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To cite this article: Gaffar Hafiz Sagala & Dóra Óri (26 Aug 2024): Exploring digital transformation strategy to achieve SMEs resilience and antifragility: a systematic literature review, Journal of Small Business & Entrepreneurship, DOI: [10.1080/08276331.2024.2392080](https://doi.org/10.1080/08276331.2024.2392080)

To link to this article: <https://doi.org/10.1080/08276331.2024.2392080>



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Published online: 26 Aug 2024.



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Exploring digital transformation strategy to achieve SMEs resilience and antifragility: a systematic literature review

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ABSTRACT

Nowadays, the business environment has become more dynamic, making survival issues more challenging for small and medium enterprises (SMEs). Academic literature proposes digital transformation as a facilitator for SMEs to generate resilience and antifragility to overcome this challenge. However, SMEs need appropriate strategies to be successful in their digital transformation journey. This study aims to construct a digital transformation strategy framework for SMEs to generate resilience and antifragility. We use systematic literature review (SLR) to capture critical knowledge from the published literature. The primary articles were analyzed using thematic analysis with Wolcott's (1994) procedure to construct the framework based on the primary studies. We found the critical values SMEs need to achieve successful digital transformation, including dynamic capabilities, digital capability, digital inclusion, leadership orientation, learning and knowledge management, and collaboration. However, SMEs need a deeper level of learning, higher digital capability, flexibility, and agility to be antifragile. Furthermore, we found that dynamic capabilities are the leading theory used to describe and investigate how a firm generates successful transformation. Finally, this study proposes a conceptual framework for digital transformation strategies to generate SME resilience and antifragile by connecting theory and practical concepts. It also suggests future research agendas.

RÉSUMÉ

De nos jours, l'environnement commercial est devenu plus dynamique, ce qui rend les questions de survie plus ardues pour les petites et moyennes entreprises (PME). La recherche propose la transformation numérique comme un moyen pour les PME de générer de la résilience et de l'anti-fragilité afin de surmonter ce défi. Les PME ont toutefois besoin de stratégies appropriées pour réussir leur parcours de transformation numérique. Cette étude vise à construire un cadre stratégique de transformation numérique pour que les PME génèrent de la résilience et de

ARTICLE HISTORY

Received 6 May 2024
Accepted 10 August 2024

KEYWORDS

SME; digital transformation; digital strategy; resilience; antifragility; information systems; small business

MOTS-CLÉS


PME; transformation numérique; stratégie numérique; résilience; anti-fragilité; systèmes d'information; petites entreprises

SUBJECT

CLASSIFICATION CODES

M15; L26; D81

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/08276331.2024.2392080>.

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l'anti-fragilité. Nous employons la méthode de la revue systématique de la littérature pour saisir les connaissances critiques émanant de la littérature publiée. Les articles principaux ont été analysés de manière thématique selon la méthode de Wolcott (1994) afin de construire le cadre sur la base des études principales. Nos travaux révèlent les valeurs essentielles dont les PME ont besoin pour réussir leur transformation numérique, notamment les capacités dynamiques, les capacités numériques, l'inclusion numérique, l'orientation du leadership, l'apprentissage et la gestion des connaissances, ainsi que la collaboration. Cependant, pour être anti-fragiles, les PME doivent faire preuve d'un niveau d'apprentissage plus approfondi, d'une plus forte capacité numérique, de flexibilité et d'agilité. En outre, nous avons constaté que la principale théorie utilisée pour décrire et étudier la manière dont une entreprise gère une transformation réussie repose sur les capacités dynamiques. Enfin, cette étude propose un cadre conceptuel pour les stratégies de transformation numérique visant à générer la résilience et l'anti-fragilité des PME en reliant la théorie et les concepts pratiques. Elle suggère également de futurs programmes de recherche.

Introduction

Research related to digital transformation (DT) in Small and Medium Enterprises (SMEs) has grown significantly. According to the Scopus database, the 'digital transformation AND SME' keyword combination results in more than 900 articles in the related fields (Accessed from scopus.com, date: April 29th, 2024). Research related to that topic has continuously increased since 2017. Several literature reviews relating to this topic have also already been published. Previous literature reviews have proposed an integrative framework of managerial dimensions and strategic change that is critical to the success of digital transformation (Ben Slimane, Coeurderoy, and Mhenni 2022), a state-of-the-art digital value creation, and verified added values regarding financial and strategic digital benefits (Pfister and Lehmann 2021), critical factors of digital transformation among SMEs based on triple bottom line dimensions (economic, environmental and social aspects) (Philbin, Viswanathan, and Telukdarie 2022), and the concept of human and non-human components as the determinants of digital transformation to allow or threaten it (Feliciano-Cestero et al. 2023). However, those literature reviews have not yet discussed the survivability issues of SMEs. In fact, SMEs are struggling to face their dynamic competition, which threatens their survival. At the same time, SMEs are the backbone of countries' economic development worldwide (WEF 2022).

According to the World Economic Forum (WEF 2022) and OECD (OECD 2016), 67% of SMEs are fighting for survival, and more than 50% have failed in five years. Previous studies argue that markets are becoming more competitive and dynamic, giving SMEs more challenges to survivability (Corvello, Felicetti, et al. 2023; Troise et al. 2022). Later research found that SMEs should have resilience or antifragility capability to survive in the current competitive environment (Corvello, Verteramo, et al. 2022, 2023; Ramezani and Camarinha-Matos 2019). Resilient SMEs can absorb

shock in their business environment, which helps them to recover after several changes they have made in their business (Corvello, Felicetti, et al. 2023). In a more excellent state, SMEs that can absorb the shocks, turn them into opportunities, and shift to better business performance are categorized as antifragile (Corvello, Verteramo, et al. 2023; Ramezani and Camarinha-Matos 2019; Taleb 2012). Therefore, we argue that resilience and antifragility are the areas that need further investigation to give a more comprehensive understanding of the value of digital transformation in the SME context.

Previous studies indicated that digital transformation could help SMEs to generate their resilience and antifragility (Aghazadeh et al. 2023; Corvello, De Carolis, et al. 2022; Dluhopolskyi et al. 2023; Lathabhavan and Kuppusamy 2023; Sulastris et al. 2023). Mustafa et al. (2021) argued that researchers should reconsider creativity and digitalization for business survival. Furthermore, Elia, Margherita, and Secundo (2021) found that firms that leverage digital technologies are more likely to have excellent performance regardless of firm size through undertaking a digital strategy than firms relying on a traditional strategy. Innovation and digital technology are found to be essential drivers of SMEs' agility (Jafari-Sadeghi et al. 2023). In this case, agility could make companies flexible and speed up decision-making, which is needed in the current competitive environment (Han and Trimi 2022; Jafari-Sadeghi et al. 2023). Digital technology helps SMEs to transform their obsolescent business processes, develop their adaptive capabilities, and generate resilience against environmental volatility by regularly developing (Ates and Acur 2022).

Indeed, several SMEs have succeeded in exploiting digital tools to improve their business and gain a competitive advantage (El-Haddadeh 2020; Troise et al. 2022). However, most are stagnant and struggling to succeed in their digital transformation projects (Corvello, Felicetti, et al. 2023; Troise et al. 2022). Becker and Schmid (2020) found that SMEs did not always have planned strategies for digitizing their businesses. Other research found that many SMEs cannot deal with digital business models because they were not initially designed to scale that way, and it is challenging to manage the shift to that scale (Mika Westerlund, 2020). Therefore, SMEs need a well-designed strategy for a holistic and successful digital transformation. However, Ates and Acur (2022) argued that there is a lack of conceptual clarity on the notion of obsolescence and the means of avoiding it. Besides, SMEs face a series of difficulties from interrupting their operations, which has caused severe liquidity problems, risking their business continuity and maintaining jobs (Rodrigues et al. 2021). In addition to carefully developing digital strategy and innovation planning, SMEs should carefully identify and measure the need for investment in information and communication technology (ICT) infrastructure (Roman and Rusu 2022).

According to previous literature, strategizing of digital transformation among SMEs is under-researched. At the same time, SMEs are facing difficulties in executing effective digital transformation due to the lack of knowledge and literacy. Whereas digital transformation is a probable exit door to solve survivability issues. Lang et al. (2023) argued that SME entrepreneurs should develop digital transformation programs at the strategic level. Therefore, this study aims to construct digital transformation strategy frameworks for SMEs to generate resilience and antifragility. Casalino

et al. (2019) argued that it is essential to strategize digital transformation to improve digital resilience which is a critical factor for the success of SMEs. Digital resilience needs to be embedded as an integral part of the strategy and mission of SMEs (Casalino et al. 2019). Neirotti and Pesce (2019) found that SMEs can rarely take advantage of their ICT-based innovation to start high-growth phenomena. Besides, the view regarding digital technologies as one of the enablers of antifragility is limited and probably misleading (Corvello, Verteramo, et al. 2022).

This study seeks to deliver a bridge of theoretical concepts and strategic implications that are beneficial to guiding SMEs in taking advantage of digital transformation to succeed. Appropriate digital transformation could help SMEs turn challenges into opportunities and then achieve competitiveness and, in turn, become resilient entities, even antifragile (Akpan, Effiom, and Akpanobong 2023; Corvello, Straffalaci, et al. 2022). To achieve the current study objectives, we formulate the following research questions to answer:

RQ1: According to the primary literature, how could SMEs exploit digital transformation strategy to achieve resilience and antifragility?

RQ2: According to the primary literature, what is the leading theory generally used to describe digital transformation strategy to achieve resilience and antifragility?

RQ3: According to the primary literature, what is the conceptual framework of a digital transformation strategy to achieve SME resilience and antifragility?

Previous studies have already done a literature review related to SME resilience. Akpan, Effiom, and Akpanobong (2023) have explored a knowledge base of COVID-19 survival techniques and post-pandemic sustainable growth strategies among SMEs. Furthermore, Costa and Castro (2021) have identified strategic options and guidelines for a smooth digital transition among SMEs. Klein and Todesco (2021) have discussed how a knowledge management strategy could start from a resilience strategy to assist SMEs in seizing digital transformation opportunities. Razavi Hajiagha et al. (2023) have identified the influential factors affecting SMEs' international performance and digital resilience. In contrast to the above studies, this study adds value in proposing a conceptual framework connecting theoretical foundations to the strategic and operational level of digital transformation to achieve resilient and antifragile business. This study could help SMEs operationalize the related theory to the appropriate digital transformation strategy. This study also considers resilience and antifragility to indicate successful transformation in the current dynamic business environment. We argue that resilience and antifragility are the relevant indicators in referring to the SME's survivability issues and the targeted benefit of digital transformation to solve them.

The rest of this article is organized as follows: First, after the motivation statement and research objectives, we explain the method used for this research. Furthermore, we discuss our findings and the proposed conceptual framework. The final part of the study is the conclusion and the future research agenda.

Research method

Systematic Literature Review (SLR) is a practical approach for conducting theoretical reviews based on scientific evidence from published literature with systematic

procedures so it can minimize bias (Cook, Mulrow, and Haynes 1997; Tranfield, Denyer, and Smart 2003). This approach has been commonly used in the information systems fields and is even recommended to gain a comprehensive understanding of emerging conceptions (Okoli 2015; Webster and Watson 2002). The SLR in this research focuses on developing holistic and coherent theoretical concepts by summarizing evidence, identifying methodological gaps in primary articles, and providing a framework for future research endeavors (Fink 2019; Okoli 2015; Webster and Watson 2002). To operationalize those objectives, we applied a qualitative approach, including coding and thematic analysis, to identify critical variables rather than categorizing them into several relevant themes. This approach is practical in constructing knowledge maps and structured frameworks regarding SMEs' digital transformation strategy (Lucas et al. 2007; Patel et al. 2017; Ward, House, and Hamer 2009). We used credible intellectual works as sources of knowledge and extracted them to capture a comprehensive concept of the relation of the digital transformation strategy, resilience, and antifragility among SMEs (see: Lucas et al. 2007; Ward, House, and Hamer 2009).

Article selection protocol

In general, we used the Scopus databases to collect the primary literature. Scopus is one of the most extensive and credible academic databases listing reputable publishers and journals. Furthermore, we limited the literature sources only to journal articles. According to González-Albo and Bordons (2011), journal articles are more complete research reports and influential research than proceeding papers. Therefore, we focused on the literature source only on journal articles. We also limited the subject area for the 'Business, Management, & Accounting' field to manage the relevancy. Finally, inclusion and exclusion criteria were applied to select relevant primary articles according to the research objectives.

