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IT'S HERE TO STAY: LESSONS, REFLECTIONS, AND VISIONS ON DIGITAL TRANSFORMATION AMID PUBLIC CRISIS

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"The value of digital channels, products, and operations is immediately obvious to companies everywhere right now ... this is a wake-up call for organizations that have placed too much focus on daily operational needs at the expense of investing in digital business and long-term resilience." (Gartner, 2020)

1. INTRODUCTION

The onset of the global COVID-19 pandemic has spurred rapid digital transformation, defined as the process of adopting new digital technologies to drive lasting structural, operational, strategic, and other changes in various domains (e.g., Aquila-Natale et al., 2022; Gharbi et al., 2022; Khan et al., 2022)¹. To survive the pandemic-engendered tough times, many companies across various industries, regions, and countries have experimented with new digital technologies to maintain and increase customer experience, operational effectiveness, employee productivity, and supply chain resilience (McKinsey & Company, 2020; Santos et al., 2023). Meanwhile, to effectively contain the pandemic, governments have collaborated with high-tech companies and public health agencies to develop and promote digital solutions to track its spread (He et al., 2022; Xu et al., 2023). As a result, digital transformation has extensively contributed to transforming many aspects of the socio-economic environment through the adoption, application, and utilization of digital technologies aiming to enhance the performance of individuals, organizations, and governments to accommodate the challenges of this unprecedented crisis situation (Kohn et al., 2023; Xie et al., 2022). Since many digital technologies developed and used in the pandemic persist in societies today, they have long-lasting impacts on the future of businesses (Van den Heuvel et al., 2023).

¹ Digital transformation is a broader concept that goes beyond 'digitization', that is, converting analog into digital objects, and 'digitalization', that is, changing simple organizational processes and tasks (Blanka et al., 2022; Verhoef et al., 2021). Digital transformation refers to the application of digital technologies across different levels of business functions, which may lead to substantial and long-term changes in how an organization deals with its key stakeholders (Kraus et al., 2022; Nadkarni and Prügl, 2021).

While digital transformation has been widely studied in the past literature from diverse perspectives (Verhoef et al., 2021), the COVID-19 pandemic-induced global crisis has created a new unique environment that has accelerated the pace and altered the nature of this transformation. For example, during the pandemic, repeated lockdowns in various parts of the world forced governments, organizations, and individuals to carry out their daily activities primarily relying on existing or emerging digital solutions (e.g., Gharbi et al., 2022; Khan et al., 2022; Whillans et al., 2021). After the pandemic, these stakeholder groups continue to explore ways to capitalize on and further advance digital solutions developed during the crisis for various purposes, such as improving online shopping experiences, encouraging teleworking, managing supply chain activities, and providing public services (Guesalaga et al., 2023; He et al., 2022). These dramatic changes inevitably call for a serious reassessment of digital transformation approaches and outcomes which is the focus of our study.

Multiple researchers (e.g., Modgil et al., 2022; Tønnessen et al., 2021; Xie et al., 2022) have swiftly responded to study these emerging trends, aiming to enhance the understanding of digital transformation's role in organizational interactions with consumers, employees, supply chain partners, governments, and other stakeholders during crisis times. Their studies highlight various opportunities and challenges open to organizations around the globe. However, knowledge accumulated on digital transformation amid public crisis is too fragmented to provide a panoramic picture of the subject. This has resulted in discrepancies among researchers on specific roles of digital transformation in the current and future global crises and disjointed academic discourses and implications for practice. Therefore, the present study seeks to contribute to addressing this research gap.

Several previous efforts were made to review the literature on the digital transformation

phenomenon. For example, Nadkarni and Prügl (2021) synthesized 58 peer-reviewed studies on digital transformation published from 2001 to early 2019, while Kraus et al.'s (2022) review of 217 studies assessed digital transformation in business and management during the period 2010-2020². Notwithstanding their usefulness, these reviews did not: (1) cover articles on digital transformation amid public crisis (such as the recent COVID-19 pandemic), focusing instead on specific dimensions/areas of digital transformation; (2) take into consideration the most recent developments on the subject, despite the occurrence of dramatic digital changes during and after the pandemic; (3) evaluate the theoretical and methodological aspects of pertinent studies; and (4) examine practical implications and future research directions in this line of research, despite its significant implications for firm survival and sustainable development in a post-crisis world.

Against this backdrop, this study aims to systematically review, evaluate, and integrate the extant literature on digital transformation during and after the COVID-19 pandemic crisis across different geographical regions. This would help develop a more comprehensive and holistic understanding of the subject. Specifically, we have four key objectives to accomplish: (1) to develop a conceptual framework to organize digital transformation practices amid this public crisis; (2) to assess extant research along theoretical, methodological, and thematic grounds; (3) to offer useful lessons and practical implications derived from extant knowledge on the subject; and (5) to provide directions for future research on digital transformation amid ongoing and future public crises based on input derived from the literature and augmented with views by academics in the field.

We contribute to the literature in three major ways. *First*, we review and consolidate

² Gharbi et al. (2022) have also recently carried out a review of 17 empirical studies examining various digital transformation and digitalization-related issues during the COVID-19 pandemic. Although this review study delineates important dimensions of digital transformation and digitalization alongside a range of digital solutions and technologies tailored to address business challenges during the crisis, its findings are limited by the small number of studies reviewed and the fact that it covered digital transformation practices occurring during the first year of the pandemic.

previously fragmented and ambiguous findings about digital transformation amid the public crisis caused by the COVID-19 pandemic. Specifically, we provide a theoretical framework for organizing digital transformation practices amid the public crisis into five domains: organization-consumer, intra-organizational, organization-employee, inter-organizational, and organization-government. This framework identifies key digital transformation domains and their applications that have experienced significant acceleration in response to unprecedented challenges during and after a public crisis involving various stakeholder groups across geographical regions.

Second, the establishment of an antecedent–digital transformation–performance outcome chain, which, apart from aiding in systematically synthesizing extant knowledge on the subject, promotes important and actionable implications for both corporate and public policymakers. Specifically, our organizing framework demonstrates that digital transformation in response to public crises like COVID-19 has enhanced consumer experiences, increased intra-organizational efficiencies, improved employee productivity, strengthened collaboration among supply chain partners, and enabled resilient public service delivery. Moreover, our study offers important new insights for researchers across various disciplines (e.g., marketing, management, and public policy), facilitating a better understanding of the vital role of digital transformation in crisis times.

Third, we identify criticisms concerning the theoretical underpinnings and methodological challenges relating to digital transformation research during and after crisis times. This critical assessment reveals notable shortcomings in extant research, which have limited the synthesis of the findings across empirical studies and the accumulation of knowledge in the realm of digital transformation. In light of these criticisms, we moved a step further and sought the views of academics in the field outlining key approaches that should be considered in future investigations of digital transformation amid public crisis, which can further enhance our knowledge in this

important research domain.

The remainder of this article is structured as follows. First, we identify and describe key digital transformation domains that are mostly accelerated during and after the pandemic. Next, we specify the methodology adopted to review the pertinent literature on digital transformation amid the COVID-19 pandemic crisis. We then provide details of our theoretical, methodological, and research scope assessments of the studies reviewed, followed by the development of an organizing framework of the key issues addressed in each of the identified digital transformation domains. This is followed by practical implications for various stakeholders derived from the systematic review conducted. Subsequently, we propose directions for future research extracted from the studies reviewed and augmented with input from academic experts in the field. In the final section, we draw conclusions from our analyses.

2. DIGITAL TRANSFORMATION DURING AND AFTER THE PANDEMIC CRISIS

Coping with the unprecedented nature of the global pandemic, organizations have hastened digital transformation to effectively address the evolving needs of their stakeholders (Hill et al., 2022). According to McKinsey & Company's (2020) Global Survey of Executives, the speed of digital transformation increased considerably within just a few months of the COVID-19 pandemic crisis. This crisis has accelerated digital transformation for customer and supply chain interactions, as well as firms' internal operations, by three to four years and the development of digital or digitally enabled products by seven years compared with pre-crisis times (McKinsey & Company, 2020). Moreover, most companies have developed and implemented at least temporary solutions to stay competitive in this new business and economic environment (McKinsey & Company, 2020). More importantly, both academia and practitioners agree that most digital initiatives are long-lasting with high investment in time and effort to establish digital transformation as a core business

competency rather than merely a source of cost-efficiencies. Early evidence suggests that during the global crisis, successful companies possessed a broader range of digital capabilities, enabling them to develop advanced technologies and expedite experimentation and innovation processes within a short and critical time (McKinsey & Company, 2020; Trefcer, 2023).

In a crisis situation, digital transformation involves multifaceted engagement across various business functions and stakeholders, resulting in substantial changes with long-term impacts on business performance (Sharma et al., 2021). We conceptualize digital transformation as the strategic utilization of digital technologies to navigate uncertainty during a crisis, entailing alterations not only in existing structures, processes, and tasks but also in the organization's interactions with diverse stakeholder groups, both within and beyond the crisis. Given the multidisciplinary nature of digital transformation, a holistic approach is crucial to explore the wide-ranging impact of digital transformation amid public crisis (Verhoef et al., 2021). By adopting an inductive-deductive approach (Srnrka and Koeszegi, 2007) in our systematic review process with 160 articles published during the period 2020-2023, we elucidate five key digital transformation domains that have experienced expedited growth to accommodate the unparalleled challenges arising during and after the pandemic, namely, organization-consumer, intra-organizational, organization-employee, inter-organizational, and organization-government (see **Web Appendix A**). **Table I** summarizes the specific digital technologies employed in each of these five digital transformation domains together with their areas of application while these are explained in more detail in the following sub-sections.

Digital transformation domains	Specific digital technologies employed	Application areas
Organization-consumer-related	Digital platforms for communicating with consumers	Digital communication platforms: social media for conveying accurate information to consumers during the pandemic (Bae et al., 2021), digital humans (Silva and Bonetti, 2021), and mobile applications for online purchases (Jiang and Stylos, 2021).
	Digital platforms for facilitating digital services	Digital services: digital food delivery services (Leung and Cai, 2021) and online commerce (Takeda et al., 2022).
	Artificial intelligence (AI) enabled digital platforms for virtual reality services	Virtual reality tourism (Talwar et al., 2022), virtual reality shopping (Huang and Liu, 2021), and image interactivity technology (e.g., video, virtual try-on, 3D models; Racat et al., 2021).
Intra-organizational-related	IT systems for new product development	Digital fabrication tools (3D printing, laser cutting, and Computer Numerical Control milling) to facilitate the new product development process (Corsini et al., 2021).
	IT systems of cross-function collaboration	Enterprise resource planning (ERP) systems (Roffia and Mola, 2022) to sustain operational continuity.
	Big data analytics	Big data analytics capabilities (Behl et al., 2022; YahiaMarzouk and Jin, 2023), Cloud computing (Xie et al., 2022).
	Digital entrepreneurship	Digital entrepreneurship opportunities in technology, healthcare, entertainment, and e-commerce (Modgil et al., 2022; Xu et al., 2023).
Organization-employee-related	Digital tools for collaboration and training in teleworking	- IT system for remote training (Kohn et al., 2023). - IT system for remote collaboration (Tønnessen et al., 2021).
	Digital tools for communication in teleworking	Virtual communication tools: Enterprise video conferencing (Khan et al., 2022; Robertson et al., 2021), Microsoft Teams, or Zoom (Schoch et al., 2022).
Inter-organizational-related	Digital technologies for integrating information, monitoring, and controlling supply chain activities to enhance supply chain resilience through connectivity, accuracy, and transparency.	Supply chain digital twin (Nasir et al., 2022) and big data analysis (Bag et al., 2021; Belhadi et al., 2021) for real-time information sharing among supply chain partners.
	Digital technologies for automation	Robotic process automation, AI, machine learning, Internet of Things, and blockchain technology (Ngo et al., 2022) in managing relationships with suppliers, forecasting customer demands, and optimizing resource allocation.
Organization-government-related	IT system for controlling the spread of COVID-19	Digitally-enabled control system: Digital Contact Tracing (Abdulaziz et al., 2023; Aringhieri et al., 2022), Bluetooth-enabled digital proximity tracing using smartphones (Riemer et al., 2020).
	Digital public services to citizens	Digital labor platform (Howson et al., 2022), government-sponsored digital platforms for local communities (Shen et al., 2022), and digital volunteering platform (Miao et al., 2021) to better leverage human capital and technology in public service delivery.

