

# How do SMEs shape business model innovation? A digital infrastructure, improvisational, and dynamic capability perspective

Rogier van de Wetering<sup>1</sup>, Joshua Doe<sup>2</sup>, Ronald van den Heuvel<sup>1</sup> and Hussam Al Halbusi<sup>3</sup>

<sup>1</sup> Faculty of Science, Open University, Heerlen, the Netherlands [rogier.vandewetering@ou.nl](mailto:rogier.vandewetering@ou.nl)

<sup>2</sup> Marketing department, Central University, Accra, Ghana

<sup>3</sup> Department of Management, Ahmed bin Mohammed Military College, Doha, Qatar

**Abstract.** Dynamic capabilities embody various capabilities that drive the organization's adaptiveness and are studied from disciplines including management, organizational sciences, and information systems. However, the impact of dynamic capabilities manifested through management system adaptability, adaptive capability, and improvisational capabilities on business model innovation under tumultuous times still has to be unfolded for small to medium-scale enterprises (SMEs) in a developing country context. Therefore, this study investigates these capabilities' role in Ghana's SMEs during the COVID-19 crisis. Moreover, we investigate the role of a digital infrastructure capability that supports business connectivity and information exchange with business partners in strengthening the impact of improvisational and dynamic capabilities on business model innovation under COVID-19. Also, we propose that technological turbulence that erupted due to COVID-19 acts as a key contingent factor that positively moderates the relationship between business model innovation and the organizational performance of SMEs. Using an online survey, we obtained survey data from 105 SMEs sampled from the Greater Accra Region of Ghana and analyzed the data using partial least structural equation modeling (PLS-SEM). This study shows that dynamic and improvisational capabilities positively impact business model innovation. This study unfolds that business model innovation positively impacts organizational performance during the COVID-19 crisis. Moreover, our work shows that digital infrastructure capability is crucial in shaping dynamic and improvisational capabilities. This digital capability seems crucial to quickly adapt to the changing customer, technology, and competitor landscape during a pandemic.

Finally, the analyses unfold that technological turbulence is a key moderating factor in the research model that strengthens the relationship between business model innovation and organizational performance. Hence, our results extend the current knowledge base of dynamic and organizational capabilities while offering various implications for practice. We also offer various practical recommendations that help overcome business model innovation challenges during tumultuous times.

**Keywords:** management system adaptability, adaptive capacity, dynamic capabilities, improvisational capabilities, digital infrastructure capability, business model innovation, organizational performance, COVID-19

## 1 Introduction

Following the global outbreak of COVID-19 and subsequent lockdowns worldwide, numerous businesses have been forced to close. The lockdown has significantly impacted individuals, businesses (for-profit and not-for-profit), and countries globally, including economic, psychological, social, political, and technological effects (Ritter & Pedersen, 2020). The pandemic was predicted to continue, with institutions such as the World Health Organization forecasting them. Additionally, the World Bank has forecasted a global economic contraction, with increased global debt, which has been unprecedented since the 1970s (World Bank, 2021). The economic impact has varied across different economies, with some shrinking more than others. The World Bank (2021) has projected a decade of disappointing growth for businesses and economies globally, including those in sub-Saharan Africa, due to the disincentivized investment climate, disruptions in education, and concerns about the sustainability of the global value chain. The most affected businesses will likely be those in emerging economies, where safety nets are limited (Yeniaras, Kaya, & Dayan, 2020).

In light of the expected economic downturns caused by crises, the ability of businesses to survive can be affected by their agility and innovation (Eikelenboom & De Jong, 2018; Yeniaras et al., 2020). The question then arises as to how organizations in developing countries adapt to the sudden external shock brought about by the pandemic. Various scholars have proposed different strategies for coping with COVID-19, including cooperation, crisis-comparative dimensions, open innovation, and relationship strategies (Crick & Crick, 2020; Obal & Gao, 2020; Radziwon, Bogers, Chesbrough, & Minssen, 2022). However, most of these proposals are conceptual and require empirical validation. Therefore, there is a need for an empirical understanding of how firms in emerging economies utilize their organizational capabilities to create agile and innovative business processes to survive external shocks like COVID-19. This study focuses on SMEs and their capabilities to address downturn events. SMEs are essential in supporting entrepreneurship within a country's economy, and many studies investigating larger firms' responsiveness and adaptiveness neglect smaller businesses (Battisti & Deakins, 2017; Simms, McGowan, Pickernell, Vazquez-Brust, & Williams, 2022).

The impact of SMEs on a country's economy is significant as they promote innovation, diversify the economy, and generate employment opportunities, particularly in developing countries like Ghana (Thurik & Wenekers, 2004). COVID-19 has imposed numerous challenges for SMEs, such as virtual collaboration and maintaining employee satisfaction. However, we lack sufficient knowledge on why some SMEs recover quickly from crises while others fail and which specific resources and capabilities they use to recover. Despite limited research on SMEs, several studies have focused on resource management (Battisti & Deakins, 2017), dynamic capabilities (Ashiru, Adegbite, Nakpodia, & Koporcic, 2022; Weaven et al., 2021), strategic agility (Zahoor, Golgeci, Haapanen, Ali, & Arslan, 2022), organizational inertia (Nedzinskas, Pundzienė, Buožiūtė-Rafanavičienė, & Pilkiene, 2013), and learning to understand how SMEs respond to external shocks learning (Permana, Laksmana, & Ellitan, 2017).

While it is important for businesses to have deliberate decision-making processes and capability planning during tumultuous times and crises, it may not be enough to tackle the changing business conditions and drive business model innovation (Brunelli, Gjergji, Lazzarotti, Sciascia, & Visconti, 2022; Tsilika, Kakouris, Apostolopoulos, & Dermatis, 2020; Zhang & Merchant, 2020). According to Pavlou and El Sawy (2010), firms should focus on improvisation to handle unexpected shocks. Improvisational capabilities help firms reconfigure existing resources quickly, leading to innovation and new business models to tackle unpredictable situations (Jun et al., 2021; Pavlou & El Sawy, 2010; Tseng, Lee, & Chu, 2015). SMEs can use improvisation to address emerging business model challenges and create innovative services and service propositions (Baker, Miner, & Eesley, 2003; Jun et al., 2021).

The present study concentrates on the roles of improvisational and dynamic capabilities in enhancing business model innovation during crises for SMEs. The research aims to contribute to the existing literature on organizational capabilities and business model innovation in a crisis, addressing a knowledge gap in this area. The dynamic capabilities framework (DCF) is employed to analyze the research findings (Rachinger, Rauter, Müller, Vorraber, & Schirgi, 2018). As SMEs in developing countries often face a scarcity of resources and capabilities, developing and reconfiguring organizational resources is critical for long-term success (D'Annunzio, Carattoli, & Dupleix, 2015; Daou, Karuranga, & Su, 2013; J. K. Doe, Van de Wetering, Honyenuga, & Versendaal, 2022; Ofosu-Ampong & Acheampong, 2022; Smallbone, Deakins, Battisti, & Kitching, 2012; Tejumade & Kevin,

2012).. Dynamic capabilities refer to the firm's ability to shape, reconfigure and adapt resources to respond to changes in the business environment, while improvisational capabilities refer to the ability to act spontaneously in the short-term, which can complement dynamic capabilities in times of crisis (Guo, Su, & Ahlstrom, 2016; Pavlou & El Sawy, 2010). Together, these capabilities shape a firm's competitive position and offerings and are crucial for achieving strategic objectives. The development of these capabilities depends on the combination of assets, activities, and people, connecting a firm's day-to-day activities with its strategic ambitions.

Several academics contend that comprehending how dynamic and improvisational capabilities contribute to achieving business model innovation during tumultuous times is crucial, as most scholarly work on the subject is mainly theoretical (Pavlou & El Sawy, 2010; Randhawa, Wilden, & Gudergan, 2021; D. J. Teece, 2018). Business model innovation involves making deliberate decisions about altering the content, structure, and governance of transactions designed to exploit business opportunities, resulting in the implementation of a new business model for the company (Guo et al., 2016; D. J. Teece, 2018). This research provides empirical evidence from an emerging country context on how improvisational capabilities and dynamic capabilities can drive business model innovation, thereby ensuring business performance during uncertain times like the COVID-19 pandemic. While numerous studies have examined SMEs' business model innovation, there is limited literature that investigates the impact of high technological turbulence on it (Clauss, Breier, Kraus, Durst, & Mahto, 2022; Guo, Tang, Su, & Katz, 2017; Molina-Castillo, de Reuver, Bouwman, & Clavel, 2021). Since technological turbulence can significantly affect business model innovation and SME performance success, it is important to comprehend its impact (Puriwat & Hoonsopon, 2021; Troise, Corvello, Ghobadian, & O'Regan, 2022). Therefore, this study will also explore the moderating impact of technological turbulence on SMEs' organizational performance in Ghana.

Furthermore, modern organizations benefit from having modular digital infrastructures as it supports business connectivity and information exchange with business partners in the aftermath of a crisis (Akpan, Soopramanien, & Kwak, 2021; Cenamor, Parida, & Wincent, 2019; Wetering & Versendaal, 2020). Furthermore, such digital infrastructure boosts business model innovation's impact on performance (Cenamor et al., 2019; Reis & Melão, 2023; Verhoef et al., 2019). Therefore, this study also investigates the critical role of digital infrastructure capability in shaping dynamic and improvisational capabilities to drive business model innovation and organizational performance.

