

The impact of social capital and collaborative knowledge creation on e-business proactiveness and organizational agility in responding to the COVID-19 crisis



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ABSTRACT

The purpose of this study is to explore the role of social capital and collaborative knowledge creation in achieving e-business proactiveness in responding to the COVID-19 crisis. An online survey was used to collect data from industries that had to continue working during the crisis, such as the pharmaceutical and cleaning materials sectors. The sample consisted of 198 managers. The findings show that social capital and collaborative knowledge creation have a significant role in achieving e-business proactiveness in responding to the pandemic. The results also show the positive impact of collaborative knowledge creation and e-business proactiveness on organizational agility during the crisis. The present study opens broad horizons for the exploration of emerging themes in information technology studies, including the role of collaborative knowledge creation and e-business proactiveness and their impact on organizational agility in responding to global pandemics. An understanding of the pivotal impact of social capital and collaborative knowledge creation on e-business proactiveness provides managers with valuable insights into managing the pressures of pandemics.

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Introduction

The COVID-19 pandemic is a global health crisis. It is the biggest challenge humanity has faced since the Second World War. The pandemic has expanded like a wave, with the world fighting to slow the spread of the virus by restraining travel, enforcing quarantines, and stopping large gatherings.

The spread of COVID-19 has created a new source of survival challenges for businesses. These challenges have pushed organizations to respond rapidly and operate in new ways to continue doing business, managing their supply chains—from sourcing to consumption points—effectively and efficiently. The impact of coronavirus has called on businesses to build resilience to crises and the shocks they bring. They have had to scan the continually

changing business world and adapt to thrive in an unknown landscape, where organizational agility is crucial and offers the basis for survival.

As governments make painful interventions to prevent the spread of coronavirus, businesses have had to adjust swiftly to the changing needs of consumers and suppliers. They have had to make real-time decisions, while resolving the operational and financial challenges arising due to the extraordinary pressures of the pandemic. More than ever before, proactiveness is a requirement for survival for all firms so that they can swiftly and safely deliver their goods and services in the midst of the COVID-19 crisis. The delivery of goods and services is particularly important for those at risk of infection or under curfew or quarantine. This situation highlights the role of social responsibility and ethopolitics in business (Girtli Nygren & Olofsson, 2020).

Investment in information technology (IT) during economic hardship can provide longer periods of gain when industry as a whole faces major challenges (Altschuller, Gelb, & Henry, 2010).

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According to Oh and Teo (2006), high levels of IT capabilities and manifest proactive behavior are both significant determinants for enhancing organizational resilience when crisis strikes. Innovation has been shown to be the main contributor to business success, especially in competitive and complex environments (Rajapathirana & Hui, 2018). In normal conditions, proactiveness is described as a strategic orientation to pursue innovative opportunities and introduce new products and services, enhancing business competitiveness (Jafaridehkordi, Rahim, & Aminiandehkordi, 2015). Proactiveness builds a bridge to fill that gap. Proactive firms are the first to introduce new products, services, or processes, as well as the fastest to innovate. The literature emphasizes that proactiveness is critical for businesses to sense and discover IT-enabled opportunities in uncertain environments (Oh & Teo, 2006). Damian and Manea (2019) confirm the link between technological opportunities, creative new ideas, and innovation as the essence of entrepreneurial initiatives.

The resource-based view theory affirms that firms need to use their physical, human, and organizational assets, both tangible and intangible, to maintain their competitiveness (Caseiro & Coelho, 2019). According to the perception in business, intangible assets are the most important sources of proactiveness (Grimsdottir & Edvardsson, 2018; Vannoy & Medlin, 2012; Zhang, & Wu, 2019). The previous studies have shown that entrepreneurs who proactively search for opportunities have the ability to search for unfamiliar arenas using their accumulated knowledge to envision future business opportunities. According to Martello (1994), opportunity discovery is serendipitous future scanning in which accumulated knowledge plays a fundamental role.

Innovation, entrepreneurship and knowledge have been acknowledged as the basis of economic competitiveness and growth (Piñeiro-Chousa, López-Cabarcos, Romero-Castro, & Pérez-Pico, 2020). Social capital helps firms that seek new knowledge to sense imperfections between how the market currently operates and what could be done proactively to understand and satisfy customers' needs and desires (Nafei, 2016). Research (e.g., Chen, Jiao, Zeng, & Wu, 2016) has shown that proactiveness is subject to collaboration among business partners and other members of business social networks. At the same time, collaboration is pivotal in creating new knowledge as a social process whereby knowledge is transferred and incorporated through social networks, providing businesses with social capital embedded in these networks (Chen et al., 2016; Tu, 2020). Wang (2016) confirmed that social capital affects organizational performance by serving as an input for collaborative knowledge creation.

The escalating scope of intellectual capital assets has been confirmed by tremendous advances in IT and the rise of the knowledge-based economy, in which investment in e-business is essential. Jafaridehkordi et al. (2015) emphasize the idea that, to adopt and use e-business successfully, firms must assess their intellectual capital. More specifically, the literature (e.g., Hayton; 2005; Vannoy & Medlin, 2012; Liu, Ke, We, & Lu, 2016) confirms the pivotal role of social capital in perceiving, implementing, and evaluating e-business models.

The literature acknowledges the variation in the degree of proactiveness of firms in terms of the extent of opportunity recognition and exploitation. The same applies to the proactive adoption of innovative e-business solutions in pandemics to respond rapidly and operate in new ways so as to continue to do business and minimize the effects of epidemic outbreaks on supply chains (Ivanov & Dolgui, 2020; Ivanov, 2020; Pantano, Pizzi, Scarpi, & Dennis, 2020).

