first shock (Sakurai and Chughtai, 2020) and has been largely under explored (Floetgen et al., 2021). Furthermore, recent research has highlighted the need to investigate the impact of resilient strategies for dealing with the shocks caused by Covid-19 (Paoloni et al., 2021; Verma and Gustafsson, 2020).

To shed light on the ambivalent nature of organizational resiliency, grounded in dynamic capabilities theory, in this study, we investigated the impact of firms' TO on their resilience to Covid-19 (RTC). We also considered the mediating role of the maturity of their digital strategy (MDS) to this relationship. We found that TO positively affects MDS, leading to higher RTC, whereas the relationship between TO and RTC was not significant. Thus, this study offers several theoretical and practical contributions to the existing literature. First, it offers an integrated model of the MDS by examining TO as an antecedent and RTC as an outcome. Second, it contributes to the dynamic capabilities debate by providing empirical support for the development of a strategy for digital maturity to enhance organizational resilience capabilities. Hence, it highlights for managers and policy makers the importance of adopting proactive measures to respond to disruptive changes, such as those caused by the Covid-19 pandemic and contributes to the organizational resilience literature by stressing the importance of *ex ante* initiatives to improve organizational performance.

The remainder of the study is organized as follows. Section 2 presents the theoretical framework and the development of our hypotheses. Section 3 describes the research methodology. Section 4 includes the results of the analysis. Section 5 presents the discussion and summarizes the conclusions.

2. Theoretical framework and hypotheses development

2.1. Role of technology orientation in enhancing firms' digital maturity

The increasing volatility of modern business environments, which are characterized by simultaneous market and technology changes, is pushing organizations to constantly advance in technological development (OECD, 2020). Against this background, the concept of TO has assumed relevance in strategy and innovation studies as a construct that clarifies firms' urgent need to leverage technologies to increase their performance (Bullini Orlandi et al., 2020; Martínez-Caro et al., 2020). Nyström and Haeffner's (1979) seminal study about technology-oriented firms highlighted the central role of technology changes in strategy development and showed that firms' ability to base their product ideas on new technology principles can lead to higher levels of innovation than market-oriented firms. The concept of TO, sometimes also referred to as "research and development (R&D) orientation" (e.g., Cooper, 1984), can be generally defined as an organization's ability to develop new technologies, products, and processes. Such a broad definition includes the "ability and will to acquire a substantial technological background and use it in the development of new product" (Gatignon and Xuereb, 1997, p. 78). Similarly, Zhou et al. (2005) have identified a commitment to R&D, the acquisition of new technology, and the application of the latest technologies as key features of TO. Such a view of TO borrows from the theoretical roots of the resource-based view, according to which TO can be understood as a complex bundle of resources and capabilities (Barney, 1991; Wernerfelt, 1984) that helps an organization to sustain competitive advantages by developing new technologies inside the firm. However, this view has been integrated into the dynamic capabilities framework that was developed by Teece et al. (1997). Drawing on this, Srinivasan et al. (2002, p. 48) defined technology opportunism as the "sense-and-respond capability of firms with respect to new technologies." This definition strongly influenced other conceptualizations (e.g., Chen and Lien, 2013; Garrison, 2009; Lucia-Palacios et al., 2014, 2016; Zhou et al., 2005) and has performance implications for firms' TO (Srinivasan et al., 2002). In fact, TO has increasingly been linked to firms' ability to understand, to acquire, and to assimilate internal and external knowledge about new technological development.

To systematically adapt to the disruptive changes that are imposed by markets, technologies, and external shocks, firms are expected to develop digital strategies and to achieve digital maturity (Kane et al., 2021). This means implementing systemic changes to the ways in which firms organize and develop workforces and cultivate digitally minded cultures, enlarging the strategic planning horizons, scaling small digital experiments into enterprise-wide initiatives that have an impact on business, attracting talents, and securing visionary leaders that are committed to a digital-oriented vision (Kane et al., 2017). These principles seem not to be applicable when organizations show low levels of TO. In fact, several elements that indicate higher levels of TO are expected to positively influence a firm's MDS. Such elements include an openness to new ideas, a propensity to adopt new technologies (Hurley and Hult, 1998), substantial investments in R&D, and the use of sophisticated technologies in products, processes, business model

innovation (Slater et al., 2007), and, more generally, knowledge-intensive activities (Hambrick et al., 1995). In line with these assumptions, we posit our first hypothesis:

Hypothesis 1. The TO of a firm positively affects MDS.