Against this background, we define the following research questions: *“To what extent do dynamic and improvisational capabilities impact business model innovation, and what is its subsequent impact on organizational performance under COVID-19? Furthermore, to what extent does turbulence impact the contribution of business model innovation on performance? And, finally, what is the role of digital infrastructure capability in driving dynamic and improvisational capabilities in the value path?”*

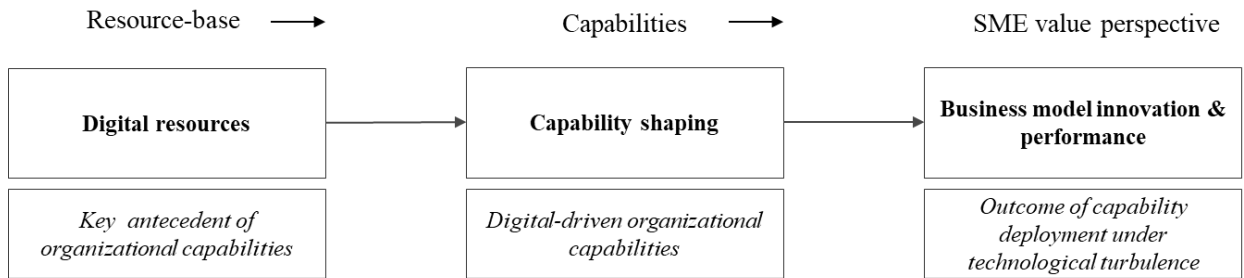
In addressing these questions, we build upon a quantitative survey approach as the literature predominantly focused on case studies limiting the generalizability of outcomes in crisis situations and turbulent environments. We gained access to 105 SMEs from the Greater Accra Region of Ghana in Africa and tested our model with associated hypotheses.

In the following sections, we review both the theoretical and empirical literature on the study constructs, discuss the methodology of this research, present data, and then make conclusions, recommendations, and present areas for further research.

## 2 Theoretical framework

Figure 1 shows our research framework. The framework accentuates a value path initiated from the firm's resource base that forms the foundation of capability shaping and the subsequent SME value perspective or outcome resulting from capability deployment. Hence, three core elements can be identified, i.e., digital resources (digital infrastructure capability), organizational capabilities (dynamic and improvisational capabilities), and the value perspective (business model innovation and organizational performance). Building upon the foundation of the resource-based view of the firm (RBV) (Barney, Wright, & Ketchen Jr, 2001) and the DCF, we argue that SME's digital infrastructure capability, as a core resource, positively impacts improvisational and dynamic capabilities and enables SME's to adapt to COVID-19 shocks. Furthermore, these digital-driven organizational capabilities subsequently positively impact business model innovation. We also argue that technological turbulence positively

moderates the effect of business model innovation on organizational performance. Table 1 highlights the definitions and describes the framework's elements.



**Figure 1:** Research framework

Framework elements	Definition and conceptualization	Supporting literature
<i>Resource-base</i>		
Digital infrastructure capability	Firms' capability to support business connectivity and information exchange with business partners through modular designs and standardized interfaces in applications and processes.	(Cenamora et al., 2019; Konopik, Jahn, Schuster, Hoßbach, & Pflaum, 2022; Stoeckli, Dremel, & Uebernickel, 2018; Van de Wetering, Versendaal, & Walraven, 2018; Wetering & Versendaal, 2020).
<i>Capabilities</i>		
Improvisational capabilities	Improvisational capabilities concern the ability to spontaneously reconfigure existing resources to build new operational capabilities to address urgent, unpredictable, and novel environmental situations.	(Pavlou & El Sawy, 2010, p. 443).
Dynamic capabilities	Dynamic capabilities can be considered the firm's behavioral orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage.	Wang and Ahmed (2007, p. 35)
<i>SME value perspective</i>		
Business model innovation	Business model innovation concerns the implementation of a business model that is new to the firm.	(Björkdahl & Holmén, 2013, p. 214).
Organizational performance	It can be regarded as a measure of how well SMEs do better than their competitors in the same industry	(Chen & Tsou, 2012; Van de Wetering, 2019)
<i>Moderating factor</i>		
Technological turbulence	Concerns the extent to which technology in the industry is in a state of flux.	(Guo et al., 2016)
<i>Imposed effects</i>		
1. The indirect effect of digital infrastructure capability	The organization's dynamic capabilities positively mediate the effect of digital infrastructure capability on business model innovation.	Further reading and support  See section 3.1

2. The indirect effect of digital infrastructure capability	The organization's improvisational capabilities positively mediate the impact of digital infrastructure capability on business model innovation.	See section 3.2
3. The indirect effect of improvisational and dynamic capabilities	Business model innovation positively mediates the impact of improvisational and dynamic capabilities on organizational performance.	See section 3.3
4. Moderating effect of technological turbulence on organizational performance	Technological turbulence positively moderates the effect of business model innovation on organizational performance.	See section 3.4

**Table 1.** Research framework elements

The following sections provide the theoretical ground necessary to position each of the research framework's elements and imposed effects. First, discuss what is known about business model innovation and how this allows firms to address downturn events. The resource-based view of the firm and the dynamic capabilities follow this section and shed light on how firms adapt under turbulent conditions and adjust their operating base with processes and technologies in line with the market demands.

## 2.1 Business model innovation

It is well-known that many organizations miss substantial business opportunities through structural complexity reduction and effective and innovative business model use (Bock, Opsahl, George, & Gann, 2012). Furthermore, they miss out on opportunities because they use traditional ways of thinking in pursuing business goals (Van Looy, 2021), while during times of crisis, a more adaptive and dynamic approach is required that focuses on business model innovation (Bhatti, Santoro, Khan, & Rizzato, 2021; Bock et al., 2012; Randhawa et al., 2021).

Business models depict the content, structure, and governance of transactions designed to create value by exploiting business opportunities (Guo et al., 2016; D. J. Teece, 2018). Each organization has a business model (Chesbrough, 2007). Some, however, have not clearly articulated and documented this. Typically, a business model describes the organization's value propositions (products/services, offerings), profit formula, the organization's key resources (e.g., people, process, technology, and support), and the processes needed for execution and collaboration (Christensen, Bartman, & Bever, 2016). In essence, business models can be considered a driving force in the organization's business operations that are in line with what customers want and how people can do their work most efficiently and with the proper behavior (Lindgardt, Reeves, Stalk, & Deimler, 2009)

It is well known that different levels of innovation ambition require different people, motivational factors, and organizational support systems (Anwar, 2018; Zott & Amit, 2007). A key focal point concerns business model innovation (Chesbrough, 2010). Business model innovation allows firms to address downturn events by changing their core value proposition to customers and their underlying operating model (Guo et al., 2016). The degree to which an organization's business model innovation is being rolled out can be boldly classified into three levels of ambition. The first is the primary 'creation' of incremental enhancement of products and services. The second is the adjacent 'sustaining innovation,' which focuses on leveraging offerings and value propositions into a new space. Finally, the third one is the 'transformational' level which embraces the development of new offers to customers and possibly even new businesses to serve markets and customer needs that may not yet exist (Christensen et al., 2016). Unfortunately, many organizations cannot achieve business benefits from their business model innovation when they re-balance the innovation portfolio from core to fundamental and subsequently to the transformational level. This is because these firms lack essential organizational resources, capabilities, and key processes to be genuinely transformative in their business model (Chesbrough, 2010; Christensen et al., 2016; D. J. Teece, 2018). Hence, we argue that organizations capable of orchestrating their organizational resources and addressing down-turn events by changing their core value proposition will successfully achieve business model innovation and high levels of organizational performance.

## 2.2 The resource-based view of the firm and dynamic capabilities

We ground this study in the DCF. The DCF can be regarded as an extension of the RBV that popularized the management and strategy literature in the 90s. RBV's core claim is that through resources (e.g., IT, data, human capital), a firm can achieve and subsequently maintain a competitive edge (Barney et al., 2001). However, the RBV did not properly account for market dynamics and changing industry conditions that can profoundly impact a firm's competitiveness (Eisenhardt & Martin, 2000; Lin & Wu, 2014). For these particular situations, the DCF explains the notion of competitiveness better than the RBV (D. J. Teece, 2007; Wang & Ahmed, 2007). Hence, this theory provides scholars and leaders with insights into how to adapt firms under turbulent conditions and adjust their operating base with processes and technologies in line with the market demands (Pavlou & El Sawy, 2010; D. J. Teece, 2018). This theory starts with the notion of a 'capability.' A capability can be regarded as aggregating several underlying elements that refer to tangible and intangible assets firms use to develop and implement the business strategy (Ray, Barney, & Muhanna, 2004). Think, for instance, about competencies (i.e., individual employee skills), business processes that produce a particular output, knowledge systems, and partnerships (i.e., the interfaces with key participants an organization needs to produce outputs) (Ismail, Rose, Uli, & Abdullah, 2012; Ray et al., 2004). The combination of these individual aspects gives an organization a particular capability. However, unfortunately, there is often confusion between capabilities and competencies. This is because capabilities are always associated with the organizational level; competencies and skillsets, in essence, describe an individual.

In this research context, we focus on specific capabilities, i.e., dynamic and improvisational capabilities. Hence, we follow Wang and Ahmed (2007, p. 35) and define dynamic capabilities as '...the firm's behavioral orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage.'

This research focuses on two crucial dimensions of dynamic capabilities: adaptive capability and management system adaptability (Akgün, Keskin, & Byrne, 2012). Adaptive capability concerns reconfiguring existing organizational resources and processes to respond to external changes (Zhou & Li, 2010). Management system adaptability concerns the degree to which firms encourage employees to challenge outmoded traditions and practices and allows a firm to respond quickly to changes in the market (Akgün et al., 2012; Gibson & Birkinshaw, 2004).

These capabilities are essential for firms as they encourage employees and managers to challenge outmoded practices across the organization and allow a firm to respond to changes in the market adequately (Akgün et al., 2012; Tuominen, Rajala, & Möller, 2004). Moreover, they enable firms and their leadership to adapt to organizational and cultural norms (Anning-Dorson, 2021).