A review of the literature reveals that great efforts are being made to research COVID-19 and the effect of the pandemic on business from different perspectives. These perspectives include human resources (Carnevale & Hatak, 2020), innovation (Chesbrough, 2020), entrepreneurship (Kuckertz et al., 2020), and

family firms (Kraus et al., 2020). Research is even being conducted to investigate how COVID-19 is changing consumer behavior (Addo, Jaming, Kulbo, & Liangqiang, 2020; Kim, 2020; Kirk & Rifkin, 2020) and to link the current pandemic with other disasters (Woodside, 2020). However, there is a lack of empirical research on the role of social capital and collaborative knowledge creation during global pandemics. Although social capital and collaborative knowledge creation are accepted as contributing to sustaining a competitive advantage, there is limited empirical evidence of the relationships between these constructs and e-business proactiveness, especially during pandemics such as COVID-19. Previous studies have largely ignored the impact of collaborative knowledge creation on organizational agility. Moreover, no studies have examined the impact of e-business proactiveness on this pandemic, which has paralyzed numerous business activities. Furthermore, while the strategic values of collaborative knowledge creation practices are clear, most firms are unable to comprehend how these practices can be adopted to enhance their e-business proactiveness in such crises.

Drawing on the aforementioned discussion, the purpose of the present study is to examine the role of social capital and collaborative knowledge creation in achieving e-business proactiveness during pandemics. This study also aims to investigate the impact of these capabilities on organizational agility in addressing the challenges of pandemics.

Literature review

Proactiveness is a forward-looking perception. It is an opportunity-seeking attitude to introduce novel products, services, and/or operations based on the anticipation of future demand (Petti & Zhang, 2011). According to Olaison and Sørensen (2014), proactiveness unquestionably played a role in the global financial crisis of 2008. The literature (e.g., Altschuller et al., 2010; Vannoy & Medlin, 2012; Madhok & Marques, 2014) confirms that the pervasiveness of fluctuations in the business environment forces firms to apply proactive and agile practices to ensure their survival. Sambamurthy, Bharadua, and Grover (2003) describe organizational agility as the ability to recognize opportunities in imperfect markets and implement proactive measures to seize those opportunities. Agile firms have the capability to rapidly discover innovative ways of doing business and proactively anticipate and respond to changes and discover new emerging opportunities (Nissen & von Rennenkampff, 2017; Oh & Teo, 2006). Madhok and Marques (2014) claim that rather than waiting for events to occur, agile firms often welcome the uncertain market volatility from which opportunities can emerge.

Considering the pivotal role of IT in today's businesses, scholars (e.g., Beckman, Eisenhardt, Kotha, Meyer, & Rajagopalan, 2012; Al Omouh, Al-Qirem, & Al Hawatmah, 2018) emphasize the idea that effective strategies for long-term sustainability should involve the adoption of e-business solutions. The target role of IT is not merely that of a reactive enabler; it should also have a proactive function in modern business (Nissen & von Rennenkampff, 2017). The literature (e.g., Beckman et al., 2012; Al Omouh et al., 2018) reports that a corporate entrepreneurial orientation includes a willingness to be proactive in the adoption of e-business solutions as opposed to reactive to competitors' actions. E-business proactiveness capability can be regarded as an organization's ability to enrich its technological innovativeness, seizing new business opportunities by adopting and using novel e-business solutions (Hull, Caisy Hung, Hair, Perotti, & DeMartino, 2007).

Proactiveness is derived from both the physical capability to act and the intellectual capability to think, including the ability to create and apply knowledge so that firms have the potential to survive and even prosper in changing and unpredictable environ-

ments (Nafei, 2016; Nissen & von Rennenkampff, 2017). With the advent of the knowledge economy, intellectual capital has become one of the most valuable sources of proactiveness (Liu, Ke, Wei, & Lu, 2016; Oh & Teo, 2006; Puhakka, 2010). The literature (Grimsdottir & Edvardsson, 2018; Son & Benbasat, 2007) confirms that organizations are not isolated entities. Instead, they are embedded in a social context, where they constantly use their social networks to obtain ideas, collect information, and learn to recognize and detect new proactive innovations. Social capital is the combined value of business relationships embedded in social networks linking business partners and society. Social capital can be mobilized to ensure the success of an organization and propel its pro-activeness and entrepreneurship (Hayton, 2005; Liu et al., 2016).

In the new economy, e-business ventures are adept at using their intellectual capital to stimulate proactiveness throughout all operations (Jafaridehkordi et al., 2015; Seethamraju & Sundar, 2013). As a major dimension of intellectual capital, social capital has been broadly acknowledged as a strategic corporate asset that provides sustainable superior performance (Tu, 2020). The literature (e.g., Léger, 2010; Vannoy & Medlin, 2012) has widely examined the effect of social capital on e-business adoption. A wide range of research (Liu et al., 2016; Oh & Teo, 2006; Son & Benbasat, 2007) has shown that e-business implementation is consistent with the shared values, principles, and expectations of business partners and other members of social networks, such as professional and trade associations, professional societies, and accreditation agencies.

A major challenge that faces today's businesses is the spread of knowledge beyond the boundaries of a single firm, where external collaboration is an effective mechanism and an essential source of novel ideas and solutions to big problems and challenges (Faccin & Balestrin, 2018). The literature has extensively investigated how collaborative knowledge creation provides businesses with a basis for proactive actions in a complex and uncertain environment (Nonaka & Takeuchi, 1995; Tu, 2020; Zhao, Zhang, & Wu, 2019). Social networks have been labeled as valuable channels for capturing and sharing explicit knowledge and extracting tacit knowledge (Hayton, 2005; Vannoy & Medlin, 2012). These networks are used not only for exchanging knowledge but also as a channel for detecting who knows what within a network. Such social networks can support collective and collaborative cognition among members, creating novel and renewable knowledge (Croasdel, 2001).