2.2. Technological orientation and resilience to Covid-19 crisis

Early studies that directly or indirectly investigated the role of TO focused primarily on the relationship between TO and the adoption of new technology (Garrison, 2009; Srinivasan et al., 2002). More recently, researchers have expanded the focus to explore the role of TO as a moderator in several relationships, including CEOs' transformational leadership and corporate entrepreneurship (Chen et al., 2014) and organizational culture and healthcare supply chain resilience (Mandal, 2017). The role of TO has also been investigated in relation to organizational performance. More precisely, Chen and Lien (2013) tested the influence of technological opportunism on firm performance and measured it in terms of new product success rate, return on investment, sales growth, market share, and profitability. Conversely, Sarkees (2011) considered revenue, profit, and market value as indicators of firm performance. These studies have focused mainly on the economic performances of firms to evaluate the impact of technologies and technology orientation on a firm's competitive advantage. However, strategy and organization literature has increasingly recognized that competitive advantage, as it is traditionally understood, is not enough to allow firms to survive and to thrive in the long term (Bertello et al., 2022). Achieving and maintaining a sustained competitive advantage in highly turbulent business environments requires agility, resilience (Ferraris et al., 2021), and organizational logics that go beyond linear planning and traditional management tools (Ferraro et al., 2015; Forliano et al., 2022). It requires the ability to constantly update an organization, to be flexible without sacrificing efficiency (Junni et al., 2015), and to effectively overcome external shocks and quickly adapt to technological and market changes (Linnenluecke, 2017). The Covid-19 pandemic became a crisis that led to unexpected challenges that typically required fast and decisive strategic decision-making (Kraus et al., 2020). Thus, the key focus in strategic management is how firms can be flexible and can quickly adapt to new ideas, technologies, and socio-economic aspects, and changing norms and values (Weber and Tarba, 2014). Prior studies have found that firms' openness to novel technologies enhances the development of flexible structures that could ensure higher levels of innovation and a better chance of dealing with disruptions (Ho et al., 2016; Mandal and Saravanan, 2019). Following this line of reasoning, we propose the following hypothesis:

Hypothesis 2. The TO of a firm positively affects its RTC.

2.3. Firms' digital maturity and their resilience to Covid-19

The Covid-19 crisis represents a catalyst for the transition toward a more digital society. Policy measures that imposed smart working and social distancing challenged the traditional way of organizing the workplace (Kraus et al., 2022); however, they also created entrepreneurial opportunities (Shepherd, 2020) for digital innovation that met urgent and overwhelming social needs (Bacq and Lumpkin, 2020; Scheidgen et al., 2021). To respond to exogenous and pervasive shocks, such as Covid-19, organizations need to own and to leverage digital capabilities. As the existing literature suggests (e.g., Adamides and Karacapilidis, 2020), new ICT and digital capabilities are key for organizational innovation and performance. Westerman et al. (2014) identified the strategic dimension of digital capabilities as one of the core elements for turning firms into digital masters. Rossmann (2018) built on this concept by highlighting that a digital strategy must be implemented, documented, and properly communicated across the organization. Moreover, it has the capacity to influence existing business and operating models by being constantly evaluated and adapted. MDS is expected to positively influence corporate performance (Westerman et al., 2014), especially when organizations are subjected to turbulent environments that require them to effectively adapt and to quickly respond to a disruption to their activities (Ambulkar et al., 2015). Covid-19 has disrupted workplaces' organization and has accelerated many of the changes that were already underway, including the increasing use of digitalization in organizing work and workplaces (Kraus et al., 2022). However, as suggested by Amankwah-Amoah et al. (2021, p. 602), the adoption of emerging technologies may also be hindered by "vested external interests, nostalgia, and employer opportunism, as well as negative effects on employee well-being that undermine productivity, work-life balance, and future of work." Thus, firms that have higher levels of MDS are expected to be more resilient to the effects of Covid-19. Given these arguments, we propose the following hypothesis:

Hypothesis 3. A firm's MDS positively affects its RTC and moderates the relationship between this and TO.

