

SPECIAL ISSUE ARTICLE**COVID-19 crisis and SMEs responses: The role of digital transformation**Vinícius Barreto Klein¹  | José Leomar Todesco² ¹Catarinense Federal Institute (IFC), Blumenau, Brazil²Federal University of Santa Catarina (UFSC), Blumenau, Brazil**Correspondence**

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In addition to causing dramatic damage to people's health, the coronavirus has affected also the financial health of companies worldwide. Among them, SMEs (small and medium-sized enterprises) tend to be more vulnerable. Characteristics such as scarcity of financial resources and lack of specialized knowledge make their situation even harder. This pandemic has resulted in increased digital transformation, changes in customer behavior and the managerial and technological knowledge gap to address them. Therefore, this article discusses the general weaknesses, strengths, challenges and opportunities for SMEs to face this pandemic, and how the field of knowledge management (KM) can help. Based on the concepts of organizational resilience, we drafted a conceptual model to illustrate how their first responses were and how they could become more adapted. First, we conducted a literature search to investigate how SMEs responded to this scenario. We found responses to the financial impacts in the form of mass layoffs, temporary and permanent closures, bootstrapping of digitalization and strategic alliances. In the discussions section, we raise some key questions to demonstrate how knowledge can improve the role of digital transformation. We approach how a KM strategy could start from organizational resilience concepts to assist SMEs to seize digital transformation opportunities. As practical implications, our research raises awareness of digital transformation's role as a set of tools to adapt during and after the pandemic, along with resilience engineering and knowledge management principles. Future researchers can use this report as a conceptual guide to start their own response and adaptation plans.

1 | RESPONDING TO THE COVID-19 CRISIS

The current pandemic of coronavirus-associated acute respiratory disease, called coronavirus disease 19 (COVID-19; Gorbalenya, Baker, Baric, de Groot, & Drosten, 2020), has dramatically taken away many lives all over the world. As a side effect, many economies were strongly impacted. The impacts of lockdowns are causing a global recession, from the top economies to developing countries (Globaldata, 2020; OECD, 2020). Between the affected companies, the SMEs (small and medium-sized enterprises), SBs (small businesses; Bartik et al., 2020) or SMBs (small and medium businesses; Beley & Bhatarkar, 2013) have attributes that make them more vulnerable to the current pandemic

crisis. Their scarcity of financial resources and gaps in specialized knowledge make it difficult for them to respond to the challenges posed by the COVID-19 crisis. Specific characteristics of SMEs in comparison with large firms certainly make difficult SMEs' responses to this crisis: lack of human resources, limited managerial capacity (procedures, techniques and tools), limited capital resources and no knowledge management (only tacit knowledge, nothing is formalized; Garengo, Biazzo, & Bititci, 2005). Furthermore, according to Eggers (2020), SMEs face a liability of smallness (Freeman, Carroll, & Hannan, 1983), which simply means that the smaller the firm, the more vulnerable it is to internal and external events (Eggers, 2020). Some also face a liability of newness, meaning that the youngest companies tend to be more vulnerable than older ones (Freeman et al., 1983; Stinchcombe, 1965). In

TABLE 1 Systematic review: Reproducible research protocol

| Parameter | Value |
|--|--|
| Research question | How are SMEs responding to COVID-19 crisis? What opportunities and challenges can be tracked from their responses? |
| Objective | To find response actions from SMEs to COVID-19 crisis; to obtain insights about opportunities for SMEs; to analyze digital response actions |
| Combination of keywords (in title or abstract) | "SMEs"; "COVID-19"; "response"; "opportunities"; "challenges"; "digital transformation"; "strengths"; "weaknesses"; "threats" |
| Search engines | Google Scholar, CAPES https://www.periodicos.capes.gov.br |
| Virtual bases | Springer, Scielo, Scopus, Web of Science, ProQuest, Science Direct (Elsevier), IEEE |
| Type of materials | Scientific papers, white reports, conference papers, open-access materials |
| Year of publication | Only 2020 |
| Selection criteria | <ol style="list-style-type: none"> 1. Preference on peer-reviewed journals (refereed or scholarly), from management field of study 2. Search for keywords in title and abstract 3. The most cited materials |
| Data extraction method | Text/content analyses: Focus on objectives and main results |
| Search refinement (cycles) | Keywords were searched more than once to include newest publications (since the pandemic is still going on). Reviews of research results were also made |
| Total No. of articles analyzed | Nine |

Note: The searches were refined and restarted during the evolution of the paper.

addition, government financial aid measures, together with changes in the supply chain, strongly influence SMEs' operations and survival.

On the other hand, opportunities may come from this disruption. The current situation triggers changes in customer behavior, market balance and supply chains (Carvalho, Bonzo, & Zenaide, 2020; Ceylan, Ozkan, & Mulazimogullari, 2020), and digital technologies can help them to take advantage of this window of opportunity. Even though it is probably out of necessity in most cases, it is no coincidence that this crisis has accelerated the adoption of digital technologies by approximately 5 years in 8 weeks (Baig, Hall, Jenkins, Lamarre, & McCarthy, 2020). Butt (2020) states that this pandemic has highlighted DT (digital transformation) in such a way that organizations now feel the adversities of not having embraced it earlier.

Along with the increase in digitalization attempts, another element can be highlighted: the *absence of knowledge*. Knowledge, or the

lack of it, plays a pivotal role in overcoming the current pandemic. For instance, according to Cunningham, Goh, and Koh (2020), the absence of knowledge to develop a definitive treatment, in the form of a vaccine or specific antiviral drugs to treat critically ill patients, is what increased the global challenges. In a similar way, SME managers may suffer from the lack of knowledge to deal with the economic effects caused by the pandemic. Knowledge is necessary to understand the new consumption patterns, the new supply-demand relationship, how to approach them with knowledge extraction tools, which digital technology products or services to invest and, last but not least, how to use it. Therefore, knowledge management research could provide SMEs with the needed knowledge to face such crisis. An overview of strategies adopted by SMEs, and the unique challenges faced by them in their different sectors and regions around the globe, could better equip small businesses to develop a benchmark approach to deal with such pandemics (Ravindran & Boh, 2020). Besides, understanding the new behavior of customers, during and possibly after the pandemic, is a concern that KM together with DT studies can help shed light on. New knowledge models can help us to understand how SMEs can adapt and respond to the new society's demands, how to use digital technologies to rethink their operations and business models (Arkan, 2016; Erbert & Duarte, 2018; Mahraz, Benabbou, & Berrado, 2019) and to be better prepared for eventual new crises (Ravindran & Boh, 2020).

Considering this context, we raised three research questions: how are SMEs responding to COVID-19 crisis? What are the general weakness, strengths, opportunities and challenges that can be tracked from their responses? How can the KM assist SMEs through this acceleration of DT, which is also known as the fourth industrial revolution or Society 5.0? In order to answer those questions, first, we analyze the current context for SMEs through their responses in articles found in academic literature and entrepreneurship ecosystem, worldwide and especially in Brazil. Then, we discuss the role of DT and the need for both a KM approach and a resilient behavior, which will better prepare SMEs for the "new normal society." As practical implications, our article starts with a conceptual draft that uses organizational resilience to guide SMEs to learn, adapt, monitor and anticipate the new challenges presented by society's new demands. Finally, we mark DT as a major instrumental challenge, which requires a strong focus on KM for companies to succeed.

2 | METHODOLOGY

We analyze the results of studies conducted at the global and Brazilian level. The main materials were returned through a systematic review, which is a type of secondary research that focuses on reviewing the literature through rigorous, explicit and reproducible procedures, oriented to answer a relevant research question (Green, Johnson, & Adams, 2006; Kitchenham & Charters, 2007). In this sense, we describe our procedures in Table 1. We used a varied combination of keywords applied to different databases and search engines. The keywords were searched in the title and abstract of the

articles. We prioritized open-access materials, peer-reviewed (or refereed) journals from the management field of study and white reports from consolidated organizations. In order to find the information we needed, we included different kinds of sources, and re-executed the search steps to verify the publication of newest and important articles in both scientific and business publications. We used interfaces such as Google Scholar and the CAPES (Coordination

for the Improvement of Higher Education Personnel) web aggregator interface, a service provided by Brazilian government, to get access to national and international publications, such as those by Springer, Scielo, Scopus, Web of Science, ProQuest, Science Direct (Elsevier), IEEE, and others (CAPES, 2014). Because of the current pandemic, some restricted materials were open in order to help COVID-19 research, which were very helpful.