The literature (e.g., Hull et al., 2007; Faccin & Balestrin, 2018) reports that the coordination of the process that organizations follow to create new knowledge significantly influences proactiveness. Recently, the strategy to access knowledge resources has shifted from knowledge creation within an organization to interorganizational collaboration and relational dynamics inherent in business networks and communities of practice (Hayton, 2005). According to the theory of interfirm collaboration, knowledge creation is a spontaneous result of interaction and collaboration among networks of individuals, working groups, and organizations, where members with a range of expertise, backgrounds, and resources discover a novel opportunity to gain a competitive advantage or adapt to existing conditions (Grimsdottir & Edvardsson, 2018; Nonaka & Takeuchi, 1995).

Research (Cegarra-Navarro, Jiménez Jiménez, & Martínez-Conesa, 2007; Maditinos, Chatzoudes, & Sarigiannidis, 2014) has widely studied the role of knowledge creation in generating innovative e-business solutions. At the same time, despite reaching a consensus on the role of social capital in organizational knowledge creation (Tu, 2020), the literature notes a lack of empirical studies of the impact of social capital and collaborative knowledge creation on e-business proactiveness. More importantly, the modern world in which the concepts of e-business solutions, information, and knowledge societies have prevailed had not witnessed a pandemic such as COVID-19. This global pandemic opens broad horizons for

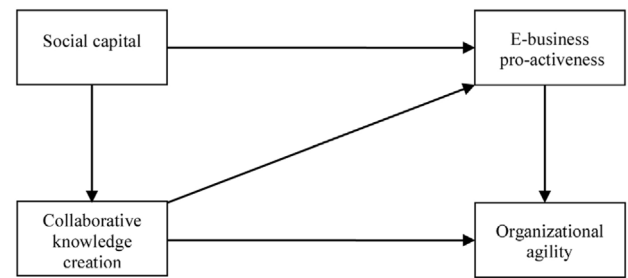


Fig. 1. Research model.

the exploration of emerging themes in IT studies, including the role of collaborative knowledge creation in e-business proactiveness in responding to global pandemics.

Research model and hypotheses

The research model of this study is depicted in Fig. 1. It proposes that social capital has a direct impact on collaborative knowledge creation and e-business proactiveness in responding to pandemics. The research model also posits that collaborative knowledge creation directly affects e-business proactiveness. Furthermore, it proposes that collaborative knowledge creation mediates the impact of social capital on e-business proactiveness. Finally, the research model suggests that collaborative knowledge creation and e-business proactiveness play a significant role in achieving organizational agility in responding to crises such as the COVID-19 pandemic.

The impact of social capital on e-business proactiveness

Today's organizations must be able to sense and exploit IT-enabled opportunities in turbulent environments (Oh & Teo, 2006; Pouloudi, Ziouvelou, & Vassilopoulou, 2003). Al Omouh (2020) cites the top management's level of proactiveness as one of the major organizational resources that foster the role of e-business to create a forward-looking strategy for organizational survival. The speed of perceiving opportunities and obstacles, organizing resources, and creating innovations is a powerful driver of organizational resilience in turbulent environments (Ahmed, Najmi, Mustafa, & Khan, 2019). Oh and Teo (2006) confirmed that IT capability and managerial proactiveness are critical for improving organizational resilience, including a business's ability to endure irregularities and adapt to new high-risk environments. Vannoy and Medlin (2012) argue that understanding how organizational social networks use IT to respond to unexpected events may create new opportunities for businesses to build flexible responsiveness to withstand environmental volatility.

Social capital is pivotal to the proactiveness of firms (Grimsdottir & Edvardsson, 2018; Petti & Zhang, 2011; Vannoy & Medlin, 2012). The literature on social capital focuses on the business's internal and external networks that might be conducive to innovation capabilities that lead to proactive strategic behavior (Petti & Zhang, 2011). The research (Ghane & Akhavan, 2014; Léger, 2010; Liu et al., 2016) emphasizes the direct and indirect influences of social capital on perceiving, applying, and evaluating e-business solutions. Studies (e.g., Pouloudi et al., 2003; Oh & Teo, 2006) have also confirmed that social capital and social networks provide valuable opportunities to leverage e-business capabilities to create complex products, diversify operations, and expand market share. Based on this discussion, the following hypothesis is proposed:

H1: Social capital has a significant role in achieving e-business proactiveness in responding to the COVID-19 crisis.

The impact of social capital on collaborative knowledge creation

Studies (e.g., Puhakka, 2010; Tu, 2020) have investigated how social capital supports knowledge management, helping firms to achieve sustained superior performance in turbulent markets. The literature also widely explores how social capital affects knowledge creation from an individual perspective. Knowledge creation can be seen as a dynamic process that occurs through social interactions between an organization and its partners (Chen et al., 2016). Organizational social networks work as channels, where fragmented information and knowledge can be quickly transmitted and integrated (Vannoy & Medlin, 2012). In the context of social capital, Vannoy and Medlin (2012) confirmed that an organization's social networks play a pivotal role in optimizing collective awareness of market fluctuations, providing powerful stations for businesses to share and create new knowledge in dynamically complex domains.

Collaborative knowledge creation can be viewed as the process whereby business partners create new knowledge through cooperation and co-creation to develop a better understanding of the environment, gain insights, and respond to the turbulent market by working together (Zhao et al., 2019). Collaboration represents the social process whereby knowledge is transferred, coordinated, and integrated through social interaction (Faccin & Balestrin, 2018). According to Nonaka (1994), organizational knowledge creation is a dynamic process, and the pivotal point of this process is the collaborative creation of knowledge. Kaschig, Maier, and Sandow (2016) also confirmed that collaborative knowledge is jointly created by direct and indirect partners embedded in social relationships.