In line with the previously introduced theoretical background, the research model and the hypotheses of the study are depicted in Fig. 1.

3. Research methodology

3.1. Data collection

To test the research model, we conducted an online survey of a final sample of 186 firms in Italy and Germany. We chose these countries as a unit of analysis because they were among the first countries in which the Covid-19 epidemic spread in Europe. In fact, Germany reported the first case of a person infected by a nonparent outside of China on 27 January 2020 (Deutsche Welle, 2020) and imposed restrictions on activities after a couple of months, while Italy reported its first cases after a few days and was one of the most affected countries in the early phases of the pandemic. Thus, Italy became the first country in the world to impose a national lockdown and was second only to China in the number of reported cases in March 2020 (World Health Organization, 2020). In line with prior studies (e.g., Lin and Kunnathur, 2019), we adopted the key informant approach for targeting potential respondents inside firms. Thus, we identified them among managers who oversaw the defining of their firm's strategies and were engaged in the digital transformation of their firm (e.g., CMO, CFO, CEO, CPO, CIO). To ensure compliance with privacy rules, we guaranteed respondents of their anonymity and aggregate data usage.

We developed, pretested, and refined the survey in collaboration with seven academics who have strong backgrounds in survey methodology and digital transformation research. The pretest of the survey was conducted in a sample of 35 firms. We collected data about the independent variables in T1, between March 2019 and February 2020 in Italy and Germany, and the data about the dependent variable were collected in T2, between 12 and 18 months after this.

We obtained the initial Italian sample by drawing a random sample of 250 firms from the AIDA-Bureau Van Dijk database, the most comprehensive database of Italian limited companies. From the 250 targeted firms, we collected a final sample of 66 fully completed surveys (which were answered in T1 and T2) for a response rate of 26.4 %. Conversely, in Germany, we adopted a snowball sampling approach, which was more appropriate because of the specific pandemic situation, as has been suggested in prior studies (e.g., Al-Omoush et al., 2021). By using the managers' alumni network of a leading business school, we reached a final sample of 119 firms in T2. Of the collected online surveys, six had some missing data in T1. However, we managed to not remove them all by employing a full information maximum likelihood (FIML) estimation technique, which is highly recommended as a method for dealing with missing data in structural equation modeling (Enders and Bandalos, 2001).

In addition, given the possible differences between the chosen countries, we conducted a statistical test on the two samples to check

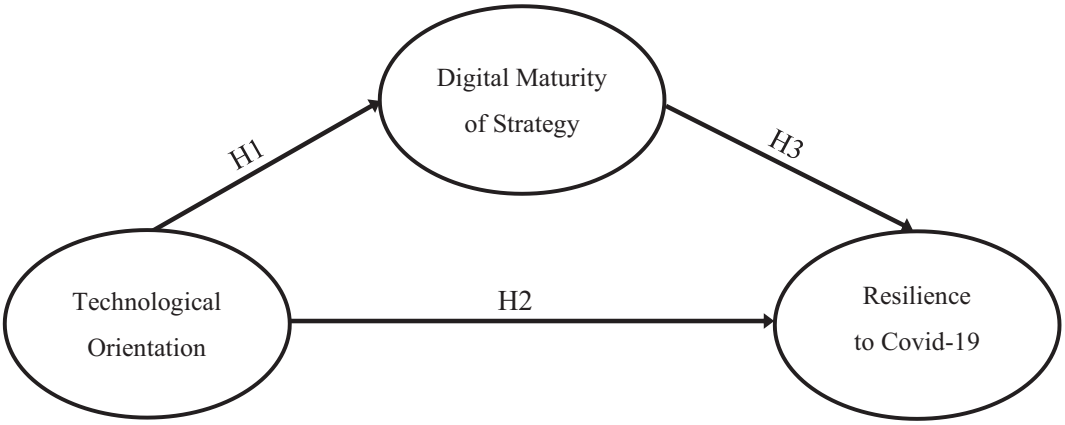

Fig. 1. The research model of the study.

whether they display significant differences in terms of the distributions of the dependent and the independent variables. We ran the Mann–Whitney *U* test on the distributions of the three analyzed variables (TO, MDS, and RTC) in the two countries. The results of the test, whose null hypothesis is that the distributions are significantly different, suggest that the distributions of the Italian and the German datasets are strongly similar for TO ($p < 0.91$) and for RTC ($p < 0.54$), while the distributions for MDS do not show a strong similarity. In this case, the *p*-value is $p < 0.048$, which is close to 0.05 and shows that there is not very strong evidence of differences between the two distributions.