The article collection in this SLR was done three times: first, to collect articles on SMEs' digital transformation strategy; second, to collect articles on SMEs' resilience; and third, to collect articles on SMEs' antifragility. We used different search keys for each article collection while using the same inclusion and exclusion criteria for each database. Furthermore, the selection protocol consisted of three phases. The first phase was the article collection process. The setting of the search key did selection in this phase. The difference between each search key was the combination of keywords, which is 'SMEs AND digital transformation', 'SMEs AND digital transformation AND resilience', and 'SMEs AND antifragility'. Furthermore, we used similar inclusion criteria by including only journal papers in 'Business, Management, & Accounting' field and English language in the article collection. We applied inclusion and exclusion criteria in the second phase through abstract reading. In the first phase, we collected 492 articles on SMEs' digital transformation strategy, 36 articles on SME resilience, and six articles on SME antifragility. In the second selection phase, we applied inclusion and exclusion criteria by abstract reading. We focused the inclusion criteria on articles that discuss strategy issues. In this phase, we collected 97 articles on SMEs' digital transformation strategy, 22 articles on SME resilience, and three

articles on SME antifragility. Finally, we applied further exclusion criteria in the third phase by reading the full paper. The focus of the exclusion criteria was on excluding articles that did not contain specific and detailed explanations about the particular strategy of digital transformation in SMEs or practical concepts. This final phase left 58 articles on SMEs' digital transformation strategy, 22 on SME resilience, and three on SME antifragility. Table 1 and Figure 1 summarize the article selection protocol.

Coding and analysis technique

We used a qualitative approach to the primary studies to identify the shared quotes and categorize them into themes. In general, we used thematic analysis to identify the critical variables regarding SMEs' digital transformation strategy, resilience, and anti-fragility, categorizing them into themes and reconstructing them into a conceptual

Table 1. Article selection protocol.

No.	Selection Protocol		
	Digital Transformation Strategy	SMEs Resilience	SMEs Antifragility
1.	Article collection (<i>search code</i>): (TITLE-ABS-KEY (sme OR smes OR "small business" OR "micro enterprise" OR "small medium enterprise" OR "small medium enterprises") AND TITLE-ABS-KEY (digitalisation OR digitalization OR "digital transformation")) AND (LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English"))	(TITLE-ABS-KEY ("small-medium enterprise" OR "small-medium enterprises" OR "small business" OR sme OR smes) AND TITLE-ABS-KEY ("digital transformation" OR digitalization OR digitalisation) AND TITLE-ABS-KEY (resilience)) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "ECON"))	(TITLE-ABS-KEY (sme OR smes OR "small business" OR "micro enterprise" OR "small medium enterprise" OR "small medium enterprises") AND TITLE-ABS-KEY (antifragility OR anti-fragile OR "anti-fragile")) AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English"))
	N = 492	N = 36	N = 6
2.	Abstract reading (<i>inclusion and exclusion criteria</i>) <i>Inclusion criteria</i> 1. Investigate the determinants of the initiation or success of digital transformation among SMEs. 2. Investigate strategic issues of digital transformation among SMEs. <i>Exclusion criteria</i> 1. Investigating external factors and/or regulation independently (without a strategic response from SMEs).		
	N = 97	N = 22	N = 3
3.	Full paper reading (<i>inclusion and exclusion criteria</i>) <i>Exclusion criteria</i> 1. Not specific and detailed explanation of the particular strategy of digital transformation in SMEs. 2. Using broad terminology and not practical concepts.		
	N = 58	N = 22	N = 3

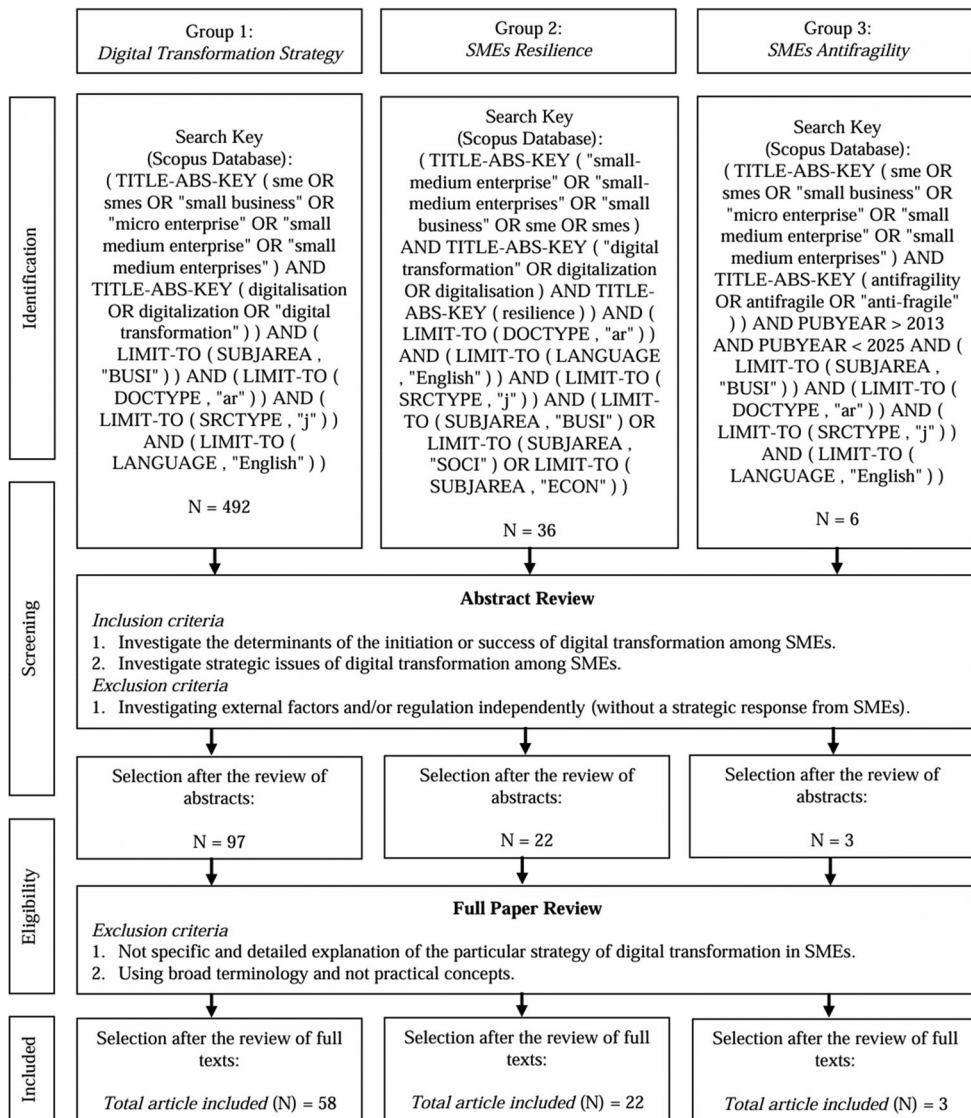


Figure 1. Article selection diagram.

framework (Ben Slimane, Coeurderoy, and Mhenni 2022; Lucas et al. 2007). We reconstructed the findings into a structured conceptual framework referring to the theoretical foundation mentioned in the primary literature. The result of the analysis was presented separately in tables and a figure. We used Wolcott’s (1994) procedure to analyze the primary literature. Wolcott’s (1994) procedure is simple and focuses on forming a conception from the primary studies (Creswell and Poth 2016). The analysis phases include:

1. Sketching ideas from the primary studies. In this phase, we identified and noted the research findings of each primary article. This phase was useful for collecting,

- summarizing, and understanding the main research findings of all primary articles. The results of this phase are presented in [Appendix 1](#), [Appendix 2](#), [Appendix 3](#);
2. Coding, condensing, and reducing information to identify patterns and themes. In this phase, we gave code to research findings that have similar contexts and related concepts to each other. After that, we categorized each finding according to the code, grouping them and giving the themes. In the final step, we extracted it into keywords that represented the findings. The results of this phase are presented in [Table 3](#), [Table 4](#), and [Table 5](#);
 3. Contextualising and constructing the framework from the primary literature. According to the themes and code, we contextualized the framework by categorizing it into three layers, including theoretical foundation, operational aspect, and strategic aspect. We constructed the framework by referring to the primary article's findings and distributing it into steps of digital transformation strategy towards resilience and antifragility.
 4. Displaying findings in tables and figures. The identified themes and keyword findings were presented in tables, and the conceptual framework was presented in a figure.

Results and discussion

Demography of primary articles

First, we identified the country of origin of primary studies. This demography helps see which country significantly contributes to the research related to SMEs' digital transformation strategy, resilience, and antifragility. This information is also useful for understanding which region's current evidence exists and potential areas that need further research. According to the tabulation presented in [Appendix 4](#), [Appendix 5](#), and [Appendix 6](#), Italy is the country most used as a research subject in digital transformation strategy, with 12 primary studies. Furthermore, for SME resilience research, India is more used as a research subject than other countries, with three articles, and for SME antifragility, Italy is the only subject that has already been researched. According to the continent, European countries are mostly used as subjects for SMEs' DT strategy, while for SMEs, resilience related to DT is mostly researched in the Asian continent.

Furthermore, we tabulated the demography of the research method used by the primary articles. This demography helps to identify the maps of methods that are commonly used in the related field and what kind of methods are potentially used for further research avenues. The summary of the research method tabulation is presented in [Table 2](#). In the SMEs DT strategy group, 31 primary articles used a quantitative approach, while 27 used a qualitative one. A case study is mainly used in qualitative articles. The survey method with structural equation modeling (SEM) technique is the standard method used in the quantitative literature. The same pattern also exists in SMEs' resilience. Case study is the most common method used in qualitative articles, and survey with SEM is the most common method used in quantitative articles. Furthermore, four primary articles in the SMEs resilience group used

Table 2. Summary of research method tabulation.

No.	Research Method	Technique	n (Based on Primary Articles Group)		
			SMEs DT Strategy	SMEs Resilience	SMEs Antifragility
1	Qualitative	Action Research	1	1	–
		Case Study	12	3	–
		Multiple Case Study	7	–	3
		Narrative	3	–	–
		Grounded Theory	3	1	–
		Ethnography	1	–	–
		Fuzzy-set Qualitative Comparative Analysis (fsQCA)	1	–	–
		Literature Review	–	3	–
		Total	27	8	3
		2	Quantitative	Survey (questionnaire)	
Cross-tabulation	1			–	–
ANOVA	1			–	–
Factor Analysis	1			1	–
SEM	10			9	–
Regression Analysis (Parametric & Non-Parametric)	15			1	–
Fuzzy interpretative structural modelling (F-ISM)	–			1	–
Design Research	1			–	–
Secondary Data	–			–	–
Regression Analysis	1			1	–
Bibliometric Analysis	–	1	–		
Total	31	14	–		

Source: Summary of [Appendix 4](#), [Appendix 5](#), and [Appendix 6](#).

a literature review approach three of them using SLR while the rest used bibliometric analysis. However, there is still a rare study investigating SMEs’ fragility, and all the articles that exist use case studies.

Thematic analysis

According to the thematic analysis of the primary study, we extracted them into five themes for the Digital Transformation Strategy group of primary articles, including 1) dynamic capability, 2) learning, digital capability, and alignment, 3) entrepreneurship ecosystems and collaboration, 4) need assessment, and 5) leadership orientation and decision making. For the SME resilience group of primary articles, we also extracted them into five themes, including 1) dynamic capability & change management, 2) knowledge management, learning, and frugal innovation, 3) digital literacy and digital inclusion, 4) leadership (paradoxical and situational), and 5) collaboration. Furthermore, we only extracted the SMEs antifragility group of the primary articles into a single theme due to the limited study in this area. The theme is collaboration. Factually, most of the identified themes of digital transformation strategy and SME resilience group have the same meaning, like dynamic capabilities, digital capability and digital inclusion, leadership orientation, learning and knowledge management, and collaboration. These findings indicate that the value of successful SMEs is the same for digital transformation cases, resilience cases, and antifragility cases. SMEs

Table 3. Keywords of digital transformation strategy.