## 2.3 Improvisational capabilities

The extant literature distinguishes between dynamic and improvisational capabilities (Pavlou & El Sawy, 2010). Hence, improvisational capabilities denote repetitively engaging in improvisational actions without formal planning by building innovative products and solutions to enhance operational and competitive benefits (Guo et al., 2016; Senyard, Baker, & Davidsson, 2009). These capabilities are emergent and enable SMEs to react spontaneously to changes. Improvisational capabilities can be defined as "...the ability to spontaneously reconfigure existing resources to build new operational capabilities to address urgent, unpredictable, and novel environmental situations" (Pavlou & El Sawy, 2010, p. 443). As can be gleaned from this definition, improvisational capabilities are particularly relevant for SMEs under conditions with high levels of uncertainty, like the COVID-19 pandemic. Pavlou and El Sawy (Pavlou & El Sawy, 2010) argue that under these 'stormy' conditions, typically, political, economic, technological, and social changes, aspects rapidly change, and there is no time available for adequate planning and long-term plans. Instead, SMEs need improvised actions to meet customers' needs and ensure competitive benefits during turbulent times (e Cunha, Gomes, Mellahi, Miner, & Rego, 2020).

These capabilities complement dynamic capabilities that focus more on capability building and motivating, enabling, and enacting the changes needed to install a self-sustaining capability (D. Teece & Leih, 2016).

Improvisational capabilities operate as a "third hand," according to Pavlou and El Sawy (Pavlou & El Sawy, 2010), next to 'planned' dynamic and operational (zero-order) capabilities—that drive the current business operations—as a driver of change, adaption, and innovation during tumultuous times (Van de Wetering, 2019).

### 3 Framework's hypotheses development

We adopt a complementarity and ambidexterity perspective, claiming that the simultaneous execution of two seemingly opposing capabilities, i.e., improvisational and dynamic capabilities, complement each other to achieve business model innovation during crises collectively. This idea resonates well with Mintzberg's 'intended' versus 'emerging' strategy (Mintzberg, 1987). He argues that a 'strategy' is not fixed. Mintzberg also argues that it does not change systematically at pre-arranged times solely at the will of management.

#### 3.1 Digital infrastructure capability, dynamic capabilities positively, and their impact on business model innovation

Consistent with prior research on innovativeness that shows that dynamic capabilities drive the use the new technological innovations and enable business process innovations (Schoemaker, Heaton, & Teece, 2018; D. Teece & Leih, 2016; Van de Wetering & Besuyen, 2021; van de Wetering, Hendrickx, Brinkkemper, & Kurnia, 2021), we now argue that the firm's dynamic capabilities drive the firm's business model innovation.

The first essential dimension of dynamic capabilities, i.e., management systems adaptability, is actively reducing inefficient coordination and control mechanisms across the organization and encouraging communication and information flow among the organization's teams and employees (Akgün et al., 2012; Tuominen et al., 2004). In this regard, organizations that have managerial systems that are flexible and adaptive can better challenge outmoded traditions and practices, respond faster to shifts in the market and harness the organization-wide skills and competencies necessary to innovate (Akgün et al., 2012; Tuominen et al., 2004; van de Wetering et al., 2021). Moreover, management systems adaptability is especially crucial during sudden disruptions, like the COVID-19 pandemic, as firms must react and adapt to changing customer demands and behaviors, seize business and technological opportunities and embrace new service innovations (Jiang & Stylos, 2021; Rogier van de Wetering, 2021; Van de Wetering & Besuyen, 2021; van de Wetering et al., 2021).

Through such a capability, firms drive diverse leadership systems and provide a competitive advantage in addressing a wide range of complex business model innovation issues. Moreover, specifically for SMEs, this leadership-driven capability facilitates market flexibility and drives innovation, creativity, and competitiveness within and at the interface of distinct organizational functions and cultures (Anning-Dorson, 2021; Yin & LIU). Thus, substantial, visible, ongoing participation and commitment from senior leaders are critical throughout the deployment of business strategies and to driving and sustaining business model innovation and change (Lindgren, 2012; O'Regan, Ghobadian, & Sims, 2004). In addition, management systems adaptability supports using and adapting the firm's key resources in new domains. It facilitates the orchestration of multiple strategic initiatives and business model changes so that they can be brought to the market effectively and successfully (Codini, Abbate, & Petruzzelli, 2022; Lindgren, 2012). Through management systems adaptability SMEs can develop a clear and tangible strategic path to achieve business model innovation and yield results.

Next to management systems adaptability, SMEs need to shape their adaptive capabilities further as this also is a source of competitive advantage and enables them to deliver business model innovation results (Nada & Ali, 2015). SMEs' adaptive capabilities are tightly integrated within the business strategy to activate their competencies and resources to foster business changes in light of environmental turbulence (Barreto, 2010; De Jardin et al., 2022; D. J. Teece, Pisano, & Shuen, 1997).

Especially during crises where the business ecosystem landscape is getting more complex, firms need to be able to sense the environment and examine and assess threats and possible business model opportunities to disrupt traditional value chains (Clampit, Lorenz, Gamble, & Lee, 2022; Heider, Gerken, van Dinther, & Hülsbeck, 2021). Moreover, through adaptive capabilities, SMEs can mobilize digital innovations, enable new delivery models and services, and create customer value (Matarazzo, Penco, Profumo, & Quaglia, 2021). This can also be done through close collaboration with other SMEs. Adaptive capabilities can also assist in searching throughout the organization's operations to discover ways to collaborate with business partners (Grimaldi, Quinto, & Rippa, 2013; Sawers, Pretorius, & Oerlemans, 2008). This is especially important for SMEs in developing countries as they are typically confronted with substantial challenges in addressing market and customer demands while having less access to financial resources and investment options (Tejumade & Kevin, 2012). Therefore, SMEs must have those capabilities that also support and drive the adoption of (digital) innovations and connect it to results and growth (J. K. Doe et al., 2022).

Crucial for dynamic capabilities to have an actual impact on business model innovation and its subsequent contribution to organizational performance, it is important that firms can design a modular digital infrastructure that drives and strengthens the envisioned strategic changes (Bouwman, Nikou, & de Reuver, 2019; Pucihar, Lenart, Kljajić Borštnar, Vidmar, & Marolt, 2019; Vaska, Massaro, Bagarotto, & Dal Mas, 2021). Therefore, digital infrastructure can be regarded as a key resource that reshapes a firm in the current turbulent economy (Bygstad & Øvrelid, 2020; Giustiziero, Kretschmer, Somaya, & Wu, 2021; Wetering & Versendaal, 2020).

In essence, such a digital infrastructure capability refers to the firms' digital infrastructure that supports business connectivity and information exchange with business partners through modular designs and standardized interfaces in applications and processes (Cenamor et al., 2019; Wetering & Versendaal, 2020). Such a capability boosts the impact of dynamic capabilities on business model innovation in several ways. First, it allows firms to transform SMEs digitally and align business processes (Konopik et al., 2022; Van de Wetering et al., 2018; Verhoef et al., 2019), which is crucial during a pandemic. Second, this capability further drives the alignment of digital technologies and the SMEs business strategy and the subsequent purposeful use of digital technologies, which is crucial during times that require continuous adjustments and adaptation in pursuit of both survival and growth (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013; Li, Liu, Belitski, Ghobadian, & O'Regan, 2016; Sabherwal, Hirschheim, & Goles, 2001; Walraven, van de Wetering, Helms, Caniëls, & Versendaal, 2022). Moreover, recent work suggests that flexible leadership and management systems can enhance SMEs' success in the market (Li et al., 2016). Third, facilitated by digital capabilities, SME leaders can respond more promptly to threats in the business ecosystem and possible business opportunities using the organization's digital infrastructure (Canhoto, Quinton, Pera, Molinillo, & Simkin, 2021; Li et al., 2016; Pattij, van de Wetering, & Kusters, 2022). Finally, this capability drives the operational implications in progressing from a disparate channel model to a digital omnichannel business model, which is crucial in developing and delivering new services to customers (Amit & Zott, 2010; Christensen et al., 2016; Johnson & Lafley, 2010; D. J. Teece, 2018).

To summarize, dynamic capabilities driven by digital infrastructure capability equip SMEs with adequate skills, competencies, and digital capabilities to adapt through an integrated and orchestrated perspective (Randhawa et al., 2021; D. J. Teece, 2018; Warner & Wäger, 2019). Furthermore, adaptive capability and management systems adaptability are considered key antecedents of business model innovation. Bocken and Geradts (2020) summarize this well: dynamic capabilities "...are critical for corporations to craft, refine, and transform their business models."

Based on the above, we define the following:

**Hypothesis 1 (H1):** *The organization's dynamic capabilities positively mediate the effect of digital infrastructure capability on business model innovation.*

### 3.2 Digital infrastructure capability, improvisational capabilities, and their impact on business model innovation

As improvisational capabilities are somewhat 'emergent,' they enable SMEs to take action spontaneously rather than based on rigorous planning. Also, under conditions of high uncertainty where there is no time for organizational resource planning, these capabilities are crucial as they offer firms the reflexive instincts and needed improvisational activities to adapt and respond to the problems using the resources available (Baker et al., 2003; e Cunha et al., 2020; Senyard et al., 2009). Hence, improvisational capabilities provide firms with the necessary skill set to adapt the firm's products, propositions and services, delivery channels, and technological platforms and support the way customer transactions are done (Guo et al., 2016; Pavlou & El Sawy, 2010; Senyard et al., 2009; D. J. Teece, 2018).