Thus, the final sample employed in the analysis is a combination of the Italian and the German samples that comprises a total of 186 observations from a range of industries and dimensions.

In terms of representation levels for the top management roles, the sample is composed of chief executive officers (31.8 %), chief marketing officers (6.6 %), chief operating officers (5 %), chief technology officers (3.3 %), chief information officers (2.7 %), chief strategic officers (2.7 %), and chief digital officers (2.2 %).

A broad and equal variety of industries are included: food industry (9.3 %), retail (7.1 %), financial and insurance services (7.1 %), real estate (7.1 %), automotive (6 %), ICT (5.5 %), and several other sectors (e.g., pharmaceutical, mechanical, and agriculture) that have a representation level of <5 % each (totaling 57.9 %). We measured the sample's firm sizes by applying the EU Commission's size classes (2003/361/EC). Thus, the final sample includes 25.3 % micro firms, which have between zero and nine employees, 18.1 % small firms (10–49 employees), 15.9 % medium-sized firms (50–249 employees), and 40.7 % large firms (>250 employees).

3.2. Measures

The survey contains multi-item scales that were developed by prior management and information systems research (see Table 1). We measured the variables by using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree).

We assessed the scales' psychometric properties, namely reliability, convergent validity, and discriminant validity, by conducting the following analyses (see Table 2): exploratory factor analysis (EFA), composite reliability (CR), Cronbach's alpha (CA), and average variance extracted (AVE). Finally, confirmatory factor analysis (CFA) was performed.

Table 1 presents the results of the EFA with factor loadings. We ran the EFA analysis in SPSS 28 because of its better results visualization. Moreover, we ran CR, CA, AVE, and CFA by employing the lavaan package in R, which allowed us to manage the six incomplete surveys by using the FIML approach and to keep them in the analyses.

We assessed the reliability by analyzing the CA and the CR scores, all

Table 1
Constructs, items, and sources.

Construct	Item	Scale items (item loading)	Source
Maturity of the digital strategy (MDS)	MDS 1	Our company has implemented a digital strategy. (0.87)	Rossmann (2018)
	MDS 2	The digital strategy of our company is documented and communicated. (0.88)	
	MDS 3	The digital strategy of our company has a significant influence on the existing business model. (0.77)	
	MDS 4	The digital strategy is being continuously evaluated and adapted when necessary. (0.82)	
Technological orientation (TO)	TO 1	We use sophisticated technologies in our new product development. (0.77)	Gatignon and Xuereb, (1997); Zhou et al. (2005)
	TO 2	Our new products always use state-of-the-art technology. (0.78)	
	TO 3	Technological innovation based on research results is readily accepted in our company. (0.77)	
Resilience to Covid-19 (RTC)	RTC 1	We are able to cope with changes brought by the pandemic (Covid-19) disruption. (0.83)	Ambulkar et al. (2015)
	RTC 2	We are able to adapt to the pandemic (Covid-19) disruption easily. (0.83)	
	RTC 3	We are able to provide a quick response to the pandemic (Covid-19) disruption. (0.83)	
	RTC 4	We are able to maintain high situational awareness at all times. (0.68)	

Table 2
Assessment of constructs' convergent and discriminant validity.

Construct	M	SD	CR	CA	AVE	1	2	3
1. MDS	4.94	1.41	0.90	0.93	0.69	0.83		
2. TO	4.68	1.51	0.84	0.88	0.64	0.47	0.80	
3. RTC	5.16	1.32	0.87	0.86	0.63	0.31	0.24	0.79

1. M = mean; SD = standard deviation; CR = composite reliability; CA = Cronbach's alpha; AVE = average variance extracted.
2. Numbers on the diagonal are the square root of AVEs. The other numbers are correlations among constructs and are all significant at 0.01 level.

of which are above the suggested threshold of 0.7. Furthermore, the items' loadings were all above 0.7, except for the new scale of RTC, which was 0.68. However, such a value can be considered acceptable because of the study's sample size (Hair et al., 2010).