No	Themes	Keywords	Primary Studies
1	Dynamic Capability	Orchestration new meaning, multidimensional dynamic capability, niche dynamic adjustment, developing dynamic capability.	Garzoni et al. (2020); Soluk and Kammerlander (2021); Garbellano and Da Veiga (2019); Khurana et al. (2022), Zhang et al. (2022); Oliveira et al. (2021); Guo et al. (2020)
2	Learning, Digital Capability, and Alignment	Learning capabilities, internal digital capabilities and readiness, referencing level of digitalization, step-by-step development, incremental digital tools, aligning digital capability, agile and adaptive modes, innovative culture.	Matarazzo et al. (2021); Zangiacomì et al. (2020); Olsson and Bernhard (2021); Gavriła and de Lucas Ancillo (2021) Cenamor et al. (2019); Del Guidice et al. (2021); Cassetta et al. (2020); Müller et al. (2021); Scuotto et al. (2021); Rozak et al. (2023); Jun et al. (2022); Rupeika-Apoga et al. (2022); Riera and Iijima (2019); Troise et al. (2022); Ukko et al. (2019); Eller et al. (2020); Nasiri et al. (2020), Denicolai et al. (2021)
3	Entrepreneurship Ecosystems and Collaboration	Business community as knowledge sources, collective capacity, strategic relationship, partnership, collaboration, engagement, empower, knowledge synergy, co-creation, creating value, multi-stakeholder cooperation.	Crupi et al. (2020); Beliaeva et al. (2020); Han and Trimi (2022); Mandviwalla and Flanagan (2021); Balta et al. (2021); Kolagar et al. (2021); Arcidiacono et al. (2019); Nudurupati et al. (2022); Pisoni (2021); Ricci et al. (2021); Chierici et al. (2020); Sassanelli and Terzi (2022); Rupeika-Apoga et al. (2022); Lassnig et al. (2018)
4	Need Assessment	Identifying areas for improvement, evaluating planned investment, refocus, matched, assessing-conveying-exploring-decision making, data as driver.	Kääriäinen et al. (2021); Depaoli et al. (2020); Reim et al. (2022); Andersen, Aagaard, and Magnusson (2022); Lee et al. (2021); Kamble et al. (2020); Gaglio et al. (2022); El-Hilali et al. (2020)
5	Leadership orientation and decision-making	New leadership style, intricate tensions, sense-making, agile and flexible, fast response, innovation orientation, willingness to change, digital leadership culture, positive attitude.	Bencsik (2020); Yu et al. (2022); Cobelli and Chiarini (2020); Fachrunnisa et al. (2020); Peter et al. (2020); Chatterjee et al. (2022); Pappas et al. (2021); Scuotto et al. (2020); Scuotto et al. (2022); Lorente-Martinez et al. (2020); Bollweg et al. (2020)

Source: Summary of Appendix 1.

that have that value and can operationalize that value on their strategy will be successful during the digital transformation journey and then gain resilience and antifragility. However, we also found several practical differences regarding the strategy SMEs should have to gain resilience and antifragility through digital transformation. The differences are in the level of agility, leadership capacity, and learning capacity. In the next section, we summarize the findings according to the identified themes.

Digital transformation strategy

Dynamic capability

Soluk and Kammerlander (2021) found that digital transformation requires a series of processes that change the processes, products, and services of the SME business model. This process requires the creation of new value within the company (Garbellano and Da Veiga 2019). Therefore, SMEs must build their *dynamic capability* to optimize enablers, control barriers, and break the boundaries to achieve value

Table 4. Keywords of SMEs resilience strategy.

No	Themes	Keywords	Primary Studies
1	Dynamic Capability & Change Management	Non-cognitive dynamic capabilities, second-order dynamic capabilities, change management.	Ates and Acur (2022); Kala Kamdjoug (2023); Khurana et al. (2022)
2	Knowledge Management, Learning, and Frugal Innovation	Entrepreneurial competencies, knowledge intensive, education and training, frugal innovation.	Al Omoush et al. (2023); Hrivnák et al. (2021); Klein and Todesco (2021); Kumar et al. (2023); Lang et al. (2023)
3	Digital Literacy and Digital Inclusion	Technology adoption and exploitation, digital capability, digital business maturity, digital training, user-generated content, user experience tracking, digital finance inclusion.	Aghazadeh et al. (2023); Costa and Castro (2021); Dluhopolskyi et al. (2023); Lathabhavan and Kuppusamy (2023); Spremić et al. (2022)
4	Leadership (paradoxical and situational)	Situational leadership, paradoxical leadership, internal resources, aligning, organizational culture, stakeholder governance, human capital management, atom enabler, willingness, entrepreneurship synergy.	Akpan et al. (2023); Astuty et al. (2024); Awad and Martín-Rojas (2023); Isensee et al. (2023); Ragazou et al. (2022); Trieu et al. (2023); Žebryte et al. (2019)
5	Collaboration	Strategic collaboration, collaboration capability, customer intimacy, agile, innovation value.	Eriksson et al. (2022); Sulastri et al. (2023)

Source: Summary of Appendix 2.

Table 5. Keywords of SMEs antifragility strategy.

No	Themes	Keywords	Primary Studies
1	Collaboration (<i>for research and innovation processes and slack financial resources</i>)	Collaborative network, digital technology, research and innovation process, research institution, slack financial resources, strategic and operational agility.	Corvello, Verteramo, et al. (2022); Corvello, Straffalaci et al. (2022); Corvello et al. (2023)

Source: Summary of Appendix 3.

creation and then achieve resilience (Guo et al. 2020; Khurana, Dutta, and Singh Ghura 2022; Soluk and Kammerlander 2021). In this regard, Garzoni et al. (2020) proposed that SMEs gradually increase their digital engagement through digital awareness, digital inquiry, digital collaboration, and digital transformation. Each level, of course, requires a different strategy to be executed, but in principle, SMEs must pay attention to the digital tools that will be used, what resources they already have, the digital innovation that they need, and the networks that can be accessed to help the transformation process (Garzoni et al. 2020; X. Zhang, Gao, and Zhang 2022). In gradual innovation, SMEs can execute it with dynamic niche adjustments, such as niche expansion, niche dislocation, and niche construction (Zhang, Gao, and Zhang 2022). In this way, SMEs can also gradually amplify their autonomy and reduce external dependencies through developing processes, internalizing new functions, or investing in product development (Oliveira, Fleury, and Fleury 2021).

Learning, digital capability, and alignment

To make digital instruments contribute to business model innovation and value creation, SME owners and managers must be able to sense and constantly learn new digital and business skills (Cassetta et al. 2020; Denicolai, Zucchella, and Magnani 2021; Matarazzo et al. 2021; Nasiri et al. 2020; Olsson and Bernhard 2021). SMEs can learn from the existing literature, current challenges, their own experience, and best practices from other successful companies and then use them as references to develop digital transformation strategies (Zangiacomì et al. 2020). Specifically, Olsson and Bernhard (2021) argued that learning by doing, informal learning, and step-by-step self-development were critical to generating business growth and competitive advantage. This process should be applied in parallel with the dynamic capability in digital transformation phases. SMEs should deal with learning and relearn activity during digital transformation phases. Consistently, incremental digital tools or niche innovation could be a solution to starting digital transformation, which is planned to achieve long-term survival in the business competition (Gavrila and de Lucas Ancillo 2021).

Cenamora, Parida, and Wincent (2019) found that SMEs should be concerned with aligning digital capability with their business orientation. The targeted digital tool to invest in should align with the service demands the company plans to supply. Furthermore, Del Giudice et al. (2021) found that agile and adaptive modes are core elements that create innovation processes. In this case, SMEs should learn how technologies can enhance customer centrality, ensuring a sustainable and unique selling proposition, and understanding to resolve various technological issues to help SMEs improve their alignment, adaptivity, and agility (Del Giudice et al. 2021; Denicolai, Zucchella, and Magnani 2021; Eller et al. 2020; Troise et al. 2022). Adaptive and agile SMEs could be able to be resilient and even improve their operational capacity and generate financial performance even during volatility (Eller et al. 2020; Ukko et al. 2019).

In a formal concept, Müller, Buliga, and Voigt (2021) proposed an absorptive capacity process through the acquisition, assimilation, transformation, and exploitation of knowledge from the environment to enable companies to explore and exploit innovation strategies. Learning would improve absorptive capacity, which, in turn, would improve SMEs' internal digital capabilities to respond to market changes and stimulate continuous innovation (Riera and Iijima 2019; Scuotto et al. 2021). SMEs with appropriate digital skills, digital literacy, and improvisational capability will be able to face increasingly complex and interactive tasks that demand the use of ICT, social media engagement, and organizational agility (Jun et al. 2022; Rozak et al. 2023; Rupeika-Apoga, Petrovska, and Bule 2022; Scuotto et al. 2021)

Entrepreneurship ecosystem and collaboration

SMEs need to engage in the business community. The business community can benefit SMEs as the knowledge source that facilitates community members to execute digitalization through collaboration (Crupi et al. 2020). The business community can play a role as innovation ecosystems that help SMEs develop their ability to adapt and create value by configuring internal and external resources from strategic relationships (Beliaeva et al. 2020). SMEs need a depth of collaboration in the digital transformation process to understand firm and industry needs of digital services or

products and to create mutual trust among the parties (Ricci, Battaglia, and Neirotti 2021). In this case, the business community could facilitate a network for collaboration. That collaborative network gives SMEs an alternative to flexible and interoperable strategy, fostering digital platform adoption, creating multiple inter and intra-communications, favouring resource exchange, and developing joint services (Sassanelli and Terzi 2022). It is essential because SMEs need various kinds of assistance to solve their limitations to cope with digital transformation (Rupeika-Apoga, Petrovska, and Bule 2022). Companies should consider unique strategies referring to their enablers, sets of connections between parties, technology integration, and shared platforms to facilitate effective collaboration (Beliaeva et al. 2020; Han and Trimi 2022). In this case, digital technology would facilitate effective collaboration and engagement among the SME business community (Mandviwalla and Flanagan 2021). Digital technology enables stakeholder empowerment and encourages interaction and co-creation of value (Balta et al. 2021). Besides, each party must have knowledge synergy, knowledge integration, and value co-creation (Kolagar et al. 2021). Furthermore, Kolagar et al. (2021) proposed three strategic frameworks to execute effective collaboration: digital servitization innovation strategy, ecosystem strategy, and scaling strategy.

Alternative collaboration strategies that are probably applied are long-term partnerships with suppliers of digital technologies, internal collaboration with the involvement of workers in technological change, and engaging customers to stimulate internal innovation by creating new product value (Arcidiacono et al. 2019; Pisoni 2021). SMEs could exploit those strategies separately or simultaneously. This type of collaboration could help SMEs solve their limited analytical skills, digital skills, and technological expertise (Nudurupati et al. 2022). Besides, Nudurupati et al. (2022) argued that multi-stakeholder cooperation enables circular economy adoption and improves collective competitive advantage. Chierici et al. (2020) found that the spread of resources and the sharing intensity contribute to the collective capacity of SMEs to innovate, indicated by the greater use of digital tools. Therefore, SMEs must better engage with their partners regarding digital transformation to support their digital readiness checks, benchmarking, identifying the company's needs, solving their limitations, and developing a digital transformation strategy (Lassnig et al. 2022).

Need assessment

Reim et al. (2022) argued that there is no 'one-fits-all' solution for digital transformation strategy. Therefore, digitalization activities should match and refocus on business needs, challenges, resource availability, organizational capabilities, and communication requirements (Depaoli, Za, and Scornavacca 2020; Reim et al. 2022). Kääriäinen et al. (2021) developed a free access tool named ApuaDigiin.fi to help SMEs analyze their digitalization status and identify areas for improvement. Digital tools to measure the digital readiness of SMEs and assess the need for improvement are valuable to help SMEs understand their business circumstances and plan appropriate digital transformation strategies. Andersen, Aagaard, and Magnusson (2022) proposed process activities that are needed before making a decision, including (1) assessing new opportunities, (2) conveying a sense of urgency, (3) exploring and

experimenting with new opportunities, and (4) making decisions based on data, analysis results, and intuition. Data, customer preference, and planned innovation are drivers that companies should work on during digital transformation (El Hilali, El Manouar, and Janati Idrissi 2020). Regarding the areas to improve, Lee, Falahat, and Sia (2021) proposed areas that should become fundamental forces for SMEs, that is, 1) sales, 2) marketing, 3) process improvement, and 4) product development. For the planned investments, SMEs should evaluate cost, quality, flexibility, time, integration, optimized productivity, real-time diagnosis & prognosis, computing, and social and ecological sustainability (Kamble et al. 2020). Regarding the digital tools planned to invest in, SMEs must consider the types of digital technologies most accessible and beneficial to small firms (Gaglio, Kraemer-Mbula, and Lorenz 2022).