TABLE 2 Overview of the challenges faced by SMEs during the pandemic

| Authors and objective | Main results |
|---|---|
| Sandberg, Stanford, and Buttle (2020) To provide a better understanding of which businesses are still operational, where they are located, and what their most pressing needs are | SMEs' biggest challenges are access to capital and to follow customers' new behavior pattern; to adapt, SMBs are turning to web tools |
| Humphries, Neilson, and Ulysea (2020) To show the effects of the COVID-19 pandemic on small businesses and how these effects have evolved since the passage of the CARES Act (assist from the U.S. government) | 59% of survey respondents reported to have laid off a significant number of their employees; 30% believe their business will not recover within 2 years; the smallest businesses had the least awareness of government assistance programs |
| Bartik et al. (2020) To demonstrate how COVID-19 is affecting small businesses (in the United States) | 43% of businesses are temporarily closed; businesses have on average reduced their workforce by 40% up to January; three-quarters of respondents state that they only have enough capital to cover 2 months of expenses or less; retail, arts and entertainment, personal services, food services, and hospitality and tourism businesses all report employment declines exceeding 50% |
| Eggers (2020). <i>Masters of disasters? Challenges and opportunities for SMEs in times of crisis.</i> To outline a way for SMEs to overcome the current COVID-19 crisis; to search what tactics and strategies can be applied and how these are impacted by other market players, in particular financing institutions and governments | Banks offer tighter credit conditions for SMEs, due to their liability of smallness and newness. However, several authors find positive performance effects of innovative postures in SMEs in times of crisis in SMEs. Beyond that, small businesses with higher EO (strategic orientation) have better chances of surviving than those that were started out of necessity |
| Kuckertz et al. (2020) To analyze how innovative startups (in Germany) are being affected: Their reaction to the crisis and opinion on the measures put in place to mitigate its economic effect | Startups (a special type of SME) have increased difficulties as well, because the "economic climate" is currently unfavorable for investments in innovation. Their response is to adapt their processes to the current needs, in a resilient posture |
| <i>Digital Results, Endeavor and Small Enterprises Big Businesses</i> (2020) A survey to collect data about Brazilian SMEs status and actions during the COVID-19 crisis | On average, B2B companies had a negative impact on revenues of -29.3%, while B2C companies had an impact of -46%; 36.53% of the interviewees migrated to online care; in the future post-pandemic moment, 77.9% of SMEs say that their relationship channels will be primarily digital |
| SEBRAE (2020) Another survey to analyze Brazilian SMES behavior during COVID-19 crisis, including digital actions | When asked if their company would work even with restriction of mobility of people, 44% said no because the business only works in person; 12% said yes, but that it does not have the structure to use digital technologies; 32% said yes, they were using digital technologies, and 18% said yes, but for other reasons |
| Van den Born, Bosma, and Van Witteloostuijn (2020) To look into the dynamics of digital maturity, its impact on digital innovation, and its effect on organizational survival and success in times of extreme adversity (COVID-19 and SMEs as a "natural experiment") in Netherlands Their central argument is as follows: Different from previous crisis, like the 2008 financial crisis, the lockdown imposes digital disruption. Therefore, the more digitally mature an organization was before the lockdown, the less radical (digital) changes it needs and the more chances of its surviving | The work is still under development, but their hypotheses add a great contribution: There are two opposing behavior patterns triggered in response to extreme (economic) adversity: failure-induced change (FIC), and threat-rigidity response (TRR) theory, which combined with different digital maturity indexes and different types of leadership will result in failure or success of an SME |
| OECD (2020) To discuss how SMEs are affected by the current COVID-19 pandemic and provide an inventory of government responses to foster SME resilience | Difficulties and creative entrepreneurship initiatives found across many sectors and countries |

Note: Results found by the time the paper was written.

2.1 | Review of papers

First we present the responses of SMEs to the financial impacts they have had (Table 2). Next, we describe the reactions during the pandemic, to understand their attempts to survive. Then, we structure the review of papers in the form of a SWOT analysis. We discuss the general weaknesses, strengths, threats and opportunities of SMEs facing COVID-19 and DT, as summarized in Figure 1, and explain them in detail in that sequence.

2.1.1 | Financial threats

During the pandemic, the scarcity of financial resources of SMEs was exacerbated for different reasons. In summary, there were barriers to access government help, changes in customer behavior, decrease

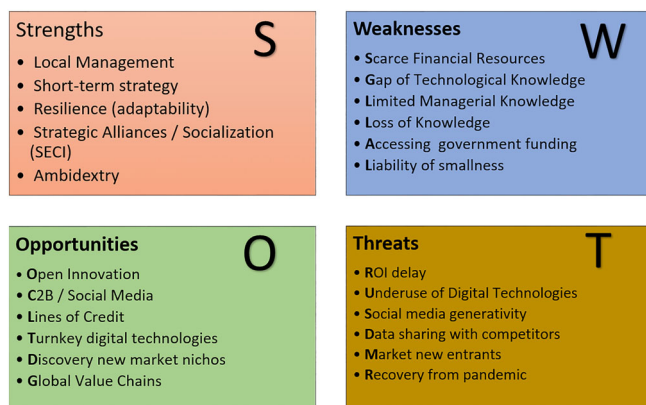


FIGURE 1 General weaknesses, strengths, threats, and opportunities for SMEs to face digital transformation (and COVID-19 pandemic) [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

in cash flow and reduction of supply of resources (Humphries et al., 2020; OECD, 2020; Sandberg et al., 2020). Nevertheless, the impact was stronger in different sectors of the economy. Globally, in accommodation and food service companies for example, 76% of SMEs reported having been severely affected by partial and full lockdown (International Trade Center, 2020). In comparison, the information technology (IT) sector reported an impact of only 30% (International Trade Center, 2020). In Brazil, reports show that SMEs of the creative industry (cultural industries), tourism, health clubs and the food industry had negative financial impacts of more than 69%, while in the pet, agribusiness and automobile repair industry, it was less than 48% (SEBRAE, 2020). However, SMEs are overrepresented in the sectors with the biggest impact (International Trade Center, 2020).

In the United States, Facebook and Small Business Roundtable conducted a survey with approximately 86,000 people who owned, managed or worked for a small and medium-sized business (SMB) in various sectors of economy. According to Sandberg et al. (2020), 31% of owners and managers reported that their SMB was not currently operating, while their biggest challenges were the access to capital and changes in customer behavior. Twenty-eight percent of SMBs said the biggest challenge of the next few months is *cash flow*, and 20% said it would be lack of demand. In another report, a survey applied to 8,000 small business owners showed that 59% of the respondents reported to have laid off a substantial number of their employees, while 30% of respondents believed their business would not recover within the next 2 years (Humphries et al., 2020). Globally, the situation is as presented at Table 3.

In Brazil the situation is not different. Two studies showed how Brazilian SMEs were challenging the current adversities. The first survey was conducted by the Brazilian Support Service for Micro and Small Enterprises (SEBRAE, 2020). They conducted a web survey that interviewed 10,384 small entrepreneurs. Of these, 56.7% are MEIs

TABLE 3 Overview of SMEs situation around the globe

| Date | Country | Impact on SME | Expectations |
|-------------|-------------|---|---|
| 10 February | China | 80% of SMEs have not resumed operations yet | One-third out of business in 1 month, another 1/3 in 2 months |
| 25 February | Finland | One-third anticipated a negative or very negative impact | n.a. |
| Early March | Italy | 72% directly affected | n.a. |
| 19 March | USA | 96% have been affected | 51% indicate will not be able to survive beyond 3 months |
| 20 March | Netherlands | 50% startups lost significant revenue | 50% expect to be out of business within 3 months |
| 24 April | Germany | 58% of SMEs experience a drop in turnover by on average 50% | Half of SMEs have only 2 months' liquidity reserve |
| 13 May | UK | 37% of firms are considering, or have already made, redundancies | 41% of firms have temporarily closed, 35% fear they will not reopen again |
| 9 March | Japan | 39% report supply chain disruptions, 26% decrease in orders and sales | n.a. |

Note: Adapted from "Coronavirus (COVID-19):SME Policy Responses", by OECD (Organisation for Economic Co-operation and Development) (July 15, 2020). Retrieved from https://read.oecd-ilibrary.org/view/?ref=119_119680-di6h3qgi4x&title=Covid-19_SME_Policy_Responses.