The above-mentioned analyses of CR confirm convergent validity (Hair et al., 2010) and, furthermore, all the AVEs were above 0.5 (Fornell and Larcker, 1981).

We assessed discriminant validity by verifying that the squared roots of AVE were higher than the other inter-construct correlations (Fornell and Larcker, 1981). Furthermore, we verified that each item's loading on its construct was greater than all the cross-loadings on other constructs (Farrell, 2010).

Lastly, the CFA for the measurement model displays acceptable fit indices: $CFI = 0.98$, $TLI = 0.98$, $RMSEA = 0.05$, and $SRMR = 0.03$.

In particular, to measure TO, we used a scale that was developed in two of the most-cited papers that deal with this construct (Gatignon and Xuereb, 1997; Zhou et al., 2005). The scale consists of three items that reflect the level at which organizations readily accept innovations from technological research and employ state-of-the-art technologies ($CA = 0.88$). Then, we measured the level of MDS by employing a multi-item scale that was proposed by Rossmann (2018) to assess whether organizations have developed, documented, communicated, and implemented a digital strategy at the corporate level ($CA = 0.93$). To measure RTC, we adapted Ambulkar et al.'s (2015) four-item scale on organizational resilience in regard to the items' wording ($CA = 0.86$).

In addition, we considered the following four control variables in the bootstrapped regression analyses. The firm's country as a dummy is equal to 1 for Germany and 0 for Italy, the firm's size is measured with seven ranges (from 1 = <10 to 7 = >2500), and there are two dummies for the industries that could be more easily digitalized, namely ICT (*Ind_ICT*) and financial services (*Ind_FIN*). The other, more representative, industries were also tested as control variables and the results did not change. Therefore, we decided to include only those two industries to make the presentation of the results clearer.

4. Results

To test the research hypotheses of our study, we employed covariance-based structural equation modeling (CB-SEM), which is particularly appropriate for theory testing when models are reasonably simple and have a sufficient number of observations (Hair et al., 2014). In addition, to test the mediation, we employed a bootstrapped regression-based analysis that was proposed by Hayes (2022). All the results tables are displayed to show that they confirm the SEM analysis results.

The results of the structural model analysis indicate that the model has an adequate fit with the data because all the relevant values are above the 0.90 threshold that was suggested by Bagozzi and Yi (1988) and Chau and Hu (2001): $\chi 2 = 62$, $df = 41$, $CFI = 0.98$, $TLI = 0.98$, $IFI = 0.98$, $RMSEA = 0.053$, $SRMR = 0.033$, and $p = 0.018$. Fig. 2 shows the results of the CB-SEM.

Hypothesis 1 stated that the TO of a firm positively affects its level of MDS. Interestingly, TO is strongly and significantly associated with MDS (H1: $\beta = 0.58$, $p < 0.001$). Thus, Hypothesis 1 is supported.

In contrast, Hypothesis 2 suggested that the TO of a firm positively affects its RTC. However, the analysis results indicate that the relationship between TO and RTC is not significant. Hence, Hypothesis 2 is not supported. This finding is not surprising given that Hypothesis 3 suggested a mediation effect of MDS in the relationship between TO and RTC, which, it appears, can be a full mediation.

Finally, Hypothesis 3 stated that the level of a firm's MDS positively affects its resilience to Covid-19 and MDS mediates the impact of TO on RTC. The results show that there is a strong association between MDS and RTC (H3: $\beta = 0.24$, $p < 0.01$). To test the mediation effect, we employed the bootstrapped procedure for mediated models with *PROCESS* in SPSS 27 to control for country, firms' industry, and firms' dimensions (see Tables 3, 4, and 5). The results show that there is no direct effect of TO on RTC and only the indirect effect of TO via MDS is significant (indirect effect TO → MDS → RTC = 0.10; *BootLLCI* = 0.035, *BootULLCI* = 0.18), which leads us to support Hypothesis 3.