Table I. Digital technologies employed by digital transformation domain during the COVID-19

2.1 Organization-Consumer-Related Digital Transformation

With physical stores closed or limited in capacity, as well as strict stay-at-home measures during the pandemic, e-commerce and online shopping experienced a massive surge in demand (McKinsey & Company, 2020). In response, retailers, grocery stores, and restaurants have had to quickly adapt to online selling and communication, and consumers have become more comfortable with buying

products and services online, as well as interacting with organizations via digital platforms such as social media (Bae et al., 2021) and mobile applications (Jiang and Stylos, 2021). The pandemic has also accelerated the shift toward digital services with contactless transactions, such as telemedicine and virtual healthcare (Abdulaziz et al., 2023), digital food delivery services (Leung and Cai, 2021), online commerce (Takeda et al., 2022), and digital learning (Núñez-Canal et al., 2022)³. This shift has led to an increase in more advanced digital infrastructure and logistics to facilitate a smoother online purchase process and better consumer experience via augmented reality such as virtual reality tourism (Talwar et al., 2022), virtual reality shopping (Huang and Liu, 2021), and image interactivity technology (e.g., virtual try-on, 3D models; Racat et al., 2021).

2.2 Intra-Organizational-Related Digital Transformation

The rapid spread of the pandemic put a strain on the supply of essential items. In response, many organizations and countries have begun using novel digital systems/platforms to meet the urgent demand for critical items, such as the proliferation of frugal innovations via digital fabrication tools, open innovation, and exaptive innovation. Internal digital systems such as enterprise resource planning (ERP) (Roffia and Mola, 2022) enhance organizational dynamics – a continuous process of enhancing efficiency and productivity through organizational learning and information integration. Moreover, with the shift to remote work, organizations have had to rely more on data to make timely decisions. Digital tools for big-data collection, analysis, and visualization have become critical for understanding customer behavior, monitoring performance, and identifying areas for improvement (Behl et al., 2022; Rengarajan et al., 2022). These tools empower digital innovation experimentation not only during the pandemic but also in the post-crisis world (Mariani

³ Digital learning refers to various online teaching methods, such as video conferencing, interactive multimedia modules, and virtual classrooms and learning spaces, that have been adopted by many educational institutions during the COVID-19 pandemic. This new learning mode was deemed necessary because these institutions were forced to temporarily suspend physical contact with students to reduce the spreading of the disease. These new technologies have transformed teaching methods in many educational institutions around the world (Núñez-Canal et al., 2022).

and Nambisan, 2021; Xu et al., 2023). The global crisis has not only led to the scaling-up of technological changes in optimizing organizational operations but also fueled digital entrepreneurship aiming at addressing different challenges in cybersecurity, online entertainment, and e-commerce services (Modgil et al., 2022).

2.3 Organization-Employee-Related Digital Transformation

The introduction of public health measures, including mandated and recommended teleworking orders, created a sudden need for businesses and their employees to start or increase remote work arrangements (OECD, 2021). Digital transformation (i.e., digital tools for training, collaboration, and communication such as video conferencing, messaging apps, and cloud-based project management tools) has become essential to maintain employee productivity and enable a significant proportion of employees worldwide to continue earning incomes (Schoch et al., 2022; Tønnessen et al., 2021). This shift has also led to a greater focus on digital security and privacy to protect sensitive information processed and shared online on organizations' internal and external platforms (Garcia-Perez et al., 2021).

2.4 Inter-Organizational-Related Digital Transformation

The global pandemic brought about a “black swan” situation in which organizations across industries can neither predict such a crisis's scale and timing nor specify the best response strategy for such an event, especially when it comes to inter-organizational activities such as supply chain management. Research indicates the need to focus on using digital technologies in supply chain management to monitor pandemic situations and enable immediate actions to mitigate disruptive risks in supply chains. In such a context, automation and artificial intelligence (AI) have become particularly important in reducing human contact and improving efficiency in supply chain

activities, such as logistics and inventory management, thus achieving excellent supply chain performance (Ngo et al., 2022).

2.5 Organization-Government-Related Digital Transformation

The pandemic has had a significant impact on the way governments and public agencies operate, accelerating the adoption of digital technologies to cope with the crisis. For example, mobile apps and Global Positioning System (GPS) tracking have been used to track the spread of the virus and identify potential outbreaks. Contact tracing apps have also been used to notify people who have been in close contact with an infected person (Ghose et al., 2023; Riemer et al., 2020). Moreover, e-government services with chatbots and virtual assistants have been increasingly introduced to provide citizens with access to accurate and timely information, advice, and support during the pandemic (Howson et al., 2022; Miao et al., 2021).

2.6 Similarities and differences in digital transformation across geographical regions

We observe key similarities and differences in digital transformation practices across different geographical regions during the COVID-19 pandemic (see **Table II** and **Web Appendix B**)⁴. With regard to *similarities*, there is a consistent focus across regions on the digital transformation of firms' internal operational processes, such as new product development, manufacturing activities, human resource management, and information processing and sharing within organizations. There is also an emphasis on firms' interactions with customers, particularly focusing on enhancing online shopping experiences, facilitating accurate and effective marketing communications, and offering novel digital services (e.g., virtual reality tourism and virtual reality shopping) across

⁴ Europe and Asia were the predominant areas of digital transformation research amid the COVID-19 pandemic crisis. However, while European research emphasized digital transformation in relation to organization-consumer, intra-organizational, and organization-employee issues, research in Asia primarily focused on issues relating to inter-organizational and organization-government aspects. Surprisingly, other geographical regions (e.g., North America, Middle East, Africa, Oceania, and Latin America) received much less research emphasis on all digital transformation domains, the only exception being organization-government issues that attracted some attention (See Web Appendix B).

regions. However, regional *differences* were also observed. First, in Europe, North America, and Latin America, significant attention was directed toward the adoption of digital technologies to facilitate communication and collaboration in teleworking (Alvarez-Torres and Schiuma, 2022; Kohn et al., 2023; Schoch et al., 2022). This emphasis reflects the widespread popularity of remote work arrangements in these regions compared to others (Slack, 2020). Moreover, in Asia, Africa, and Latin America, there is a notable emphasis on digital transformation within supply chain management (Li et al., 2022b; Song et al., 2022a; Tortorella et al., 2022). One primary reason for this emphasis is that these regions are global production hubs across various product categories, which makes it imperative to alleviate disruptions in their supply through the employment of advanced technologies (e.g., AI and Internet of Things) (Ngo et al., 2022). Finally, Asia, Oceania, and the Middle East have undergone significant digital transformation in public service delivery, for governments and public agencies in these regions demonstrated a proactive stance toward adopting new technologies to mitigate the spread of the pandemic and enhance citizen services (Boeing and Wang, 2021; Riemer et al., 2020).

Geographical region	Indicative country	Focus of digital transformation practices
Europe	Germany	• Use of digital technologies for internal operations for family businesses (Soluk, 2022) and small and medium-sized enterprises (SMEs) (Bertschek et al., 2023), as well as for teleworking practices (e.g., communication and collaboration technology; Schoch et al., 2022).
	Italy	• Use of digital technologies for internal operations and enhancing online consumer experience, especially in the case of retailer entrepreneurship (Candelo et al., 2021; Dicuonzo et al., 2022) and in the B2B industry (Corsaro and D'Amico, 2022; Hu and Olivieri, 2023), as well as for minimizing COVID-19 incidences (Aringhieri et al., 2022).
	United Kingdom	• Use of digital technologies to facilitate teleworking with a focus on employees' wellbeing (Singh et al., 2022) and digital security and resilience (Garcia-Perez et al., 2021).
Asia	China	• Use of digital technologies for internal operations (e.g. developing dynamic capabilities and resources; Li et al., 2022a), supply chain resilience, and sustainable development (Li et al., 2022b; Song et al., 2022a), and provision of better public services (Boeing and Wang, 2021).
	India	• Use of big data analytics and blockchain for internal operations (Behl et al., 2022) and improvement of customers' online shopping experience with AI applications (Bag et al., 2022; Paliwal et al., 2022).
	Vietnam	• Focusing on digital transformation for supply chain management to minimize supply chain disruption risks (Ngo et al., 2022) and improve exporting (Nguyen et al., 2023).
North America	USA	• Use of digital technologies to achieve organizational resilience (He et al., 2023; Santos et al., 2023), improving customers' online experience based on virtual reality and technologies of touch (Racat et al., 2021; Talwar et al., 2022).
Latin America	Brazil, Chile	• Use of digital technologies for communication and collaboration across functions within organizations and in teleworking (Alvarez-Torres and Schiuma, 2022), as well as for supply chain management (Tortorella et al., 2022).
Middle East	United Arab Emirates	• Use of digital technologies to facilitate online shopping (e.g., mobile payment; Al-Qudah et al., 2022) and provide online public services (Abdulaziz et al., 2023; Durugbo et al., 2022).
Africa	South Africa	• Use of digital technologies for resilient healthcare supply chains, as well as for internal operations (Bag et al., 2021).
Oceania	Australia	• Use of digital technologies for online learning (Huang and Chueh, 2022) and training for analytics empowerment for internal operations (Motamarri et al., 2022).

Table II. Digital transformation practices amid the pandemic crisis across geographical regions and countries

3. REVIEW METHOD

3.1 Literature Search

We employed the systematic literature review approach (Williams et al., 2021) to ensure that the literature search process was rigorous, objective, and transparent to provide a holistic overview of knowledge related to digital transformation amid the pandemic crisis. The search process began with the definition of our central concepts (i.e., digital transformation and COVID-19) and specific research objectives (see **Figure 1**). We restricted our review to articles meeting the following eligibility criteria: (1) to have been published in peer-reviewed journals (written in English); (2) to have an academic research format; and (3) to primarily focus on examining digital

transformation effects from an organizational and/or consumer perspective. We also considered only articles published from the beginning of the COVID-19 outbreak in January 2020 up to December 2023. Second, we conducted a keyword search in the widely recognized academic databases (i.e., Thomson Reuters Web of Science and Google Scholar) to identify articles meeting our criteria within the subject areas of “management”, “business”, and “economics”. The search string included “digital*” (or “digital*” AND “transform*”) AND “COVID-19” OR “Sars-Cov-2” and “Pandemic” OR “Coronavirus” in the title and abstract fields. By searching for the general term “digital*”, we included all the relevant concepts of digital transformation, digital technologies, digitalization, and digitization. Guidance for the journals included in our review was based on the 2021 edition of the Chartered Association of Business Schools (ABS) journal list⁵. To identify eligible articles for our study from journals contained in this list, we relied on the Web of Science (WoS), which is a very credible database, from which we identified 2116 articles relevant to our study. However, this electronic literature source does not fully cover all journals included in the ABS list, and for this reason, we have used Google Scholar to identify articles in the remaining journals, resulting in additional 21 articles. In total, we identified 2137 publications.