Digital infrastructure capability drives SMEs' improvisational capability as it allows organizations to design the infrastructure using modular software components so that they can be reused in various other business applications, and firms can adapt when needed and respond to the changing customer, technology, and competitor landscape (Cenamor et al., 2019). Moreover, digital infrastructure capability enables SMEs to leverage digital options such as cloud, web portals, and mobile apps to enable collaboration with business partners as well as drive innovative customer interaction and services as well as help to restructure and re-organize traditional businesses operations to digital operating models (Sambamurthy, Bharadwaj, & Grover, 2003; Stoeckli et al., 2018). Improvisational capabilities allow organizations to foresee trends, developments clearly, and market disruption, deeply understand market dynamics, and adjust accordingly. As a result, SMEs can realize business model innovation by meticulously changing targeted components like their products and services, processes, digital options, and delivery channels

(Amit & Zott, 2010; Clauss et al., 2022; Randhawa et al., 2021). Furthermore, improvisational capabilities provide the organization with the adequate skills and competencies to deal with threats and business model problems (Archer, Baker, & Mauer, 2009; Guo et al., 2016). Furthermore, they enable firms to use combinations of resources (people, processes, technology) for new business operations, allowing firms to respond to the market quickly and business changes and drive business model innovation (Akgün et al., 2012; Guo et al., 2016; Pavlou & El Sawy, 2010; Tuominen et al., 2004). Hence, SMEs with well-developed reflex and improvisational capabilities, adaptive capability, and adaptability management systems are more likely to realize business model innovation (Pavlou & El Sawy, 2010).

Synthesizing from the above, we define the following hypothesis:

**Hypothesis 2 (H2):** *The organization's improvisational capabilities positively mediate the impact of digital infrastructure capability on business model innovation.*

### 3.3 Improvisational, dynamic capabilities, business model innovation, and organizational performance

Deducting from our theoretical framework, we argue that business model innovation is a crucial antecedent to achieving high levels of organizational performance. For example, business model innovation is a key enabler for organizations to efficiently deliver excellent services, offerings, and value to their customers through new digital technologies and online channels (Chesbrough, 2007; Christensen et al., 2016). In addition, especially during times of high uncertainty, customers want mobility in product and service delivery and a seamless service experience that ultimately results in high customer satisfaction (Clauss, Kesting, & Naskrent, 2019; Keiningham et al., 2020). SMEs can better achieve business value for customers with business model innovation when supported by improvisational and dynamic capabilities (Pang, Wang, Li, & Duan, 2019). These complementary capabilities enhance processes and drive new service delivery. This is especially important during uncertain times when it is essential to get key insights into trends and developments to drive value creation and capture using the resources at hand (Guo et al., 2016; Pavlou & El Sawy, 2010; D. J. Teece, 2018). Therefore, improvisational and dynamic capabilities are essential to the value path in further shaping business model innovation, which ultimately leads to better organizational performance (Amit & Zott, 2012).

Business model innovation allows firms to address downturn events like COVID-19 by changing their core propositions to customers and the firm's underlying operating model (Clauss et al., 2022; Guo et al., 2016). Also, business model innovation drives an organization's growth ambitions (e.g., high profitability, increased market share) by transforming the organization's (go-to) markets and segments and the way the business operations can be scaled and deliver high-quality personalized services (Amit & Zott, 2010; Christensen et al., 2016; Johnson & Lafley, 2010; D. J. Teece, 2018). The organization can accelerate new revenue streams through business model innovation so that opportunities can be capitalized cost-effectively (Baker et al., 2003; e Cunha et al., 2020; Jiang & Stylos, 2021; Keiningham et al., 2020; Pohle & Chapman, 2006; Uçaktürk, Bekmezci, & Uçaktürk, 2011).

In addition, research has shown that business model innovation will substantially impact the firm's competitiveness and value-creation processes for the organization (Amit & Zott, 2012; Anwar, 2018; Bhatti et al., 2021). Finally, we define:

**Hypothesis 3 (H3):** *Business model innovation positively mediates the impact of improvisational and dynamic capabilities on organizational performance.*

### 3.4 The moderating impact of technological turbulence

The COVID-19 crisis affected customers and markets in unexpected and extremely specific ways. The earliest phases of the crisis presented rare opportunities for SMEs to generate disproportionate returns, enhance their competitive positions, and drive a step-change in their positioning through bold business model transformation moves (Clauss et al., 2022; Fitriyasari, 2020). A downturn opens up rare opportunities to outmaneuver other SMEs, but first, they need to put their own house in order (Akpan, Udoh, & Adebisi, 2022; Caballero-Morales, 2021). Under the conditions of COVID-19, SMEs will have to get used to operating in a challenging and, in some cases, recessionary environment. While the overall impact may be challenging, the disruption also creates real opportunities for SMEs to change industry dynamics and build new sources of competitive advantage (Akpan et al., 2022). Hence, to survive—and, eventually, to flourish—SMEs must learn to exploit the crisis, looking beyond costs and strategic business plans (Adam & Alarifi, 2021) and embracing digital transformation

(Klein & Todesco, 2021). The COVID-19 crisis exposed various challenges for SMEs' adoption and use of digital technologies.

Moreover, SMEs face an environment that is highly volatile, uncertain, complex, and ambiguous (Troise et al., 2022). During the early phases of the crisis, and also during later stages, we have seen an extreme uptake of new radical digital technologies creating an environment with high technological turbulence, which can be regarded as "the extent to which technology in the industry is in a state of flux" (Guo et al., 2016). Technological turbulence can have a tremendous impact on the performance of firms and business model innovation success (Pratono, Ratih, & Arshad, 2018; Puriwat & Hoonsopon, 2021). Moreover, recent works show that SMEs that embrace new digital technologies as part of their business model innovation during tumultuous times of technological change thrive and are more successful than others (Molina-Castillo et al., 2021; Pratono, 2018; Troise et al., 2022). This is consistent with previous work showing that SMEs' business model innovation under technological turbulence is crucial for survival and competitiveness (Ali, Warren, & Mathiassen, 2017). Thus, finally, we propose:

**Hypothesis 4 (H4):** *Technological turbulence positively moderates the effect of business model innovation on organizational performance.*

## 4 Methods

### 4.1 Data collection process

We developed an online survey using previously established scales and pretested this with four scholars and two senior SME practitioners and entrepreneurs to enhance readability, face, and content validity (Straub, Boudreau, & Gefen, 2004; Taherdoost, 2016). The survey consisted of two parts. i.e., part I, the descriptive part, included questions concerning the organization, SME (e.g., size, age), and the respondent's function. Part II concerned the constructs of the research model.

We used this survey anonymously and conveniently distributed it among SMEs in Ghana through our professional and educational network. This convenience sampling approach is a readily affordable non-probability sampling approach to collect useful data (Etikan, Musa, & Alkassim, 2016). However, due to the nature of this method, remedies for possible method bias should be taken seriously (Fricker & Schonlau, 2002; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Therefore, we targeted senior business practitioners, like chief executive officers, chief information officers, chief digital officers, and IT managers from SMEs in line with our research aims. Within Ghana, SMEs form the backbone of the economy (J. Doe, Van de Wetering, Honyenuga, Versendaal, & Boateng, 2018) and makeup to 60% of the total employment. The data collection process was performed between 8<sup>th</sup> April and 20<sup>th</sup> May 2020.

We applied various procedural remedies against possible common method bias (CMB), such as offering explicit instruction on how to approach the survey and filling in the questions (with information about the scales), providing detailed goals of the research, and guarantying anonymity of the response, (Fricker & Schonlau, 2002; Podsakoff et al., 2003).

After removing incomplete and inadequate responses, our sample size was 105 SMEs. Table 1 shows the demographics of our final dataset.

Element	Classification	N	Percentage
Nr. of employees	1-5	35	33%
	6-29	34	32%
	30-99	29	28%
	>100	7	7%
Age of firm	0-5 years	74	70%
	6-10 years	22	21%
	11-20 years	2	2%
	20-25 years	4	4%
	Over 25 years	2	2%
Working experience respondents	0-5 years	20	19%
	6-10 years	29	28%

	11–20 years	32	30%
	20–25 years	12	11%
	Over 25 years	12	11%
Functions	Chief executive officer (CEO) / owner	31	30%
	Chief information officer (CIO)	25	24%
	Business manager	4	4%
	IT manager	13	12%
	Operations manager	10	10%
	Innovation manager	9	9%
	Business or IT consultants	11	11%
	Other:	2	2%
Industry category	Private Sector	74	70%
	Public Sector	22	21%
	Private-Public Partnerships (PPP)	3	3%
	Non-Governmental Organization (NGO)	4	4%
	Non-Profit Organization (NPO)	2	2%

**Table 1:** Sample demographics

#### 4.2 Constructs and items

We adopted previously empirically validated measures for all constructs of the framework. We measure digital infrastructure capability through 4 indicators based on work by (Cenamor et al., 2019; Verhoef et al., 2019; Wetering & Versendaal, 2020). Furthermore, we adopted four items from (Guo et al., 2016) to measure the firm's capability to engage in improvisational actions without formal planning, i.e., improvisational capabilities, three items from (Akgün et al., 2012; Gibson & Birkinshaw, 2004) to measure the firm's management system adaptability and four items from (Zhou & Li, 2010) to measure adaptive capability. In addition, we used nine indicators from (Guo et al., 2016; Zott & Amit, 2007) to measure business model innovation.

We measured technological turbulence, and thus the extent to which technology in the industry is in a state of flux, with three indicators from (Guo et al., 2016). Finally, we adopted five measures from (Chen & Tsou, 2012; Van de Wetering, 2019) to measure organizational performance during COVID-19 and evaluate performance from a broad and balanced perspective.

This study also included several control variables that might influence the organizational performance of SMEs (Battisti & Deakins, 2017; J. K. Doe et al., 2022; Kraus, Rigtering, Hughes, & Hosman, 2012). Hence, we controlled for firm size, i.e., the years the SME operates. This control variable was measured on a five-point Likert scale (1. < 100 employees; 2. 101–300; 3. 301–1000; 4. 1001–3000; 5. > 3000 employees). Next, we controlled the outcomes for firm age. This variable was also measured on a five-point Likert scale (1. 0–5; 2. 6–10; 3. 11–20; 4. 20–25; 5. > 25 years). Next to these two control variables, we also included the industry category as a control variable: (1. Private Sector; 2. Public Sector; 3. Private-Public Partnerships; 4. Non-Governmental Organization; 5. Non-Profit Organization). We included these five categories and not the specific industries of the SMEs in order to avoid multicollinearity issues during the analyses. Finally, we included market turbulence. All measures, including reliability statistics, are included in the Appendix.

