A Systematic Literature Review of Supply Chain Resilience in Small–Medium Enterprises (SMEs): A Call for Further Research

Ozlem Bak, Sarah Shaw, Claudia Colicchia, and Vikas Kumar

***Abstract*—In this article, with the increased disruptions faced by businesses and the occurrence of natural disasters in the world, supply chain resilience remains a major challenge especially for small- and medium-sized enterprises (SMEs). Despite the relevance of SMEs to the economy, there is limited scholarly work on resilience practices in SMEs and a limited understanding of how SMEs can achieve resilience. To understand the role of supply chain resilience in SMEs, we undertake a systematic literature review (SLR), which results in the identification and analysis of 101 journal articles, published between 2006 and 2019, on SME supply chain resilience. Our analysis into SME supply chain resilience highlights four focal areas: 1) the role of collaboration and culture; 2) the role of SMEs' capabilities; 3) the role of Information Systems; and (4) the role of cost and financing. Our SLR investigation identifies future research directions and focal areas tailored to SMEs to help them to assess and develop their supply chain resilience.**

***Index Terms*—Resilience, small–medium enterprise (SME), supply chain management, supply Chain Resilience, systematic literature review (SLR).**

I. Introduction

THE increased supply chain interconnectivity and complexity in the last decade have made supply chains vulnerable to risks [124] generating a widening debate on how supply chain resilience can be achieved [61] and to what extent it is feasible [18]. With the increased disruptions faced in businesses due to the increasing occurrence of disasters, the resilience agenda has become a key priority for public and private sectors [19], [109], [96], [101]. Linnenluecke [67] noted that following five key streams of research have developed which are worthy of enquiry:

1) Organizational responses to external threats;
2) Organizational reliability;
3) Employee strengths;
4) The adaptability of business models;
5) Design principles that reduce supply chain vulnerabilities and disruptions.

Hence, four prominent capabilities enhance business resilience: 1) redundancy, which involves maintaining excess resources (e.g., carrying safety stock or low capacity utilization), 2) flexibility (e.g., sourcing and manufacturing flexibility), 3) collaboration with supply partners, and 4) developing a risk-focused culture [86]. In this regard, we can see that resilience is a multidimensional and multidisciplinary concept, and although supply chain resilience has been widely explored, there is still no comprehensive definition and consensus on a roadmap to achieve resilience [18], [61], [62], [73], [110], [69]. This is partially due to the fact that supply chain resilience is "… a subset of a systems' [which entails] the capacity for response ….. to recognize threats, evaluate the current risks …. self-regulate, prepare for future protection efforts" [6, p. 215]. Resilience in this context can be interpreted as a supply chain capability, which can complement the traditional risk processes [123] and has the potential to offset the severity of vulnerabilities in the supply chain [125]. Treiblemeier [103, p. 440] noted that "the question remains how companies can cope with those forces and how they can move quickly into a more favorable state." However, this coping mechanism would depend on the degree of the supply chain's ability to respond, react, adapt, and flex to contextual and environmental changes [130]. In some cases, this is formed through the strategic vision and resilience skills of top management or the CEO [14].

However, for small–medium enterprises (SMEs), this picture differs. Notwithstanding the relevance of SMEs to many economies around the world, evidence suggests that SMEs are relatively less prepared than larger organizations to cope with disruptions, due to the volatile and resource-constrained environment in which SMEs operate [15, 22]. SMEs often have limited access to a broader set of coping strategies, are generally not well prepared to deal with disruptions, and also sometimes characterized by informality and noncompliance with industry norms and regulations, limiting their capacity to adopt risk management tools and expand customer and supply base [15]. For SMEs, resilience is incorporated into their short-term tactical operations planning, especially in developing countries context [15, 22]. As noted by Linnenluecke and Griffiths [66, p. 25], the resilience of an organization relates to its size, for instance, "disruption of operations in a local branch may seem minor

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from the perspective of a large, global organization, but can be significant for a small organization which operates only in a few locations." Considering SMEs employ 50–200 people which globally account for 70% of the world's production, its impact on the resilience agenda is noteworthy [11], [61], [62]. Within the context of the European Union, SMEs are defined as companies with fewer than 250 employees and/or turnover less than €50 million. Their impact upon the EU economy is high considering that "SMEs represent 99% of all businesses in the EU" [37]. SMEs face particularly two key challenges: 1) their susceptibility to disruptions and 2) their ability to recover from disruptions.