Shakina and Barajas (2014) emphasized that, social capital enables firms to survive during crises and difficult economic conditions. The literature (e.g., Kaschig, Maier, & Sandow, 2016; Tu, 2020) explains how social capital that pools different expertise and resources enhances collaborative knowledge creation. However, Zhao et al. (2019) investigated collaborative knowledge creation under the high pressure of environmental uncertainty based on dynamic multilayer social networks. Chen et al. (2016) also confirmed a significant relationship between collaborative knowledge creation and supply chain flexibility in a highly uncertain market environment. According to Faccin and Balestrin (2018), collaborative knowledge creation is reflected in evolving organizational knowledge and is exemplified by continuous learning, sensing, and adaptation to environmental changes and swiftly changing market requirements. Drawing on the previous discussion, the following hypothesis is proposed:

H2: Social capital has had a significant role in collaborative knowledge creation during the COVID-19 crisis.

The role of collaborative knowledge creation in achieving e-business proactiveness

The ability to develop a flexible and adaptable learning process and acquire new knowledge is vital for firms to grow and innovate, especially in periods of pressure, even after a crisis abates (Muukkonen, Lakkala, Lahti-Nuuttila, Ilomäki, Karlgren, & Toom, 2019). Knowledge management consists of a wide range of strategies and practices to create, capture, share, and apply individual or organizational knowledge, providing valuable sources for novel innovations (Faccin & Balestrin, 2018). Knowledge creation is seen as a starting point for both knowledge management and proactiveness (Grimsdottir & Edvardsson, 2018). The literature (e.g., Hull et al., 2007; Faccin & Balestrin, 2018; Grimsdottir & Edvardsson, 2018) shows that, to reinforce its proactiveness potential, an organization must intensify its collaborative knowledge creation efforts so that it can generate powerful new insights or novel business ideas and practices. Researchers (Chen et al., 2016; Lumpkin, Coglisier, & Schneider, 2009; Puhakka, 2010) agree that quickly drawing upon

prior knowledge and collaboratively learning and creating new knowledge can reinforce an organization's ability to sense market imperfections and discover opportunities, pursuing new ventures and achieving continuous alignment with the business environment. Drawing upon prior knowledge and collaboratively learning and creating new knowledge, and an organization's ability to sense market imperfections and discover opportunities implies that the capabilities of creating, sharing, and using knowledge are employed to search proactively for future business opportunities (Puhakka, 2010).

Crisis management requires knowledge-based initiatives, including IT innovations. E-business proactiveness is an outcome of the creation and implementation of novel knowledge and the combination of this knowledge with existing business resources and capabilities (Hayton, 2005). The literature (e.g., Cegarra-Navarro et al., 2007; Maditinos et al., 2014) emphasizes the important role of organizational learning and new knowledge creation in the development of IT capabilities, the promotion of e-business innovation, and proactiveness. Sambamurthy, Bharadwaj, and Grover (2003) explain how knowledge creation provides renewable sources of intelligence and novel ideas and thus positively affects the success of e-businesses. Khamis, Sulaiman, and Mohezar (2014) affirm that the flexibility of e-business firms and the ability to adapt to the changing environment rely principally on creating new knowledge. According to Song (2015), the numerous opportunities offered by the Internet in the financial crisis have created a business environment where the role of knowledge has grown to become highly important. However, many scholars (e.g., Cegarra-Navarro et al., 2007; Maditinos et al., 2014; Al Omouh, 2020) have affirmed the crucial role of collaboration and interaction with business partners and other organizations in determining the successful implementation of e-business in highly uncertain business environments and industries with high levels of fluctuation. The above discussion leads to the proposal of the following hypothesis:

H3: Collaborative knowledge creation has a significant role in achieving e-business proactiveness in responding to the COVID-19 crisis.

The impact of e-business proactiveness on organizational agility

Organizational agility is a transition toward constantly foreseeing the future, detecting opportunities or problems before they occur, and having the capabilities and resources to change before they are obvious to others (Nissen & von Rennenkampff, 2017). Thus, proactive behavior by an organization is determinant for enhancing organizational agility, especially during market volatility and in environments with unpredictable demand (Oh & Teo, 2006). High IT agility contributes to enhancing business agility (Nissen & von Rennenkampff, 2017; Sambamurthy et al., 2003). The literature (e.g., Sambamurthy et al., 2003; Oh & Teo, 2006; Vannoy & Medlin, 2012) explores the impact of IT on initiating a forward-looking strategy for promoting organizational agility. Altschuller et al. (2010) conclude that IT investment improves organizational agility during periods of industry turbulence.

Organizations increasingly depend on e-business innovations in their search for agility (Nissen & von Rennenkampff, 2017). E-business capabilities provide new opportunities to implement newer business models swiftly and initiate novel platforms of organizational agility (Nafei, 2016). Studies (e.g., Seethamraju & Sundar, 2013; Nissen & von Rennenkampff, 2017) have emphasized the idea that advanced e-business capabilities are intended to provide the requisite agility for businesses. E-business proactiveness reflects the capability of a firm to sense environmental changes and respond swiftly using web-based systems and electronic networks, enhancing the firm's agility in turbulent environments (Oh & Teo, 2006).

Drawing upon the previous discussion, the following hypothesis is proposed:

H4: E-business proactiveness has a direct positive impact on organizational agility in responding to the COVID-19 crisis.