#### 4.3 A composite-based analytical approach

We used structural equation modeling (SEM). SEM assesses both the structural and measurement model (Jöreskog, 1978). SEM (or 'causal modeling') is typically used to simultaneously validate multifaceted phenomena in tentative cause and effect variables, including causal effects. SEM techniques are specifically suited for modeling complex processes, including various latent constructs and relationships.

We used this method as the preferred approach to test the research model's hypotheses over alternative estimations techniques such as LISREL and AMOS that use covariance-based modeling. PLS is a composite-based approach to SEM, thus, a variance-based approach that uses weighted linear combinations of measurable items as proxies for underlying theoretical conceptualizations (Dijkstra & Henseler, 2011). PLS fits our research well, as PLS emphasizes prediction. In addition, PLS maximizes the explained variance in the dependent construct. Also, PLS readily handles both reflective and formative measures (Joseph F Hair Jr, Sarstedt, Ringle, & Gudergan, 2017; Henseler, 2020; Ringle, Sarstedt, & Straub, 2012), as this research does, and it allows scholars to understand the interrelationships among the constructed latent constructs (W. Chin, 1998; Joseph F Hair Jr, Hult, Ringle, & Sarstedt, 2016; Ringle et al., 2012). Finally, PLS allows flexibility concerning the assumptions on multivariate normality, the ability to run parameter estimates for smaller samples, and reduces the overall error associated with the model (Astrachan, Patel, & Wanzenried, 2014; Joseph F Hair Jr et al., 2017). (Joseph F Hair Jr et al., 2017; Petter & Hadavi, 2021). As a final remark, composite-based SEM allows scholars to extend existing theory by examining the model's ability to predict instead of establishing model fit only, as in covariance-based SEM (Joseph F Hair, Risher, Sarstedt, & Ringle, 2019; Petter & Hadavi, 2021). PLS-SEM is, therefore, considered a full estimator of SEM used in various types of research, including exploratory research and relationship assessment between different proxies, confirmatory research, and predictive research (Henseler, 2018).

We used SmartPLS version 3.2.7. (Ringle, Wende, & Becker, 2022) to run the parameter estimations. SmartPLS is an SEM tool that uses Partial Least Squares (PLS). For the PLS algorithm, this study uses the path weighing scheme within SmartPLS. Finally, a non-parametric bootstrapping procedure (using 5000 replications) was employed to obtain stable results and interpret the significance of the path coefficients between this study's key construct. We used a two-step approach to investigate PLS outcomes. First, we used PLS to assess the measurement model, assessing the construct quality and analyzing the model's psychometric properties. Then, the hypotheses are tested using the outcomes of the structural model assessment.

#### 4.4 Data quality assessments

As we used a survey, it is important to control for non-response bias or late participant response bias, as we want to ensure that our final sample is not influenced by significant differences between early and late respondents (Berg, 2005). Hence, we accounted for possible non-response bias through a series of T-tests and showed no significant differences between early and late respondents for the various research model's latent constructs. We can, therefore, conclude that our sample was not affected by non-response bias.

Furthermore, we performed a series of tests to control for common method bias (CMB), which is considered to be "...systematic variance attributable to common measurement artifacts that alter (e.g., inflate or deflate) correlations in the underlying constructs (W. W. Chin, Thatcher, & Wright, 2012, p. 1004). Thus, CMB is typically caused by the study's measurement method, not through the research model's series of cause-and-effect relationships (Kock, 2015).

As a first test, we performed Harman's single factor test using IBM SPSS Statistics v.28.0.1.0 and ran an exploratory factor analysis (EFA) by loading all the research model's constructs. Using this test, researchers can extract various factors and identify whether or not a single factor accounts for more than 50% of the variance, which is considered the maximum (Podsakoff et al., 2003). Our EFA showed that a single factor's maximum amount of variance was 35%, which is well below the threshold (Fuller, Simmering, Atinc, Atinc, & Babin, 2016). Several other CMB tests were performed as it has been suggested that combinations of methods minimize the possible impact of CMB and contribute to the accurate measurement of respondents' perception (Lindell & Whitney, 2001; Podsakoff et al., 2003; Tehseen, Ramayah, & Sajilan, 2017). This is especially important in this study, where we used a single respondent to measure all items (Gefen, Rigdon, & Straub, 2011). Therefore, we also investigated the (Pearson) correlations matrix and examined if the correlations among the constructs were greater than  $r > .9$  (Bagozzi, Yi, & Phillips, 1991; Lowry & Gaskin, 2014). None of the correlations were higher than the above threshold value, suggesting that the likelihood of CMB is low. In a subsequent step, we investigated if the Variance Inflation Factor (VIF) values from a full collinearity test for the 'inner' model (thus between latent constructs) are less than 3.3 (Kock, 2015). Results showed that none of the VIF values exceeded 3.3. The highest VIF value was 2.4; the rest of the obtained values were even lower. (Lowry & Gaskin, 2014).

As a final analysis, we used an unrelated marker variable, 'years of working experience' (mean = 3; min = 1, 0–5 years; max = 5, over 25 years; median = 3; Std. = 1.24) and included that into the structural model (Lindell &

Whitney, 2001). After running a bootstrapping procedure, results show that the average correlation of the marker variable with other constructs was .08 and all were non-significant, confirming that CMB is not a serious threat to our current study.

The sample size does exceed minimum threshold values to obtain stable PLS outcomes (Joe F Hair, Ringle, & Sarstedt, 2011). This was confirmed by running an a-priori power test using G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Results of this analysis show that with an error probability of 5%, an effect size of 0.20, and four predictor variables (also taking the direct effect of the moderator into account) as key parameters, a minimum sample of 56 cases was required. Our final sample of 105 SMEs far exceeds this amount. Hence, we can now estimate the measurement properties of the research model.

#### 4.5 Psychometric property assessments

Before testing the hypotheses, we first establish the reliability and validity of the study constructs. Hence, we assessed the measurement model by evaluating the internal consistency reliability through Cronbach's alpha (CA) and composite reliability (CR). Moreover, for each of the first-order latent constructs that are part of the research model, we evaluated the average variance extracted (AVE) for convergent validity (Joseph F Hair et al., 2019; Ringle et al., 2022).

Table 2 shows the outcomes of these first measurement model tests. It can be concluded that all measures are sufficient. This means that all CA and CR values are above .7, and all AVE values are well above .5 (J. Hair, Hollingsworth, Randolph, & Chong, 2017). This outcome shows that the constructs are reliable, and AVE values above .5 indicate that the respective latent construct can explain more than 50% of the variance.

	CA	CR	BMI	AC	IMP	MSA	DIC	Perf
BMI	.89	.92	<b>0.81</b>	-	-	-	-	-
AC	.86	.90	0.63	<b>0.84</b>	-	-	-	-
IMP	.87	.91	0.74	0.66	<b>0.85</b>	-	-	-
MSA	.70	.83	0.68	0.60	0.67	<b>0.79</b>	-	-
DIC	.88	.92	0.64	0.48	0.46	0.45	<b>0.89</b>	-
Perf	.87	.91	0.59	0.54	0.58	0.67	0.32	<b>0.85</b>

Note: *BMI: business model innovation; AC: adaptive capacity; IMP: improvisational capability; MSA: management systems adaptability; DIC: digital infrastructure capability; Perf: Organizational performance*

**Table 2:** Reliability and validity statistics

We will now assess the discriminant validity. This is done through recommended analyses, i.e., cross-loadings, Fornell Larcker, and Heterotrait-Monotrait Ratio of Correlations (HTMT) (Joseph F Hair et al., 2019). First, we investigated the cross-loading of all the items. In doing so, we checked that some items load higher on other constructs than their own. This was not the case with our data. Second, we investigated if the the square root of the AVE (see bold entries in Table 2) is greater than any of the correlations between that construct and others. These values are greater than the correlations. Thus, discriminant validity is achieved.

As a final step, we analyzed the HTMT (Joseph F Hair et al., 2019). This particular discriminant validity measure assesses the degree of similarity (or difference) between constructs using indicator correlation within and between constructs and is considered a superior metric compared to other discriminant validity measures (Joseph F Hair et al., 2019). Hence, discriminant validity can be established with values below or equal to the conservative threshold of .85 (Henseler, Ringle, & Sarstedt, 2015). Furthermore, as seen in Table 3, all measures comply with the conservative threshold, confirming discriminant validity.

	BMI	AC	IMP	MSA	ODIC	Perf
BMI	-	-	-	-	-	-
AC	0.71	-	-	-	-	-
IMP	0.83	0.76	-	-	-	-
MST	0.83	0.76	0.84	-	-	-
ODIC	0.72	0.53	0.52	0.57	-	-
Perf	0.67	0.65	0.66	0.85	0.37	-

**Table 3:** HTMT values

Finally, for the dynamic capabilities construct (i.e., second-order formative construct), results show following a bootstrap analysis that both adaptive capability ( $\beta=.68$ ;  $t=20.29$ ) and management systems adaptability ( $\beta=.43$ ;  $t=12.93$ ) are significant. Moreover, as the VIF values for these respective capabilities were well below 3.3, and, thus, multicollinearity is not a problem. Thus, these outcomes support including the second-order factor in the research model. Based on the outcomes of the measurement model analyses, we can conclude that all the research model's constructs are reliable and valid and that this study's hypotheses can now be tested.