SMEs typically have focused on product offerings, targeting a particular industry sector or niche market: this choice makes them vulnerable [112]. Thus, a supply chain disruption on a specific product or customer market can have significant repercussions for SMEs. Furthermore, SMEs often lack the "tangible" resources and capabilities, such as financial and technological that help to recover. In addition, when compared to counterparts larger firms, SMEs are found to be less able to exploit innovation [97] and often have weak or unstructured decision-making processes [91]. Their counterparts larger firms have the capability to spend considerable time and resources on strategic sourcing and business continuity planning, to evaluate suppliers not only on price but also on the level of risk [111], thus limiting their exposure to disruptions. SMEs, however, possess less tangible assets that enhance resilience.

Despite the relevance of SMEs to the economy, Kamalahmadi and Parast [61, p. 128] noted there is "a very limited scholarly work on resilience practices in SMEs" and a limited understanding of "how organisations, particularly SMEs, can achieve degrees of resilience" [18 p. 5388]. Current academic research findings focus on supply chain resilience which is rather problematic, as they focus on supply chains without further classifications such as the scope of businesses and range of industries [4], [95]. Further studies highlighted the importance of SME resilience and called for further research into how SMEs maintain and enhance resilience to disruptions, exploring the role of internal resources and/or capabilities that are pertinent to smaller firms [61], [65], [46], [86]. Similarly, Kamalahmadi and Parast [61, p. 131] noted that "questions remain on how SMEs can enhance resilience, and whether resilience principles associated with large enterprises are also applicable to SMEs." Therefore, in this article, we aim to address the above issues with two key questions by reviewing the extant literature as follows:

1) What are the major issues experienced by SMEs in terms of supply chain resilience?
2) To what extent are the key gaps addressed in SME supply chain resilience literature?

The subsequent sections of the article provide the process of the systematic literature review (SLR) and the sample selection criteria, followed by an analysis of supply chain resilience categories in SMEs, while highlighting the main trends in the SME supply chain resilience agenda. Finally, the key trends and areas with potential for further research are identified and discussed.

II. Defining Supply Chain Resilience in SMEs

Resilience is defined as "…the capacity to act or react in response to these unpredictable events to prevent them from having a negative impact" on the organization and its profitability [29 p. 187]. Wieland and Wallenburg [109] noted that "A supply chain can… be resilient if its original stable situation is sustained or if a new stable situation is achieved….resilience is understood as the ability of a supply chain to cope with change." However, it is also important to look at the definition of resilience more specifically in the context of SMEs. Table I also indicates the resilience complexity and its challenges for the SMEs. One of the results of such a differentiation is built upon the fact that the "literature surrounding resilience within the context of SMEs is quite recent and not as well developed" [29, p. 191].

Building upon previous definitions, we can define resilience within the SME context as 1) "an important characteristic of SMEs competing in today's business environment" [62, p. 5432] that combines adaptability, responsiveness, sustainability, and competitiveness [46]; 2) "the capability to self-renew over time, to maintain status-quo or move to a new desirable state after (or before) being disturbed" Li *et al*. [50, p. 7], which is impacted by external and internal events the network of organizations forming the supply chain, locally and globally [15], [49].