The impact of collaborative knowledge creation on organizational agility

The effects of knowledge capital on organizational agility have been widely acknowledged. The literature (e.g., Maditinos et al., 2014; Nafei, 2016; Nissen & von Rennenkampff, 2017) regards agility as the ability to manage and apply knowledge effectively empowering a firm to develop an early response and adjustment to industry turbulence and market dynamics. According to Naylor, Naim, and Berry (1999), agility requires the use of market knowledge and collaboration to explore novel opportunities in volatile marketplaces. Altschuller et al. (2010) claim that the creation of knowledge and the ability to redeploy existing knowledge across the organization reflect the value of knowledge capital in enabling organizational agility. Competitive agility also requires strategizing through learning and the creation of knowledge faster than competitors to translate this new knowledge into action quickly (Madhok & Marques, 2014). Studies (e.g., Croasdell, 2001; Borgatti & Cross, 2003; Altschuller et al., 2010; Madhok & Marques, 2014) have confirmed that collaboration and knowledge sharing with all direct and indirect partners are determinants of organizational agility. Therefore, the following hypothesis is proposed:

H5: Collaborative knowledge creation has a direct positive impact on organizational agility in responding to the COVID-19 crisis.

The mediating role of collaborative knowledge creation

Social networks have mostly been contemplated as powerful mechanisms for creating, transferring, and sharing explicit and tacit knowledge (Hayton, 2005). The literature (e.g., Subramaniam & Youndt, 2005; Léger, 2010; Vannoy & Medlin, 2012) confirms that businesses with high levels of social capital have better knowledge-management capabilities than businesses with low levels of social capital. Likewise, studies (Faccin & Balestrin, 2018; Hull et al., 2007) have broadly investigated the effect of knowledge creation on organizations' proactiveness. Borgatti and Cross (2003) and Öberg (2019) investigated the role of social networks and relationships in generating new proactive innovations by enriching knowledge creation through collaboration.

According to Tallon (2008), social capital is a determinant of a firm's capacity for IT-based innovations because of its role in creating new knowledge and converting it into novel applications. Notably, a number of studies (e.g., Hayton, 2005; Léger, 2010; Al Omouh, 2020) have investigated the importance of social capital in e-business adoption and entrepreneurship. The discussion implies that collaborative knowledge creation mediates the impact of social capital on e-business proactiveness. Therefore, the following hypothesis is proposed:

H6: Collaborative knowledge creation mediates the impact of social capital on e-business proactiveness in responding to the COVID-19 crisis.

Research method

Measures and instruments

The measures employed to operationalize the variables in the research model are adapted from prior research (Table 1). Collaborative knowledge creation was measured using the four dimensions of the SECI model: socialization, externalization, combination, and

Table 1
Sources of measures.

| Constructs | Number of items | Reference/s |
|----------------------------------|-----------------|--|
| Social capital | 5 | Hayton, 2005; Liu, Ke, We, & Lu, 2016 |
| Collaborative knowledge creation | 7 | Nonaka & Takeuchi, 1995; Faccin & Balestrin, 2018; Chen et al., 2016; Muukkonen et al., 2019 |
| E-business proactiveness | 5 | Oh & Teo, 2006; Hull et al., 2007; Al Omouh et al., 2018 |
| Organizational agility | 5 | Sambamurthy et al., 2003; Nafei, 2016; Nissen & von Rennenkampff, 2017. |

internalization (Chen et al., 2016; Muukkonen et al., 2019; Nonaka & Takeuchi, 1995). The measure focused on the extent of collaboration in these dimensions. Table 1 shows the sources of the measures used in this study.

Data were collected using an online questionnaire. As shown in Table 2, the questionnaire included 22 questions that captured data on the constructs in the research model. All items were recorded using a five-point Likert-type scale.

Sampling and questionnaire distribution

During the COVID-19 crisis, many industries had to continue working. Examples of these essential industries are the pharmaceutical, medical products, and medical devices industry, the sterilization, disinfection, and cleaning materials industry, and many others, most notably the food industry. Therefore, these industries are attractive for the study of e-business proactiveness in pandemics. The sample in this study was taken from Jordanian manufacturing firms in these industries.

Jordan became one of the first countries in the Middle East to ease its lockdown against the COVID-19 outbreak (Aljazeera, 2020). Jordan implemented the mandatory closure of all nonessential businesses. Vital sectors were exempt from this closure. These sectors urgently needed full collaboration with their supply chains and other business partners. The impact of the coronavirus outbreak has forced organizations to reprioritize their processes, activities, and relationships toward adopting innovative e-business applications.

Under the pressures of the pandemic, society sought digital solutions. Public administrations and governments have addressed this issue through major interventions (Haroon & Rizvi, 2020). For example, the Jordanian government has launched a unified online platform (www.mouneh.jo) to encourage firms and licensed applications to meet the basic needs of citizens and provide goods delivery to homes. To ensure that Jordanian students' studies are not disrupted by this crisis, the Ministries of Education, Higher Education, Digital Economy, and Entrepreneurship have collaborated with telecommunication companies to develop comprehensive online education platforms and smartphone applications. Furthermore, the government launched online platforms and applications to provide basic services to citizens and businesses, encouraging all members of society to use e-payment systems and mobile e-wallet services.

Under the exceptional circumstances of the COVID-19 pandemic, 24 companies (shown in Table 3) agreed to participate in the study.