## 5 Empirical results and interpretation

To analyze the structural model, we first evaluated its path coefficients (beta regression) and, thus, the effect of independent constructs on a dependent construct in the model and their significance. Next, the coefficient of determination ( $R^2$ ) was examined to determine how well the model predicts the outcomes, and effect sizes ( $f^2$ ) were analyzed. These effect sizes are important to estimate as they show the distinct contribution of exogenous constructs to endogenous constructs (Joseph F Hair Jr et al., 2016; Joe F Hair Jr, Matthews, Matthews, & Sarstedt, 2017).

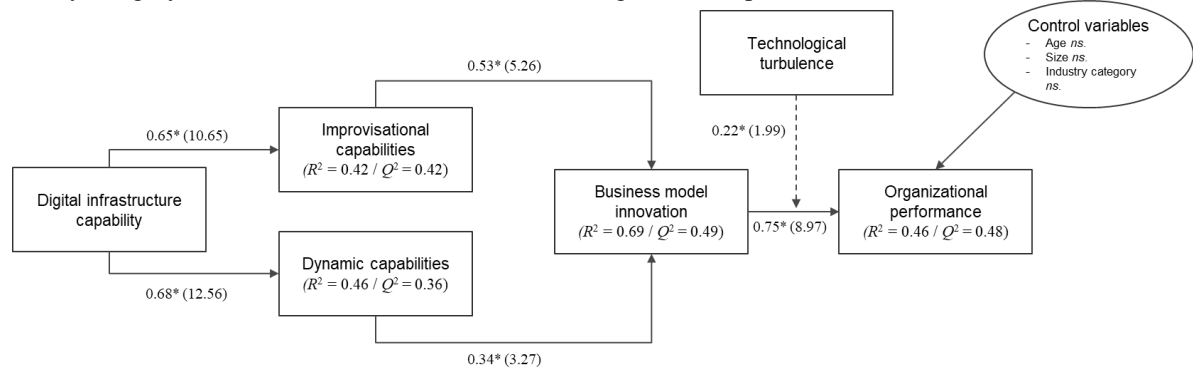
Finally, we assessed the research model's predictive validity using the Blindfolding procedure in SmartPLS. After running an accelerated bootstrapping procedure, we obtained the significance of the respective path coefficients in the model. Results of this analysis show that digital infrastructure capability significantly impacts improvisational capabilities ( $\beta = .65$ ;  $t = 10.65$ ;  $p < .0001$ ) and dynamic capabilities ( $\beta = .68$ ;  $t = 12.56$ ;  $p < .0001$ ). These results show this digital capability's significant value as a foundation to shape capabilities and drive business model innovation. Furthermore, results also show that both improvisational capabilities ( $\beta = .53$ ;  $t = 5.26$ ;  $p < .0001$ ) and dynamic capabilities positively impact business model innovation ( $\beta = .34$ ;  $t = 12.59$ ;  $p = .0001$ ). Therefore, it can be concluded that these two strategic and complementary capabilities are crucial to achieving business model innovation for SMEs. Furthermore, the next relationship in the structural model, i.e., business model innovation  $\rightarrow$  organizational performance, was also significant ( $\beta = .60$ ;  $t = 10.19$ ;  $p < .0001$ ), confirming that business model innovation is the crucial antecedent of obtaining high levels of organizational performance. Furthermore, outcomes show that the research model explains 42% ( $R^2 = .42$ ) of improvisational capabilities and 46% ( $R^2 = .46$ ) of the variance for dynamic capabilities. The model also explains 69% ( $R^2 = .69$ ) of the variance for business model innovation. These coefficients of determination are considered to represent substantial (Joseph F Hair Jr et al., 2016).

When looking at the respective  $f^2$ , we see that the effect size of digital infrastructure capability on improvisational capability is .72. On dynamic capabilities .84. The effect size of improvisational capability on business model innovation is .28. Dynamic capabilities had an effect size of .12. The effect of business model innovation on organizational performance had an effect of .75. All these values are well beyond minimum threshold values, thus showing medium to large effects (Cohen, 1988). The moderating effect has an effect size of 0.90. For a moderating effect, this outcome can be considered a large effect (Aguinis, Beaty, Boik, & Pierce, 2005; Joseph F Hair Jr et al., 2016).

Finally, we assessed the model's predictive validity using the blindfolding procedure. This procedure estimates the predictivity of the theorized model paths. Outcomes show that the  $Q^2$  (Stone-Geisser's) values far exceed '0'

(improvisational capabilities:  $Q^2 = .42$ ; dynamic capabilities:  $Q^2 = .36$ ; business model innovation:  $Q^2 = .30$ ; organizational performance:  $Q^2 = .22$ ), indicating the overall model's predictive power.

Figure 2 shows the outcomes of the structural model assessment using SmartPLS. This Figure also shows the software's obtained  $t$ -values (i.e., the coefficient divided by the associated standard error and the construct's importance in the model). We also controlled these outcomes by including the control variables "Age," "Size," and "Industry category" in the model. These variables had no significant impact on the outcomes.



**Fig. 2.** Results of the key relationships in the structural model.

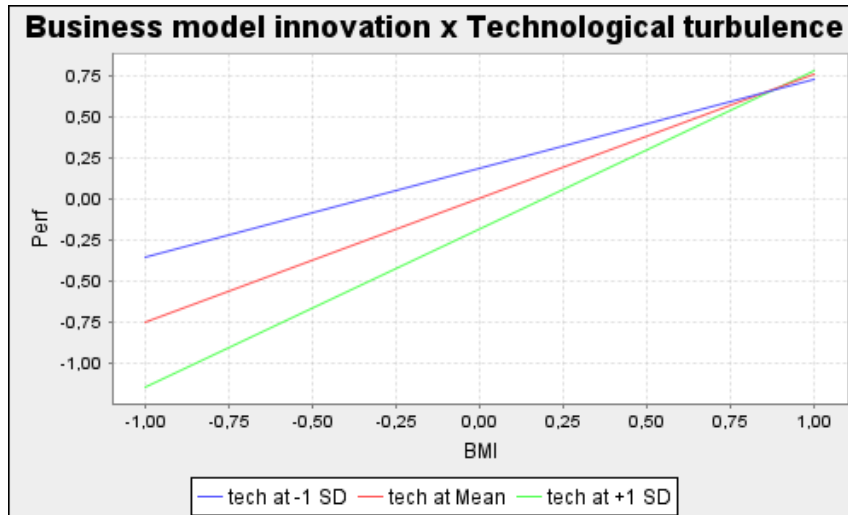
#### 4.1 Multiple-mediation, moderation, and hypotheses testing

Now that we have established the significance of the key relationships in the model, we can test the hypotheses of this study. We followed guidelines and a stepwise procedure by Carrión, Nitzl, & Roldán (2017). As a first step, the significance of the indirect effect should be assessed. These indirect effects should be interpreted as the effect of an antecedent (in this case, digital infrastructure capability) on a dependent construct (in this case, business model innovation for this mediation path) through a given mediation construct (i.e., improvisational or dynamic capabilities) while controlling for the other mediating constructs. For the first path, digital infrastructure capability → dynamic capabilities → business model innovation, this was significant ( $\beta = .19$ ;  $t = 2.44$ ;  $p = 0.02$ ). Next, the direct effect (digital infrastructure capability → business model innovation) was assessed to determine the type of mediation (i.e., full or partial). Results show that this direct effect was insignificant ( $\beta = .11$ ;  $t = 1.58$ ;  $p = .11$ ), which corresponds with full mediation (Hayes, 2013) and confirms H1. These analyses were also performed for the other mediating paths in the model. Hence, the path of digital infrastructure capability → improvisational capabilities → business model innovation was significant and concerned a full mediation like the previous one ( $\beta = .33$ ;  $t = 4.27$ ;  $p < .0001$ ). Thus, also H2 is confirmed.

To assess H3, we also included the indirect effects of improvisational and dynamic capabilities on organizational performance. This way, we can evaluate whether or not business model innovation is fully or partially mediating the impact of those capabilities. Following the same procedure outlined above, we can conclude that business model innovation fully mediates the impact of improvisational and dynamic capabilities. Outcomes of this analysis show that the direct effect of improvisational capabilities was insignificant ( $\beta = .06$ ;  $t = 0.35$ ;  $p = .73$ ), while the indirect effect was significant ( $\beta = .22$ ;  $t = 2.57$ ;  $p = .01$ ). The same accounts for the mediating path of dynamic capabilities, i.e., dynamic capabilities → business model innovation → organizational performance. The indirect effect was significant ( $\beta = .12$ ;  $t = 1.97$ ;  $p = .05$ ), while the direct effect was, likewise, insignificant ( $\beta = .15$ ;  $t = 0.82$ ;  $p = .42$ ). Hence, it can be concluded that H3 holds and can be confirmed.

Finally, we assessed the moderating effect of technological turbulence on the relationship between business model innovation and organizational performance. We first included the latent construct in the research model to assess this moderating effect. Technological turbulence significantly negatively impacted organizational performance ( $\beta = -.28$ ;  $t = 2.529$ ;  $p = 0.012$ ) after bootstrapping. Then, we included the interaction term using a standardized product-indicator approach (Hayes, 2013) and ran the bootstrapping procedure once more. Now, we see that the interaction term and, thus, the moderating effect is significant ( $\beta = .22$ ;  $t = 2.000$ ;  $p < .046$ ), while the main effect becomes insignificant ( $\beta = -.16$ ;  $t = 1.701$ ;  $p = .087$ ). The addition of technological turbulence as a moderator in the model increases the  $R^2$  from 36% to 46%, a substantial increase of 28% ( $F$ -change 14.88;  $p < 0.001$ ). This

outcome further adds to the model's explanatory power. Hence, based on these results, it can be concluded that technological turbulence significantly positively affects the relationship between business model innovation and organizational performance, supporting hypothesis 4. Furthermore, this moderating effect offers insights into the relationship between business model innovation and organizational performance as the strength changes with the degree of technological turbulence, as seen in Figure 3.