The complex and changing global environment poses a threat to SMEs which are more fragile and facing a higher level of competition than large corporations from transfer pricing [58], [62], [51]. SMEs are unprepared especially for natural disasters [1], [108]. Considering the labor-intensive nature of most SMEs, disruptions may be related to the disadvantage of their size, scope, and resources [1]. SMEs are impacted also by the external business environment [46]. This is important as SMEs seem to be underinsured and have a lack of risk assessments or business-continuity plans [1], which makes them vulnerable to external factors. The consequence of unpreparedness for disasters and disruptions can be a reason for SMEs facing difficulty in creating resilience [108], [35]. Especially, where the external help can be delayed to organizations, for example, nongovernmental aid to SMEs after the Japan earthquake was provided in some cases after a year, which may impact also the vulnerability of the SMEs [27]. When it comes to natural disasters, a study carried out by Pathak and Ahmad [84] indicated that SMEs required financial, managerial, and external assistance to achieve resilience. The resilience of SMEs can be enabled by the capability of generating capital, location, adoption of technology, and marketing [35]. For example, SMEs in comparison to large and multinational corporations present different responses to resilience [13], [100], [101]. On the other hand, multinational corporations are highly dependent on SMEs and are faced with increased risk if SMEs cannot adapt to market conditions [59], [50]. Similarly, Hofmman [51, p. 129] noted that "fluctuating prices or exchange rates harm the SME to an extent that its existence becomes endangered, significant consequences for the entire supply chain (network) can occur." Hence, SME resilience is closely aligned with the wellbeing of multinational corporations [118], [51], [50]. Therefore, we can state that the SME level of contextual complexity makes it rather difficult

TABLE I
SME RESILIENCE DEFINITIONS

Gunesakaran et al. (2011)	"SMEs face common problems and challenges in the global market and operations. [Therefore, in the context of SME resilience] resilience could be viewed as adaptability, responsiveness, sustainability and competitiveness in evolving markets." [p. 5491]
Kumar and Sosnoski, (2011)	"Resilience is an important characteristic of SMEs competing in today's business environment" [p. 5432]
Wendawatta et al. (2016)	"…resilience was seen as a collective effect of vulnerability, coping strategies and coping capacities of SMEs…" [p.248]
Ballestores and Domingo (2015)	"…. resilience is associated with business continuity, i.e. the preparedness of the business sector to emergencies whereby disruption in business operation is at minimum and resumption of normal operation of business is done in the shortest time. Building SME resilience thus has to be understood in the context of the business and policy environment in which they operate. SMEs operate within the domestic and global supply chain linked with organizations that make up the value chain and logistics." [p.7]
Monsson (2017)	SME resilience is related to vulnerability and adaptive capacity… vulnerability and adaptive capacity (or short adaptability) can be interpreted as the two specific abilities of being able to resist and to recover from shocks
Herbane (2018)	SME resilience is an important precursor to wider local, regional and national economic resilience
Ozar et al. (2008)	Comparing the performance of small-scale industry before and after the Asian financial crisis shows that the evidence on SME resilience is mixed: some were hurt by the crisis whereas others were able to develop new business opportunities.
Li et al. (2015)	SME resilience emerged from the ability to configure firm resources in novel ways to address the exigencies of the [affecting] event

to understand the resilience agenda and its implications fully. Similarly, this is echoed by Kamalahmadi and Parast [61, p. 131], "questions remain on how SMEs can enhance resilience, and whether resilience principles associated with large enterprises are also applicable to SMEs." The resilience of SMEs differs specifically from larger firms based on lacking resources and capabilities (i.e., financial and technological resources) of larger firms, for instance, developing risk-focused sourcing strategies, possessing information technology that provides early warning systems about risk events, and having in place business continuity plans that enable disruption preparedness. In contrast, large firms have these resources and capabilities in abundance. Thus, SMEs may be more susceptible to disruptions and lack the resilience-enhancing capabilities to recover from disruptions when compared to larger firms. However, SMEs do exhibit some resilience, but little is known about why and how this happens [86].

III. RESEARCH PROCESS

In this article, we conducted a literature review on supply chain resilience in the context of SMEs. The literature review provided a much-needed analysis of the resilience context in SMEs, especially wherein "the resilience of SMEs is under-investigated, and results are largely inconclusive" [29, p. 187]. In the area of supply chain resilience, some connotation to SMEs were made as follows.

1) Brahms *et al.* [115] presented a literature review on "resilience" and "resilient SMEs" demonstrating that only a few studies contributed to supply chain resilience interrelationships with SMEs.
2) Ponis and Koronis [87] included a review of 134 papers in the resilience context.
3) Pereira *et al.* [116] employed an SLR in the area of supply chain resilience and procurement.
4) Kamalahmadi and Parast [61] included a literature review on supply chain resilience over a period between 2000 and 2014.