Table 2
Constructs and measurement items.

| Construct | Code | Measurement items |
|----------------------------------|--|---|
| Social capital | S1 | Our company's social networks and membership with industrial and trade bodies enhances the opportunities for acquiring cutting-edge ideas and insights. |
| | S2 | Our company has close connections and collective actions with its business partners |
| | S3 | Our business partners effectively participate in deciding on the matters that affect them. |
| | S4 | Our company relies heavily on feedback and recommendations from social networks. |
| | S5 | The social networks of the company have a great influence on developing our processes, products, and services. |
| Collaborative knowledge creation | To what extent do the following statements apply to your company: | |
| | CK1 | Getting novel ideas and technologies from social networks and interactions with suppliers, customers, associations, and other actors in the business environment. |
| | CK2 | Collaborating with partners using both inductive and deductive thinking to gain new knowledge. |
| | CK3 | Launching and exchanging ambitious and creative ideas and dialogues with partners. |
| | CK4 | Using and sharing repositories of knowledge, lessons learned, and best practices with partners. |
| | CK5 | Spending a lot of time with partners reconfiguring information and sorting, integrating, and categorizing new knowledge. |
| | CK6 | Engaging in active liaising activities and sharing new values and thoughts with its functional departments and external partners. |
| | CK7 | Spending a lot of time in conducting collaborative learning experiments and sharing results with entire departments and external partners. |
| E-business proactiveness | To what extent do the following statements apply to your company in responding to the COVID-19 pandemic: | |
| | E-P1 | Introducing new IT applications in responding to the effects of the COVID-19 crisis. |
| | E-P2 | Reinforcing the activities of exploiting innovative e-business solutions in responding to the COVID-19 crisis. |
| | E-P3 | Endeavoring to adopt new e-business applications during the COVID-19 crisis. |
| | E-P4 | Being at the forefront of discovering emerging e-business opportunities to address restrictions imposed by the coronavirus pandemic. |
| Organizational agility | E-P5 | Pioneering the adoption of new e-business solutions in responding to business challenges posed by COVID-19. |
| | OA1 | Promptly pursuing the opportunities and threats posed by the evolution of the COVID-19 crisis. |
| | OA2 | Sensing dynamic environmental changes posed by the coronavirus pandemic already underway and predicting swiftly what to do. |
| | OA3 | Improving the agility of decision making in responding to challenges posed by COVID-19. |
| | OA4 | Adapting resources, processes, and technologies to meet the needs of the changing environment caused by the coronavirus pandemic. |
| | OA5 | Considering new pricing, marketing, production, and/or alliance actions. |

Table 3
The distribution of participating firms.

| Industry | No. | % |
|-------------------------------------|-----|------|
| Pharmaceutical | 7 | 0.29 |
| Gags and medical robes | 5 | 0.21 |
| Sterilization and cleaning material | 6 | 0.25 |
| Medical equipment | 2 | 0.08 |
| Food | 4 | 0.17 |
| Total | 24 | 100 |

Table 4
Distribution of respondents.

| Respondents | No. | % |
|------------------------------|-----|------|
| Chief Executive Officer | 10 | 0.05 |
| Vice President | 5 | 0.03 |
| IT | 17 | 0.09 |
| Research and development | 14 | 0.07 |
| Customer service | 17 | 0.09 |
| Human resources | 18 | 0.09 |
| Procurement/purchasing | 16 | 0.08 |
| Sales and marketing | 18 | 0.09 |
| Finance and accounting | 16 | 0.08 |
| Operations and manufacturing | 17 | 0.09 |
| Logistics/supply chain | 16 | 0.08 |
| Other managers | 34 | 0.17 |
| Total | 198 | 100 |

The target respondents were managers from all levels. In total, 198 usable responses were received. Table 4 summarizes the distribution of the respondents.

Data analysis and results

Smart-PLS 3.0 was used for the data analysis. SEM is a regression-based approach for testing original research models with multiple constructs and measures. PLS is preferable for exploratory research, which is the nature of the present study. This approach does not require a large sample or normally distributed multivariate data (Fornell & Larcker, 1981).

Factor loadings, composite reliability (CR), and the average variance extracted (AVE) were used to estimate the convergent validity (Hair, Black, Babin, & Anderson, 2010). The factor loadings of some items were less than 0.70 on their own constructs and had to be excluded from the final analysis. Specifically, one item was excluded from the social capital scale (S5), one from the collaborative knowledge creation scale (CK7), and one from the e-business proactiveness scale (E-P4). Traditionally, Cronbach's α , rho A, and composite reliability (CR) are used to measure internal consistency. Table 5 shows that Cronbach's α , rho A, and CR for all constructs exceeded the threshold of 0.70. Furthermore, AVE values were above the threshold (0.50), which suggests convergent validity.

Table 5
Validity and reliability of constructs.

| Constructs | Cronbach's α | rho_A | CR | AVE |
|----------------------------------|---------------------|-------|-------|-------|
| Social capital | 0.813 | 0.891 | 0.855 | 0.597 |
| Collaborative knowledge creation | 0.898 | 0.909 | 0.918 | 0.617 |
| E-business proactiveness | 0.824 | 0.830 | 0.883 | 0.655 |
| Organizational agility | 0.830 | 0.852 | 0.876 | 0.587 |

Table 6
Discriminant validity.

| No. | Constructs | 1 | 2 | 3 | 4 |
|-----|----------------------------------|--------------|--------------|--------------|--------------|
| 1 | Social capital | 0.773 | | | |
| 2 | Collaborative knowledge creation | 0.643 | 0.785 | | |
| 3 | E-business proactiveness | 0.597 | 0.596 | 0.809 | |
| 4 | Organizational agility | 0.555 | 0.592 | 0.697 | 0.766 |

Discriminant validity was tested by examining the cross-loadings between constructs (Fornell & Larcker, 1981). Specifically, the AVE of each latent factor should be larger than the factor's squared correlation with any other latent factor. Table 6 reveals that the square root of the AVE of each construct was greater than the correlations with the other constructs, indicating adequate discriminant validity.