**Fig. 3.** Moderating effect of technological turbulence on the association between business model innovation (BMI) and organizational performance (Perf)

Table 4 contains a complete overview of all the mediation analyses, including effect sizes and bias-corrected confidence intervals (Lower bound, 0.5%, – Upper bound, 99.5%) of the structural model analyses.

Specified path	Effect	Bias-corrected confidence interval	t-value	Sig.	Conclusion
DIC → IMP	.65	CI (.51 – 0.74)	10.65	$p < .0001$	Significant
IMP → BMI	.53	CI (.32 – 0.70)	5.40	$p < .0001$	Significant
DIC → IMP → BMI (mediation by IMP)	.32	CI (.21 – 0.48)	4.87	$p < .0001$	H2 Supported
DIC → DC	.68	CI (.54 – 0.77)	12.56	$p < .0001$	Significant
DC → BMI	.34	CI (.14 – 0.55)	3.27	$p = .0002$	Significant
DIC → DC → BMI (mediation by DC)	.23	CI (.10 – 0.39)	3.11	$p = .02$	H1 Supported
DIC → BMI	.11	CI (-.03 – 0.25)	1.58	$p = .11$	No direct effect
IMP → Perf	0.06	CI (-.28 – 0.37)	.35	$p = .73$	No direct effect

BMI → Perf	.76	CI (.47 – 0.70)	8.97	$p < .0001$	Significant
IMP → BMI → Perf (mediation by BMI)	0.32	CI (.18 – 0.43)	4.87	$p < .0001$	H3 Supported
DC → Perf	.15	CI (-.26 – 0.48)	.79	$p = .43$	No direct effect
DC → BMI → Perf (mediation by BMI)	0.20	CI (.07 – 0.35)	3.00	$P = .003$	H3 Supported
Size → Perf	0.127	CI (-0.022 – 0.282)	1.65	NO	No confounding
Age → Perf	-0.069	CI (-0.215– 0.103)	.78	NO	No confounding
Industry category → Perf	-0.028	CI (-0.238– 0.151)	.44	NO	No confounding
<i>Note: DIC: digital infrastructure capability; DC: dynamic capabilities; IMP: improvisational capability; BMI: business model innovation; Perf: Organizational performance</i>					

**Table 4:** Multiple mediation analyses

#### 4.1 Post-hoc analysis of business value over a longer period

Our research model with performance during COVID-19 focuses on a relatively short time window. We also would like to understand whether or not SMEs with well-developed dynamic and improvisational capabilities would do well over a considerably more extended period. In addition to the above analyses, we analyzed the relationship between organizational performance during COVID-19, with emphasis on the initial weeks of the eruption of the virus, and the business value the SMEs achieved over a longer period (2-3 years). Therefore, the outcomes of these analyses contribute to the robustness of the model. Business value can be considered the value created by SMEs through their capabilities as measured by cost-based and time-based efficiency, product/service differentiation, and the degree of customization to suit individual customers (Hsu, 2013; Van de Wetering, 2019, 2022). Hence, a Pearson correlation analysis was performed using SPSS, showing that the two constructs are significantly related ( $r = .73$ ;  $p = .0001$ ). This result shows that SMEs that do well over a considerably longer period are also equipped to outperform and outgrow peers within a shorter time frame considering various performance metrics.

## 6 Discussion

It goes without saying that under tumultuous times, firms must reframe how they position their offerings in the marketplace and how they interact with customers. This work tried to unfold whether or not two strategic capabilities collectively drive the firm's business model innovation that serves as the foundation for achieving high levels of organizational performance under volatile conditions such as COVID-19. The outcomes of this work, using a composite-based approach and data from 105 SMEs from Ghana, showcased that both improvisational and dynamic capabilities are critical drivers of business model innovation. These two capabilities are supported by a digital infrastructure capability which allows the organization to use modular software components so that SMEs can adapt when needed and respond to the changing customer, technology, and competitor landscape. Moreover, this digital capability drives the purposeful use of digital technologies, which is crucial during times that require continuous adjustments and adaptation in pursuit of survival and growth in the business ecosystem. We also showed that business model innovation positively influences organizational performance under volatile conditions such as COVID-19. These outcomes have several theoretical and practical implications, which will be discussed next.

## 5.1 Theoretical contributions

The extant literature shows the importance of organizational capabilities in shaping business model innovation (Heider et al., 2021; Randhawa et al., 2021; D. J. Teece, 2018). With this study, we make several core theoretical contributions.

First, this study adds to the literature on SMEs' adaptive and organizational capabilities and how they contribute to business model innovation during external shocks such as COVID-19. We identify and subsequently elaborate on the digital-driven value mechanism that enables SMEs to thrive and shape business model innovation during the COVID-19 crisis. In doing so, we built upon the foundations of the DCF and argued that two strategic capabilities could profoundly impact organizational success. We found evidence for the study's main hypotheses and extended the work by (Pavlou & El Sawy, 2010) by showing the collective impact that dynamic and improvisational capabilities can have on the business model innovation of SMEs. These findings align with previous scholarship on organizational capabilities in SMEs (Canhoto et al., 2021; Dejardin et al., 2022; Matarazzo et al., 2021; Randhawa et al., 2021), but we add the knowledge base by further conceptualizing the key role of digital infrastructure capability in the value path (Cenamor et al., 2019; Konopik et al., 2022; Wetering & Versendaal, 2020). Evidence from this study indicates that digital infrastructure capability serves as an unambiguous antecedent for strategic organizational capabilities. Hence, this study demonstrates this capability's crucial role in shaping dynamic and improvisational capabilities and subsequently driving business model innovation and organizational performance (Cenamor et al., 2019; Verhoef et al., 2019). This outcome is important, as it shows how SMEs, especially during crises, are now dependent on digital-driven capabilities and their purposeful alignment in practice. We also add the body of knowledge on innovation and managing down-turn events (Chesbrough, 2010; Christensen et al., 2016; Obal & Gao, 2020; Radziwon et al., 2022; D. J. Teece, 2018; Tuominen et al., 2004). Specifically, this work now shows how business model innovation driven by strategic capabilities can drive high levels of organizational performance during a global pandemic like COVID-19. Hence, we stress that organizations capable of orchestrating their organizational resources and addressing downturn events by making specific changes to their core value proposition will successfully achieve business model innovation and high levels of organizational performance.

Second, in contrast to the extant literature that focuses on either dynamic or improvisational capabilities in SMEs in shaping business model innovation (Ashiru et al., 2022; Battistella, De Toni, De Zan, & Pessot, 2017; Canhoto et al., 2021; e Cunha et al., 2020; Matarazzo et al., 2021; Randhawa et al., 2021), we focus on both and their contributions to business model innovation and organizational performance during COVID-19. This is particularly important for SMEs from developing countries like Ghana as they typically have limited resources and capabilities, making them highly vulnerable to crises like COVID-19 (D'Annunzio et al., 2015; J. K. Doe et al., 2022; Ofofu-Ampong & Acheampong, 2022). However, digital-driven improvisational and dynamic capabilities collectively enable them to address market and technological disruptions and turbulence and thrive to achieve high levels of organizational performance through business model innovation. However, based on this work's outcomes, it is evident that improvisational capabilities have a more substantial impact than dynamic capabilities with their underlying components. It could be that the dynamic capabilities' effect is weaker under highly tumultuous conditions like the current COVID-19 pandemic, whereas the effect of improvisational capabilities is then more substantial, as argued by Pavlou and Sawy (Pavlou & El Sawy, 2010). This is an important outcome, as this extends the current insights on how improvisational capabilities can contribute to business model innovation under tumultuous times (Baker et al., 2003; Guo et al., 2016) and offers many scholarly opportunities. With these outcomes, we also adhere to the call by Teece (D. J. Teece, 2018) that scholars should investigate the contributions of dynamic capabilities to business model innovation. Thus, we offer a new perspective on driving business model innovation through complementary improvisational and dynamic capabilities. Furthermore, it seems that SMEs improvisational capabilities have a relatively short time horizon, and, therefore, adaptive capability and management systems adaptability complement this capability on how value is created through the business model innovation leveraging people, process, and technology (Bocken & Geradts, 2020; Christensen et al., 2016; Ross, Beath, & Mocker, 2019; Rogier van de Wetering, 2021). Now, considering the substantial path effect differences in shaping business model innovation, our current study's research framework serves as a foundation to further investigate the value path initiated from the SMEs' digital resource base that forms the foundation of capability shaping and the subsequent SME value perspective.

Finally, we also investigated the moderating impact of technological turbulence on the relationship between business model innovation and organizational performance for SMEs from Ghana. During the COVID-19 crisis, there has been an uptake of new radical digital technologies creating an environment with high technological turbulence.

This turbulence created both challenges, and for some SMEs in Ghana, it opened up opportunities to excel, drive their position through business model innovation and gain high organizational performance levels (Caballero-Morales, 2021; Clauss et al., 2022; Fitriyani, 2020). Contrary to other studies that show that technological turbulence can inhibit SMEs from improving operations and achieving a competitive advantage (Akpan et al., 2022; Pratono et al., 2018; Puriwat & Hoonsopon, 2021), our work adds to the literature by unfolding that technological turbulence strengthens the positive contribution of business model innovation on organizational performance. Consistent with other SME studies (Klein & Todesco, 2021; Molina-Castillo et al., 2021; Pratono, 2018; Troise et al., 2022) and following this study's results, we now argue that SMEs should embrace new digital technologies as part of their business model innovation during tumultuous times of technological turbulence to exploit the crisis, thrive and gain high levels of performance.