Thus, although there is a good understanding of supply chain resilience, its importance for SMEs needs further evaluation. Hence, an SLR was conducted with the aim of collecting and analyzing up-to-date relevant academic research on supply chain resilience within SMEs.

A. Stage 1: Conducting the SLR

The use of an SLR provides "a key tool …to manage the diversity of knowledge for a specific academic inquiry" [114, p. 208] with the benefit of an evidence trail, while minimizing the level of possible bias and error [114], which allows the identification, selection, and analysis of secondary data through a three-stage approach: 1) planning the review, 2) conducting the review, and 3) reporting and dissemination of the review, enabling the researchers to assure internal validity and reduce potential bias in the analysis[113], [114]. To reduce the human-error, extraction forms based on Microsoft Excel forms have been used to ascertain information from sources such as title, author, and year of publication, methods utilized, and emerging

TABLE II
CODING CATEGORIES FOR JOURNAL PAPERS

Categories	Variables	Description of the categories coded
Author(s)	Author 1 -7	Refers to incl. of all co-authors
Years	Years	Year of publication
Authors Affiliation	Location	Authors` location
Type	Paper type	Classification of article type (Conceptual, Literature review, simulation, modelling, survey, technical, viewpoint, case study)
Years	Timeframe	Timeframe for the articles if stated i.e. literature review, longitudinal studies
Keywords	Keywords	Define keywords
Industry	Industry context	Industries involved in the research
Sampling	Sample size	This category highlights the sample size
Context	Contextual setting	This category identifies the setting of network, and country
Research Method	Methodology	Research Methods utilized
Method	Specific methods used	Includes the range of methods utilised
Findings	SCR SME impact area	Identifies the impact areas of SCR in SMEs
Journal Title	Title	Title of the journal- identification of research areas

theories and concept synthesized [117] (Table II). The papers were independently screened by two of the authors, who discussed any discrepancies on inclusion/exclusion. For the SLR, the following keyword search was set.

1) Based on the academic and professional discussions, the search included keyword search strings in abstract "supply chain," "resilience," "SME," or "small–medium."
2) Publications including law aspects have not been included due to the inherent broader range of complexity that may not fall under the supply chain scope [126].
3) The search included the major databases; Elsevier, Springer, Emerald, Wiley, and other library services such as Ebscohost.

Similar to Pilbeam *et al.* [119] after the first screening, duplication and conference papers were eliminated. The initial screening resulted in 115 papers to be considered for relevancy, after the assessment only 60% of papers were included in the sample. This also indicates one of the weaknesses of the SLR, particularly in underdeveloped research areas. Hence, the use of stage two, including an additional manual search, discussed next, became imperative.

B. Stage 2: Inclusion of Relevant Articles

Given the relatively small number and leads to other journal articles, the authors included an additional step in the research. Similar to Kamalahmadi and Parast [61], due to the emerging nature of SMEs resilience, we employed a second step to collect relevant articles in addition to those yielded by the keyword search. We did this using two techniques: 1) a "snowballing technique" from the reference and citation lists of the SLR journal papers identified, and 2) deploying our background knowledge of the resilience subject areas as researchers. As far as the "snowballing technique" is concerned, we conducted a backward and forward snowballing following the steps proposed by Wohlin [115]: publications referenced from and referencing to previously selected studies were considered iteratively. At each step, we applied the same criteria for inclusion/exclusion presented above and we removed papers from the list that have already been examined or selected in a previous iteration. New papers identified in the iteration are taken into account for the next iteration. We iterated the process until no new papers were found.

The two abovementioned techniques enabled us to identify a further 80 papers for screening, which were important but were not part of our SLR results, from which 41% were considered according to the steps described above. The resulting 101 remaining papers from both stages were then categorized by four researchers, according to the coding categories shown below. The study relied on a thematic analysis to perform data analysis and categorization of papers [134].

Specifically, the authors tried to identify patterns that emerged from all the retrieved articles. For the findings category, these patterns were structured in groups and eventually a total of four focal areas were identified in the literature. During the development of the focal areas, the authors discussed any discrepancies or different judgments on the interpretation of the content of the papers until the point of agreement was reached. Analyzing the distribution of the journal papers, we see that the SME supply chain resilience has been evaluated based on a number of categories (Tables II–IV).