(individual and micro entrepreneurs), 38.1% are MEs (micro-enterprises) and 5.2% are EPPs (small companies, in Portuguese, “empresas de pequeno porte”). In Brazil, this classification is mainly based on the annual turnover of each business, where MEs bill up to R\$81,000 per year, MEs up to R\$360,000 and EPPs up to R\$4.8 million (Pereira, 2019). The data are summarized in Table 4.

A second research on SMEs in Brazil also shows important challenges during the crisis. Another survey was conducted by a partnership between three entities: Digital Results, Endeavor, and Small Companies Big Business (2020). In this study, 1,180 companies were

TABLE 4 Summary of survey: Brazilian SMEs responses to financial challenges

| Brazilian SMEs' reaction: Between May and April 2020 | Percentage (from a total of 10,384 interviews) |
|---|---|
| Closed permanently | 7% |
| Closed temporarily for 2 months | 59% |
| Can your company work with restriction of movement of people? | No 44%; 32% yes, with digital tools; 12% yes it would, but have no digital infrastructure |
| What happened to your monthly billing? | 88.7% said they had losses; their monthly sales decreased by 64% |
| What were the most affected sectors? | Gyms and physical activities, tourism, culture and leisure industry |
| What were the least affected sectors? | Pet industry, agribusiness, automobile repair shops |
| Will you need a loan to avoid firing employees? | 59% yes; 21% do not know yet |
| Since the beginning of the crisis, have you tried to seek a loan? | 38% yes |
| What happened to your loan application? | 58% were denied; 28% are still waiting for an answer |
| Closed permanently | 7% |
| Closed temporarily for 2 months | 59% |
| Can your company work with restriction of movement of people? | No 44%; 32% yes, with digital tools; 12% yes it would, but have no digital infrastructure |
| What happened to your monthly billing? | 88.7% said they had losses; their monthly sales decreased by 64% |
| What were the most affected sectors? | Gyms and physical activities, tourism, culture and leisure industry. |
| What were the least affected sectors? | Pet industry, agribusiness, technology industry. |
| Will you need a loan to avoid firing employees? | 59% yes; 21% do not know yet |

Note: Adapted from “The impact of the coronavirus pandemic on Small Businesses—3rd edition”, by SEBRAE—Brazilian Service of Support for Micro and Small Enterprises (May 5, 2020). Retrieved from https://datasebrae.com.br/wp-content/uploads/2020/05/Impacto-do-coronav%C3%ADrus-nas-MPE-3%C2%AAedicao_por-porte-v1.pdf.

interviewed. Among them, 98% are SMEs. Naturally, this shows that the lockdown severely affected sectors that relied on physical stores: the greatest losses were in retail (−47.2%), events (−67.4%) and tourism (−80.8%; Digital Results, Endeavor, & Small Companies Big Business, 2020). Consequently, more than half of companies will need to access funding sources in the next 6 months (Digital Results, Endeavor, & Small Companies Big Business, 2020). Indeed, the Brazilian government has taken some measures. A budget of R\$20 billion was released as aid to SMEs (Do Senado, 2020a), and changes in the regulations of work are being defined, which will structure the rules for remote working, anticipation of vacation and the creation of specific rules for health professionals (Do Senado, 2020b). However, some difficulties in accessing aid were also reported (Martins, 2020; Nascimento, 2020).

Bartik et al. (2020) also report mass layoffs in the United States as a response to this crisis and difficulties related to accessing government aid: the U.S. CARES (Coronavirus Aid, Relief, and Economic Security). Forty-three percent of businesses are temporarily closed, and, on average, they have reduced their employee counts by 40% relative to January; three-quarters of small businesses stated that they have enough cash to cover maybe 2 months (Bartik et al., 2020). As a governmental response, the U.S. CARES act provided 350 billion dollars to fund the Paycheck Protection Program (PPP) to assist small businesses (Humphries et al., 2020). However, there were challenges related to information access, since the smallest businesses had the least awareness of government assistance programs (Humphries et al., 2020). In addition, even after the CARES Act, recession is still highly jeopardizing small businesses. Layoffs continue, and 80% of small businesses stare at the possibility that their business would close permanently or would declare bankruptcy in the next 6 months (Humphries et al., 2020).

Difficulties to access private funds were also reported. In addition to the scarcity of resources, SMEs face a specific challenge: banks see them as presenting a higher risk during crisis and usually offer tighter credit conditions (Eggers, 2020). Those conditions mainly derive from their liability of smallness (Freeman et al., 1983), and some of them are due to their liability of newness (Stinchcombe, 1965). Liability of smallness means that smaller firms have less power to influence external changes, which makes them more vulnerable to internal and external events, such as key employees resigning to join big companies, less financing options, new competitors entering the market and major crises like the current one (Eggers, 2020). Liability of newness affect the youngest companies, because they rarely have well-established business models, processes and legitimacy (Eggers, 2020).

Kuckertz et al. (2020) corroborate the financial difficulties of startups (considered a type of SME) during the COVID-19 crisis in Germany. Government measures included taxation support, state support for short-hour working, loans and special programs (Kuckertz et al., 2020). However, as startups are usually considered as investments for the future, they are suffering because the “economic climate” is currently unfavorable for investments, since investors are also being affected by the pandemic (Kuckertz et al., 2020). However, some entrepreneur opportunities can also be seen as a response to this crisis, as we demonstrate in the following sections.

TABLE 5 Types of SME response to COVID-19 crisis in Brazil: From 10,384 interviews

| Type | Response | Percentage of SMEs |
|---------------------|---|--------------------|
| Digital action | Started to sell online through social media (Instagram, Facebook, WhatsApp, etc.) | 28.5 |
| Digital action | Started to manage company bills through banking app | 11.7 |
| Digital action | Joined different online communities to reach new clients | 8.3 |
| Digital action | Started selling through smartphones/apps (e.g., Ifood, Uber eats, Rappi, etc.) | 7.5 |
| Digital action | Employees started to work remotely (home-office) | 7.4 |
| Digital action | Paid for online advertisement | 6 |
| Digital action | Made sales through a specific website | 5.4 |
| Strategic alliance | Local partnerships for joint sales and deliveries | 3.1 |
| Supply chain resize | Started to sell directly to customer, without middlemen | 2.6 |
| Supply chain resize | Started to buy directly from supplier, without middlemen (sales representatives) | 2.1 |
| None | None of the options | 52.9 |

Note: Adapted from “The impact of the coronavirus pandemic on Small Businesses—3rd edition”, by SEBRAE—Brazilian Service of Support for Micro and Small Enterprises (May 5, 2020). Retrieved from https://databrae.com.br/wp-content/uploads/2020/05/Impacto-do-coronav%C3%ADrus-nas-MPE-3%C2%AAedicao_por-porte-v1.pdf.

2.1.2 | Strengths to react

The difficulties described above triggered a race for fast digitalization and for strategic partnerships to adapt to the new relation between supply and demand. As a response to this crisis, it is possible to see SMEs searching for fast digital adaptation, and for collaboration between each other, in order to adapt to new demands (Digital Results, Endeavor, & Small Companies Big Business, 2020; OECD, 2020; Sandberg et al., 2020; SEBRAE, 2020). *Strategic Alliances* is a collaboration strategy tool to share available resources between willing partners (Vătămănescu, Cegarra-Navarro, Andrei, Dincă, & Alexandru, 2020), which helps SMEs with their scarcity of resources in this pandemic.