Next, we extracted the full bibliographic record of the articles including information on the title, author, keywords, abstract, journal, year, and other publication information. We reviewed the titles, keywords, and abstracts of the publications and excluded 606 that were nonempirical work, conference proceedings, edited books, reports, trade publications, editorials, research notes, commentaries, and highly technical reports. We further excluded 1354 of the remaining 1510 articles

⁵ The Chartered Association of Business Schools (CABS) of the United Kingdom has been publishing the Academic Journal Quality Guide (known as the ABS list) since 2007. This list contains 1703 journals covering 22 disciplines, ranging from marketing and management to finance and economics. All journals are classified into five numeric categories, from the lowest level (1) to the highest level (4*) in terms of quality. This list is determined by synthesizing the Journal Citation Reports, the SCImago Journal Rank, and the Source Normalized Impact per Paper, as well as the CiteScore. The ABS list has been extensively employed by various scholars (e.g., Eshghi, 2022; Leonidou and Leonidou, 2011; Vrontis et al., 2022) as a reliable proxy for journal quality in review and meta-analysis studies across various disciplines.

as either being outside the management, business, and economics fields (e.g., articles from computer science, regional studies, and medicine) or not having a robust and rigorous methodology (e.g., empirical articles based on anecdotal evidence) or being duplicated (i.e., articles appearing twice due to the use of different keyword combinations) (see **Figure 1**). To collect comprehensive data, we manually inspected the reference lists of the articles to identify any additional relevant contributions that were missing in the initial electronic literature. We then conducted thorough readings and performed in-depth analyses of the remaining papers. Consequently, we further excluded 17 articles having their primary focus on digitization (i.e., the conversion of analog into digital objects) or digitalization (i.e., changing simple organizational processes and tasks) (Verhoef et al., 2021). The final database consists of 160 articles published in 63 academic journals from January 2020 to December 2023 (see **Web Appendix C**). The number of digital transformation articles grew sharply during the four-year period examined, indicating the increasing importance of the subject.

3.2 Coding Procedure

To identify possible digital transformation domains, we adopted an inductive-deductive approach (Srnska and Koeszegi, 2007). For the deductive approach, we defined categories by drawing from recent review articles on digital transformation in general (e.g., Kraus et al., 2022; Nadkarni and Prügl, 2021) and those reviewing studies on digital transformation during the pandemic (Gharbi et al., 2022). We also sought the views of academic and professional experts in the field. The inductive approach took place during the data analysis process when additional themes emerged from the articles reviewed, which helped to refine the previously defined categories and come up with five digital transformation domains that were mostly accelerated during and after the COVID-19 pandemic crisis. This inductive-deductive approach represents an efficient way to offer a comprehensive analysis, improve generalizability, and ensure robust and insightful research

outcomes (Srnrka and Koeszegi, 2007).

To code the relevant information contained in the articles selected, we developed a special coding protocol based on previous business review studies (e.g., Leonidou and Leonidou, 2011; Li et al., 2023). This was organized into four major categories, namely: (a) *theoretical approaches* (i.e., number of theories applied, specific theoretical foundation, type of theory employed); (b) *research design* (i.e., design method, topical scope, problem crystallization, variable association, time dimension); (c) *research methods* (i.e., sampling design, sample size, response rate, data collection method); and (d) *research scope* (i.e., number of countries involved, geographical region focus, number of industries covered, product emphasis, unit of analysis). The coding protocol was accompanied by a coding manual, which provided detailed information about each dimension incorporated in each category. Two researchers with substantial experience in the digital transformation field were responsible for the coding process, under the supervision of the principal investigator. Before the full-scale coding, the coders underwent rigorous training and coded some of the articles under the supervisor's close surveillance who provided clarifications in the case of mistakes. The two coders then proceeded to independently code each of the 160 articles selected, resulting in an inter-coder reliability score ranging from 87% to 100%. In the case of discrepancies, these were resolved at a meeting with the supervisor, until reaching a mutually acceptable code. The finalized set of clean coded data was subsequently used for further analyses.

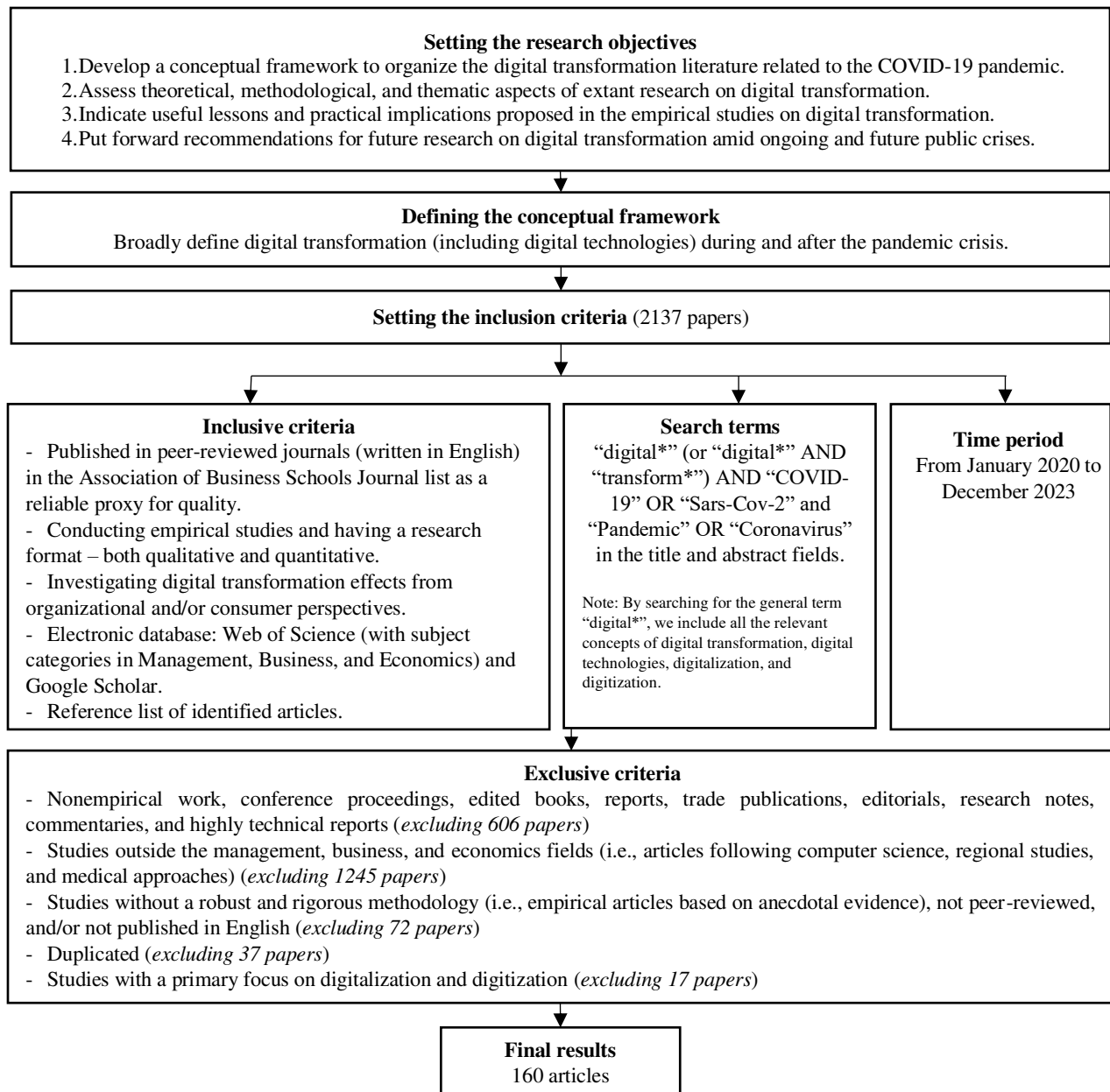


Figure 1. The literature searching process

4. FINDINGS

4.1 Theoretical Assessment

Slightly more than half (50.63%) of the articles were not anchored on a specific theory, while the remainder relied more on a range of existing theories (23.12%) rather than expanding (16.25%) or developing new theories (10.00%) (see **Web Appendix D**). The most popular theories employed

are dynamic capabilities theory (6.25%), organizational information processing theory (3.13%), unified theory of acceptance and use of technology (UTAUT) (2.50%), theory of planned behavior (2.50%), conservation of resources theory (1.88%), contingency theory (1.88%), institutional theory (1.88%), resilience theory (1.88%), and diffusion of innovation theory (1.88%). In addition, 39.37% of the articles had a single theoretical base, while 10.00% used two theories or more.

Dynamic Capabilities theory suggests that selecting and deploying assets are critical for organizations to survive and create long-term competitive advantages in a turbulent environment (Helfat et al., 2009). To rapidly address the challenges stemming from this environment, firms leverage dynamic capabilities to integrate, build, and reconfigure internal and external competencies. This theory emphasizes transformative processes whereby organizational resources and capabilities are translated into outputs (e.g., products or services) that ultimately provide superior customer value in a swift, precise, and creative manner (Eisenhardt and Martin, 2000). Applied into the context of digital transformation amid public crisis, this theory provides a relevant framework to evaluate how firms used digital technologies to reduce business risks and cope with the challenges associated with the adverse business conditions caused by the COVID-19 pandemic crisis (Li et al., 2022a), while adapting at the same time their digital technologies to enhance agility and performance outcomes (Zahoor et al., 2022). Specifically, this theory has been used: (1) to uncover the distinct effects of breadth (i.e., scope) and depth (i.e., scale) of digital technology deployment on organizational resilience during the crisis (Li et al., 2022b); (2) to highlight the role of market capitalizing agility and operational adjustment agility in driving performance outcomes of digital transformation (Li et al., 2022a); and (3) to explore the complex links among digital transformation, innovativeness, modularization, and supply chain resilience (Song et al., 2022a).

Organizational Information Processing theory focuses on a firm's ability to collect,

analyze, and use information effectively to predict market changes and make proactive adjustments to mitigate risks and develop organizational resilience (Galbraith, 1974; Xie et al., 2022). According to this theory, an organization can maintain and develop its information processing capacity by cultivating lateral relationships, encompassing both intra-organizational collaborations across various departments and inter-organizational partnerships with external entities (Srinivasan and Swink, 2018). Amid escalating uncertainty in times of crisis, as in the case of the COVID-19 pandemic, this theory posits that organizations need to enhance their information-processing capabilities to gain deeper insights into their business landscapes and adeptly navigate conflicts inherent in risk management practices (Xie et al., 2022). This theory was used by digital transformation studies to explain how big-data analytics capabilities can help improve supply chain coordination and increase mutual trust among supply chain members across national markets (Behl et al., 2022), how digital technologies moderate the impact of business networks on organizational resilience (Xie et al., 2022), and how digital transformation contributes to organizational resilience and performance (Baral et al., 2022).