5. Discussion and conclusion

In recent years, digital transformation has become central for firms to survive and to thrive (e.g., Bullini Orlandi et al., 2020; Del Giudice et al., 2019; Santoro et al., 2018). The Covid-19 crisis further required companies to advance their technological competencies (Kraus et al., 2022; Shepherd, 2020; Verma and Gustafsson, 2020). However, despite

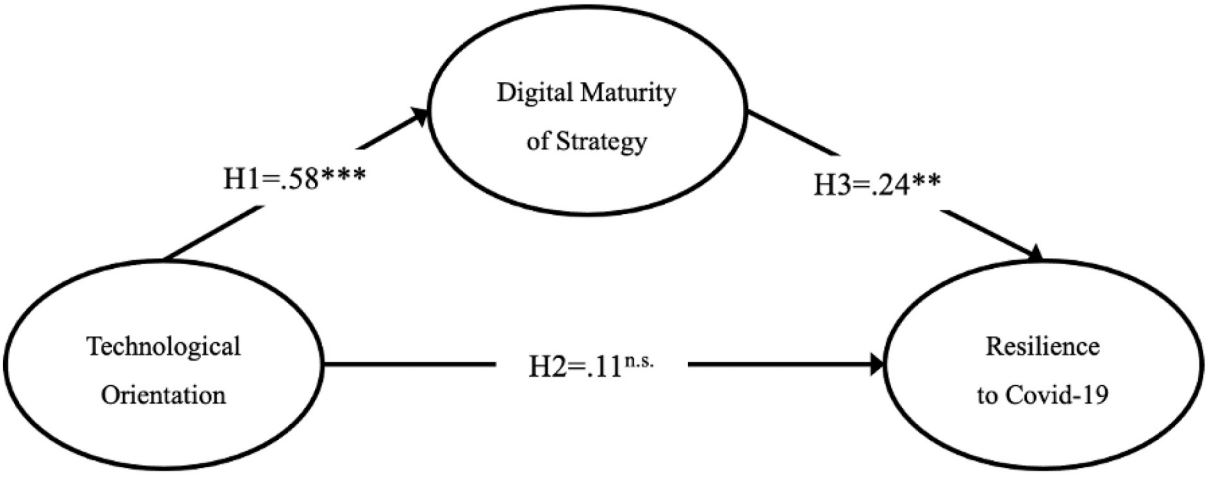

Fig. 2. Structural model and results.

Table 3
Direct effect of TO on MDS.

Outcome variable: MDS						
Model summary						
R	*R*-sq	*MSE*	*F*	*df*1	*df*2	*p*
0.5312	0.2822	19.911	139.968	5	178	0.0000

Model						
	Coeff	*se*	*t*	*p*	*LLCI*	*ULCI*
Constant	26.653***	0.3856	69.125	0.0000	19.044	34.262
TO	0.4873***	0.0732	66.601	0.0000	0.3429	0.6317
Controls						
Ind_Fin	0.8702*	0.3774	23.057	0.0223	0.1254	16.149
Ind_ICT	0.7317	0.4545	16.098	0.1092	−0.1653	16.286
Employee	0.0635	0.0535	11.862	0.2371	−0.0421	0.1690
Country	−0.7225**	0.2284	−31.629	0.0018	−11.732	−0.2717

1. n.s. = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 4
Direct effect of TO and MDS on RTC.*

Outcome variable: RTC						
Model summary						
R	*R*-sq	*MSE*	*F*	*df*1	*df*2	*p*
0.3540	0.1253	15.402	42.263	6	177	0.00005

Model						
	Coeff	*se*	*t*	*p*	*LLCI*	*ULCI*
Constant	36.783***	0.3819	96.306	0.0000	29.246	44.320
TO	0.0756n.s.	0.0719	10.508	0.2948	−0.0664	0.2175
MDS	0.2141**	0.0659	32.472	0.0014	0.0840	0.3442
Controls						
Ind_Fin	0.2555	0.3368	0.7584	0.4492	−0.4093	0.9202
Ind_ICT	0.5831	0.4027	14.482	0.1493	−0.2115	13.778
Employee	0.0034	0.0472	0.0721	0.9426	−0.0898	0.0966
Country	0.0657	0.2065	0.3184	0.7505	−0.3417	0.4732

1. n.s. = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 5
Direct and indirect effect of TO on RTC.