The intensification of e-commerce (electronic commerce) was a strong response from small companies. According to Sandberg et al. (2020), in the United States, 51% of small businesses reported increasing online interactions with their clients; 36% of personal businesses that use online tools reported conducting all their sales online; and 35% of businesses that have changed operations have expanded the use of digital payments. Brazilian SMEs also taken small actions

toward digitalization of parts of their business processes. They used combinations of easy entrance technologies for each of their essential activities. Social networks were widely used to promote sales, in combination with bank apps to collect the payments (SEBRAE, 2020). Sales were promoted directly on social networks (e.g., Instagram, Facebook, WhatsApp), payments transactions were made through applications provided by their banks and some SMEs paid for the first time for online advertisements (SEBRAE, 2020). These actions are detailed at Table 5.

Responses in the form of collaboration (strategic alliances) and resizing of supply chains were also found in Brazil. Of the interviewed, 3.1% started to create partnerships for joint deliveries of products; 2.6% of SMEs began selling directly to the customers, without needing any intermediary; and 2.1% started to buy directly from suppliers, excluding sales representatives from the supply chain (SEBRAE, 2020). These changes may affect severely the chain in the future by replacing or reintroducing industry intermediaries (“middleman”), through the intermediation/disintermediation/re-intermediation cycle (Chircu & Kauffman, 1999). Currently, Brazilian reports show that B2B (business-to-business) companies had a negative impact on revenues of -29.3% , while B2C (business-to-costumers) companies had a bigger impact of -46% (Digital Results, Endeavor, & Small Companies Big Business, 2020).

Digital actions were the predominant type of responses, followed by alterations in the supply chain and collaboration between Brazilian SMEs. In summary, if the data reported is grouped, of the percentage that pointed to have been able to react, 74.8% mentioned to have started some digital action as a response; 4.7% redesigned their position in the supply value chain and 3.1% searched for local partnerships to help (SEBRAE, 2020).

In Germany, SMEs also reacted through fast adaption and by identifying opportunities through collaboration and improved flexibility. Startups responded by asking for goodwill from partners, exchanging information on policy measures, sharing expertise in different disciplines, and promoting quick responses to maintain cash flow (Kuckertz et al., 2020). Concomitantly, new opportunities were pursued. They used government subsidies to implement short-term work, acquired more knowledge about crisis responses, reallocated resources and processes to meet new customer demands, and started to sell through new channels (Kuckertz et al., 2020).

In summary, small digital actions have been a key response in various forms. Along with government support, SMEs' entrepreneurial and digital abilities have been applied to adapt more substantial parts of their process, while creativity was pursued. For example, virtual fashion showrooms linked supply and demand in fashion sector; small firms and schools started to move their content online, and several countries launched hackathon competitions to potentialize creativity and entrepreneur solutions to the crisis (OECD, 2020). Digital divide was also a concern, and there were government programs to support students to buy internet infrastructure to participate in online classes, which can increase digital inclusion in emerging economies and boost local economies (IFC, 2020). Nevertheless, the lack of skills is an important concern. In SMEs, teleworking (remote work) is more difficult to adopt because they are often far behind big companies in

terms of digital infrastructure and digital skills, even in top economies (Brussevich, Dabla-Norris, & Khalid, 2020).

2.1.3 | SWOT analysis

As mentioned earlier, we have structured the insights derived from the review of the papers in the form of a SWOT analysis. The general weaknesses, strengths, threats, and opportunities (SWOT) of SMEs for facing COVID-19 and DT are summarized in Figure 1, and counter-pointed and explained in detail below:

- *Scarcity of Financial Resources*: SMEs have limited capital resources (Garengo et al., 2005; International Trade Centre, 2020; Moeuf, Tamayo, Lamouri, Pellerin, & Lelievre, 2016). This crucial issue leaves them far behind their big-size counterparts while facing this pandemic but also leads them to develop other weaknesses, since they cannot afford other valuable resources.
- *Gap of Technological Knowledge*: Many SMEs have very little expertise on how to extract DT technologies' potential. Such firms tend to have low knowledge of available solutions and their potential benefits (European Investment Bank, 2019). Owners and managers are *less aware* of how and where to apply digital solutions to business processes, while employees have *few capabilities* to integrate these digital solutions, lack of skills to address transformational projects on a large scale, and to articulate more robust technical implementation roadmaps (European Investment Bank, 2019). In addition, owing to financial constraints, SMEs have limited access to external consultants (Goerzig & Bauernhansl, 2018), which exacerbates the lack of more specialized IT professionals capable of extracting more value from more complex DT tools (Erbert & Duarte, 2018) such as machine learning and big data. Even with the first and simpler steps of digitalization, SMEs have been lagging behind in DT and, consequently, in developing expertise on the subject. For instance, in OECD countries in 2015, only 20% of SMEs were engaged in sales through e-commerce, as against 40% of large firms (BIANCHINI, 2019).
- *Limited Managerial Knowledge*: Managerial capacity of SMEs is often limited. It is common for SMEs to have only short-term planning; IT management is oriented only at the operational level and not at the tactical and strategic levels (Pelletier & Cloutier, 2019). Moreover, they often lack infrastructure, tools, and techniques, which affects their absorptive capacity for adoption and integration of new knowledge (*absorptive capacity*; Saad, Kumar, and Bradford (2017). Beyond that, the absence of methods and procedure as well as of knowledge management (only tacit knowledge is often managed, nothing is formalized; Garengo et al., 2005; Moeuf et al., 2016) increases their dependence on tacit knowledge of key employees.
- *Loss of Knowledge*: SMEs rely very much on tacit knowledge, and so a loss of key employees (i.e., long-term, experienced, and skilled staff) can make small business extremely vulnerable (Durst & Wilhelm, 2011), especially during this pandemic. Lay-offs due to financial impacts, or even missing key personal to the coronavirus, can pose a serious trouble for SMEs. In the worst case scenario, the loss of a key employee can put the SME's survival at risk (Durst & Wilhelm, 2011).
- *Accessing aid funding*: Difficulties in accessing government financial help was hampered by both bureaucratic and information barriers during the pandemic (Bartik et al., 2020; Humphries et al., 2020; Kuckertz et al., 2020). Smaller companies were less aware of government assistance programs (Humphries et al., 2020) and, often before the pandemic, private financing used to offer more restrictive credit conditions due to the greater risk that SMEs present (Eggers, 2020).
- *Liability of smallness* (Freeman et al., 1983): The smaller the company, the more vulnerable it is to external (and internal) events (Eggers, 2020). Some of them still can be vulnerable through a liability of newness (Stinchcombe, 1965). For example, in 2008, in Brazil, reports showed that two-year-old organizations had a 45.8% mortality rate (SEBRAE, 2016). However, not only size but also the sector of SMEs influences their performance (SEBRAE, 2020; Table 4). There is a cause-effect relationship between the sector and the ability to explore and exploit knowledge to remain competitive (ambidexterity), since market and technology dynamism vary in different sectors, as well as the complexity and lack of knowledge base in certain sectors (Cegarra-Navarro & Dewhurst, 2007).
- *Underuse of Digital Technologies*: Pelletier and Cloutier (2019) state that SMEs today have more access to *turnkey digital tools* that support their business functions such as marketing (e.g., platforms for e-commerce and social media applications); finance and accounting (e.g., mobile secure payment solutions), or human resources (e.g., video conferencing and instant messaging). Such technologies are presented as a solution to reduce the complexity of management processes and as a way to enrich the relationship with customers and suppliers (Pelletier & Cloutier, 2019). Indeed, digital services can even allow SMEs insertion in new digital chains (*global value chains*; Barann, Hermann, Cordes, Chasin, & Becker, 2019; Choi & Sethi, 2010). However, besides the benefits, investing in those solutions may impose some additional challenges (Pelletier & Cloutier, 2019): (a) SMEs unfairly and unrealistically assess their IT needs, and there could be strategic misalignment of their business objectives (one-size-fits-all approach with IT solution is not recommended); (b) SMEs feel more the impact of the gap of IT skills and the growing complexity in the information ecosystem. Actors such as IT specialists, service providers, and socioeconomic support professionals (e.g., management specialists in public organizations) become part of the process, and their different terminologies and different understanding of business requirements increase the problem; (c) Some specific external factors also influence SMEs more. It is common to have a business context in which the main actors (city halls, governments, entrepreneurs) underestimate the potential of IT skills and resources to innovate (Pelletier & Cloutier, 2019), especially in minor cities.