Leadership orientation and decision making

Bencsik (2020) found that SME managers tend to postpone human development decisions and focus more on technical development. The severe task in digitalization is human development. In this case, managers have not arranged new leadership styles for changes to the digital future (Bencsik 2020). Therefore, leadership style and orientation should be other concerns for SMEs during digital transformation. Digital leadership and culture are critical instruments that operate all the drivers of digital transformation (Peter, Kraft, and Lindeque 2020). Chatterjee (Chatterjee et al. 2022) and Lorente-Martínez, Navío-Marco, and Rodrigo-Moya (2020) found that the willingness to change and attitude toward the technology of the SME leader significantly impact corporate digital entrepreneurship. Indeed, Yu, Fletcher, and Buck (2022) found that the complexity of digital transformation may escalate due to intricate tensions between strategic digital transformation and new product development.

SMEs feel that high uncertainty due to a lack of available resources, low perception of external pressures, low intentions to use, and low current digitalization use results in ambiguity regarding what to do and where to begin the digital transformation (Bollweg et al. 2020). Therefore, SME leaders need to make sense-making to improve their leadership and decision-making quality, such as 1) confusion to confidence, 2) suspicion to trust, 3) frustration to education, and 4) mistrust to cooperation (Cobelli and Chiarini 2020). Regarding the decision-making process, Pappas et al. (2021) found four types of decision-making among SMEs, including 1) rational through risks and opportunities evaluation; 2) enthusiast through highlighting transformation benefits to gain a competitive advantage; 3) cautious through emphasizing risks and barriers; and 4) futurist through considering future technological necessities. In this case, a positive attitude and leader orientation are critical to their decision-making quality to intercept disruptive technologies and optimize investments (Bollweg et al. 2020; Scuotto et al. 2022). Furthermore, the cognitive dimension, research-based decision-making, and knowledge transfer practices are needed to manage leader innovation orientation (Scuotto et al. 2022). Additionally, Fachrunnisa et al. (2020) proposed agile leadership and strategic flexibility as keys to success in implementing digital transformation. The fast response of the leader, followed by strategy flexibility plays a significant role in digital transformation success (Fachrunnisa et al. 2020). The thematic analysis for the digital transformation strategy is summarized in [Table 3](#).

SMEs resilience strategy

Dynamic capability & change management

Ates and Acur (2022) and Nayak, Chia, and Canales (2020) proposed noncognitive dynamic capabilities as the essential internal capability that SMEs must have to underpin dynamic capability to generate change in the company. Ates and Acur (2022) argued that SME managers must pay attention to developing noncognitive dynamic capabilities to avoid the obsolescence trap and lead to successful digital transformation. SMEs can understand their noncognitive dynamic capabilities by tracing their habitus and empirical sensitivity to see to what extent they are sensitive to the changing environment and making transformative decisions to cope and deal with those changes (Ates and Acur 2022; Nayak, Chia, and Canales 2020). With different terminology, Khurana, Dutta, and Singh Ghura (2022) argued that SMEs should move toward the periphery of their organizational boundaries by highlighting a shifting play of sensing, seizing, and transforming and then embracing digital technologies to produce the second-order dynamic capability to generate resilience (Khurana, Dutta, and Singh Ghura 2022). SMEs should be sensitive to the changing environment rather than carefully translate it into their change management to operate their dynamic capability (Kala Kamdjoug 2023). Digital transformation success is essential for enhancing the SMEs' resilience, while change management of human resources is key to digital transformation success.

Knowledge management, learning, and frugal innovation

The existing knowledge in the company should be well-exploited and communicated to produce new knowledge related to the needs of innovation in the company. SMEs should also be able to absorb external knowledge to support that knowledge creation. Knowledge Management strategy helps SMEs to be resilient by assisting SMEs to seize digital transformation opportunities because there is a set of tools to adapt (Klein and Todesco 2021). Besides, there are various enablers that SMEs should identify (Kumar et al. 2023). Therefore, management competencies, knowledge management, and monitoring and controlling are crucial factors (Kumar et al. 2023). Specifically, Hrivnák, Moritz, and Chreneková (2021) found that knowledge-intensive increased SMEs' resilience towards economic shocks due to the ability to change the management to adapt to a crisis swiftly (Hrivnák, Moritz, and Chreneková 2021). Related to this, Lang et al. (2023) and Al-Omouh et al. (2023) argued that entrepreneurial competencies should be improved through organizational learning, training activities, and participation in professional associations, particularly for digital transformation. The new knowledge should be exploited to execute digital transformation. In the transformation phase, Al-Omouh et al. (2023) proposed frugal innovation for SMEs to contribute to SMEs' resilience. Frugal innovation supports step-by-step change that is arguably suitable for SMEs as they have limited resources.

Digital literacy and digital inclusion

The struggle for e-commerce adoption and exploitation among SMEs is at the top of the agenda and should be resolved as a turnkey for economic recovery (Costa and Castro 2021). The challenge is that many companies did not pay attention to

implementing digital tools. There is a challenge in digital inclusion. Whereas acceleration of digital inclusion, both for business and financial purposes, was revealed as a significant factor in growth (Aghazadeh et al. 2023; Dluhopolskyi et al. 2023). Lathabhavan and Kuppusamy (2023) found that digital leadership, digital training, and empowerment are the key antecedents of organizational resilience (Lathabhavan and Kuppusamy 2023). Consistently, Aghazadeh et al. (2023) found that digital platform capability mediates digital resources to SME growth and resilience. User-generated content and user experience tracking are critical to reaching and sustaining digital business maturity (Spremić et al. 2022). Therefore, digital capability and literacy are not enough for SMEs' growth. SMEs should take strategic actions to adopt and exploit digital technology and then make transformations to improve competitive advantage and gain growth.

Leadership (paradoxical and situational)

Researchers found that the willingness of SME leaders to adapt to new circumstances, accept the challenge, and transform their business models are effective in cultivating resilience and staying competitive (Awad and Martín-Rojas 2023; Ragazou, Passas, and Sklavos 2022). However, SME leaders need the correct orientation and appropriate strategy to deal with the challenges (Akpan, Effiom, and Akpanobong 2023; Astuty, Sudirman, and Aryanto 2024; Awad and Martín-Rojas 2023; Trieu et al. 2023). SME leaders must have situational leadership abilities to enhance internal operations and secure funding through digital technology adoption, business model modification, and business process innovation (Akpan, Effiom, and Akpanobong 2023). Specifically, Astuty, Sudirman, and Aryanto (2024) found that aligning internal resources with responsive strategies can effectively perform sustainable resilience strategies. At the same time, Akpan, Effiom, and Akpanobong (2023) argued that securing funding for SMEs' digital transformation can be challenging but offers enormous survival opportunities and sustainable growth. Trieu et al. (2023) proposed paradoxical leadership to stimulate organizational ambidexterity. In this case, organizational ambidexterity reduces missed opportunities and increases organizations' responsiveness to market volatility, which, in turn, strengthens organizational resilience (Trieu et al. 2023). Isensee, Teuteberg, and Griese (2023) proposed six success factors related to the leadership orientation of organizational resilience, including 1) investing in managerial human capital, 2) performing stakeholder governance, 3) professionalizing organizational culture, 4) reinforcing external orientation, 5) proactively managing macro-factor, and 6) diversify. The same conception was also proposed by Žebryté et al. (2019), arguing entrepreneurs should strengthen their businesses' resilience by adjusting the decision-making processes, having greater awareness of future economies, and considering atom-enabled to transform and reduce dependency through digitalization.

Collaboration

Consistent with the previous findings regarding collaboration for digital transformation success to gain resilience, the primary study also proposes collaboration as the critical factor. Eriksson, Heikkilä, and Nummela (2022) found that digitalization,

strategic collaboration, customer intimacy, agile use of resources, and expertise are the essential sources of resilience that could improve the revenue model. In line with that, Sulastrri et al. (2023) found that digital transformation, collaboration capability, and innovation value affect SMEs' resilience substantially. The thematic analysis for SMEs resilience strategy is summarized in Table 4.

SMEs antifragility strategy

Corvello, Verteramo, et al. (2022) and Corvello, Straffalaci, et al. (2022) found that digital technologies significantly contribute to developing the antifragility of SMEs. Specifically, Corvello, Verteramo, et al. (2022) highlighted slack financial resources, strategic agility, external networks, and digital technology as the critical factors of SMEs' antifragility (Corvello, Verteramo, et al. 2022). In the case of the digital transformation context, digital tools played an important role for SMEs to interact with the dynamic environment, understanding the changes on time, gaining visibility for possible initiatives, managing internal work, and coordinating with employees, and automating business processes (Corvello, Straffalaci, et al. 2022). Corvello, Straffalaci, et al. (2022) found that business activities are critical to generating SME antifragility. In this case, SMEs must learn to be digitally competent to navigate the digital tools appropriately (Corvello, Straffalaci, et al. 2022). Corvello, Straffalaci, et al. (2022) also found that research and innovation processes through collaboration with research institutions are found a crucial strategy for building antifragility. SMEs should explore slack financial resources and diverse research and innovation partners and exploit them to improve operational agility, speed, and creativity (Corvello, Verteramo, et al. 2023). In this case, Corvello, Verteramo, et al. (2023) argued that entrepreneurial orientation, context insightfulness, and operational agility become SMEs' main ingredients of antifragility. The thematic analysis for SMEs antifragility strategy is summarized in Table 5.

Framework of SMEs digital transformation strategy towards resilience and antifragility

Firstly, we use Dynamic Capability as the basis of the proposed framework, as the concept is identified in each group of primary articles and covers the phases of transformation. According to Teece, Pisano, and Shuen (1997, p. 516), dynamic capabilities are '*firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments*'. The core influential factor of dynamic capabilities is market dynamism, which stimulates a company to develop its capability and make an evolution in its business (Eisenhardt and Martin 2000; Wang and Ahmed 2007). Furthermore, Wang and Ahmed (2007) proposed adaptive, absorptive, and innovative capabilities as component factors, while integration, reconfiguration, renewal, and recreation as the underlying process of dynamic capabilities. With those capabilities, the company could generate new forms of competitive advantage on the given path dependencies and market positions (Leonard-Barton 1992; Teece, Pisano, and Shuen 1997). Vogel and Güttel (2013) argued that Dynamic

Capability is a significant approach to strategic management. They found that research on dynamic capability focuses on learning and changing capabilities, merging aspects of organizational theory and strategic management, and parallelizing the differentiation process in the overall business operation (Vogel and Güttel 2013). Teece (2007) stated that dynamic capabilities enable the company to not only adapt to the business ecosystems but also enhance its business performance through innovation and collaboration to gain long-term enterprise success. Related to that view, the concept of dynamic capability is highly relevant to the need for a digital transformation strategy among SMEs to enhance resilience and antifragility.