UTAUT and the *Theory of Planned Behavior* are two psychological theories commonly used to explain individuals' intentions and behaviors. While UTAUT proposes that performance expectancy, effort expectancy, social influence, and facilitating conditions collectively influence users' behavioral intentions and actual technology usage (Venkatesh et al., 2003), the Theory of Planned Behavior suggests that users' attitudes, subjective norms, and perceived behavioral control shape their usage intention (Ajzen, 1991). Given the unprecedented nature of the COVID-19 crisis era, digital transformation studies extend these two theories by incorporating contextual factors relevant to the extraordinary circumstances of the pandemic, such as perceived fear (Erjavec and Manfreda, 2022) and perceived emergency (Mishra et al., 2023). Particular emphasis

was put on understanding various user behavior issues, such as new mechanisms affecting consumers' online shopping behaviors (Wang et al., 2022), managers' intention to introduce mobile applications for SME business processes (Rakshit et al., 2021), and managers' intention to implement ERP (Roffia and Mola, 2022).

4.2 Methodological Assessment

Regarding *research design*, 55.00% of the studies employed quantitative methods to formulate and empirically test the performance effect of digital transformation and its underlying mechanism, while more than a third (36.88%) used the qualitative approach to explore novel insights into how different types of organizations adapt to exogenous shocks such as the COVID-19 pandemic (see **Web Appendix E**). Despite its higher robustness in research design and data collection, only a small percentage (i.e., 8.12%) of studies adopted a mixed-method approach. The overwhelming majority (88.75%) had a *cross-sectional* nature, with only 11.25% being longitudinal. This low percentage of studies adopting a longitudinal approach can be attributed to the transient nature of the COVID-19 crisis as a short-term exogenous shock (i.e., four years) covered by our review. However, as time passes, it is expected that some additional studies will have a longitudinal nature aiming to capture the dynamics of digital transformation in the firm's interactions with consumers, employees, organizations, and governments spearheaded by the pandemic.

Regarding the *sampling method*, the overwhelming majority of studies (79.37%) used nonprobability samples, usually taking the form of convenience samples or purposive samples, reflecting difficulties in data gathering during the pandemic (see **Web Appendix F**). Surveys were the predominant *data collection* method in primary research, reported in 46.88% of the studies, followed by in-depth/personal interviews (i.e., 30.63%). A fifth (20.00%) of the articles employed secondary data extracted from either internal (e.g., company internal databases) or external (e.g.,

industry reports, governmental databases) sources.

4.3 Research Scope Assessment

Our review reveals that the majority of digital transformation research adopted a *single-industry* perspective (i.e., 52.50%) with a great focus on the service industry (60.00% of the articles) (see **Web Appendix G**). This reflects the severe impact of the pandemic on this sector of the economy, which often requires physical contact between organizations and customers, leading to disruptions in business operations, revenue losses, and shifts toward remote or digital service delivery. It was also revealed that more than three-quarters of the studies (i.e., 76.24%) had a *single-country* focus, while the most widely researched geographical regions were Europe and Asia (42.50% and 41.25% of the articles, respectively). North America, particularly the U.S., attracted less digital transformation research emphasis during the pandemic (being the focus of only 15.63% of the articles), while other geographical regions (e.g., the Middle East, Africa, Latin America, and Oceania) received minimal research attention.

5. ORGANIZING FRAMEWORK OF DIGITAL TRANSFORMATION AMID PUBLIC CRISIS

This section demonstrates the antecedents and performance outcomes of digital transformation amid the public crisis caused by the COVID-19 pandemic. Taking into consideration the five key digital transformation domains identified earlier, we developed a five-dimensional framework to organize the antecedents and performance outcomes across each of these key thematic domains (see **Figure 2**).

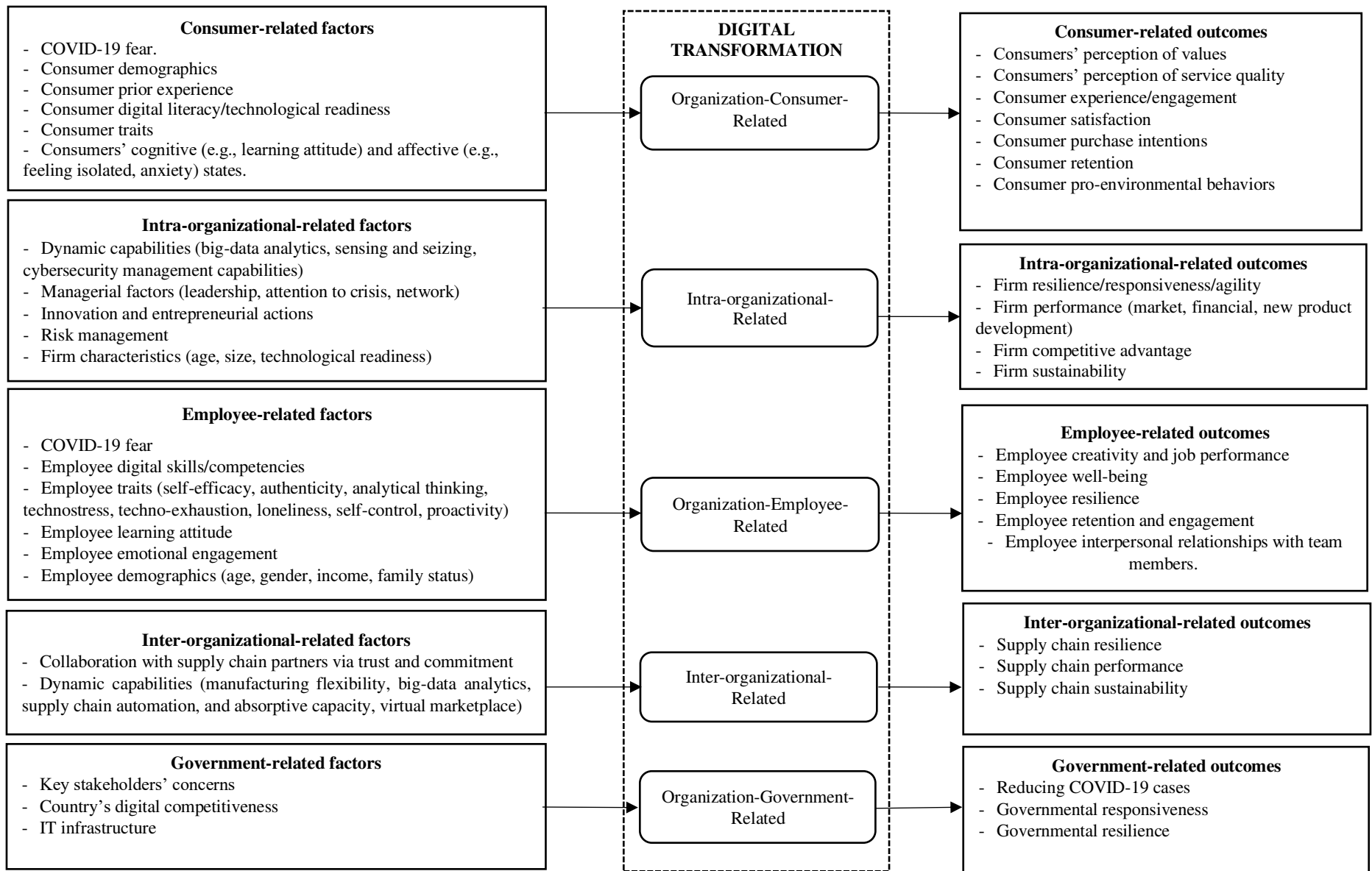


Figure 2. Organizing framework of digital transformation amid public crisis

5.1 Theme 1: Organization-Consumer-Related Digital Transformation

The use of digital technologies in enhancing consumer experience during the crisis is identified as a key research area. This is mainly because the recent surge in digital and omnichannel adoption, among not only existing users but also new or infrequent users, is likely to continue despite restrictions lifting in most countries (Accenture, 2020). Consumers' fear of COVID-19 and their perception of its severity were reported to be the most important reasons for turning to online shopping (Acquila-Natale et al., 2022; Leung and Cai, 2021). Consumers' characteristics (Silva and Bonetti, 2021), prior experience (Mariani and Nambisan, 2021), personality traits (Wang et al., 2022), and digital literacy (Huang and Liu, 2021) are salient enablers of using digital technologies for contactless shopping. Consumers' cognitive (e.g., learning attitude; Núñez-Canal et al., 2022) and affective (e.g., feeling isolated, anxiety; Jiang and Stylos, 2021) states significantly affect their intention to use digital solutions during the pandemic.

The studies reviewed also extensively explored the outcomes of organization-consumer-related digital transformation, mainly from a consumer perspective. During the pandemic, digital transformation has brought many benefits to organizations in attracting new consumers by increasing their perception of value and service quality (e.g., Jiang and Stylos, 2021), as well as enhancing their shopping experiences (e.g., Hoang et al., 2022). This entails higher consumer purchase intentions (Leung and Cai, 2021), greater consumer satisfaction (Bag et al., 2022), better consumer retention (Huang and Chueh, 2022), and increased pro-environmental behaviors (Talwar et al., 2022). Extant studies uniformly show that consumers have increasingly recognized and appreciated the digital transformation efforts undertaken by companies across various industries. The pandemic significantly disrupted traditional modes of organizational operations, leading to a greater reliance on digital solutions. The convenience, efficiency, and safety provided by these

digital solutions were invaluable during times of lockdowns and restricted movements. As consumers experienced firsthand the benefits of digital transformation in maintaining access to goods, services, and information, they have valued more organizational efforts to swiftly adapt and implement digital solutions. This heightened appreciation stems from the recognition that digital transformation has become not just a convenience but a necessity in navigating the challenges posed by the pandemic.

5.2 Theme 2: Intra-Organizational-Related Digital Transformation

An increasing number of articles focused on understanding how various organizational factors accelerate digital transformation and its subsequent impact on operational effectiveness and performance outcomes. Managerial factors, including leadership (Bag et al., 2021; Bartsch et al., 2020), managers' attention to issues related to rare events (Henningsson et al., 2021), and owners' business network (Xie et al., 2022), boost digital transformation during the crisis. These factors contribute to improving different dynamic capabilities crucial for digital transformation, such as big-data analytics (Bag et al., 2021), sensing and seizing capabilities (Zahoor et al., 2022), and cybersecurity management (Garcia-Perez et al., 2021). Different innovation types, such as exaptive innovations (Sedita et al., 2022), entrepreneurial actions and innovative behavior (Xu et al., 2023), and adapted resources (Soluk, 2022) triggered by the shocks are vital factors in enabling the effective digital transformation process in a constrained environment. Risk management (e.g., ERP-risk control, supply chain risks) is also crucial to leverage information and digital technologies to alleviate the disruptive effects of the pandemic (Behl et al., 2022; Roffia and Mola, 2022). Finally, organizational characteristics such as age, size, and technological readiness are important to determine digital transformation speed during a crisis (Muzi et al., 2023; Roffia and Mola, 2022). The dominant outcomes of intra-organizational-related digital transformation during

the crisis are organizational resilience, responsiveness, and agility (Bag et al., 2021; Xie et al., 2022) and business performance (He et al., 2023; Iyanna et al., 2022). Leveraging digital technologies for improving internal operations in crisis times also helps organizations enhance their competitive advantage and sustainability in the long run (Behl et al., 2022; Gavrilă and De Lucas, 2022; Popkova and Sergi, 2023).