- *Social Media Generativity*: For SMEs, the ability of social media to promote their products, leverage reputations, and collect new unexpected ideas from customers (Nambisan, Wright, & Feldman, 2019) is powerful if combined with open innovation approaches (Demirkan, Spohrer, and Welsler, 2016). However, in the C2B (consumer-to-business) flow, the high generativity (potential for unexpected ideas) of social networks can both leverage a reputation or ruin it in a viral way (electronic word of mouth; Götz, Bartosik-Purgat, & Jankowska, 2018; Nambisan, Wright, & Feldman, 2019).

Despite the weaknesses and threats mentioned above, some general strengths can be linked to SMEs to embrace this accelerated DT. To structure them, we have used some specificities of SMEs (centralized management, low specialization, short-term strategy, informal communication; Julien, 1990; Torrès & Julien, 2005):

- *Centralized Leadership and Local Market/Management*: SMEs' management styles have an increased centralization and fewer intermediaries between owner/managers, employees, customers, and suppliers, which can be described as *hierarchical proximity* (Torres, 2004). Therefore, as the stakeholders are closer (Eggers, 2020), it may be easier and faster to collect, understand, and respond to customer-specific demands. In addition, SMEs often prefer more informal communication media and have a direct contact with their *local market* (known as *proximity information systems*; Torres, 2004). Thus, their simpler organizational structure, together with a more personal style of management, implies in less bureaucracy and better fluidity in communication, which may help them to implement changes quickly (Leone, 1999). As some SMEs have a culture of fast adaptation (instead of anticipation; Leone, 1999), if this feature is combined with the potential for personalizing the user experience that digital technologies provide, they could produce very rich and customized new products/services to their local market.
- *Resilience and Flexibility*: SMEs may have greater flexibility, resilience, and adaptability (Eggers, 2020; Kuckertz et al., 2020; Smallbone, Deakins, Battisti, & Kitching, 2012). According to Kuckertz et al. (2020), small and medium firms may have a good chance to excel in response to the COVID-19 pandemic since they have already showed great resilience and a high level of adaptability and flexibility in response to major economic downturns (Smallbone et al., 2012). However, not every SME has the same profile. Some of them are most likely to have innovation in their DNA because they were born from market opportunities, while others were born from necessity (necessity-driven entrepreneurship): for example, individuals who were unemployed before starting the business (Fairlie & Fossen, 2018). For that reason, SMEs with higher strategic orientation have better chances of surviving than those that were started out of necessity (Eggers, 2020). Even so, SMEs tend to have more flexible and generalist professionals, instead of a rigid and highly specialized staff (Torres, 2004). Where resources are scarce, a flexible and change-oriented team within the company can be crucial (Borch & Madsen, 2007).

Therefore, SMEs with flexible employees can find inspiration and support for new business concepts and find the link between their dynamic capabilities and innovative strategies (Borch & Madsen, 2007). In addition, SMEs have experience with short-term strategy (Moeuf et al., 2016; Torres, 2004), which can help them to respond quickly to new opportunities and short-term government *lines of credit*, for example (Kuckertz et al., 2020).

- *Dynamic Capabilities*: Teece, Pisano, and Shuen (1997) define dynamic capability (DC) as the firm's ability to build or reconfigure internal and external competences to address rapidly changing environments. DC is a strength to seek in every type of company. Nevertheless, small firms may have a better chance to develop this strength because of their flexibility and low level of labor specialization (Torres, 2004). More generalist professionals may be more easily relocated to new tasks and deliver new products/services. However, in a long-term perspective, low levels of digitalization can be a problem. DCs are boosted by the adoption of an integrated information systems (IIS) (e.g., CRM × ERP) by improving the IT infrastructure and by aligning the business strategy and IT knowledge to increase the responsiveness of the market, learning capacity, and resource coordination and reallocation (Wang & Shi, 2009). In addition, since internationalization sometimes may not be a matter only of size but of entrepreneur behavior (Calof, 1994), SMEs can aim to achieve global value chains through a dynamic DT process. The potential of SMEs for internationalization can grow with use of their information systems, social capital, and dynamic capabilities to seize international opportunities (Carlos, 2011).
- *Ambidexterity*: An ambidextrous organization is one that manages to implement both incremental and revolutionary changes in order to remain successful over both long periods and major changes in the market (Tushman & O'Reilly III, 1996). Thus, ambidextrous organizations are able to balance organizational learning through exploration of new knowledge (e.g., experimentation, flexibility) and the exploitation of their current intellectual capital (e.g., refinement, efficiency; March, 1991). According to O'Reilly and Tushman (2008), the essence for an organization to become ambidextrous is to develop its dynamic capabilities. Dynamic capabilities emphasize that organizations must sense opportunities and threats (exploration), seize those opportunities, and reconfigure their resources (align exploration and exploitation; O'Reilly & Tushman, 2008). Therefore, ambidexterity comes when leadership aligns competencies, structures, and cultures to engage in exploration of new knowledge and to nurture a contrasting focus on exploitation of current knowledge assets (O'Reilly & Tushman, 2008). However, ambidexterity is not a trivial strength to pursue. For a business to be ambidextrous, it needs to compete simultaneously in both mature and emerging markets, exploit and explore it, which demands simultaneously different pairs of diverging abilities: discipline and flexibility, people control and autonomy, formality versus informality, secure versus risk-taking strategies (O'Reilly and Tushman, 2008). Thus, an appropriate balance between exploration and exploitation is an important factor for survival and

prosperity (March, 1991) but extremely difficult to implement (Tushman & O'Reilly III, 1996), particularly for SMEs (Voss & Voss, 2013). However, it is possible that SMEs perform well in this regard, which may not be a matter of size but sometimes related to the sector and context in which they operate (Cegarra-Navarro & Dewhurst, 2007). According to the above authors, ambidexterity is a variable that changes according to both market dynamism and its lack of a knowledge base. In summary, managers need to foster an ambidextrous context, because the alignment of knowledge exploitation and exploration may help them to increase customer capital (Cegarra-Navarro & Dewhurst, 2007).

- **Strategic Alliances:** During this pandemic, SMEs may find other partners and competitors in the same difficult conditions and are therefore more willing to start a partnership. Strategic alliances can help them to deal with their scarcity of resources and increase their innovative performance, expanding the limits of knowledge-sharing between SMEs and their specialized professionals, and share with others their available resources (Vătămănescu, Cegarra-Navarro, Andrei, Dincă, & Alexandru, 2020). In addition, strategic knowledge can be created from strategic alliances: after the interaction in a strategic alliance, competitors with complementary capacities and resources can learn with each other and augment their own organizational knowledge (Cegarra-Navarro, 2005). This is a powerful insight because the ability of companies to harvest knowledge is a fundamental capacity to achieve competitive advantage (Cegarra-Navarro, 2005). According to Chesbrough (2017), one of the benefits of open innovation is that organizations can incorporate external sources of knowledge across organizational boundaries, instead of relying only on internal production of knowledge, such as closed R&D departments. Through collaboration with other firms, open innovation can help SMEs to access external resources and competences to effectively develop and commercialize their innovations, master new technologies, and enter new markets (Colombo, Piva, & Rossi-Lamastra, 2014). Indeed, innovation in SMEs usually has an interorganizational component (Brunswick & Vanhaverbeke, 2015), which can make it easier for SMEs to adapt and collaborate with each other. However, data exchange between suppliers and salespeople is not a consensus, due, for example, to competition between different traders or customers (Choi & Sethi, 2010).
- **Socialization (SECI Model):** One of SMEs' strengths is that they tend to have the dominance of the socialization activity of the SECI cycle (Desouza & Awazu, 2006). SMEs may present a high level of both informal and formal socialization methods of knowledge-sharing, such as weekly meetings or informal conversations on a daily basis (Desouza & Awazu, 2006). In SMEs, it is common to exist a closer contact between employees and owners, which can help share and preserve their knowledge (Desouza & Awazu, 2006) and engage workers for new business concepts (Torres, 2004). The lack of explicit knowledge repositories (e.g., ontologies, intranet) and the consequent loss of knowledge sometimes is minimized by informal socialization methods between owners/managers and employees (Desouza & Awazu, 2006).