## 6.2 Practical implications

Next to theoretical contributions, our study also provides implications for practice in line with the value path of our research framework. Hence, our work reveals that SMEs can benefit from high levels of technological turbulence by embracing digital technologies and shaping business model innovation. Moreover, our work shows that investing in business model innovation is partly interdependent on technological turbulence. Hence, SMEs should sense the external environment and pay careful attention if they are closely aligned to gain benefits from business model innovation.

In doing so, SMEs can proactively respond to disruptions. Hence, we argue that SMEs that excel in their business model innovation should embrace a strategic approach using an integrative process of project management and dynamic resource allocation; and an organizational model that establishes the right capabilities, metrics, incentives, decision rights, and responsibilities. Through business model innovation SMEs can align themselves with their overall business strategy and goals. The business model, as such, is the bridge that provides SMEs the ability to translate strategy into processes and eventually industry-leading performance as it shows the operating structure and how an organization does business.

In doing so, SMEs should start by gaining an overview of how the current business model's components are configured and function. It is essential to understand that the details of these components differ by SME. The SME leadership should clearly understand each business model component's current strengths and weaknesses and define what it will take to achieve the firm's strategic objective and goals to reach the next level of innovation. These components range from products, services, and customers, to operations, people, processes, and digital infrastructures. Crucial in this process is that the organization highlights the most important drivers of efficiency, the core business and operating structure, processes, roles, and responsibilities, and defines the future state before deep-diving into detailed organization structure design and assigning any names. Through these insights, SME leadership and managers can make deliberate decisions concerning how functions and processes should be configured and where operations should be performed. It goes without saying that the leadership should actively involve its employees and adequately equip them for possible new tasks, roles, and responsibilities through training and mentoring. Interactions between the business model's components must be closely monitored during implementation.

Also, decision-makers within SMEs should develop dynamic capabilities to proactively identify, manage, and evaluate a wide range of new businesses, projects, opportunities, and risks. This is important as SMEs need to navigate through ambiguity to adapt quickly and well to the ever-changing markets, industry, and customer expectations. Moreover, these capabilities enable the organization to challenge the status quo and leave outmoded traditions and practices. Strong, sustainable business results require both adaptive capabilities as well as management systems adaptability to act on the business strategy effectively. During crises like the COVID-19 pandemic, firms must be flexible and anticipate and respond to their customers' real business constraints. We also advise SME decision-makers to leverage the vast network of resources within the firm and beyond to meet clients' and customers' needs and wishes. Ensuring proper and timely collaborations for the seamless delivery of products and services in turbulent environments is crucial for modern SMEs. To make this happen, SMEs need to strengthen the diverse leadership capabilities of all members and consistently move beyond their current operational strengths to build the skills needed for long-term relationships with key clients. In this challenging process, we foresee that the entire organization should be engaged to reach tangible business results while proactively developing teams and individuals.

Also, firms should actively engage in improvisational activities and allow the firm to respond quickly to changes in the market. Hence, business model innovation and its subsequent impact on performance must start with and be guided by a clear set of choices that connect to the overall firm and even department and business unit strategies. We unfolded that SMEs' improvisational capabilities, next to dynamic capabilities, are very relevant during crises. Thus, decision-makers should invest in developing improvisational and dynamic capabilities to drive business model innovation and required growth ambitions.

Finally, we argue that SMEs can navigate a downturn by leveraging their digital infrastructure capability and developing improvisational and dynamic capabilities. The study's results indicate that digital infrastructure capability plays a crucial but indirect role in shaping business model innovation and generating high levels of organizational performance. Hence, this further shows the necessity for SMEs to invest in such a capability and actively consider its key components. Developing a SMEs digital infrastructure capability will enable the organization to rapidly align processes with the digital infrastructure and modular software components, support data and information exchange, and transform the business digitally. However, it should be noted that heavy investing during stable periods with low environmental and technological complexity will not necessarily lead to business model innovation and performance payoffs.

### 5.3 Limitations and future work

This study has several limitations that future work could address. First, we only collected data from Ghana, possibly inhibiting the generalization of these outcomes to developed countries, even though we expect that the outcomes will be generalizable to other emerging countries. Moreover, the data were collected using a single informant strategy. Although, this strategy is in line with other studies. See, e.g., (Nguyen, Huynh, Lam, Le, & Nguyen, 2021), method bias could still be a concern (Podsakoff et al., 2003). Future work could remedy this limitation by using a matched pair design where different respondents address the dependent and independent constructs. Another limitation related to the sampling method is that we applied convenient sampling. Although it is well known that this approach is suited to get data from a particular group, we acknowledge various limitations of this procedure. For instance, this procedure assumes that the final data sample is representative. This is a risky assumption in such a non-probability sampling context, and it is difficult to assess if it will hold (Etikan et al., 2016).

Next, the theoretical model only included dynamic and improvisational capabilities as an antecedent of business model innovation. Apart from the discriminant validity tests, showing the distinctiveness of each construct, Pavlou and El Sawy (Pavlou & El Sawy, 2010) argue that dynamic and improvisational capabilities can have different relationships with their antecedents (e.g., IT system support or flexibility), and their outcomes (consequences). Future work could investigate these particular relationships and take an in-depth look through case studies of how business model innovation was achieved and through which particular business model components. Moreover, we only focused on two dimensions of dynamic capabilities, i.e., management system adaptability and adaptive capability. The DCF embraces various capabilities, including sense and respond capabilities, knowledge processes, and strategic flexibility (Akgün et al., 2012; D. J. Teece et al., 1997; Tuominen et al., 2004; R Van de Wetering, 2021; Rogier van de Wetering, 2021; van de Wetering & Versendaal, 2021; Zhou & Wu, 2010). Thus, future work can also unravel the contributions of organizational capabilities to business model innovation.

Also, this work focused on capabilities on the collective (SME/firm) level of analysis. However, research at the micro-level of individuals (e.g., dynamic managerial capabilities) might be a fruitful avenue for further research and could build on our model to test these relationships under a different, i.e., micro-level lens (Rodenbach & Brettel, 2012).

Finally, we collected data at a single point in time, and a cross-sectional design does not embrace the evolvability of SMEs' capabilities over a more extended period. Future work should investigate the evolving role of dynamic and improvisational capabilities under crises and their aftermaths.

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## Appendix A: Measurement items

### *Digital infrastructure capability*

CA: 0.85; CR: 0.90; AVE: 0.69

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

To what extent do you agree with the following statements?

DIC1: Our digital infrastructure easily accesses data from our partners' IT systems

DIC2: Our digital infrastructure is a crucial driver to transform our business digitally

DIC3: Our digital infrastructure and operational business processes are tightly integrated

DIC4: Our digital infrastructure consists of modular software components, most of which can be reused in other business applications

### *Improvisational capabilities*

CA: 0.79; CR: 0.86; AVE: 0.61

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

To what extent do you agree with the following statements?

IMP1: We apply combinations of business and IT resources at hand to pursue new strategic initiatives such as entering a new market

IMP2: We apply combinations of resources at hand for new business operations

IMP3: We apply combinations of resources at hand for expansion

IMP4: We apply combinations of resources at hand to create new products or services

### *Management system adaptability*

CA: 0.87; CR: 0.92; AVE: 0.81

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

To what extent do you agree with the following statements?

MSA1: The management systems in this organization encourage people to challenge outmoded traditions/practices/sacred cows

MSA2: The management systems in this organization are flexible enough to allow us to respond quickly to the current changes in our markets

MSA3: The management systems in this organization evolve rapidly in response to shifts in our business priorities

### ***Adaptive capability***

CA: 0.81; CR: 0.91; AVE: 0.84

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

*To what extent do you agree with the following statements?*

ADAC1: We are capable of reacting properly to the current changes in the market

ADAC2: Our existing competency can withstand current changes in the industry

ADAC3: Our existing competency can withstand the challenges brought about by the COVID-19 crisis

ADAC4: Our existing competency can withstand the challenges brought about by the digital models and solutions trend

### **Business model innovation**

CA: 0.89; CR: 0.92; AVE: 0.66

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

*Please indicate your firm's capabilities relative to competition for each of the following:*

BMI1: Our business model offers new combinations of products, services, and information

BMI2: Our business model attracts a lot of new customers

BMI3: Our business model attracts a lot of new suppliers and partners

BMI4: Our business model bonds participants together in novel ways

BMI5: Our business model links participants to transactions in novel ways

BMI6: We frequently introduce new ideas and innovations into our business model

BMI7: We frequently introduce new operational processes, routines, and norms into our business model

BMI8: We are pioneers of the business model

BMI9: Overall, our business model is novel

### **Technological turbulence**

CA: 0.80; CR: 0.87; AVE: 0.69

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

*As a result of the current COVID-19 virus, we experience that:*

TT1: Technologies in our industry are currently changing rapidly

TT2: Technological developments in our industry are currently rather major

TT3: Newly developed technologies and processes in our industry can now easily become out of date

### **Organizational performance during COVID-19**

CA: 0.87; CR: 0.91; AVE: 0.72

(7-point Likert Scale, 1 = Strongly disagree, 7 = Strongly agree)

*For the past few weeks, our company, relatively to our main competitors in the same industry (for non-competing governmental agencies, you could also read competitors as 'other ministries or departments'), has been able to maintain or increase:*

OP1: Customer satisfaction

OP2: Business brand and image

OP3: Customer loyalty

OP4: Market share

OP5: Profitability

**Business value** (as part of the post-hoc analyses)

CA: 0.81; CR: 0.88; AVE: 0.75

(7-point Likert Scale, , 1 = Strongly disagree, 7 = Strongly agree)

*For the past 2-3 years, our company, relatively to our main competitors in the same industry (for non-competing governmental agencies, you could also read competitors as 'other ministries or departments'):*

BV1: Has very low total quality costs relative to the total output

BV2: Reveals outstanding delivery speed and reliability

BV3: Delivers high-quality products/services

BV4: Customizes products and services to suit individual customers