5.3 Theme 3: Organization-Employee-Related Digital Transformation

COVID-19 fear is the strongest motive for why organizations and employees extensively used digital technologies during the mandated teleworking period (Reizer et al., 2022). The adoption of digital technologies for job-related tasks was also influenced by: (1) employees' characteristics, such as age, gender, and family status (Fischer et al., 2022); (2) digital literacy (Piroșcă et al., 2021); and (3) specific personality traits, such as proactivity and autonomy (Fischer et al., 2022), technostress (Battisti et al., 2022), and core-belief challenge (Tuan, 2022). Taking into consideration cognitive and emotional efforts in learning and using digital technologies in teleworking, researchers focused on how employees' learning attitudes (Serfonty-Baniule et al., 2022) and emotional engagement (Alvarez-Torres and Schiuma, 2022) can help increase their digital transformation adoption and subsequent job performance outcomes. Existing studies also adopted diverse approaches to measuring performance implications of employee-related digital transformation, illuminating that the use of digital platforms increased employees' creativity (Tønnessen et al., 2021) and task performance (Abelsen et al., 2021). Other researchers spotlight additional relevant positive outcomes of digital transformation in teleworking, such as employees' resilience (Fischer et al., 2022), higher retention and engagement (Chadee et al., 2021), and enhanced interpersonal relationships with team members (Bellis et al., 2022). However, digital transformation can be a double-edged sword as it can negatively affect employees' well-being

(Alvarez-Torres and Schiuma, 2022; Singh et al., 2022).

5.4 Theme 4: Inter-Organizational-Related Digital Transformation

To alleviate the impact of current and future crises, shortcomings in inter-organizational operations amid the pandemic crisis centered on supply chains must be corrected (Trefcer, 2023). Leveraging digital capabilities and emerging technologies becomes an inevitable supply chain risk mitigation strategy. Several studies (e.g., Baral et al., 2022; Li et al., 2022b) particularly stressed the importance of trust and commitment in supply chain collaboration as a key component in creating a digitally transformed and trusted supply chain during crisis times. Dynamic capabilities, such as manufacturing flexibility, big-data analytics, supply chain automation, and absorptive capacity, can boost real-time information flow and improve supply chain visibility and agility (Bag et al., 2021; Ngo et al., 2022). Extant studies have shown that digital transformation in supply chain management enhances supply chain performance (Ye et al., 2022), resilience (Balakrishnan and Ramanathan, 2021), efficiency (Rengarajan et al., 2022), and sustainability (Song et al., 2022b).

5.5 Theme 5: Organization-Government-Related Digital Transformation

As digital technologies have become powerful tools to keep track of the COVID-19 spread and facilitate online public services, a number of studies examined antecedents and consequences of organization-government-related digital transformation. For example, several researchers (Boeing and Wang, 2021; Riemer et al., 2020) emphasized how key stakeholders interact within the digital context to govern contact tracing during the pandemic and presented important implications for governments' digital transformation during the crisis at the societal level. Concerns with the integration of digital technologies into existing governance systems, as well as countries' digital competitiveness and current IT infrastructures, enabled e-government services, including digital labor (Howson et al., 2022), digital communication with citizens (Khan et al., 2022), and digital

volunteering (Miao et al., 2021). In general, digital transformation not only allowed some control over COVID-19 (Aringhieri et al., 2022) but also enhanced government resilience and responsiveness (Shen et al., 2022). However, digital transformation efforts vary significantly across countries, depending on their IT infrastructure, resources, and existing governance systems.

6. PRACTICAL IMPLICATIONS

While the eruption of COVID-19 in China and its evolution into a global pandemic was unexpected, it is not simply a random incident but a representative of a public crisis that warns how significantly and severely unforeseen external shocks can damage businesses. Our review of the pertinent digital transformation literature revealed valuable practical implications for organizations to better fine-tune strategies to be vigilant against and resilient to future exogenous shocks. Consistent with our organizing framework, we categorized these implications along the five digital transformation domains (see **Table III**).

Digital transformation domains	Lessons learned	Practical implications
Organization-consumer-related digital transformation	Attention to consumers' online shopping experience Consumers' attitudes toward and experience of digital shopping Consumer psychology and behavior Rising concerns about consumer rights and well-being Consumer experience vs. Big Data Big Data vs. consumer sovereignty	- Using digital initiatives to enhance consumers' perceptions of values and service quality, experience, and satisfaction when shopping and interacting with organizations online. - Developing a deeper understanding of changes in consumer behavior across regions and countries for better segmentation and targeting during and after the pandemic. - Improving digital security and protection - Legislations of consumer rights
Intra-organization-related digital transformation	Digital transformation for internal operations Cybersecurity and digital infrastructures IT training and support Leadership and organizational culture Management styles Digital transformation for business alliances Partner relationship development Industrial affiliations Integrating digital transformation into organizational strategies Innovation development Multi-platform operations Networking Sustainability	- Investing in ongoing cybersecurity and digital infrastructure development to facilitate digital transformation and to cope with current and future crises. - Listening to, training, and supporting employees to increase technological readiness in adopting digital technologies for internal operations. - Ensuring innovative leadership and building organizational cultures of cohesiveness, trust, support, and sharing in digital transformation. - Data-driven management style (particularly on big data from both micro and macro levels and from consumers' experience and satisfaction) to sense and seize novel opportunities and prevent or prepare for future risks and crises. - Facilitating mutual trust for interorganizational data sharing and collaboration across departments and functions and with external organizations. - Developing the industrial culture of data and information sharing, mutually supportive collaboration, and value co-creation with strategic partners. - Digital-based frugal innovation centered on mobilizing local networks and utilizing local resources. - Multi-platform operations in terms of data collection and analysis, marketing, resource allocation, services provision, and supplier selection. - Building up and maintaining relationships/partnerships with industrial partners and governments in dealing with issues in a public crisis. - Sustainability = Environmentalism + Long-term vision of continuous, innovative, as well as ethical digital transformation.
Organization-employee-related digital transformation	Enhancing employee training, skills, and capabilities for teleworking The variance in employee digital literacy caused communication issues and lowered already-damaged productivity. Improving employee well-being The blurred boundary between personal and professional lives Cultivating a digital transformation-centered organizational culture Ongoing digital transformation in organizations The diluted sense of belongings with increased loneliness	- Providing and engaging employees with necessary digital literacy training, which can be facilitated by working on performance evaluation criteria or incentive schemes; - Understanding and recognizing employees' cognitive and emotional efforts in learning and adapting digital technologies for teleworking; - Issuing family-friendly policies to enhance work-life balance. - Cultivating an organizational culture of continuously adapting to, diversifying, and renewing digital solutions - Promoting a security-aware workforce and planning the telework security policies during the crisis. - Facilitate formal social interaction, collaborative work, and innovative leadership in crisis times.
Inter-organization-related digital transformation	Supply chain resilience Singular supply chain reliance Supply chain flexibility	- Digitalize lean production management for higher production efficiency - Diversifying suppliers and building an omnichannel supply chain in order to build and maintain trust and commitment with multiple suppliers to lower risk.
Organization-government-related digital transformation	Governmental responsibility for digital transformation in damage control and information sharing Governmental laws and regulations Governmental support and coordination	- Providing firms with reliable and timely data about crises to help them make well-informed business decisions. - The misuse of digital tools and technologies should be studied, evaluated, and regulated by both firms and states. - Receiving all possible types of governmental support and having governments involved in market coordination are keys for business survival amid public crisis and for business recovery after the crisis.

Table III. Practical implications derived from the extant studies in digital transformation

6.1 Implications for Organization-Consumer-Related Digital Transformation

6.1.1 Attention to consumers' online shopping experience

Attention to consumer digital shopping experience surged largely due to multiple lockdowns that coerced nearly all consumers into rapid digital transformation (Jiang and Stylos, 2021). Regardless of their previous digital literacy, consumers had to use digital devices to order basic goods and services (Leung and Cai, 2021), as well as luxury products (Hoang et al., 2022), which were otherwise purchased offline. Online market competition has thus intensified among firms to offer superior online shopping experiences than competitors. As a result, firms have increasingly relied on consumers' psychological factors to enhance consumer experience by helping them overcome their fear of the virus (Erjavec and Manfreda, 2022), reduce risk perception (Leung and Cai, 2021), and change attitudes toward digital transformation (Wang et al., 2022). As shopping online persists in the post-COVID era and becomes a novel social norm, firms strive to further strengthen their digital capabilities to lower consumers' risk perceptions of online shopping (Leung and Cai, 2021) and enhance their perceived value and service quality (Jiang and Stylos, 2021). This goal necessitates firms' efforts to leverage digital tools to gain deeper insights into consumer behaviors, which frequently vary across regions, cultures, and countries (Bag et al., 2022). Such knowledge will also help firms sharpen their segmentation and targeting strategies (Wang et al., 2022).

6.1.2 Rising concerns about consumer rights and well-being

Firms also confronted rising concerns about consumer rights amid the crisis-accelerated digital transformation (Boeing and Wang, 2021). Rapid digital transformation has led consumers, especially younger ones, to significantly reduce in-person interactions (Hartmann and Lussier, 2020), suggesting an overreliance on digital tools and devices in carrying out daily activities during the pandemic period. Such overreliance may slow down younger individuals' future development

of face-to-face socialization skills (Downey and Gibbs, 2020), which are vital to overcome social phobic and improve social competency (Spence et al., 1999). At a social level, massive-scale usage of big-data technologies, which were rapidly developed as remedies for business survival (YahiaMarzouk and Jin, 2023; Ye et al., 2022), was accelerated during and after the pandemic by marketing efforts to improve customization in the digital consumption experience. Taken together, we consider the rapid digital transformation in personal lives and the prevalence of big-data technologies in the commercial sphere to have rendered legal bodies incapable of timely establishing specific laws, thus significantly threatening consumers' well-being, privacy, and sovereignty. Consequently, in their post-crisis managerial practices, instead of being reactive and waiting for states regulatory and legal mandates, we suggest companies take an active role in proactively driving organizational policy changes. These policy changes should focus on improving digital security and protection policies for consumer information safety and, more importantly, on engaging with and seeking to shape the legislation in consumer rights and well-being amid the digital era through political lobbying.

6.2 Implications for Intra-Organizational-Related Digital Transformation

6.2.1 Digital transformation for internal operations

We identify four key implications in this digital transformation area. *First*, our analysis suggests that companies did not recognize their lack of updates on IT infrastructures and cybersecurity until they were hit by the pandemic. Before the crisis, managers put great emphasis on growing intellectual capital through strategic recruitment of key managers and employees directly dealing with manufacturing and marketing activities, but not digital capital composed of staff working behind the scenes on cybersecurity and organizational online platforms. When the crisis emerged and forcefully shifted most business operations from offline to online (Hill et al., 2022), inadequate

investment in digital capital led to a surge in cyber incidents, particularly during critical periods when both employees and consumers relied heavily on organizational digital platforms (Garcia-Perez et al., 2021), thus further hampering business performance. Given this hard-learned lesson, we suggest companies in the post-COVID-19 era be better prepared for future crises by investing in digital capital, especially IT infrastructure and cybersecurity management, to securely support ongoing organizational digital transformation.