According to the primary articles, we translate the dynamic capabilities concept into the operational and strategic levels to understand the implication of that theory into a practical idea of SMEs' digital transformation strategy. Therefore, the proposed framework contains three layers: theory, operational, and strategy. This practical implication is used to differentiate the application of the dynamic capabilities concept in SMEs, particularly in the case of achieving resilience and antifragility through digital transformation. In the initial phase, we propose that SMEs' traditional business operations be the starting point. At the operational level, we translate it to limited resources as much research highlights this limitation as the characteristics of SMEs in facing digital transformation (Corvello, Felicetti, et al. 2023; Lassnig et al. 2022; Nudurupati et al. 2022; Rupeika-Apoga, Petrovska, and Bule 2022; Troise et al. 2022). In fact, OECD (2016) and WEF (2022) also argued that SMEs facing financial, technological, and human resources cannot deal with digital transformation due to their operating simple business processes that do not need a high level of technology and digital skills. Furthermore, we propose collaboration as the strategy to solve this problem. According to Corvello, Verteramo, et al. (2022), Corvello, Straffalaci, et al. (2022), Corvello, Verteramo, et al. (2023), Eriksson, Heikkilä, and Nummela (2022), and Sulastri et al. (2023), collaboration could fill the gap in digital skill, technology availability, and financial access. The partnership could be aimed to improve company internal knowledge through knowledge transfer agenda like training, coaching, mentoring, benchmarking, or project collaboration with digital mature company (Balta et al. 2021; Beliaeva et al. 2020; Han and Trimi 2022; Kolagar et al. 2021; Mandviwalla and Flanagan 2021; Nudurupati et al. 2022; Pisoni 2021; Ricci, Battaglia, and Neirotti 2021). Alternatively, collaboration could be aimed at improving company decision-making through collaboration with a research institute that could help SMEs understand the company position and improve it according to market expectations (Corvello, Straffalaci, et al. 2022; Corvello, Verteramo, et al. 2022, 2023). Those collaborative works could solve the financial slack problem in parallel through capital-sharing and profit-sharing forms. In this case, each party should communicate the contract clearly to meet the mutual satisfaction of the collaborative project. Finally, those collaboration initiation and action would depend on SME leaders and managers' orientation of their business future strategy.

Furthermore, the next phase that SMEs should deal with is initiating digital transformation. This phase is in line with the sensing phase in dynamic capabilities. The core issue that SMEs should be concerned about is learning to understand their current business position and improving their internal digital capability. As mentioned

earlier, SMEs could benefit from collaboration to make this learning process effective. Firstly, SMEs should understand their current limitation, market circumstances, and business objectives and subject to improvement. To understand this issue, primary studies propose a need assessment to clearly understand their business position (T. M. Andersen 2008; Depaoli, Za, and Scornavacca 2020; Reim et al. 2022). Corvello, Verteramo, et al. (2022) argued that SMEs could collaborate with research organizations to help them make innovative decisions based on data. Furthermore, SMEs should develop their internal strategy through a knowledge management strategy to construct their digital capabilities (Al Omoush, Lassala, and Ribeiro-Navarrete 2023; Hrivnák, Moritz, and Chreneková 2021; Klein and Todesco 2021; Kumar et al. 2023). This internal capability is also critical for seizing the next phase of dynamic capabilities.

The next phase of dynamic capabilities that SMEs should develop is seizing. Seizing means to what extent a company can mobilize the resources globally to create opportunities (Teece 2007, 2012). In this phase, SMEs still need research to assess their actual business needs. We propose research-based decision-making at the strategic level of the framework. Furthermore, at the operational level, the core issue that decision-makers should consider is the IT-business alignment (Astuty, Sudirman, and Aryanto 2024; Cenamor, Parida, and Wincent 2019). The new technology that is planned to be invested in should be aligned with business needs. The IT-business alignment could prevent mis-investment, over-investment, and unclear value of IT investments (De Haes et al. 2020). At this phase, we also propose a research and experimentation cycle as the process that SMEs should do until they achieve the fit setting of the new digital tools into their new business model. The research and experimental cycle involves learning, aligning, and innovating processes.

The next phase is transforming. According to Teece (2012), transforming is 'continued renewal'. In the proposed framework, we divide it into transformation decisions and continuous improvement. In transformation decisions, we propose frugal innovation as the alternative innovation action SMEs could start with. In this case, SMEs could exploit an atom enabler in their company to make minor changes to accommodate their digital transformation need (Žebryte, Fonseca-Vasquez, and Hartley 2019). Frugal innovation is appropriate for SMEs as they have limited resources. Small and gradual innovations would be manageable for SMEs; besides, they can parallelly learn about further innovations needed for bigger improvements. At the strategic level, we propose change management that SMEs should do to shift their company into the new business model. They should consider how to prepare the employees to deal with the new business process, such as supply chain, production, sales and promotion, accounting and data management, and customer relationship management.

Finally, to generate resilience and antifragility, SMEs should deal with continuous improvement in their digital transformation. In the competitive dynamic business environment, the changes become regular and the company should be adaptable to that. At the strategical level, we adopt the concept of paradoxical and situational leadership to deal with this dynamic. Paradoxical leadership is the capability of navigating complex and dynamic situations with agility and adaptability by fostering

psychological empowerment, engaging employee participation, and exploring and managing seemingly conflicting or contradictory ideas to create new opportunities (Fürstenberg et al. 2021; Trieu et al. 2023; Yeow, Soh, and Hansen 2018; S. Zhang et al. 2021). In this case, new opportunities should be executed to create new value in the company. Therefore, in the final phases on the strategic level, we propose a value creation cycle. SMEs should continuously evaluate their digital transformation strategy, considering their current business situation, and continuously create new value to develop their strategic agility. At the operational level, continuous innovation could effectively improve company agility and growth in business performance. At the theoretical level, if SMEs can survive in dynamic business environments, then they have fulfilled indicators of resilience, and if SMEs can reach business performance growth, then they have fulfilled indicators of antifragility.

Resilience and antifragility are the concepts that indicate SMEs' capability to adapt to change (Corvello, Verteramo, et al. 2023; Ramezani and Camarinha-Matos 2020). The difference between resilient and antifragile SMEs is in the level of the result of their adaptability. Resilience corresponds to preserving the pre-crisis state, while antifragility is associated with a better status in post-crisis (Corvello, Verteramo, et al. 2023; Munoz, Billsberry, and Ambrosini 2022). The capabilities that make different results of this adaptability are the level of learning, agility, flexibility, and preparedness to face the changes brought by the crisis (Corvello, Verteramo, et al. 2022, 2023). In this case, digital transformation plays the role of facilitator of SMEs to be more flexible, agile, and adaptable to make continuous changes and modify goals and behaviour following the dynamic of environments (Manyati and Mutsau 2021; Ramezani and Camarinha-Matos 2020). Therefore, SMEs need digital competence to use digital tools appropriately to support their business model and goals. SMEs could use their past occurrences to their changing scenario, learn from others' digital initiatives, adopt online business operations, remote teamwork or collaboration, and other distinctive features of technology to support their innovation initiative (Corvello, Verteramo, et al. 2023; Depaoli, Za, and Scornavacca 2020). Furthermore, Corvello, Verteramo, et al. (2023) found that the presence of slack resources in SMEs significantly strengthens the relationship between digital technologies and antifragility because it allows SMEs to have room for manoeuvre in adapting to change. The conceptual framework is presented in Figure 2.

Recommendation for future research agenda

According to the demography of the primary article, research in the digital transformation field is mostly conducted in European SMEs, while the SME resilience field is conducted in European and Asian companies, and the SME antifragility field is still scarce. From a methodological point of view, quantitative surveys are dominant, particularly surveys using the SEM technique. Furthermore, the qualitative approach using case studies is also common. Future research endeavours related to SMEs' resilience and antifragility are needed, particularly in qualitative research. Qualitative inquiries would help scholars gain a deeper understanding of the value of digital transformation strategy in generating SMEs' resilience and antifragility. In particular,

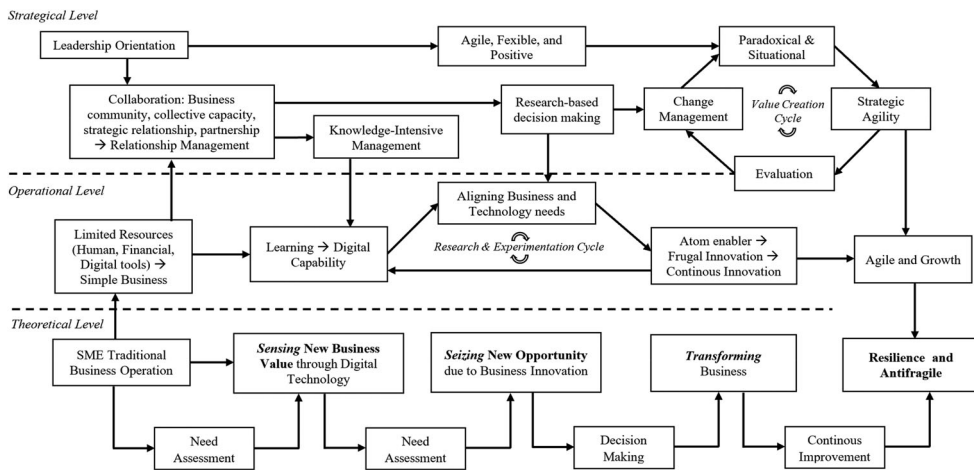


Figure 2. Conceptual framework of digital transformation strategy towards resilience and antifragility of SMEs.

scholars need to explore and report best practices from successful SMEs in developing their antifragility. Future research could use phenomenology, case studies, and ethnography on successful SMEs to collect in-depth and detailed evidence. Furthermore, more evidence from developing countries is needed as SMEs are probably more critical in developing countries’ economies. Furthermore, empirical research using quantitative research method is also necessary to accommodate the external validity of the related phenomenon.

According to the literature review, we proposed several alternatives for future research agenda, including: 1) investigating antifragile SMEs in developing countries through phenomenology and case studies. This research agenda is needed to identify the core success factors of SMEs’ antifragility in different business environments; 2) defining SMEs’ digital transformation levels according to different needs. This agenda is essential to identify the core success factors of digital transformation and SME antifragility in different contexts of SMEs; 3) exploring and investigating the effective collaboration model of SMEs to facilitate digital transformation endeavours and generate agility; 4) validating the proposed framework using empirical survey research. This research agenda is critical to deliver empirical validation of the conceptual framework.

Conclusion

This study aimed to answer 1) how SMEs could use digital transformation strategy to achieve resilience and antifragility, 2) what is the commonly used leading theory to describe digital transformation strategy to achieve resilience and antifragility, and 3) how the conceptual framework of a digital transformation strategy to achieve SME resilience and antifragility through the SLR approach. According to the primary literature, this study has found the shared value SMEs need to achieve successful digital transformation, resilience, and antifragility, namely: dynamic capabilities, digital capability, digital inclusion, leadership orientation, learning and knowledge management, and collaboration. More specifically, SMEs need a deeper level of learning, digital

capability, flexibility, and agility to be antifragile. Furthermore, we found that dynamic capabilities are the leading theory used by the primary articles to describe and explore how a firm creates successful transformation and gains resilience. Therefore, we used dynamic capabilities as the theoretical foundation for the proposed conceptual framework. The conceptual framework was presented and elaborated in the discussion section. Recommendations for further research agenda were also given.

This study has contributed to connecting theoretical concepts to the strategic and operational levels of digital transformation and has defined the core values needed to achieve resilience and antifragile state as a result of digital transformation. The proposed framework includes three levels: theoretical, operational, and strategic, which are used to elaborate the connection between theory and practical concepts. Theoretically, this study could be a starting point or reference for future research efforts. Business and information systems scholars should consider resilience and antifragility as a business performance that indicates the successful digital transformation of SMEs. This concept is relevant for solving the survivability problems of SMEs. Practically, SME practitioners could use the proposed framework as a guide to define the appropriate strategy for their digital transformation efforts. Collaboration could be the gateway to solving limited resource issues when embarking on digital transformation. In addition, continuous learning is a must for experimentation and value creation during digital transformation.