Direct effect of X on Y:					
Effect	*se*	*t*	*p*	*LLCI*	*ULCI*
0.0756	0.0719	10.508	0.2948	−0.0664	0.2175

Indirect effect of X on Y:				
	Effect	*BootSE*	*BootLLCI*	*BootULCI*
Via MDS	0.1043	0.1043	0.0348	0.0387

such a pressing necessity, most companies strive to achieve their intended outcomes when embarking on a path of digitization (Abood et al., 2017; Tabrizi et al., 2019), especially if they do not have a clear digital strategy (Kane, 2017; Kane et al., 2015). In the context of the Covid-19 pandemic, some studies (e.g., Abidi et al., 2022; Giotopoulos et al., 2022) have stressed that technology and, in particular, ICTs have played a key role in responding to the crises, which likely underestimates the impact of digital strategy on ICT investment and innovation. In answering the call for more research, Paoloni et al. (2021) and Verma and Gustafsson (2020) aimed to shed light on the role played by digital strategies when dealing with the pandemic. CB-SEM and mediation analyses were performed in this study to test the relationship between a firm's TO and its RTC. Moreover, the mediating role of a firm's MDS was considered. By doing so, this study paves the way for several theoretical and practical implications.

First, it adds to the literature on organizational resilience and dynamic capabilities by investigating the role played by TO. Several studies, especially in the agility and adaptive co-management subfields, have found that companies' openness to novel technologies helps them to develop flexible structures that ensure higher levels of innovation performance and a better chance of dealing with disruptions (Ho et al., 2016; Mandal and Saravanan, 2019). Nonetheless, while one study found that more than two halves of managers believe that their business will change because of technological advancements (Gartner, 2019), in

another study released by Accenture, only 13 % believe that digital investments have helped their company to achieve higher levels of efficiency, cost savings, and growth (Abood et al., 2017). Similarly, Tabrizi et al. (2019) suggested that 70 % of digital transformation projects do not achieve their desired outcomes. Indeed, recent research found that a heavy reliance on information technologies can result in knowledge overloads (Haug et al., 2020; Kim et al., 2021) or strategic inertia, which are activated by path-dependent behaviors that make firms resistant to changing environments and hinder their organizational learning processes (Sydow et al., 2020). From the findings of this study, we support this latter perspective, which is in line with other empirical works (e.g., Abood et al., 2017; Tabrizi et al., 2019). In particular, our study confirms that a strategic approach to digitalization is central, even in firms with a high level of TO, to achieve organizational resilience.

Second, this study contributes to the literature on innovation and strategic management by examining the function of TO and MDS during unusual times, such as those imposed by the Covid-19 pandemic. By doing so, it offers factual support to the literature by arguing that possessing the right resources is not sufficient to guarantee a firm's survival in fast-changing business environments (Teece, 2014). Indeed, change can occur at a range of intensities, be incremental or abrupt, be predictable or unpredictable, and be reversible or irreversible, and can dramatically affect organizations' operations if not effectively managed (Burt et al., 2017). As a result, every organization that is willing to thrive in such a complex scenario must be able to implement effective strategies to sense and to adapt to external changes and technological advancements (Fitzgerald et al., 2014; Li and Liu, 2014; Teece, 2007). Thus, the lack of a digital transformation strategy is a frequent cause of failure (Kane et al., 2021), which manifests in a variety of ways, including in initiatives that do not contribute to the intended goal, in wasteful resource allocation, and in an ever-growing backlog of transformation projects (Sebastian et al., 2017). As a result, businesses need a digital strategy that cover all facets of the organization and establish a shared culture of digital transformation across the company (Kane et al., 2017; Mandal, 2017; Martínez-Caro et al., 2020).