- **Communities of Practice (CoPs):** These are a strong point to nurture in SMEs, which can be a natural fit due to their potential for inter- and intra-organizational socialization. CoPs are informal groups of people that have the same passion on a topic and are bound together to share their knowledge in their field of expertise (Wenger & Snyder, 2000). The organic interorganizational discussions and practices in such groups can bring value to organizations since their members can think on new lines of business, solve new problems quickly, transfer best practices, and develop professional skills, while recruiting and retaining talent (Wenger & Snyder, 2000). For instance, CoPs can implement methods such as problem-based learning and help SMEs by serving as a low-cost source of personal and professional development (O'Brien & Hamburg, 2013); At the same time, they foster both innovation and collaboration networks. Owing to their greater proximity to local stakeholders and strong socialization practices, SMEs can seize CoPs as a competitive advantage.

In the following section we propose a KM strategy based on the SWOT elements presented above.

2.2 | Discussion

To discuss the results, first we present this article's practical implications and then its future directions and limitations.

2.2.1 | Practical implications: A knowledge management strategy

As practical implications, our research does both raising the awareness of the role of DT as a set of tools to react during and after this pandemic and presenting insights for a knowledge-based strategy for SMEs to cope with current situation and future uncertainties. To enrich our practical implications, we detail below a conceptual draft, which demonstrates how SMEs could start their own knowledge approaches from now on.

This study showed the ways SMEs have been responding to this crisis, which enables a benchmark approach for small firms to generate their own insights and to develop reaction plans. Therefore, we searched for additional constructs of knowledge to enrich possible strategies for SMEs, as we address below. It is firmly based on KM and on the concept of organizational resilience (Hollnagel, 2010), as we explain below.

First, it is necessary to discuss the society's possible new reality and customer's new demands. The COVID-19 pandemic and the various lockdowns in world economies have added up to accelerate an already existing change caused by the pervasiveness of digital technologies. DT is a broader process that has been changing paradigms in our society since the popularization of computer science technologies, back in the 1980s (Legner et al., 2017). Their application in different

sectors of society has led to considerable changes in the way we live, work, communicate, and produce value.

DT is also referred to as “Society 5.0” in Japan (Pereira, Lima, & Charrua-Santos, 2020), as “Industrie 4.0” in Germany (Hermann, Pentek, & Otto, 2016), or as the fourth industrial revolution (Hirschi, 2018; Morrar, Arman, & Mousa, 2017). The most recent wave inside DT technologies is a convergence of digital and physical technologies, such as information services, big data, augmented reality, and 3D printers, which transforms products and services along the chain of value, resulting in a heterogeneous convergence between emerging technologies (Erbert & Duarte, 2018; Maynard, 2015). The use of digital technologies can bring improvements in business processes (automation, time and cost reduction), business model innovation (market share, profitability ratio), and customer experience (satisfaction and trust level), which are considered as key drivers of DT (Levkovsky, Betzwieser, Löffler, & Wittges, 2020).

Consequently, companies can create new value streams, where knowledge plays a central role. There are new ways of interaction between society's organizations and customers, powered by the Internet and social media. C2B relationship has been boosted by social media, and this has created a large amount of online data to be transformed into knowledge about people's needs and expectations (Götz et al., 2018). Together with globalization, the Internet allows customers to swiftly report their feedback experiences publicly online, highlighting a brand reputation and empowering customer opinion (Götz et al., 2018; Weiss, 2019) and generating more data and possible insights to be analyzed. Elsewhere, products are the result of operations carried out in different continents, while customer expectations and products are linked in real time with little geographic barriers. This increases the expansion capacity of multinational companies and demands knowledge to create new logistics and explore new niche markets (Gorender, 1997). In addition, reports show that new generations will probably prefer online experiences than physical stores (Ram, 2017). New generations are increasingly using their devices to meet many of their needs, whether it is an information need, or others like socialization, consumption or leisure, for example (Berman & Bell, 2011). In other words, even without the current pandemic, and even considering that different sectors are affected differently, organizations still should transform their processes, organizational culture, and business models. A full DT would keep up with the implications of new digital technologies and the new demands of customers (Arkan, 2016; Berman & Bell, 2011; Erbert & Duarte, 2018; Mahraz et al., 2019; Taruté, Duobienė, Klovienė, Vitkauskaitė, & Varaniūtė, 2018). Hence, to develop a DT plan, we adopted the concept of organizational resilience of Hollnagel (2010), as we explain below.

A resilient behavior plan for anticipation

The term “resilience” is multidisciplinary and has some variations in its definitions (Fraga, 2019). According to Pinheiro (2004), the original Latin term “resiliens” means to jump back, to return, to spring back, to retreat, or to shrink. In the English language, it refers to the idea of elasticity and rapid recovery capacity (Pinheiro, 2004).

According to McAslan (2010), the modulus of resilience forms part of the design concepts of civil and mechanical engineers and naval architects, defined as “the ability of a material to absorb and release energy, within the elastic range” (Gere & Goodman, 2009, p. 146). With a similar meaning, in the field of psychology, a resilient individual is “one who has the ability to recognize pain, perceive its meaning, and tolerate it until resolving conflicts constructively” (Pinheiro, 2004).

According to Fraga (2019), the historical evolution of the term can be highlighted in four moments: in 1807, with Young, who introduced the concept of elasticity in physics, referring to the resistance capacity of materials; in 1966, with Flatch, who applied the term to describe the psychological forces needed by individuals to overcome adversity and changes in life; in the 1970s, when Holling applied the concept in the field of ecology, referring to the ability of a system to face the risks in its environment; and in 1998, when Mallak explains organizational resilience, which is a positive reinforcement mindset with reward for desired behaviors (Fraga, 2019). Tavares (2001) states that a resilient organization creates a resilient environment, where people have empathy intelligence to adapt to changes (Pinheiro, 2004).

Since the elaboration of those initial concepts, organizational resilience has embraced new ideas. In this article, we use Hollnagel's concept of organizational resilience, or as the author calls it, “resilience engineering” (RE), as follows: “Resilience is the intrinsic ability of a system or an organization to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.”

Thus, resilience in social systems is more than an adaptive capacity, because it embraces the human ability of forward-looking or anticipatory behavior (Holling & Walker, 2003). Indeed, “adaptation” in RE is defined as a successful condition: “the ability of organizations, groups and individuals to recognize and adapt to unexpected change and surprising developments” (Madni & Jackson, 2009). Even more, in RE, there are two types of resilience: reaction and adaptation. Reaction implies “immediate or short-term action, while adaptation implies long-term learning” (Madni & Jackson, 2009), which consequently changes the way organizations adapt to external demands, which in turn requires anticipation through monitoring external changes (Hollnagel, 2010).

Therefore, organizational resilience can guide in developing a knowledge strategy. It can describe behavioral patterns that any organization must incorporate in order to be better prepared and respond to the uncertainties of a near digital future. According to Hollnagel (2010), RE is a proactive approach to enable organizations to adapt to changes by monitoring, anticipating, learning, and responding to them (Hollnagel, 2010). Its goal is to enhance the ability of organizations to create processes that are robust yet flexible to monitor and revise risk models and to use resources proactively in the face of disruptions (Dekker, Hollnagel, Woods, & Cook, 2008). It is the capacity of complex socio-technical systems to sustain the production of essential services in the face of social, technological, and environmental change or disruption (Van Der Merwe, Biggs, & Preiser, 2018).