Second, digital competencies, encompassing the knowledge and skills required for performing tasks in the digital workplace, emerge as crucial for fostering employee resilience (Fischer et al., 2022). When the pandemic erupted, training initiatives aimed at enhancing employees' digital competencies facilitated organizations in swiftly transitioning to online teleworking modes, thereby sustaining daily operations (Hill et al., 2022). This timely conversion saved many organizations from bankruptcy during the crisis and allowed them to leverage the crisis as an opportunity to speed up organizational digital transformation. This showcased the role of digital transformation in lowering business risks in critical situations, thus suggesting the need for organizations to continuously keep their IT infrastructure updated (Ngo et al., 2022) and provide employees with digital technology training and IT support (Hu and Olivieri, 2023; Kohn et al., 2023). More importantly, the evolution of digital technology and market dynamics was rapid. Organizational business interests in developing and using digital solutions to gain competitive advantages are also changing. Considering the dynamic marketplace and evolving management practices, we propose that organizations constantly improve digital technology training. This should not only align with business objectives and interests but also cater to employees' evolving digital knowledge and skill requirements for internal operations.

Third, from their efforts to survive, organizations had a better understanding of the essential

role of leadership and organizational culture (Bellis et al., 2022; Mariani and Nambisan, 2021). Our analysis suggests the embrace of digital technology allows both for-profit organizations and public institutions (e.g., schools, universities, and hospitals) to maintain their fundamental intra-organizational activities vital for the basic function of societies amid the crisis (Huang and Chueh, 2022; Iyanna et al., 2022). Regarding organizational culture, although the rapid digital transformation generated concerns about organizational cohesion because it forced employees to make dramatic changes in their working habits (Bartsch et al., 2020; Bellis et al., 2022), as our thematic analysis indicates, these dramatic changes were critical for businesses to survive. These lessons underscore the importance of maintaining strong leadership in digital-based innovation (He et al., 2022; Li et al., 2022a; Tønnessen et al., 2021), while fostering a culture of cohesiveness and mutual trust (Candelo et al., 2021) to encourage supportive and collaborative workplace behaviors. No matter how advanced digital solutions are, it is always well-managed employees who drive organizational success.

Fourth, understanding the impacts of rare societal shocks requires managers to promptly utilize digital technologies, platforms, and channels (Ngo et al., 2022) to mobilize business networks, involving public agencies (Miao et al., 2021; Wang et al., 2022) and industrial peers (Kumar et al., 2021) (including but not limited to suppliers). This strategic approach has proven invaluable for facilitating agile decision-making crucial for sustaining and revitalizing businesses both during and after the crisis. This stresses a data-driven management style based on collecting and analyzing data from both the macro level (Bag et al., 2021) and micro-level (Rengarajan et al., 2022) for risk prevention, as well as crisis forecasting and preparation (Huang and Chueh, 2022). Doing so will help organizations develop critical digital capabilities to sense and seize novel opportunities in current and future crises (Zahoor et al., 2022).

6.2.2 *Digital transformation for business alliances*

Business operations hinge on value chains (Porter, 1985) comprised of inter-organizational interactions, collaborations, and operations, limiting organizations' ability to survive as individual entities. This is particularly true in a public crisis, during which limited resource availability compels suppliers, producers, and distributors to depend on each other more than ever. Therefore, they must develop and embrace digital-aided methods to meticulously coordinate and sustain their activities (Belhadi et al., 2021; Kumar et al., 2021). Owing to lockdown policies (Acquila-Natale et al., 2022; Li et al., 2021a), demands were primarily derived from and fulfilled on online platforms, thus giving rise to the adoption of more precise digital-assisted management styles, techniques, and platforms. These digital-enabled approaches allowed organizations to effectively collaborate, ensuring the continuity of their industries. We suggest that organizations further consolidate digital-enabled coordination for effective production, supply, and distribution. To do so, organizations can continue using and further improving digital information-sharing and communication platforms established during the pandemic (Bag et al., 2022). At an industry level, given the importance of information sharing among organizations, we suggest industrial associations motivate their members to establish an industrial culture of data sharing. As our analysis indicates that knowledge about market and societal dynamics is useful for future crisis forecasting and prevention, we suggest such industrial data sharing should be focused on members' constant collection and analysis of data regarding micro- and macro-environments. Such knowledge would serve as a collective asset for industrial associations and their members to amplify individual organizations' power of identifying and tackling future crises, thus contributing to increasing industrial resilience against exogenous shocks.

6.2.3 Integrating digital transformation into organizational strategies

Several lessons can be derived from integrating digital transformation into organizational strategies. The *first* centers on innovation development (Soluk, 2022) amid internationalization, with a particular emphasis on carrying out innovation with limited sources during crisis times. This lesson advises companies, especially multinational corporations (MNCs), to pay sufficient attention to frugal innovation (Corsini et al., 2021). Instead of implementing one-size-fits-all innovation strategies across organizations' international branches, frugal innovation calls for providing firms operating in different geographical locations with certain flexibility and autonomy to draw on locally available networks and resources to plan and produce digital innovations compatible with local conditions and market dynamics.

The *second* lesson refers to the advantages of multiplatform operations in lowering business risks. This calls for organizations to create or adapt various digital platforms to operate in the post-crisis era using their market-specific data collection and analysis of consumers' distinct motivations to guide marketing activities (Hu and Olivieri, 2023), resource allocation (Bae et al., 2021), supplier selection (Sharma et al., 2021), and service provision (Acquila-Natale et al., 2022).

The *third* lesson is about organizational networking with not only industrial partners but also governments (Belhadi et al., 2021; Miao et al., 2021; Xu et al., 2023), who played vital roles in providing resources, support, and policies necessary for organizations to build or improve their digital capacities critical for the prevention of large-scale business collapse amid the crisis. Accordingly, we suggest organizations further invest in maintaining and enlarging networks with state agencies for further governmental support of digital transformation.

The *fourth* lesson is about sustainability. In general, sustainability is associated with digital practices taking into consideration the long-term environmental development of human societies

(Popkova and Sergi, 2023; Talwar et al., 2022). We found that, during and after the pandemic, a second meaning was added to sustainability—namely, long-term business development enabled by digital transformation. Specifically, digital transformation practices like embarking on digital literacy at educational institutions (Núñez-Canal et al., 2022) and digital training at organizations (Kohn et al., 2023), boosting business productivity and management efficiency via novel digital solutions (Modgil et al., 2022), offering the flexibility to employees and consumers of working and shopping from home (Jiang and Stylos, 2021), and reducing the environmental footprint by replacing physical with digital contact (Khan et al., 2022) are likely to stay with rising ethical concerns. This urges organizations to renew their strategic vision of sustainability by synthesizing environmentalism with an everlasting vision and commitment to not only continuous and innovative but also ethical digital transformation practices. To achieve enduring business stability and resilience, practices such as enforcing laws and policies across micro-, meso-, and macro-levels that regulate the violation and abuse of individual privacy (Li et al., 2021a), facilitating and protecting employees' work-life balance (Singh et al., 2022), preventing digital products from over targeting teenagers to reduce addiction (Hartmann and Lussier, 2020), and allowing regulatory interventions guiding individuals and organizations to balance their virtual and in-person socializations (Abelsen et al., 2021) are critical to ensure that ethical compliance will persist into the future of digital transformation.

6.3 Implications for Organization-Employee-Related Digital Transformation

6.3.1 Enhancing employee training, skills, and capabilities for teleworking

The breakout of the pandemic forced many companies to rapidly shift to remote work, exposing certain employees' lack of proficiency in using digital devices and software, causing communication barriers and confusion (Mariani and Nambisan, 2021) and further lowering

productivity and performance outcomes already compromised amid the crisis (Modgil et al., 2022). To stabilize employee productivity and performance in future crises, we urge organizations to provide employees with digital literacy training programs regularly and better engage them by integrating the outcomes of digital training with performance evaluation systems or incentive schemes (Abelsen et al., 2021; Reizer et al., 2022). Meanwhile, an increasing number of companies, especially those in the high-tech industries, are still encouraging employees to work from home even after the pandemic (Kohn et al., 2023). This channels employees into constant learning and adaptation of digital technologies requiring their cognitive and emotional efforts (Abelsen et al., 2021; Bellis et al., 2022). Hence, to protect employee well-being in a digital-intensive work environment, we suggest a better understanding and recognition of these efforts, as well as offering employees the necessary psychological, technological, and financial support to build and sustain permanent teleworking (Hill et al., 2022; YahiaMarzouk and Jin, 2023).

6.3.2 Improving employee well-being

Rapid digital transformation resembles a double-edged sword, because, apart from benefits, it also generates negative impacts on employees. The boundary between work and family life was blurred by the new trend of digital-enabled teleworking, forcing them to psychologically and physically convert homes into offices and blend private time with professional activities (Chadee et al., 2021; Singh et al., 2022). Meanwhile, proper and comprehensive cybersecurity systems were too difficult to be developed and implemented to match the rapid progress of digital transformation. Against this background, fully online teleworking puts employee privacy at risk (Motamarri et al., 2022). In addition, the mandate of home quarantine during the pandemic minimized normal and frequent interpersonal socialization among colleagues (Hartmann and Lussier, 2020). Working in a highly virtual environment not only diluted employees' sense of belonging and community (Abelsen et

al., 2021) but also increased loneliness and social exclusion (Wang et al., 2022), thus putting employee well-being at risk (Hill et al., 2022). Since the quality of employees' family lives, is linked with their organizational commitment (Chadee et al., 2021), we advise companies to issue family-friendly policies to ensure and improve employees' work-life balance.

6.3.3 Cultivating a digital transformation-centered organizational culture

Digital transformation is still ongoing in organizations that have adopted either permanent remote or traditional office work models. Cultivating an organizational culture that focuses on continuously adapting to, diversifying, and renewing digital solutions has become a necessity. In addition, organizations need to promote a security-aware workforce to keep employees informed of common social-engineering attacks. To do so, regular employee training on identifying and reporting cyber risks is necessary. To reinforce employees' sense of belongingness to teams and organizations (Carpenter, 2023), we suggest organizations, especially those encouraging remote work, facilitate professional or informal social interactions, collaborative works, and workshops in both online and offline settings regularly. As organizational leadership plays an important role in facilitating such events (Carpenter, 2023), we call for organizations to cultivate innovative leadership supporting explorations and experimentations on ways to integrate resources and techniques to forge an organizational culture of communities in virtual and physical workplaces.

6.4 Implications for Inter-Organizational-Related Digital Transformation

Critical implications that surfaced from this area were valorized around supply chain resilience from two perspectives. The *first* has to do with strict lockdown policies which rendered manufacturers incapable of maintaining production and exporting activities, causing serious *supply chain disruptions* for a large number of companies, as in the case of Chinese suppliers and their Western business buyers (Belhadi et al., 2021). With their overreliance on Chinese suppliers

and supply interruptions, many companies discovered a supply chain lack of capabilities and limited knowledge about other potential international suppliers and supply markets (Li et al., 2022b; Xie et al., 2022). These lessons motivated companies to develop better supply chain strategies that are resilient to unexpected supply chain disruptions (Balakrishnan and Ramanathan, 2021; Belhadi et al., 2021). One effective way to achieve this is to further digitalize their lean production management systems for higher production efficiency and better inventory management to optimize production plans amid limited supplies.