Research hypothesis testing

The results of the structural modeling analysis are summarized in Fig. 2. The figure shows the estimates of causal relationships between social capital, e-business proactiveness, collaborative knowledge creation, and organizational agility. Path coefficients (β), t values, and p values were employed to test the research hypotheses. A rule of thumb is that a path coefficient that is greater than 0.1 with a t value that are greater than 1.96 is statistically significant at the 0.05 level of significance (Hair et al., 2010).

The results of testing the direct relationship hypotheses are summarized in Table 7. The results support the significant role of social capital in achieving e-business proactiveness (H1) and collaborative knowledge creation (H2). The results also indicate that collaborative knowledge creation has a significant role in achieving e-business proactiveness in responding to coronavirus (H3). Furthermore, the findings indicate that e-business proactiveness and collaborative knowledge creation have a direct positive impact on organizational agility in responding to the COVID-19 crisis. Consequently, hypotheses H4 and H5 are supported.

Table 7
Results of testing the research hypotheses.

| H | β | t value | Sig. | Result |
|---|---------|---------|-------|-----------|
| 1 | 0.364 | 4.449 | 0.000 | Supported |
| 2 | 0.643 | 15.620 | 0.000 | Supported |
| 3 | 0.363 | 4.337 | 0.000 | Supported |
| 4 | 0.533 | 5.303 | 0.000 | Supported |
| 5 | 0.274 | 2.113 | 0.035 | Supported |

Table 8
Results of testing the mediating role of collaborative knowledge creation.

| H | z value | p value | Result |
|---|---------|---------|-----------|
| 6 | 4.166 | 0.000 | Supported |

The mediating role of collaborative knowledge creation in the causal relationship between social capital and e-business proactiveness was examined using the Sobel test.

The results in Table 8 reveal significant mediation by collaborative knowledge creation in the impact of social capital on e-business proactiveness in response to the COVID-19 crisis (H6), z- value = 18.413, $p < 0.000$.

Conclusions

The COVID-19 pandemic is the greatest challenge humanity has faced this millennium. High IT capabilities and proactive behavior are both significant determinants for enhancing organizational resilience when such crises strike. The pandemic has provided unprecedented opportunities to study the determinants and role of e-business solutions in global crises that sweep the world and disrupt offline life and human activity. In this context, this study explores the role of social capital and collaborative knowledge creation in achieving e-business proactiveness and organizational agility to address competition in difficult contexts (Ricciardi, Zardini, & Rossignoli, 2018).

The results show that social capital has a significant role in achieving e-business proactiveness in responding to the COVID-19 crisis. These results are in line with prior findings (e.g., Petti & Zhang, 2011; Vannoy & Medlin, 2012; Grimsdottir & Edvardsson, 2018), confirming that social capital is pivotal for firms to develop proactiveness. Many studies (e.g., Léger, 2010; Ghane & Akhavan, 2014; Liu et al., 2016) have emphasized the role of social capital in creating IT-based entrepreneurial ideas and initiatives and

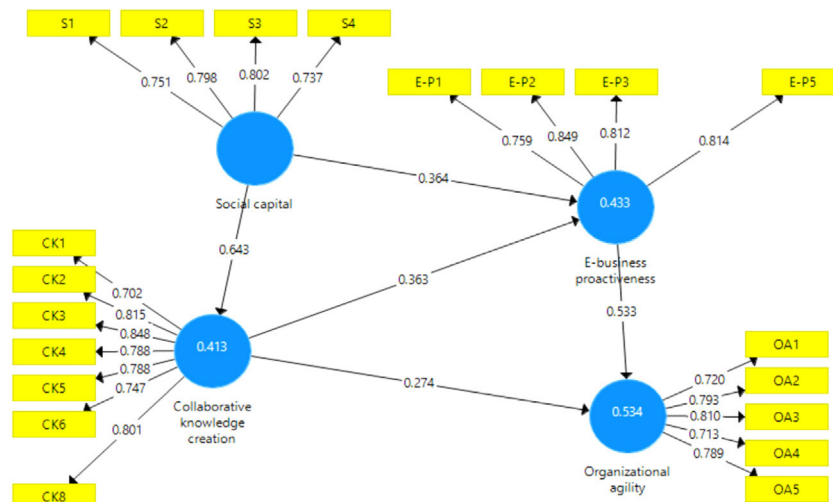


Fig. 2. Path coefficient analysis.

in the way that innovative e-business opportunities are detected, applied, and evaluated. The results also reveal that social capital has a significant role in collaborative knowledge creation in the COVID-19 crisis. These findings are consistent with recent studies (e.g., Zhao et al., 2019; Tu, 2020), which confirm that social capital pools different expertise and resources to support collaborative knowledge creation. Furthermore, these findings are consistent with the impact of intellectual capital on entrepreneurship. The findings confirm that social capital supports firms that seek new knowledge to sense imperfections between how the market currently operates and what could be done proactively to understand and satisfy customers' needs and desires (Nafei, 2016).

The results show that collaborative knowledge creation has a significant role in achieving e-business proactiveness in responding to the COVID-19 crisis. These findings are in line with prior research (e.g., Beckman et al., 2012; Song, 2015; Grimsdottir & Edvardsson, 2018). The findings confirm the role of collaborative knowledge creation as a renewable source of collective intelligence and novel ideas that reinforce an organization's ability to sense market imperfections and discover opportunities, pursuing new ventures in highly turbulent and rapidly changing business environments. The literature (e.g., Cegarra-Navarro et al., 2007; Maditinos et al., 2014) also emphasizes the significant impact of organizational learning and knowledge creation on the development of necessary capabilities, the promotion of e-business innovation, and proactiveness.