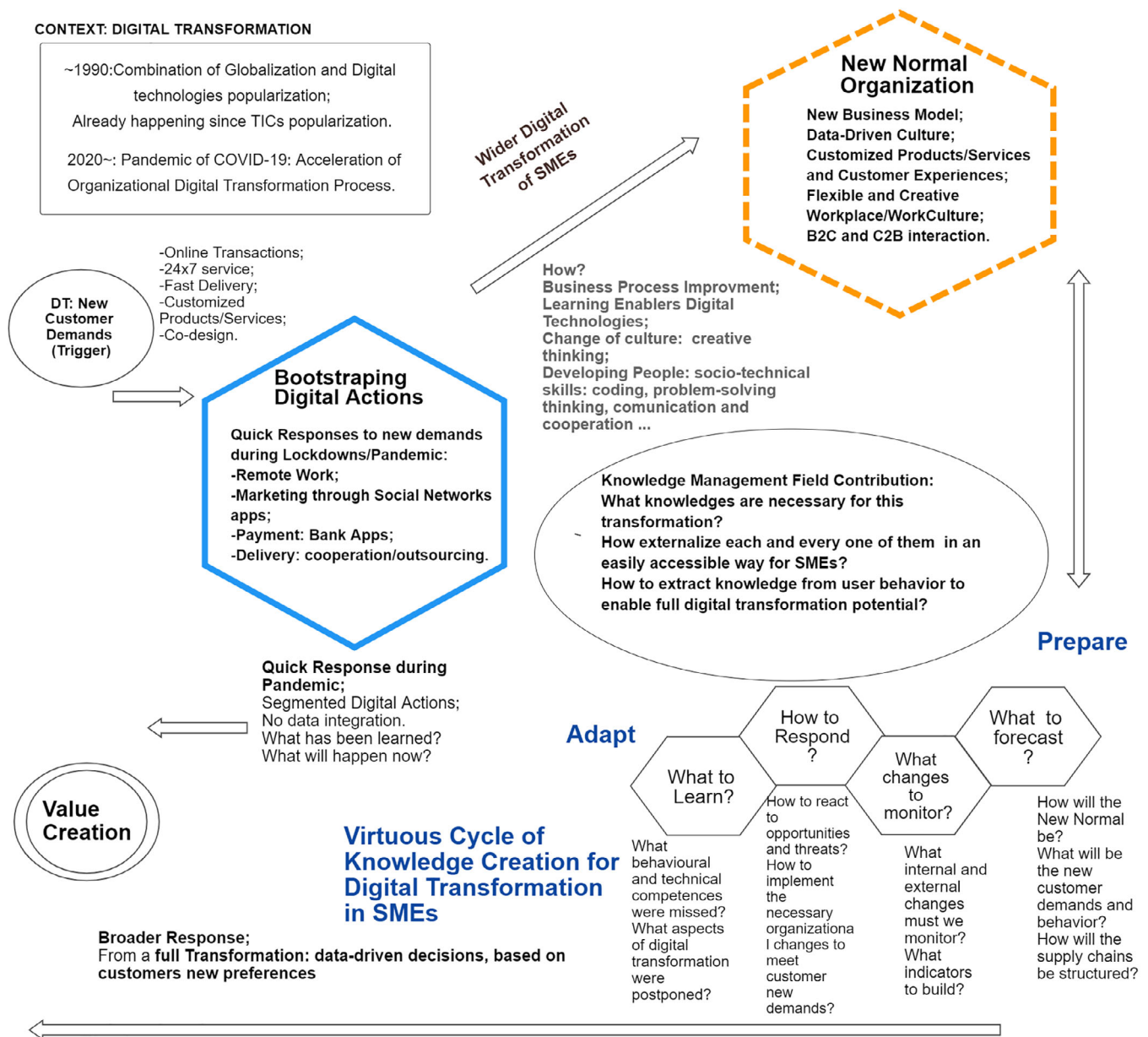


FIGURE 2 A conceptual model drawn to try to guide the start of a knowledge management approach to assist SMEs to respond to the current crisis. It is based on resilience engineering concepts and digital transformation instruments [Colour figure can be viewed at wileyonlinelibrary.com]

Nevertheless, organizational resilience is not merely about being able to just restore its normal operations, but it is both a function of adapting to chronic situations (*adaptive resilience*) and of planning for future crisis (*planned resilience*; Barasa, Mbau, & Gilson, 2018).

Considering the organizational resilience constructs (Barasa et al., 2018; Fraga, 2019; Hollnagel, 2010), we have drafted a conceptual schema to assist in how SMEs may develop their knowledge strategies in the current and future context (Figure 2). We understand that organizational resilience is a multidisciplinary concept that addresses the processes of adaptation and response of individuals,

groups, and organizations to changes in its surroundings (Fraga, 2019). Therefore, when combining KM with organizational resilience, some questions can be raised (Fraga, 2019): how to identify the knowledge resources needed to contribute to the potential for organizational resilience, and how to assess the criticality of this knowledge and, thus, prioritize KM actions to increase resilience capacities (Fraga, 2019). Beyond those, we add: what *knowledge constructs* are necessary to be monitored and learned (*internalize, socialize*) to later generate more accurate responses and future projections (*externalize, combine*).

According to Hollnagel (2010), in order to be resilient, an organization must have four basic abilities: to respond (addressing the actual), to monitor (addressing the critical), to anticipate (addressing the potential), and to learn (addressing the factual). Those abilities must be explored by a KM project that aims to assist in DT. Therefore, we address those four abilities of organizational resilience by structuring them within the unified model of knowledge management (Nonaka & Takeuchi, 1991, 1995; Nonaka, Toyama, & Konno, 2000).

For Nonaka et al. (2000), in a world where technologies, markets, and societies change rapidly, continuous innovation as well as the knowledge that enables such innovation constitutes a vital competitive advantage. They view organizations as entities that interact with and reshape its environment and itself through the process of knowledge creation, for example, by launching a new product or service (Nonaka et al., 2000).

Since DT has been changing intensively society as we know, the lack of knowledge to understand both its new mechanisms for value creation and new society's demands is not a trivial challenge for SMEs to face. Therefore, a key question must be raised: how SMEs can develop their own knowledge strategies, to face DT, and to follow its new demands. For Nonaka et al. (2000), knowledge is the source for continuous innovation and it can be created, maintained, and exploited under a dialectical flow. It has three key elements: (a) the SECI (socialization, externalization combination, internalization) process of knowledge conversion (Nonaka & Takeuchi, 1991; Nonaka & Takeuchi, 1995); (b) “ba,” which is a shared context for new knowledge creation (different from CoPs); and (c) knowledge assets: inputs and outputs of knowledge creation (e.g., explicit knowledge in products or database, tacit knowledge expressed through skills and organizational culture).

According to Nonaka et al. (2000), in the SECI process, knowledge (e.g., mental models about customers' needs, new concepts for products) is created by individuals through a dialectical way of working (Figure 3) within four modes of knowledge conversion, with interactions between explicit (which can be shared in the form of data) and tacit (highly personal and cognitive) knowledge, as we illustrate below:

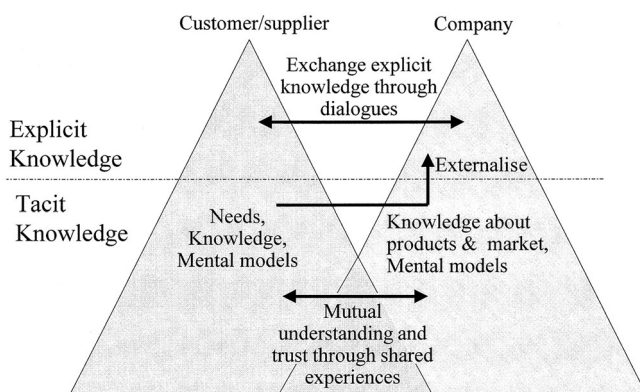


FIGURE 3 The dialectical way to create knowledge with outside constituents. Reprinted from Nonaka et al. (2000)