The *second* perspective has to do with the need to increase *supply chain flexibility* in the post-crisis era to enhance supply chain resilience and lower risks (Giotopoulos et al., 2022). Some large companies, such as Apple and Samsung, have achieved this by replacing their Chinese suppliers with others from other Asian countries such as India and Vietnam (Wong, 2023). SMEs, however, have substantially less capital, influence, and sources available in international markets than MNCs. Thus, to increase supply chain flexibility, we urge SMEs to initiate and consolidate trust and commitment primarily with local suppliers and facilitate real-time information and data sharing on local market dynamics. Doing so would allow them to lower supply chain risks by forging a local and self-sustainable ecosystem of business activities.

6.5 Implications for Organization-Government-Related Digital Transformation

There are three important lessons stemming from organization-government-related digital transformation. *First*, governmental responsibility for digital transformation in *damage control and information sharing* is a key factor in overcoming crises. It includes states' timely response to negative impacts caused by a public crisis on social and organizational activities (Bag et al., 2021; Khan et al., 2022). In the context of COVID-19, given the unanticipated increase in public health system budgets, governments took digital-enabled actions reasonably fast to tackle public health

threats. Examples include the different types of applications tracking virus contact and spread in real-time, encouraging vaccination (Boeing and Wang, 2021; He et al., 2022), and providing up-to-date healthcare information (Ghose et al., 2023; Iyanna et al., 2022). We argue that states' digital transformation effort to contain crises and share key information with the public will remain useful in the future, as it helps organizations and citizens stay vigilant in sensing signs of novel crises and associated market changes to take appropriate and timely adjustments to mobilize the necessary social, cultural, labor, technological, and financial resources to maintain business operations.

Second, formal governmental regulations and laws on using digital tools and devices, as well as handling big data collected at a societal level, were left behind by rapid digital transformation, which served as an immediate fix for socioeconomic damages caused by the COVID-19 breakout (He et al., 2022). As a result, within organizations, policies on self-regulating digital transformation ethically remained either vague or completely absent. Large quantities of personal data from consumers — the major target of big-data-driven digital technologies (He et al., 2022) — were exposed to the risk of abuse or misuse. Taking into consideration the renewed understanding of business sustainability, both governments and organizations must work conjointly on establishing protocols, measurements, and legal documents to ensure ethical digital transformation conduct in the long haul.

Finally, due to their digital transformation experience, especially during and after the pandemic, companies developed a better understanding of the importance of *having government involvement* in pursuit of digital transformation. During the pandemic, organizations, especially SMEs, were under extra pressure to invest in constructing or improving digital infrastructures. These organizations had to provide employees with suitable digital tools and devices, offer training to improve their digital literacy, skills, and competencies, and give them the technological and

psychological support needed for teleworking (Núñez-Canal et al., 2022; Roffia and Mola, 2022). In light of these developments, we propose companies seek governmental support in the form of financial subsidies or tax reductions to ease these pressures. Such support contributes to coordinating organizations across industries to work more efficiently with each other, making it possible for societal constructions of digital infrastructures to accommodate the crisis (Muzi et al., 2023; Song et al., 2022b). Governmental support should also help to preserve organizational digital transformation to protect business activities when future crises arise.

7. FUTURE RESEARCH DIRECTIONS

We developed a two-stage procedure to shed light on key themes that merit further investigation into digital transformation and its usefulness for addressing challenges of ongoing and other unforeseen public crises affecting businesses in the future. In the *first stage*, we systematically analyzed the future research directions provided by the 160 articles reviewed to identify key themes worth further investigation. We classified these key themes using the 5W+H (what, who, where, why, when, and how) framework proposed by Meyer et al. (2014) as a useful organizing tool to dimensionalize multilevel factors influencing the dynamics of a given research context. Specifically, we employed this framework to specify *what* digital transformation areas should be investigated (e.g., sociocultural and socioeconomic perspectives), *whom* digital transformation should be addressed to (e.g., stakeholders), *where* studies should be conducted (e.g., research scope), *why* digital transformation should be accelerated (e.g., research topics), *when* digital transformation should be used (e.g., research context), and *how* digital transformation research should be conducted (e.g., theoretical foundations and research methods) (see **Table IV**).

	What?	Who?	Where?	Why?	When?	How?
Key themes	• Dark sides of (rapid) digital transformation affect various stakeholders' social and psychological well-being. • Types of digital technologies that are critical and relevant for organizations to develop crisis management strategies, especially ones related to supply chain management, to respond timely and effectively to current and future public crises/external shocks; • The dynamics among organizations, consumers, and stakeholders that shape the progress of digital transformation at organizational, micro, meso- and macro-levels; • The normalization process of digital technologies in the post-crisis era for both individual consumption and business purposes;	• <u>Intra-organizational level:</u> - Top managers - Employees • <u>Micro-level</u> - Consumers - Suppliers - Competitors - Shareholders - Local communities - Academics • <u>Meso-level</u> - Industrial standards/norms - Industrial association • <u>Macro-level:</u> - Government, local authorities, and regulatory and legal bodies - Geographical communities	• <u>Contextual factors:</u> - Cultural dimensions, - Ethics, - Regulatory and legal dimensions - Market dynamics • <u>Socioeconomic factors:</u> - Developing countries vs. Developed Countries - Mature markets vs. Emerging markets • <u>Organizational factors:</u> - Firm size - Firm age - Business complexity - R&D expenditure - Private vs. public sectors	• Increasing business agility and resilience to unexpected public crises/external shocks in the future; • Better illuminating generalizable and comprehensive knowledge of ways for organizations to cope with crises/external shocks and facilitate business recovery after crises/external shocks; • Better understanding of downsides brought by digital transformation to consumers, employees, and other stakeholders to increase firm competitiveness and market performance; • Better guiding and regulating the digital transformation process at organizational, meso-, and macro-levels for both collective and individual well-being.	• <u>Coping with a specific crisis</u> - Pre-crisis - Peri-crisis - The recovery period of the crisis - Post-crisis • <u>Timing of digital transformation</u> - Timing of developing different types of digital technologies (first mover vs. follower) - Lifecycle of different types of digital technologies for supply chain management, internal operations, and customer experience.	• <u>Methodological related:</u> - Diversifying types of research designs (e.g., field experiments, participatory action research) - Diversifying data analysis methods (e.g., multilevel analysis, text mining) - Diversifying samples (e.g., cross-cultural, multilevel, longitudinal) and improving sampling methods • <u>Theoretical related:</u> - Integrating new theories from psychology, organizational studies, communication, consumer behavior, supply chain, and ethics; - Exploring new mechanisms of digital transformation with new mediators and moderators (positive and negative).
Possible research questions	• What are dynamic interrelationships between an organization and any one given stakeholder, with a focus on primary stakeholders (i.e., consumers, suppliers, shareholders) that contribute directly to the progress of digital transformation at different levels? • How do stakeholders at individual, organizational, meso-, and macro-levels negotiate power in the era of digital transformation and shape existing market dynamics and discourses? • How does the usefulness of different digital technologies developed on various platforms (e.g., mobile vs. computer-based; social media vs. specialized apps	• What are the positive/negative psychological, ethical, and/or social consequences that rapid digital transformation generates for consumers, employees, and local communities and businesses? • How do industry standards/norms facilitate or inhibit the progress of digital transformation in high vs. low-tech industries? • How do consumers' changing needs and preferences of using digital technologies for shopping before and after public crises generate constant challenges for supply chain management	• How do different cultural and religious traditions, values, and beliefs found in developed and emerging markets moderate stakeholders' attitudes towards or resistance to marketplace digital transformation? • How can governments in developing countries develop and implement policies in favor of digital transformation to incubate new high-tech start-ups or	• What organizational culture firms should cultivate and sustain to continue digital transformation aiming at strengthening firms' resilience to unforeseen public crises/external shocks in a long run? • What are utilitarian, functional, symbolic, cultural, and political factors that influence SMEs operating in different cultural backgrounds in making strategic decisions to accelerate their business recovery after crises? • How do government and local authorities effectively	• How do digital technologies that were developed rapidly and used extensively during public crises evolve in the post-crisis era? • What are common antecedents, precedents, mediators, and moderators of industrial and social transformations of digital transformation in pre-, peri-, or post-public crises/external shocks between developing and developed countries, and mature and emerging markets?	• What should new advanced methods be used to measure the effectiveness of digital transformation in the short term and the long term? • What are new theories that are suitable for explaining digital transformation and its impact before, during, and after crises?

	such as banking and video conferencing apps) in helping firms cope with public crisis have a long-lasting impact on a firm’s strategic decision making on its digital transformation in the post-public crisis era? • What are effective processes to permanently integrate digital technologies in post-public crisis for both individual consumption and business purposes? • How do firms and/or industries in favor of non-digitalized business models develop organizational, operational, and marketing strategies to resist digital transformation? How do public crises/shocks influence the effectiveness of these strategies over time? • How do different policies and regulations at organizational and meso-levels contribute to helping stakeholders reduce their over-reliance on digital tools that have been cultivated during public crises and minimize the psychological negative impacts of rapid digital transformation brought by public crises?	and influence firms’ decisions on digital transformation? • How do top managers’ attitudes towards the importance of employee wellbeing moderate the effect of digital transformation on firm performance and its competitive advantages? • How do public policymakers’ experiences of rapid digital transformation during public crises influence governments’ attitudes toward and policy-making actions on encouraging digital transformation at a societal level? • How do digital technologies affect consumers’ and employees’ well-being and their responsible behaviors in consumption and work respectively?	attract established ones from developed countries? • How can digital transformation be accelerated by public crises/shocks that influence labor and job markets in the short and long term (i.e., peri- vs. post-crisis)? • What are major firm characteristics facilitating or inhibiting the progress of digital transformation peri- vs. post-public crises?	regulate the transformation to protect the psychological, mental, and socioeconomic well-being of individual stakeholders, especially consumers, and employees? • What are boundary conditions that government and local authorities should investigate and understand to continuously facilitate digital transformation nationwide/industry-wide while minimizing its downsides?	• What are the lifecycles of digital technologies developed for supply chain management, internal operation, and customer experience? • How can start-up digital technology firms emerge specifically for addressing certain public crises/external shocks and strategize long-term business and marketing plans to sustain the normalization of their products/services in societies after crises?	
Proposed methods	• Diversifying primary and secondary data sources, compounded with multi-level data analysis among market actors (e.g., consumers, employees, suppliers, shareholders, firms, and governments). • Using meta-analysis to test potential mediating and moderating effects on the digital transformation process across micro, meso, and macro levels.	• Adopting experimental, longitudinal, and/or comparative research design. • Adopting qualitative case studies focusing on specific target informants. • Leveraging the availability of increasingly large and reliable databases and AI, empirical data, quantitative methods of data analysis, and mathematical modeling.	Comparison between developing and developed countries, among various industries, and among different cultural systems (e.g., Confucianism, Christianity, Islam)	• Large-scale collection of both qualitative and quantitative data from stakeholders at individual, meso-, and macro-levels across different countries. • Ethnographic research on organizational behavior and performance.	Longitudinal research design with a focus on collecting large-scale data at organizational, meso-, and macro-levels.	Theories from sociology, psychology, political studies, ethics, consumer behavior, and Consumer Culture Theories, of politics of consumption are applicable to understanding digital transformation.

Note: The table is developed based on the inputs from the future research direction section from 160 articles published from January 2020 to December 2023 and the online survey with academic experts in 2023.