The findings reveal that e-business proactiveness has a direct positive impact on organizational agility in responding to the COVID-19 crisis. These findings are compatible with the related literature (e.g., Madhok & Marques, 2014; Nissen & von Rennekampff, 2017), showing that proactive behavior is a determinant of organizational agility when there is market volatility and unpredictable demand. The literature (e.g., Oh and Te, 2006; Seethamraju & Sundar, 2013) shows that e-business proactiveness reflects the agile capability of a firm to sense environmental change and respond swiftly with technological innovations, enhancing its resilience and flexibility in turbulent environments. These results are in agreement with those of prior research (e.g., Maditinos et al., 2014; Nafei, 2016) that depicts agility as the ability to manage and apply knowledge effectively, empowering a firm to develop an early response and adjustment to industry turbulence and market dynamics.

The findings emphasize the mediating role of collaborative knowledge creation in the impact of social capital on e-business proactiveness. These results are consistent with a previous study by Borgatti and Cross (2003), who investigated the primary role of social networks in generating new proactive innovations by enriching knowledge creation through collaborative work. Tallon (2008) also confirmed that social capital is a determinant of a firm's capacity for IT-based innovations because of its role in creating knowledge and converting it into novel applications.

Contributions

Business functions and activities have been disrupted due to the unprecedented pressures of the COVID-19 pandemic. "No e-business, no work" is a survival maxim imposed on businesses by the pandemic. While organizations strive to satisfy the emergency needs of customers, the response to the pressures of the coronavirus pandemic has launched a new wave of e-business innovations. COVID-19 outbreak has forced organizations that used e-business as a secondary channel of doing business to reprioritize their processes and activities toward innovative e-business solutions.

This study explores the role and impact of social capital and collaborative knowledge creation on e-business proactiveness in

pandemics and their impact on organizational agility to address the challenges of pandemics. The findings show that social capital is an investment in an organization's social networks, relationships, and collaboration with business partners to support the organization's proactiveness in responding to future pandemics. The results reveal that social capital plays a pivotal role in creating a forward-looking e-business strategy for organizational survival and building organizational resilience in pandemics sweeping the world. This study confirms that collaborative knowledge creation also plays a significant role in achieving e-business proactiveness in responding to pandemics. This finding implies that collaborative knowledge creation among networks of working groups and organizations with a variety of resources enables businesses to discover novel opportunities to achieve e-business proactiveness and adapt to exceptional conditions.

The present study reveals that e-business proactiveness and collaborative knowledge creation have been determinants of organizational agility during the coronavirus pandemic. During such pandemics, e-business proactiveness plays a pivotal role in promoting the capability of a firm to sense environmental changes and respond swiftly using web-based systems and networks to enhance its agility. The results imply that organizational agility in responding to the COVID-19 crisis requires employing collaborative knowledge creation to explore novel opportunities in volatile markets. Learning and collaborative creation of knowledge and the ability to redeploy existing knowledge reflect the value of knowledge capital in enabling organizational agility. The results confirm that both of these organizational capabilities enable firms to detect opportunities and threats, sense dynamic environmental changes posed by the ongoing coronavirus pandemic, and swiftly predict what to do. They enhance an organization's resilience when such crises strike by improving the agility of decision making and helping to adapt resources, operations, and technologies to meet emerging needs.

The findings of the present study make a valuable contribution to the knowledge of academics and practitioners. The modern world in which e-business solutions, information, and knowledge societies have prevailed had never before witnessed a pandemic such as COVID-19. The present study opens broad horizons for the exploration of emerging themes in IT studies, including the role of collaborative knowledge creation and e-business proactiveness in responding to global pandemics. The findings of the present study contribute to launching a new discussion about the determinants and the impact of e-business proactiveness in global crises that sweep the world and disrupt offline life and human activity. The findings provide a unique contribution to scholarly understanding of how collaborative knowledge creation and e-business capabilities support an organization's resilience when such crises strike. The results of the study show the importance of organizational agility as a performance evaluation measure in responding to coronavirus and other such pandemics. Such an evaluation is useful for gaining new theoretical insights from future studies that seek further knowledge of the value of collaborative knowledge creation and e-business proactiveness during pandemics.

The results of this study have several practical implications. An understanding of the pivotal role of social capital and collaborative knowledge creation in achieving e-business proactiveness and their impact on organizational agility provides managers with valuable insights into managing the pressures of the pandemic. Achieving e-business proactiveness requires investment in social capital and collaborative knowledge creation to respond to such crises. Managers should be aware that having a rich and scalable IT infrastructure and distinctive competencies enables the use of technological opportunities to develop e-business proactiveness. Today's firms must provide powerful mechanisms to strengthen ties, social networks, and collaborations with business

partners that offer renewable knowledge resources to sense and exploit e-business-enabled opportunities under unprecedented and exceptionally turbulent environments. Finally, the research model presents a paradigm of how to achieve organizational agility. It thus provides guidance for business organizations in how to implement successful social capital, collaborative knowledge creation, and e-business proactiveness initiatives to address the challenges of pandemics.

Limitations and future research

Despite its original contributions, this study also has limitations that can provide motivation for further research. This study was performed seven months after the pandemic began, while the world was still witnessing the spread of COVID-19. Freedom of movement was still restricted by measures to prevent the spread of the virus. Under these conditions, it was difficult to collect data from a large sample. Additionally, data were collected from manufacturing firms in Jordan. Therefore, the findings of this study cannot confidently be generalized to other industries or countries, and certainly not beyond the borders of the Middle East. Hence, the research model of this study should be tested in further research, targeting larger samples from different sectors, countries, and regions to confirm these results.

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