This study has several limitations. First, it develops the framework based on the results of related published literature. This study develops a general framework that is likely to need adjustments for specific business conditions according to region and organization characteristics, business sector and area, and country economy. Therefore, further empirical investigation or field study is needed to validate the framework. Second, we limit the source of literature collection only from the Scopus database and only from journal articles. We argue that Scopus is one of the most comprehensive and reputable academic databases, and journal articles tend to be the complete report of academic work compared to proceedings articles. However, there is a possibility that some academic papers are not recognized in this study. Future research could include more academic sources and article types during the primary article collection. Finally, research related to antifragility in SMEs is significantly scarce. We collected limited evidence to justify how SMEs develop their antifragility through digital transformation strategy. Therefore, future research on antifragility in SMEs needs to be critically examined, especially in developing countries.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References

- Aghazadeh, H., F. Zandi, H. Amoozad Mahdiraji, and R. Sadraei. 2023. "Digital Transformation and SME Internationalisation: Unravelling the Moderated-Mediation Role of Digital Capabilities, Digital Resilience and Digital Maturity." *Journal of Enterprise Information Management*. Advance online publication. <https://doi.org/10.1108/JEIM-02-2023-0092>
- Akpan, I. J., L. Effiom, and A. C. Akpanobong. 2023. "Towards Developing a Knowledge Base for Small Business Survival Techniques during COVID-19 and Sustainable Growth Strategies for the Post-Pandemic Era." *Journal of Small Business & Entrepreneurship*. Advance online publication. <https://doi.org/10.1080/08276331.2023.2232649>
- Al Omoush, K., C. Lassala, and S. Ribeiro-Navarrete. 2023. "The Role of Digital Business Transformation in Frugal Innovation and SMEs' Resilience in Emerging Markets." *International Journal of Emerging Markets*. Advance online publication. <https://doi.org/10.1108/IJOEM-12-2022-1937>
- Andersen, T. C. K., A. Aagaard, and M. Magnusson. 2022. "Exploring Business Model Innovation in SMEs in a Digital Context: Organizing Search Behaviours, Experimentation and Decision-Making." *Creativity and Innovation Management* 31 (1): 19–34. <https://doi.org/10.1111/caim.12474>
- Andersen, T. M. 2008. "The Scandinavian Model-Prospects and Challenges." *International Tax and Public Finance* 15 (1): 45–66. <https://doi.org/10.1007/s10797-007-9022-3>
- Arcidiacono, F., A. Ancarani, C. Di Mauro, and F. Schupp. 2019. "Where the Rubber Meets the Road. Industry 4.0 among SMEs in the Automotive Sector." *IEEE Engineering Management Review* 47 (4): 86–93. <https://doi.org/10.1109/EMR.2019.2932965>
- Astuty, E., I. D. Sudirman, and R. Aryanto. 2024. "Sustainable Resilience Strategy: Unleash the Micro-Businesses's Potential in the Digitalization and Sustainability Era." *Cogent Business & Management* 11 (1): 1–29. <https://doi.org/10.1080/23311975.2024.2313672>
- Ates, A., and N. Acur. 2022. "Making Obsolescence Obsolete: Execution of Digital Transformation in a High-Tech Manufacturing SME." *Journal of Business Research* 152 (July): 336–348. <https://doi.org/10.1016/j.jbusres.2022.07.052>
- Awad, J., and R. Martín-Rojas. 2023. "Enhancing Social Responsibility and Resilience through Entrepreneurship and Digital Environment." *Corporate Social Responsibility and Environmental Management* 31 (3): 1688–1704. <https://doi.org/10.1002/csr.2655>
- Balta, M., R. Valsecchi, T. Papadopoulos, and D. J. Bourne. 2021. "Digitalization and co-Creation of Healthcare Value: A Case Study in Occupational Health." *Technological Forecasting and Social Change* 168: 120785. <https://doi.org/10.1016/j.techfore.2021.120785>

- Becker, W., and O. Schmid. 2020. "The Right Digital Strategy for Your Business: An Empirical Analysis of the Design and Implementation of Digital Strategies in SMEs and LSEs." *Business Research* 13 (3): 985–1005. <https://doi.org/10.1007/s40685-020-00124-y>
- Beliaeva, T., M. Ferasso, S. Kraus, and E. J. Damke. 2020. "Dynamics of Digital Entrepreneurship and the Innovation Ecosystem: A Multilevel Perspective." *International Journal of Entrepreneurial Behavior & Research* 26 (2): 266–284. <https://doi.org/10.1108/IJEBR-06-2019-0397>
- Ben Slimane, S., R. Coeurderoy, and H. Mhenni. 2022. "Digital Transformation of Small and Medium Enterprises: A Systematic Literature Review and an Integrative Framework." *International Studies of Management & Organization* 52 (2): 96–120. <https://doi.org/10.1080/00208825.2022.2072067>
- Bencsik, A. 2020. "Challenges of Management in the Digital Economy." *International Journal of Technology* 11 (6): 1275–1285. <https://doi.org/10.14716/ijtech.v11i6.4461>
- Bollweg, L., R. Lackes, M. Siepermann, and P. Weber. 2020. "Drivers and Barriers of the Digitalization of Local Owner Operated Retail Outlets." *Journal of Small Business & Entrepreneurship* 32 (2): 173–201. <https://doi.org/10.1080/08276331.2019.1616256>
- Casalino, N., I. Żuchowski, N. Labrinos, Á. L. Munoz Nieto, and J. A. Mart\in. 2019. Digital strategies and organizational performances of SMEs in the age of Coronavirus: Balancing digital transformation with an effective business resilience. *Queen Mary School of Law Legal Studies Research Paper Forthcoming*
- Cassetta, E., U. Monarca, I. Dileo, C. Di Berardino, and M. Pini. 2020. "The Relationship between Digital Technologies and Internationalisation. Evidence from Italian SMEs." *Industry and Innovation* 27 (4): 311–339. <https://doi.org/10.1080/13662716.2019.1696182>
- Cenamor, J., V. Parida, and J. Wincent. 2019. "How Entrepreneurial SMEs Compete through Digital Platforms: The Roles of Digital Platform Capability, Network Capability and Ambidexterity." *Journal of Business Research* 100: 196–206. <https://doi.org/10.1016/j.jbusres.2019.03.035>
- Chatterjee, S., R. Chaudhuri, D. Vrontis, and G. Basile. 2022. "Digital Transformation and Entrepreneurship Process in SMEs of India: A Moderating Role of Adoption of AI-CRM Capability and Strategic Planning." *Journal of Strategy and Management* 15 (3): 416–433. <https://doi.org/10.1108/JSMA-02-2021-0049>
- Chierici, R., D. Tortora, M. Del Giudice, and B. Quacquarelli. 2020. "Strengthening Digital Collaboration to Enhance Social Innovation Capital: An Analysis of Italian Small Innovative Enterprises." *Journal of Intellectual Capital* 22 (3): 610–632. <https://doi.org/10.1108/JIC-02-2020-0058>
- Cobelli, N., and A. Chiarini. 2020. "Improving Customer Satisfaction and Loyalty through mHealth Service Digitalization: New Challenges for Italian Pharmacists." *The TQM Journal* 32 (6): 1541–1560. <https://doi.org/10.1108/TQM-10-2019-0252>
- Cook, D. J., C. D. Mulrow, and R. B. Haynes. 1997. "Systematic Reviews: Synthesis of Best Evidence for Clinical Decisions." *Annals of Internal Medicine* 126 (5): 376–380. <https://doi.org/10.7326/0003-4819-126-5-199703010-00006>
- Corvello, V., A. M. Felicetti, C. Troise, and M. Tani. 2023. "Betting on the Future: How to Build Antifragility in Innovative Start-up Companies." *Review of Managerial Science* 18 (4): 1101–1127. <https://doi.org/10.1007/s11846-023-00636-x>
- Corvello, V., M. De Carolis, S. Verteramo, and A. Steiber. 2022. "The Digital Transformation of Entrepreneurial Work." *International Journal of Entrepreneurial Behavior & Research* 28 (5): 1167–1183. <https://doi.org/10.1108/IJEBR-01-2021-0067>
- Corvello, V., S. Verteramo, and C. Giglio. 2023. "Turning Crises into Opportunities in the Service Sector: How to Build Antifragility in Small and Medium Service Enterprises." *The TQM Journal* 35 (5): 1211–1223. <https://doi.org/10.1108/TQM-12-2021-0364>
- Corvello, V., S. Verteramo, I. Nocella, and S. Ammirato. 2022. "Thrive during a Crisis: The Role of Digital Technologies in Fostering Antifragility in Small and Medium-Sized Enterprises." *Journal of Ambient Intelligence and Humanized Computing* 14 (11): 14681–14693. <https://doi.org/10.1007/s12652-022-03816-x>

- Corvello, V., V. Straffalaci, and L. Filice. 2022. "Small Business Antifragility: How Research and Innovation Can Help Survive Crises and Thrive." *International Journal of Entrepreneurship and Innovation Management* 26 (3/4): 252–268. <https://doi.org/10.1504/IJEIM.2022.124856>
- Costa, J., and R. Castro. 2021. "SMEs Must Go Online—E-Commerce as an Escape Hatch for Resilience and Survivability." *Journal of Theoretical and Applied Electronic Commerce Research* 16 (7): 3043–3062. <https://doi.org/10.3390/jtaer16070166>
- Creswell, J. W., and C. N. Poth. 2016. *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. Thousand Oaks, CA: Sage Publications, Inc.
- Crupi, A., N. Del Sarto, A. Di Minin, G. L. Gregori, D. Lepore, L. Marinelli, and F. Spigarelli. 2020. "The Digital Transformation of SMEs—A New Knowledge Broker Called the Digital Innovation Hub." *Journal of Knowledge Management* 24 (6): 1263–1288. <https://doi.org/10.1108/JKM-11-2019-0623>
- De Haes, S., W. Van Grembergen, A. Joshi, T. Huygh, S. De Haes, W. Van Grembergen, A. Joshi, and T. Huygh. 2020. Enterprise Governance of IT. In: *Enterprise Governance of Information Technology. Management for Professionals*. Cham: Springer. https://doi.org/10.1007/978-3-030-25918-1_2.
- Del Giudice, M., V. Scuotto, A. Papa, S. Y. Tarba, S. Bresciani, and M. Warkentin. 2021. "A Self-Tuning Model for Smart Manufacturing SMEs: Effects on Digital Innovation." *Journal of Product Innovation Management* 38 (1): 68–89. <https://doi.org/10.1111/jpim.12560>
- Denicolai, S., A. Zucchella, and G. Magnani. 2021. "Internationalization, Digitalization, and Sustainability: Are SMEs Ready? A Survey on Synergies and Substituting Effects among Growth Paths." *Technological Forecasting and Social Change* 166: 120650. <https://doi.org/10.1016/j.techfore.2021.120650>
- Depaoli, P., S. Za, and E. Scornavacca. 2020. "A Model for Digital Development of SMEs: An Interaction-Based Approach." *Journal of Small Business and Enterprise Development* 27 (7): 1049–1068. <https://doi.org/10.1108/JSBED-06-2020-0219>
- Dluhopolskyi, O., O. Pakhnenko, S. Lyeonov, A. Semenog, N. Artyukhova, M. Cholewa-Wiktor, and W. Jastrzębski. 2023. "Digital Financial Inclusion: COVID-19 Impacts and Opportunities." *Sustainability* 15 (3): 2383. <https://doi.org/10.3390/su15032383>
- Eisenhardt, K. M., and J. A. Martin. 2000. "Dynamic Capabilities: What Are They?" *Strategic Management Journal* 21 (10-11): 1105–1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10<1105::AID-SMJ133>3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10<1105::AID-SMJ133>3.0.CO;2-E)
- El Hilali, W., A. El Manouar, and M. A. Janati Idrissi. 2020. "Reaching Sustainability during a Digital Transformation: A PLS Approach." *International Journal of Innovation Science* 12 (1): 52–79. <https://doi.org/10.1108/IJIS-08-2019-0083>
- El-Haddadeh, R. 2020. "Digital Innovation Dynamics Influence on Organisational Adoption: The Case of Cloud Computing Services." *Information Systems Frontiers* 22 (4): 985–999. <https://doi.org/10.1007/s10796-019-09912-2>
- Elia, G., A. Margherita, and G. Secundo. 2021. "Project Management Canvas: A Systems Thinking Framework to Address Project Complexity." *International Journal of Managing Projects in Business* 14 (4): 809–835. <https://doi.org/10.1108/IJMPB-04-2020-0128>
- Eller, R., P. Alford, A. Kallmünzer, and M. Peters. 2020. "Antecedents, Consequences, and Challenges of Small and Medium-Sized Enterprise Digitalization." *Journal of Business Research* 112: 119–127. <https://doi.org/10.1016/j.jbusres.2020.03.004>
- Eriksson, T., M. Heikkilä, and N. Nummela. 2022. "Business Model Innovation for Resilient International Growth." *Small Enterprise Research* 29 (3): 205–226. <https://doi.org/10.1080/13215906.2022.2092890>
- Fachrunnisa, O., A. Adhiatma, N. Lukman, and M. N. A. Majid. 2020. "Towards SMEs' Digital Transformation: The Role of Agile Leadership and Strategic Flexibility." *Journal of Small Business Strategy* 30 (3): 65–85.
- Feliciano-Cestero, M. M., N. Ameen, M. Kotabe, J. Paul, and M. Signoret. 2023. "Is Digital Transformation Threatened? A Systematic Literature Review of the Factors Influencing Firms' Digital Transformation and Internationalization." *Journal of Business Research* 157: 113546. <https://doi.org/10.1016/j.jbusres.2022.113546>