- **Socialization** (from tacit to tacit):
 - *Tacit knowledge accumulation*: Managers gather information from newest market trends and build an empathic dialogue with customers, suppliers, and competitors, to start a mutual trust relationship (strategic knowledge). Simpler digital tools such as social media software or a more complete CRM (customer relationship management) information system can help in this phase.
 - *Extra-firm moment*: Managers strive to think of new ideas for corporate strategies through face-to-face interaction with experts and stakeholders outside the firm (strategic alliances).
 - *Intra-firm moment*: Managers design new concepts for market opportunities by wandering inside the firm.
 - *Transfer of tacit knowledge*: Managers create a work environment to engage peers to understand and engage into new concepts through practice and demonstrations. Flexible work environments help this phase. Digital tools help boost remote work, for instance. Leadership that understands organizational spiritual knowledge (vision, values and culture) is important (Bratianu & Bejinaru, 2019) and is capable of implementing a more transformational organizational mindset change.
- **Externalization** (from tacit to explicit):
 - Managers facilitate creative thinking and essential dialogue to articulate their tacit knowledge and develop new products (a form of explicit knowledge) through teamwork.
- **Combination** (from explicit to explicit) is the process of converting explicit knowledge into more complex sets of explicit knowledge:
 - *Acquisition and integration*: Managers collect data from inside and outside the organization and combine them to acquire new explicit knowledge. For instance, internal sales report of their newest products can be connected with external data from market trends, analyzed by managers, and used to create new forecasts. More complex digital tools can be used at this phase, such as machine learning and big data.
 - *Synthesis and dissemination*: managers create manuals, documents (e.g., hypertext), and databases (information systems) to store their explicit knowledge, and disseminate it through presentations. Simple digital tools for presentation and more sophisticated information systems to store product/services data are key tools.
- **Internalization** (explicit to tacit) is the process of embodying explicit knowledge.
 - Through “learning by doing,” managers teach their new product/service concepts or technical expertise with their fellows, increasing organizational knowledge assets. For instance, training programs can enable employees to learn with their managers by observation. This phase emphasizes personal experiences, simulation, and experimentation as ways for individuals to absorb organizational knowledge.

Considering the role of digital technologies and SMEs' lack of knowledge to extract more value from them, we raise some initial questions to guide the start of a strategy based on KM and organizational resilience. We start from item 1 of the SECI model to synchronize it with the “Learn” step of organizational resilience

(Hollnagel, 2010). In situations of high instability and poor predictability, the ability to learn must be considered prior to the other three (anticipating, responding, monitoring; Fraga, 2019, p. 90). We recommend this because *learn first* indicates a mindset that looks ahead and recognizes the need for knowledge to face DT:

- What external knowledge must our organization's employees *internalize*, so they can *socialize* it, *externalize* it, and then *combine* it to increase our competitive advantage (knowledge assets)?
 - *What to learn*: What knowledge, expertise, competences, or skills are necessary to enter digital world? What technologies are essential and how to extract value from their potential? What cultural changes are needed inside organization? What are our customers' needs?
 - *What to monitor*: What is the most recent pattern of customer purchases, or the next trend? What market indicators must we monitor? What are the most valuable insights provided by customers in their feedbacks (e.g., in social networks)?
- What *knowledge combinations* should we create (and then *apply to innovate*)?
 - *What to respond*: What opportunities are we missing, and what resources are necessary to respond to them? How to implement such changes? How fast can we respond and how long can it be sustained?
 - *What to anticipate*: What will be future customer needs? How to estimate their future needs, based on the current and previously ones? What most recent technology applications can affect (disrupt) our business? What is the cost-benefit of anticipating with those technologies?

Still, it is necessary to emphasize the specific challenges for SMEs. Knowledge constructs for DT need to be as simple as possible because of SMEs lack of internal expertise or financial constraints to access external specialized professionals (Erbert & Duarte, 2018; Goerzig & Bauernhansl, 2018). Additionally, the delay on ROI (return over investment) that digital technologies may have can be a problem for SMEs (Erbert & Duarte, 2018), such as the roadmap to create value from such heterogeneous technologic convergence (Erbert & Duarte, 2018). The lack of customized tools for SMEs and a misalignment between the digital tools' functionalities—provided by large technology companies—and SMEs businesses requirement are reported as additional difficulties (Erbert & Duarte, 2018; Pelletier & Cloutier, 2019). Therefore, knowledge models must clearly address specific vocabularies of SMEs' domain expertise (domain knowledge) and articulate them with the knowledge necessary to use the potential of digital technologies in a simple but effective way. Extracting a bigger value from digital technologies is not a trivial process. The main DT technologies are heterogeneous and are always evolving, which continuously requires new knowledge and skills. A high level of business domain knowledge and leadership capabilities are also required. This creates a never-ending resilient cycle of learning, responding, monitoring, and forecasting new knowledge constructs necessary to keep delivering value in a digital economy.

2.3 | Limitations

This research is limited by the number of publications on the responses of SMEs to the COVID-19 crisis, which is hampered by the fact that the pandemic still affects the routine of many researchers and universities. We could also access only open publications. The conceptual model we presented in this paper is still under development, so it has its own limitations. We based our development strongly on the widely accepted paradigm of knowledge creation by Nonaka and Takeuchi (1991). Therefore, we are inheriting both its cornerstone mechanisms and (debatable) limitations, since it could be a model more suitable for Japanese companies according Bratianu and Bejinaru (2019), which implies that the activity of sharing knowledge is maybe less used according to the culture. Therefore, future works must consider the dynamics between rational, emotional, and spiritual knowledge and the resonance phenomenon (Bratianu & Bejinaru, 2019), which may help shed light on how to engage workers for more transformational cultural changes. In near future, we will evolve this model to propose a very practical framework to guide Brazilian SMEs in the textile sector on their journey of DT.

3 | FINAL CONSIDERATIONS

In this paper, we presented how SMEs are responding to the COVID-19 crisis and analyzed their reactions through their general weakness and strengths. We also highlighted their financial challenges and opportunities born from the acceleration of DT. We note that their disintegrated digital actions were thrown to keep surviving, but there is a bigger potential in digital technologies to be unlocked. Therefore, we argue that KM is needed so that digital technologies' potential can be both explored and exploited, while organizational resilience can be combined to create a virtuous cycle of learning, anticipation, and adaptation, based on knowledge creation and application, to innovate continuously. We highlight that competitive advantage (knowledge creation) starts at the individual level and expands as it moves through communities of interaction that transcend sectional, departmental, divisional, and even organizational boundaries (Nonaka et al., 2000).

Before the lockdowns, DT had already been imposing some specific challenges to small organizations. DT and DC need expansive and sophisticated IT improvements to help increase market responsiveness, learning capability, and resources reorganizations and coordination (Wang & Shi, 2009). Even so, SMEs higher proximity with stakeholders and more fluid communication are strengths that can help them to catch opportunities coming from their customers' new needs and preferences (Torres, 2004).

Therefore, we drafted a conceptual model by raising an initial set of necessary knowledge demands for the DT era. It should assist them to initially respond and adapt to new society's demands, using organizational resilience knowledge constructs, a data-driven culture, and customer-centric vision. The current pandemic has accelerated the race for DT, also known as "Industrie 4.0" or "Society 5.0," which changes the structures of how organizations can create value by

digitally obtaining insights from their customers' behavior and by restructuring supply chains. DT was already an ongoing paradigm shift in our society before the pandemic, where organizations started to migrate from analog-based processes of production to a digital-based process of value creation, based on a data culture and C2B data stream. In this scenario, a change in organizational culture is necessary to constantly incorporate enabling digital technologies and their prerequisite knowledge. DT is a conditional process, which highly depends on organizational learning. DT happens only if the required knowledge is continuously incorporated and applied for innovation. Therefore, DT's instrumentals are the ability to manage knowledge to unlock digital technologies' full potential; the leadership and business expertise to generate new business models and culture; and acquiring knowledge about customers' new demands, to be continually internalized, socialized, externalized, and combined to create new knowledge. Within a data-driven culture, this will assist the virtuous cycle of organizational learning, monitoring, anticipating, and responding to new demands, based on the incorporated knowledge. In other words, DT requires company leaders to enhance organizational learning and resilient behavior to change organizational culture, process, and technologies, under both a data-driven culture and a customer-centric vision DT, which confirms that "in an economy where uncertainty is the only certainty, the only sure source of lasting competitive advantage is knowledge" (Nonaka & Takeuchi, 1991).

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How to cite this article: Klein VB, Todesco JL. COVID-19 crisis and SMEs responses: The role of digital transformation. *Knowl Process Manag.* 2021;28:117–133. <https://doi.org/10.1002/kpm.1660>