Table IV. Future research agenda: The 5W+H framework

The *second stage* focused on acquiring insights from academic experts in the fields of digital transformation, innovation, management, and organizational behavior to consolidate and further develop our 5W+H framework. Surveying experts helped minimize any subjective bias from the authors of the articles reviewed, as well as validate and augment the credibility of their arguments (Li et al., 2021b). Specifically, based on the outcomes of the 5W+H framework derived from the first stage, we developed an online questionnaire with a series of open-ended questions. We deployed the questionnaire on the Qualtrics platform and distributed its link via email to 41 academics who were selected from the official websites of prominent European business schools. Among them, only 21 academics with relatively high confidence levels in the topic of digital transformation and public crises completed and returned the questionnaire, yielding a 51.22% response rate. The collected data was subsequently analyzed following systematic qualitative analysis procedures (Strauss and Corbin, 1998), entailing us to integrate the experts' vision of future digital transformation study with research directions extracted from the articles reviewed.

7.1 The What Dimension

Nearly all the experts surveyed stressed the pressing need for future research on the dark sides of rapid digital transformation on stakeholders' social and psychological well-being during and after crises. Extant studies indicate that rapid digital transformation can certainly benefit organizations in terms of increasing their competitive edge, agility, and resilience to cope with unexpected public crises. However, as mentioned earlier, digital transformation can also negatively affect different stakeholder groups, particularly consumers and employees. Future research on the intrusive negative impacts of rapid digital transformation is crucial to help policymakers develop policies and regulations at organizational, industry, and national levels to protect stakeholders' well-being (e.g., Nguyen et al., 2023). Potential research questions may include what roles governments and

organizations should play in balancing digital transformation progress and people's (especially teenagers) overreliance on or addiction to digital tools, as well as in regulating organizations' overuse of digital technologies to prevent erosion of employees' personal lives and consumer sovereignty.

To do so, in line with the studies reviewed, we consider it necessary for future research to diversify data sources, incorporating both primary and secondary data (Santos et al., 2023). On the one hand, primary data can be obtained from in-depth interviews, surveys, and experiments aiming to understand behaviors, attitudes, and motivations of individuals and organizations regarding their decision-making on and involvement in using various digital products. On the other hand, useful secondary data can be extracted from sources such as the World Health Organization's guidelines on mental health at work, white books of governments and other influential nonprofit organizations (e.g., the World Economic Forum) for public well-being and mental health, and organizational annual reports and strategic plans. These diversified primary and secondary data sources will enable multilevel data analysis on key market actors, thus helping policymakers make well-informed, balanced, and sustainable decisions on digital transformation in business activities and stakeholders' well-being.

To better navigate future empirical studies, we also call for meta-analysis research on identifying and testing digital-centered operating models, value propositions, and business models that organizations can potentially develop by leveraging digital transformations that have been accelerated and normalized during and after the public crisis. To do so, researchers can draw on the five-dimensional organizing framework presented earlier, which specifies antecedents and outcomes of firms' digital transformation amid the crisis that can be tested at micro, meso, and macro levels.

7.2 The Who Dimension

Most experts surveyed mentioned the urgent need to further examine the roles of governments, local authorities, and regulatory/legal bodies in dealing with public crises via digital transformation. As discussed earlier, state apparatuses have the decisive power of coordinating and mobilizing key market actors, such as industry associations, organizations, and consumers, to co-develop digital remedies for unexpected public crises. While some authoritarian governments (e.g., the Chinese government) strived to facilitate digital surveillance-based solutions (e.g., contact tracking) that have proved effective in containing the damage of the pandemic in the short run (Miao et al., 2021; Song et al., 2022b; Ye et al., 2022), the adoption of these digital solutions raised ethical concerns pertaining to the state's plan to extend and normalize the use of digital surveillance on business and individual conduct after crises to tighten political control over societies (Li et al., 2021a). Although prior research commonly recognized the positive outcomes of state-facilitated societal digital transformation as an effective and timely remedy for unexpected public crises, little is known about the negative ethical and social consequences generated by such rapid and ongoing digital transformation on consumers, employees, local communities, and businesses in the long run across different countries.

We propose future studies to adopt experimental, longitudinal, and comparative research designs to understand how business activities and consumer lives are shaped by political ideologies that various states hold, as well as different roles of state apparatuses in intervening in, appropriating, or politicizing the ongoing digital transformation process during and after public crises. As the experts we surveyed have pinpointed, studies could glean longitudinal data and adopt specialized quantitative data analysis methods (e.g., mathematical modeling) to project potential sociopolitical or socioeconomic changes triggered by different roles of state apparatuses.

7.3 The Where Dimension

Fifteen of the 21 experts we surveyed specified various future research directions on market dynamics amid digital transformation in public crises. As presented in our thematic analysis, the acceleration of digital transformation was attributed to the need of countries around the world to contain the unexpected and shocking COVID-19 crisis and, at the same time, organizational efforts to survive (Gavrila and De Lucas, 2022; Gharbi et al., 2022; He et al., 2023). The transformation occurred by engaging key market actors, such as consumers, private and state-owned institutions, and state agencies, across micro, meso, and macro levels of the economy (Santos et al., 2023).

Although accelerated digital transformation in the world economy was the natural outcome of combating the pandemic, there are signs that this will not slow down as demonstrated by various new developments, such as the current globally heated ChatGPT phenomenon. Hence, digital transformation should be further researched using comparative studies focusing on the highly nuanced dynamics of market actors' negotiations driven by their different agendas, priorities, and interests (influenced by idiosyncratic political, socioeconomic, and cultural factors), as well as explore how such negotiations shape the progress and directions of digital transformation locally, nationally, and globally.

7.4 The Why Dimension

Most surveyed experts suggested that further exploration of the multifaceted aspects of digital transformation and its performance implications is necessary to better guide and regulate the digital transformation process to improve both collective and individual well-being during and after crises, as well as minimize its various drawbacks. In addition, echoing our thematic analysis, most business operations significantly shrunk during the pandemic, because of a series of strict emergency lockdown policies that states across the world enforced to contain the virus (Acquila-

Natale et al., 2022; Alvarez-Torres and Schiuma, 2022). What affected businesses the most, especially those producing fast-moving consumer goods and commodities, was the sudden disruption of supply chains (Giotopoulos et al., 2022; Sharma et al., 2021). In this context, future research on strategic supply chain management (Ketchen and Craighead, 2020) and digital transformation under crises with high disruption risks is necessary. While diversifying supply chain resources and partnerships is crucial for companies to increase supply chain agility, resilience, and performance when hit by external shocks (Hu and Olivieri, 2023; Ngo et al., 2022), further investigations on better integrating different types of digital technologies into supply chain management in a long run are equally important.

Future studies should also examine how digital-aided crisis forecasting and alert mechanisms (building on, for example, big data and algorithms-enabled large-scale data collection and analysis) can help organizations capture early signs of upcoming crises to further strengthen the agility and resilience of supply chains against new external shocks. More importantly, business agility and resilience hinge on organizations' proper management of not only supply chains but also marketing, finance, and human resources (Zahoor et al., 2022). Therefore, we propose future investigations to focus on the different enabling roles of digital transformation in helping organizations and their supply chains be agile and resilient to a public crisis. In addition to large-scale data collection using both qualitative and quantitative methods, cross-disciplinary collaborations among scholars from all fields of business studies, social science, and informatics would be methodologically useful for achieving such goals.

7.5 The When Dimension

Over half of the 21 experts surveyed called for a better understanding of the life cycles of different types of digital technologies, especially in supply chain management and firms' internal

operations. From a supply chain management perspective, the sudden occurrence of the pandemic damaged supply systems the most, leading many local micro-SMEs, SMEs, and MNCs to struggle with sustainable production and productivity (Nguyen et al., 2023; Sharma et al., 2021). As discussed earlier, one cause of production difficulties was many organizations' heavy reliance on Chinese suppliers, whose manufacturing and exporting businesses were dramatically reduced by the implementation of strict mass quarantine policies. This disruption significantly shifted the landscape of global business toward reevaluating singular supplier strategies and exploring alternative supply chain solutions offered locally or in the same geographical regions (Guesalaga et al., 2023). This necessitates an in-depth investigation of the way firms develop, distribute, and promote alternative local digital business solutions to pre-emptively accommodate disruptions in their manufacturing processes. In addition, understanding the way companies capitalize on digital technologies to achieve competitive advantage requires researchers to conduct longitudinal studies tracing and capturing the dynamics between the digital technological evolution of these companies and their interplay with the governmental apparatus over time.

7.6 The How Dimension

Seventeen of the surveyed experts agreed that future studies should pay heedful attention to methodologies by diversifying types of research design to facilitate more qualitative and case-based studies. Doing so would address the unbalanced research methods of quantitative-dominated designs applied in extant studies, thus helping the field better comprehend the nuanced dynamics of digital transformation caused by the public crisis that is intertwined differently by specific sociocultural (Sermonyite-Baniule et al., 2022), economic (Iyanna et al., 2022) and political-legal (He et al., 2022; Li et al., 2021a) contexts.

Our analysis also revealed that most studies had little or no application of theories, which

is understandable because these were conducted amid the pandemic and were tasked with generating timely results to support public policymaking and companies' decision-making for survival (Gharbi et al., 2022). Given the multifaceted nature and unprecedented scale of the pandemic, assumptions underpinning existing paradigms and theories in the extant literature fall short of fully comprehending the complexities and implications of digital transformation in such an extreme event. Thus, we call for developing novel organic theories aimed at providing a more comprehensive understanding of the interplay between socioeconomic factors, geopolitics, technological advancements, and the overall reshaping of organizations, industries, and societies both during and after the crisis.

Finally, from a strategy perspective, there is a need to identify influential factors in shaping strategic decisions on further promoting comprehensive digital transformations in post-crisis eras (Zahoor et al., 2022). Such a study can be combined with an events-based approach, whereby researchers can obtain a dynamic view of how strategic decision-making on future digital transformation is shaped by a set of ongoing and evolving prehensions on events and experiences of using different digital technologies before a crisis motivated by business innovation, amid a crisis for survival, and in the anticipated future after the crisis (Hussenot and Missonier, 2016),

8. CONCLUDING REMARKS

One central conclusion is that the digital transformation landscape has been radically changed as a result of the need to accommodate the challenges of the COVID-19 crisis, introducing new ways of handling interactions at the organization-consumer, intra-organizational, organization-employee, inter-organizational, and organization-government levels. At the *organizational-consumer level*, consumers have had greater involvement in online shopping, required greater privacy and safety in their digital transactions, and appreciated organizational efforts made to

sustain their lives by urgently converting daily consumption from offline to online. Regarding *intra-organizational interactions*, there has been a high increase in IT infrastructure and cybersecurity, the adoption of digital technology-based employee training, and the cultivation of a digital-innovative leadership and data-driven management style. For *organization-employee interactions*, there has been a deeper involvement of employees in digital literacy training, efforts to enhance work-life balance, and awareness of the crucial roles of digital communication and collaboration in sustainably improving employee productivity and performance outcomes in teleworking. At the *inter-organizational level*, we have witnessed the development of strategies facilitating digital information sharing with supply chain partners to improve collective business resilience. Finally, with regard to *organization-government interactions*, there has been closer cooperation between private and public sectors in timely developing digital solutions to contain the spread of the virus during the pandemic and in continually improving societal IT infrastructures to further facilitate e-government services after the pandemic. Overall, our study has underscored the importance of digital transformation as a strategic imperative for organizations and societies to cope with ongoing and future public crises. Our analysis is expected to fuel further research that will leverage the transformative power of digital technologies to cultivate more resilient businesses, responsive economies, and inclusive societies in the years ahead.

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