- Fink, A. 2019. *Conducting Research Literature Reviews: From the Internet to Paper*. Thousand Oaks, CA: Sage Publications, Inc.
- Fürstenberg, D., L. Wikström, E. Hjelseth, and O. Lædre. 2021. *Enabling automation of BIM-based cost estimation by semantic web technology*
- Gaglio, C., E. Kraemer-Mbula, and E. Lorenz. 2022. "The Effects of Digital Transformation on Innovation and Productivity: Firm-Level Evidence of South African Manufacturing Micro and Small Enterprises." *Technological Forecasting and Social Change* 182: 121785. <https://doi.org/10.1016/j.techfore.2022.121785>
- Garbellano, S., and M. do R. Da Veiga. 2019. "Dynamic Capabilities in Italian Leading SMEs Adopting Industry 4.0." *Measuring Business Excellence* 23 (4): 472–483. <https://doi.org/10.1108/MBE-06-2019-0058>
- Garzoni, A., I. De Turi, G. Secundo, and P. Del Vecchio. 2020. "Fostering Digital Transformation of SMEs: A Four Levels Approach." *Management Decision* 58 (8): 1543–1562. <https://doi.org/10.1108/MD-07-2019-0939>
- Gavrila, S. G., and A. de Lucas Ancillo. 2021. "Spanish SMEs' Digitalization Enablers: E-Receipt Applications to the Offline Retail Market." *Technological Forecasting and Social Change* 162: 120381. <https://doi.org/10.1016/j.techfore.2020.120381>
- González-Albo, B., and M. Bordons. 2011. "Articles vs. proceedings Papers: Do They Differ in Research Relevance and Impact? A Case Study in the Library and Information Science Field." *Journal of Informetrics* 5 (3): 369–381. <https://doi.org/10.1016/j.joi.2011.01.011>
- Guo, H., Z. Yang, R. Huang, and A. Guo. 2020. "The Digitalization and Public Crisis Responses of Small and Medium Enterprises: Implications from a COVID-19 Survey." *Frontiers of Business Research in China* 14 (1): 1–25. <https://doi.org/10.1186/s11782-020-00087-1>
- Han, H., and S. Trimi. 2022. "Towards a Data Science Platform for Improving SME Collaboration through Industry 4.0 Technologies." *Technological Forecasting and Social Change* 174 (September 2021): 121242. <https://doi.org/10.1016/j.techfore.2021.121242>
- Hrivnák, M., P. Moritz, and M. Chreneková. 2021. "What Kept the Boat Afloat? Sustainability of Employment in Knowledge-Intensive Sectors Due to Government Measures during COVID-19 Pandemic." *Sustainability* 13 (15): 8441. <https://doi.org/10.3390/su13158441>
- Isensee, C., F. Teuteberg, and K. M. Griese. 2023. "Success Factors of Organizational Resilience: A Qualitative Investigation of Four Types of Sustainable Digital Entrepreneurs." *Management Decision* 61 (5): 1244–1273. <https://doi.org/10.1108/MD-03-2022-0326>
- Jafari-Sadeghi, V., H. A. Mahdiraji, G. M. Alam, and A. Mazzoleni. 2023. "Entrepreneurs as Strategic Transformation Managers: Exploring Micro-Foundations of Digital Transformation in Small and Medium Internationalisers." *Journal of Business Research* 154: 113287. <https://doi.org/10.1016/j.jbusres.2022.08.051>
- Jun, W., M. H. Nasir, Z. Yousof, A. Khattak, M. Yasir, A. Javed, and S. H. Shirazi. 2022. "Innovation Performance in Digital Economy: Does Digital Platform Capability, Improvisation Capability and Organizational Readiness Really Matter?" *European Journal of Innovation Management* 25 (5): 1309–1327. <https://doi.org/10.1108/EJIM-10-2020-0422>
- Kääriäinen, J., P. Pussinen, L. Saari, O. Kuusisto, M. Saarela, and K. Hänninen. 2021. "Applying the Positioning Phase of the Digital Transformation Model in Practice for SMEs: Toward Systematic Development of Digitalization." *International Journal of Information Systems and Project Management* 8 (4): 24–43. <https://doi.org/10.12821/ijispm080402>
- Kala Kamdjoug, J. R. 2023. "Change Management and Digital Transformation Project Success in SMEs Located in the Democratic Republic of the Congo." *Journal of Enterprise Information Management* 37 (2): 580–605. <https://doi.org/10.1108/JEIM-09-2022-0340>
- Kamble, S. S., A. Gunasekaran, A. Ghadge, and R. Raut. 2020. "A Performance Measurement System for Industry 4.0 Enabled Smart Manufacturing System in SMMEs-A Review and Empirical Investigation." *International Journal of Production Economics* 229: 107853. <https://doi.org/10.1016/j.ijpe.2020.107853>
- Khurana, I., D. K. Dutta, and A. Singh Ghura. 2022. "SMEs and Digital Transformation during a Crisis: The Emergence of Resilience as a Second-Order Dynamic Capability in an

- Entrepreneurial Ecosystem.” *Journal of Business Research* 150: 623–641. <https://doi.org/10.1016/j.jbusres.2022.06.048>
- Klein, V. B., and J. L. Todesco. 2021. “COVID-19 Crisis and SMEs Responses: The Role of Digital Transformation.” *Knowledge and Process Management* 28 (2): 117–133. <https://doi.org/10.1002/kpm.1660>
- Kolagar, M., W. Reim, V. Parida, and D. Sjödin. 2021. “Digital Servitization Strategies for SME Internationalization: The Interplay between Digital Service Maturity and Ecosystem Involvement.” *Journal of Service Management* 33 (1): 143–162. <https://doi.org/10.1108/JOSM-11-2020-0428>
- Kumar, V., R. Sindhwani, A. Behl, A. Kaur, and V. Pereira. 2023. “Modelling and Analysing the Enablers of Digital Resilience for Small and Medium Enterprises.” *Journal of Enterprise Information Management*. Advance online publication. <https://doi.org/10.1108/JEIM-01-2023-0002>
- Lang, L. D., A. Behl, N. N. D. Phuong, J. Gaur, and N. T. Dzung. 2023. “Toward SME Digital Transformation in the Supply Chain Context: The Role of Structural Social and Human Capital.” *International Journal of Physical Distribution & Logistics Management* 53 (4): 448–466. <https://doi.org/10.1108/IJPDLM-12-2021-0525>
- Lassnig, M., J. M. Müller, K. Klieber, A. Zeisler, and M. Schirl. 2022. “A Digital Readiness Check for the Evaluation of Supply Chain Aspects and Company Size for Industry 4.0.” *Journal of Manufacturing Technology Management* 33 (9): 1–18. <https://doi.org/10.1108/JMTM-10-2020-0382>
- Lassnig, M., P. Stabauer, G. Breitfuß, and K. Mauthner. 2018. “Business Model Innovation in the Age of Digital Transformation and Industry 4.0.” *HMD Praxis der Wirtschaftsinformatik* 55: 284–296.
- Lathabhavan, R., and T. Kuppusamy. 2023. “Examining the Role of Digital Leadership and Organisational Resilience on the Performance of SMEs during the COVID-19 Pandemic.” *International Journal of Productivity and Performance Management*. Advance online publication. <https://doi.org/10.1108/IJPPM-02-2023-0069>
- Lee, Y. Y., M. Falahat, and B. K. Sia. 2021. “Drivers of Digital Adoption: A Multiple Case Analysis among Low and High-Tech Industries in Malaysia.” *Asia-Pacific Journal of Business Administration* 13 (1): 80–97. <https://doi.org/10.1108/APJBA-05-2019-0093>
- Leonard-Barton, D. 1992. “Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development.” *Strategic Management Journal* 13 (S1): 111–125. <https://doi.org/10.1002/smj.4250131009>
- Lorente-Martínez, Javier, Julio Navío-Marco, and Beatriz Rodrigo-Moya. 2020. “Analysis of the Adoption of Customer Facing InStore Technologies in Retail SMEs.” *Journal of Retailing and Consumer Services* 57: 102225. <https://doi.org/10.1016/j.jretconser.2020.102225>
- Lucas, P. J., J. Baird, L. Arai, C. Law, and H. M. Roberts. 2007. “Worked Examples of Alternative Methods for the Synthesis of Qualitative and Quantitative Research in Systematic Reviews.” *BMC Medical Research Methodology* 7 (1): 7. <https://doi.org/10.1186/1471-2288-7-4>
- Mandviwalla, M., and R. Flanagan. 2021. “Small Business Digital Transformation in the Context of the Pandemic.” *European Journal of Information Systems* 30 (4): 359–375. <https://doi.org/10.1080/0960085X.2021.1891004>
- Manyati, T. K., and M. Mutsau. 2021. “Leveraging Green Skills in Response to the COVID-19 Crisis: A Case Study of Small and Medium Enterprises in Harare, Zimbabwe.” *Journal of Entrepreneurship in Emerging Economies* 13 (4): 673–697. <https://doi.org/10.1108/JEEE-07-2020-0236>
- Matarazzo, M., L. Penco, G. Profumo, and R. Quaglia. 2021. “Digital Transformation and Customer Value Creation in Made in Italy SMEs: A Dynamic Capabilities Perspective.” *Journal of Business Research* 123: 642–656. <https://doi.org/10.1016/j.jbusres.2020.10.033>
- Müller, J. M., O. Buliga, and K.-I. Voigt. 2021. “The Role of Absorptive Capacity and Innovation Strategy in the Design of Industry 4.0 Business Models—A Comparison between SMEs and Large Enterprises.” *European Management Journal* 39 (3): 333–343. <https://doi.org/10.1016/j.emj.2020.01.002>