Subsequently, the third contribution of this study lies in the debate about the role that is played by *ex ante* resilience in managing environmental dynamism, which paves the way to higher levels of organizational performance (Khlystova et al., 2022; Linnenluecke, 2017). Indeed, TO does not have a significant relationship with RTC, which means that openness to novel technologies also requires long-term strategies that empower firms to effectively sense and respond to external changes (Forliano et al., 2022; Kraus et al., 2020; Ricciardi et al., 2016). This further extends the findings of prior research (e.g., Ho et al., 2016; Mandal and Saravanan, 2019) that highlight the relevance of having a mediating variable (i.e., MDS) between a firm's ability to deal with disruptions and its openness to novel technologies. Hence, the primary motivation of this study is to alert managers that do not engage in digital transformation as part of a precise digitization strategy but rather as a desire to alter the performance of specific business units. Indeed, competitive companies use digital transformation to drive organizational and cultural changes (Davenport and Westerman, 2018) that help them to deploy and to configure resources to respond to external shocks (Augier and Teece, 2009; Teece, 2014). Although our study was framed by the context of the Covid-19 crisis, we can generalize such a conclusion. Indeed, as Kane et al. (2021, p. 198) argued, "the acute COVID disruption did not lead most organizations to do fundamentally different things than they were already contemplating; it simply forced action and transformation with urgency and at scale."

Despite its contributions, this study has several limitations. First, it uses perceptual data that were collected through one key informant per surveyed firm. Thus, even if we adopted several techniques to avoid missing data, non-response bias, multicollinearity, and common-method variance, a complete lack of biases cannot be guaranteed. Hence, future studies should collect more than one survey from a single organization. Second, we collected data in only two countries and, thus, the generalizability of our results could be improved by conducting comparative analyses, for example, between developed and emerging countries. Third, we did not consider possible moderating factors that could affect the relationship between TO, MDS, and RTC. Thus, future research should be extended to consider other relevant variables. Finally, this research focused on analyzing firms' resilience at an organizational level of analysis. It would be interesting to investigate the microfoundational characteristics of firms' responses to external shocks, such as those imposed by Covid-19.

CRediT authorship contribution statement

Forliano Canio: Conceptualization, Writing – original draft, Writing – review & editing. **Bullini Orlandi Ludovico:** Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Zardini Alessandro:** Data curation, Writing – original draft, Writing – review & editing. **Rossignoli Cecilia:** Supervision, Writing – original draft, Writing – review & editing.

Data availability

The data that has been used is confidential.

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Canio Forliano is a PhD student in System Dynamics at the University of Palermo, Department of Political Science and International Relations. He also works as a research and teaching assistant at the Department of Management at the University of Turin, where he has been involved in two Industry 4.0 research projects. He is part of the SIDREA national research group regarding public universities' governance and the evaluation of their performances. His research interests cover the following topics: system dynamics, entrepreneurial universities and the third mission, and business model innovation.

Ludovico Bullini Orlandi is Assistant Professor in Organization and HRM at the University of Bologna and co-director of the Master in HR and Organization at the Bologna Business School. He holds a Ph.D. in Economics and Management from the University of Verona. His research interests revolve around digital transformation's impact on HR and organizations. He teaches Organization Theory at the University of Bologna. He has held visiting and research collaborations at the University of Lund and the Karlsruhe Institute of Technology. He has also taught at the CUOA Business School, at the Catholic University of Lille, and the University of Verona.

Alessandro Zardini is Assistant Professor in Organizational Studies. He received his Ph.D. in Business Administration from the University of Verona. He pursues research in Information Systems (knowledge management, enterprise content management, and decision support systems), outsourcing, and public management. He teaches Organizational design in the master's in business administration at the University of Verona. Previously, he was a visiting scholar at the University of Liechtenstein, the University of Leeds, the University of Valencia, and at the University of Lund. He publishes in leading journals and has presented and discussed his findings with academics, policy makers and practitioners.

Cecilia Rossignoli is Full Professor of Organization Science at the University of Verona. Previously she served as Assistant Professor at the Catholic University of Milan for 17 years. She is member of the faculty of the Graduate School of Economics and Management, University of Verona and Padua. She is responsible of the module "Organization Theory". Her research and teaching interests cover the area of Information Systems and organization studies. Recent publications regarded e-Markets and organizational reconfigurations, organizational impact of Business Intelligence Systems, inter-organizational relationships and business networks. On these subjects she has published >130 papers and books.