- Munoz, A., J. Billsberry, and V. Ambrosini. 2022. "Resilience, Robustness, and Antifragility: Towards an Appreciation of Distinct Organizational Responses to Adversity." *International Journal of Management Reviews* 24 (2): 181–187. <https://doi.org/10.1111/ijmr.12289>
- Mustafa, F., A. Khursheed, M. Fatima, and M. Rao. 2021. "Exploring the Impact of COVID-19 Pandemic on Women Entrepreneurs in Pakistan." *International Journal of Gender and Entrepreneurship* 13 (2): 187–203. <https://doi.org/10.1108/IJGE-09-2020-0149>
- Nasiri, M., J. Ulko, M. Saunila, and T. Rantala. 2020. "Managing the Digital Supply Chain: The Role of Smart Technologies." *Technovation* 96-97 (May 2019): 102121. <https://doi.org/10.1016/j.technovation.2020.102121>
- Nayak, A., R. Chia, and J. I. Canales. 2020. "Noncognitive Microfoundations: Understanding Dynamic Capabilities as Idiosyncratically Refined Sensitivities and Predispositions." *Academy of Management Review* 45 (2): 280–303. <https://doi.org/10.5465/amr.2016.0253>
- Neirotti, P., and D. Pesce. 2019. "ICT-Based Innovation and Its Competitive Outcome: The Role of Information Intensity." *European Journal of Innovation Management* 22 (2): 383–404. <https://doi.org/10.1108/EJIM-02-2018-0039>
- Nudurupati, S. S., P. Budhwar, R. P. Pappu, S. Chowdhury, M. Kondala, A. Chakraborty, and S. K. Ghosh. 2022. "Transforming Sustainability of Indian Small and Medium-Sized Enterprises through Circular Economy Adoption." *Journal of Business Research* 149: 250–269. <https://doi.org/10.1016/j.jbusres.2022.05.036>
- OECD. 2016. *Entrepreneurship at a Glance 2016*
- Okoli, C. 2015. "A Guide to Conducting a Standalone Systematic Literature Review." *Communications of the Association for Information Systems* 37 (1): 879–910. <https://doi.org/10.17705/1CAIS.03743>
- Oliveira, L., A. Fleury, and M. T. Fleury. 2021. "Digital Power: Value Chain Upgrading in an Age of Digitization." *International Business Review* 30 (6): 101850. <https://doi.org/10.1016/j.ibusrev.2021.101850>
- Olsson, A. K., and I. Bernhard. 2021. "Keeping up the Pace of Digitalization in Small Businesses—Women Entrepreneurs' Knowledge and Use of Social Media." *International Journal of Entrepreneurial Behavior & Research* 27 (2): 378–396. <https://doi.org/10.1108/IJEER-10-2019-0615>
- Pappas, N., A. Caputo, M. M. Pellegrini, G. Marzi, and E. Michopoulou. 2021. "The Complexity of Decision-Making Processes and IoT Adoption in Accommodation SMEs." *Journal of Business Research* 131: 573–583. <https://doi.org/10.1016/j.jbusres.2021.01.010>
- Patel, S. S., M. B. Rogers, R. Amlôt, and G. J. Rubin. 2017. "What Do we Mean By 'community Resilience'? A Systematic Literature Review of How It is Defined in the Literature." *PLoS Currents* 9. <https://doi.org/10.1371/currents.dis.db775aff25efc5ac4f0660ad9c9f7db2>
- Peter, M. K., C. Kraft, and J. Lindeque. 2020. "Strategic Action Fields of Digital Transformation: An Exploration of the Strategic Action Fields of Swiss SMEs and Large Enterprises." *Journal of Strategy and Management* 13 (1): 160–180. <https://doi.org/10.1108/JSMA-05-2019-0070>
- Pfister, P., and C. Lehmann. 2021. "Returns on Digitisation in SMEs—A Systematic Literature Review." *Journal of Small Business & Entrepreneurship* 35 (4): 574–598. <https://doi.org/10.1080/08276331.2021.1980680>
- Philbin, S., R. Viswanathan, A. Telukdarie, others. 2022. *Understanding how digital transformation can enable SMEs to achieve sustainable development: A systematic literature review.*
- Pisoni, G. 2021. "Going Digital: Case Study of an Italian Insurance Company." *Journal of Business Strategy* 42 (2): 106–115. <https://doi.org/10.1108/JBS-11-2019-0225>
- Ragazou, K., I. Passas, and G. Sklavos. 2022. "Investigating the Strategic Role of Digital Transformation Path of Smes in the Era of COVID-19: A Bibliometric Analysis Using R." *Sustainability* 14 (18): 11295. <https://doi.org/10.3390/su141811295>
- Ramezani, J., and L. M. Camarinha-Matos. 2019. "A Collaborative Approach to Resilient and Antifragile Business Ecosystems." *Procedia Computer Science* 162 (Itqm 2019): 604–613. <https://doi.org/10.1016/j.procs.2019.12.029>
- Ramezani, J., and L. M. Camarinha-Matos. 2020. "Approaches for Resilience and Antifragility in Collaborative Business Ecosystems." *Technological Forecasting and Social Change* 151 (March 2019): 119846. <https://doi.org/10.1016/j.techfore.2019.119846>

- Razavi Hajiagha, S. H., S. Alaei, A. Sadraee, and P. Nazmi. 2023. "A Perspective of International Performance Improvement Concentrating on Innovation and Digital Resilience of SMEs: The Case of an Emerging Economy." *Journal of Enterprise Information Management*. Advance online publication. <https://doi.org/10.1108/JEIM-02-2023-0078>
- Reim, W., P. Yli-Viitala, J. Arrasvuori, and V. Parida. 2022. "Tackling Business Model Challenges in SME Internationalization through Digitalization." *Journal of Innovation & Knowledge* 7 (3): 100199. <https://doi.org/10.1016/j.jik.2022.100199>
- Ricci, R., D. Battaglia, and P. Neirotti. 2021. "External Knowledge Search, Opportunity Recognition and Industry 4.0 Adoption in SMEs." *International Journal of Production Economics* 240: 108234. <https://doi.org/10.1016/j.ijpe.2021.108234>
- Riera, C., and J. Iijima. 2019. "The Role of IT and Organizational Capabilities on Digital Business Value." *Pacific Asia Journal of the Association for Information Systems* 11 (2): 67–95. <https://doi.org/10.17705/1pais.11204>
- Rodrigues, M., M. Franco, N. Sousa, and R. Silva. 2021. "Covid 19 and the Business Management Crisis: An Empirical Study in Smes." *Sustainability* 13 (11): 5912. <https://doi.org/10.3390/su13115912>
- Roman, A., and V. D. Rusu. 2022. "Digital Technologies and the Performance of Small and Medium Enterprises." *Studies in Business and Economics* 17 (3): 190–203. <https://doi.org/10.2478/sbe-2022-0055>
- Rozak, H. A., A. Adhiatma, O. Fachrunnisa, and T. Rahayu. 2023. "Social Media Engagement, Organizational Agility and Digitalization Strategic Plan to Improve SMEs' Performance." *IEEE Transactions on Engineering Management* 70 (11): 3766–3775. <https://doi.org/10.1109/TEM.2021.3085977>
- Rupeika-Apoga, R., K. Petrovska, and L. Bule. 2022. "The Effect of Digital Orientation and Digital Capability on Digital Transformation of SMEs during the COVID-19 Pandemic." *Journal of Theoretical and Applied Electronic Commerce Research* 17 (2): 669–685. <https://doi.org/10.3390/jtaer17020035>
- Sassanelli, C., and S. Terzi. 2022. "The D-BEST Reference Model: A Flexible and Sustainable Support for the Digital Transformation of Small and Medium Enterprises." *Global Journal of Flexible Systems Management* 23 (3): 345–370. <https://doi.org/10.1007/s40171-022-00307-y>
- Scuotto, V., E. Arrigo, E. Canelo, and M. Nicotra. 2020. "Ambidextrous Innovation Orientation Effected by the Digital Transformation: A Quantitative Research on Fashion SMEs." *Business Process Management Journal* 26 (5): 1121–1140. <https://doi.org/10.1108/BPMJ-03-2019-0135>
- Scuotto, V., D. Magni, T. Theofilos, and M. Del Giudice. 2022. "Chief Digital Officer and Organizational Creativity Toward Digitalization." *IEEE Transactions on Engineering Management* 71. <https://doi.org/10.1109/TEM.2022.3153395>
- Scuotto, V., M. Nicotra, M. Del Giudice, N. Krueger, and G. L. Gregori. 2021. "A Microfoundational Perspective on SMEs' Growth in the Digital Transformation Era." *Journal of Business Research* 129: 382–392. <https://doi.org/10.1016/j.jbusres.2021.01.045>
- Soluk, J., and N. Kammerlander. 2021. "Digital Transformation in Family-Owned Mittelstand Firms: A Dynamic Capabilities Perspective." *European Journal of Information Systems* 30 (6): 676–711. <https://doi.org/10.1080/0960085X.2020.1857666>
- Spremić, M., H. Zentner, and R. Zentner. 2022. "Measuring Digital Business Models Maturity: Theory, Framework, and Empirical Validation." *IEEE Transactions on Engineering Management* 71: 6553–6567. <https://doi.org/10.1109/TEM.2022.3226864>
- Sulastri, S., H. Mulyadi, D. Disman, H. Hendrayati, and H. Purnomo. 2023. "Resilience Acceleration Model of Small and Medium Enterprises Through Digital Transformation." *Journal of Eastern European and Central Asian Research (JEECAR)* 10 (4): 609–619. <https://doi.org/10.15549/jeecar.v10i4.1355>
- Taleb, N. N. 2012. *Antifragile: How to Live in a World we Don't Understand* (Vol. 3). London: Allen Lane.
- Teece, D. J. 2007. "Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance." *Strategic Management Journal* 28 (13): 1319–1350. <https://doi.org/10.1002/smj.640>

- Teece, D. J. 2012. "Dynamic Capabilities: Routines versus Entrepreneurial Action." *Journal of Management Studies* 49 (8): 1395–1401. <https://doi.org/10.1111/j.1467-6486.2012.01080.x>
- Teece, D. J., G. Pisano, and A. Shuen. 1997. "Dynamic Capabilities and Strategic Management." *Strategic Management Journal* 18 (7): 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- Tranfield, D., D. Denyer, and P. Smart. 2003. "Towards a Methodology for developing evidence-Informed Management Knowledge by Means of Systematic Review." *British Journal of Management* 14 (3): 207–222. <https://doi.org/10.1111/1467-8551.00375>
- Trieu, H. D. X., P. V. Nguyen, K. T. Tran, D. Vrontis, and Z. Ahmed. 2023. "Organisational Resilience, Ambidexterity and Performance: The Roles of Information Technology Competencies, Digital Transformation Policies and Paradoxical Leadership." *International Journal of Organizational Analysis* 32 (7): 1302–1321. <https://doi.org/10.1108/IJOA-05-2023-3750>
- Troise, C., V. Corvello, A. Ghobadian, and N. O'Regan. 2022. "How Can SMEs Successfully Navigate VUCA Environment: The Role of Agility in the Digital Transformation Era." *Technological Forecasting and Social Change* 174(September 2021): 121227. <https://doi.org/10.1016/j.techfore.2021.121227>
- Ukko, J., M. Nasiri, M. Saunila, and T. Rantala. 2019. "Sustainability Strategy as a Moderator in the Relationship between Digital Business Strategy and Financial Performance." *Journal of Cleaner Production* 236: 117626. <https://doi.org/10.1016/j.jclepro.2019.117626>
- Vogel, R., and W. H. Güttel. 2013. "The Dynamic Capability View in Strategic Management: A Bibliometric Review." *International Journal of Management Reviews* 15 (4): 426–446. <https://doi.org/10.1111/ijmr.12000>
- Wang, C. L., and P. K. Ahmed. 2007. "Dynamic Capabilities: A Review and Research Agenda." *International Journal of Management Reviews* 9 (1): 31–51. <https://doi.org/10.1111/j.1468-2370.2007.00201.x>
- Ward, V., A. House, and S. Hamer. 2009. "Developing a Framework for Transferring Knowledge into Action: A Thematic Analysis of the Literature." *Journal of Health Services Research & Policy* 14 (3): 156–164. <https://doi.org/10.1258/jhsrp.2009.008120>
- Webster, J., and R. T. Watson. 2002. "Analyzing the past to Prepare for the Future: Writing a Literature Review." *MIS Quarterly* 26 (2): xiii–xxiii. <https://www.jstor.org/stable/4132319>
- WEF. 2022. *Future Readiness of SMEs and Mid-Sized Companies: A Year On - INSIGHT REPORT, NOVEMBER 2022, World Economic Forum*
- Westerlund, M. 2020. "Digitalization, Internationalization and Scaling of Online SMEs." *Technology Innovation Management Review* 10 (4): 48–57. <https://doi.org/10.22215/timreview/1346>
- Wolcott, H. F. 1994. *Transforming Qualitative Data: Description, Analysis, and Interpretation*. Thousand Oaks, CA: Sage Publications, Inc.
- Yeow, A., C. Soh, and R. Hansen. 2018. "Aligning with New Digital Strategy: A Dynamic Capabilities Approach." *The Journal of Strategic Information Systems* 27 (1): 43–58. <https://doi.org/10.1016/j.jsis.2017.09.001>
- Yu, H., M. Fletcher, and T. Buck. 2022. "Managing Digital Transformation during Re-Internationalization: Trajectories and Implications for Performance." *Journal of International Management* 28 (4): 100947. <https://doi.org/10.1016/j.intman.2022.100947>
- Zangiacomi, A., E. Pessot, R. Fornasiero, M. Bertetti, and M. Sacco. 2020. "Moving Towards Digitalization: A Multiple Case Study in Manufacturing." *Production Planning & Control* 31 (2-3): 143–157.
- Žebryte, I., F. Fonseca-Vasquez, and R. Hartley. 2019. "Emerging Economy Entrepreneurs and Open Data: Decision-Making for Natural Disaster Resilience." *Journal of Small Business Strategy (Archive Only)* 29 (1): 43–54.
- Zhang, S., L. Han, K. Kallias, and A. Kallias. 2021. "The Value of in-Person Banking: Evidence from US Small Businesses." *Review of Quantitative Finance and Accounting* 57 (4): 1393–1435. <https://doi.org/10.1007/s11156-021-00982-5>
- Zhang, X., C. Gao, and S. Zhang. 2022. "The Niche Evolution of Cross-Boundary Innovation for Chinese SMEs in the Context of Digital Transformation—Case Study Based on Dynamic Capability." *Technology in Society* 68: 101870. <https://doi.org/10.1016/j.techsoc.2022.101870>