A significant number of papers are empirical with 58% dominated by qualitative or quantitative research approaches, followed by 25% conceptual papers, in contrast to limited literature review papers with 10% and viewpoints with 7% remains rather limited (Fig. 1). Most journals containing SMEs and supply chain resilience focus on the area of environment and sustainability, operations management, and operations research, general management, information science, and sectoral studies.

The inclusion of these diverse areas is noted in the academic literature on supply chain resilience. The authors noted that supply chain resilience embedded different subjects, such as

TABLE III
CATEGORIES FOR JOURNAL PAPER

Paper Type	Authors
Empirical Paper	Agrawal et al. (2012); Aleksić et al. (2013; 2014); Ali et al (2017);Arnold (2015); Asgary et al. (2012); Ates & Bititci (2011); Battistella (2014); Bergman et al. (2006); Bergmann et al. (2016); Boehle et al (2016); Bondar et al. (2017); Calabrese & Vervaeke (2017); Blake et al . (2018); Carden et al. (2019); Cespedes & Dominique (2017); Cole et al. (2017); Coles et al. (2016); Conz et al. (2017); Coutinho et al. (2013); Datta (2017); Duarte and Bressan (2015); Fielder et al. (2016); Formentini, & Taticchi (2016); Golilic et al. (2017); Gualandris and Kalchscmidt (2015); Harwood et al. (2011); Hermann & Guenther (2017); Hossan & Mohammed (2016); Jaruhuddin et al. (2016); Jayaram et al. (2014); Li et al. (2011);Lorents et al. (2016); Lotfi & Saghiri (2018); Mamillo (2015); Mandal (2014); Malek et al. (2017); Markovic et al. (2017); Martins de Sa et al. (2019); Osborn & Simpson (2017); Pal et al. (2014); Pathak & Ahmad (2016); Rehm and Goel (2017); Sahebjamnia et al. (2015); Simba et al. (2017); Song et al. (2016); Stevenson & Busby (2015);Thomas et al. (2016); Thun et al. (2011); Todo et al. (2015); Urciuoli et al. (2014); Wieland & Wallenburg (2013); Abe and Ye (2012); Muller et al (2018); Mancheri; Abidin; Gölgeci; Salisu; Yang; Yazdanparast;
Conceptual Paper	Aibogun et al. (2014); Arsovski et al. (2017); Hoffman (2011); Kumar and Sosnoski (2011); Lambert et al. (2013); Moore and Manning (2009);Mohammed et al. (2019); Ravukollu et al. (2019); Stewart et al. (2009); Wedawatta et al. (2010); Alvarenga et al. ; Hou et al. ; Mancheri et al. ; Mari et al. ; Min, H. et al. ; Rajesh et al. ; Ramezankhani et al. ; Vroegindewey et al. ; Zavitsas et al. ; Ivanov et al. ; Kaur et al. ; Paul et al. ; Rajagopal et al. ; Sáenz et al. ; Sokolinskiy et al.
Literature Review	Ahi and Searcy (2013); Annarelli and Nonnino (2016); Bak (2018); Bhamra et al. (2011); Linnenluecke & Griffiths (2017); Mandal (2014); Markovic and Parasat (2016); Stevenson and Spring (2007); Thukamuhabwa et al. (2015) Shin
Viewpoint	Bucher et al. (2016); Chin et al (2012); Genus and Mahfakkeri (2014); Gomes (2015); Gormley (2015); Graham et al. (2015); Haraguchi et al. (2016)

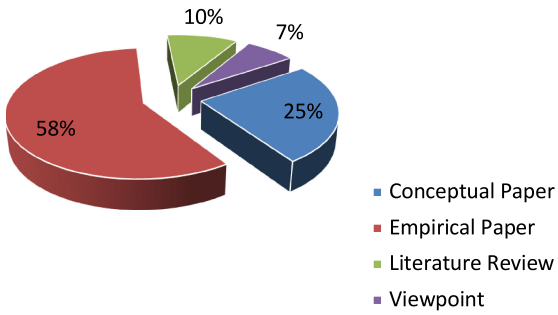

Fig. 1. Distribution of paper types.

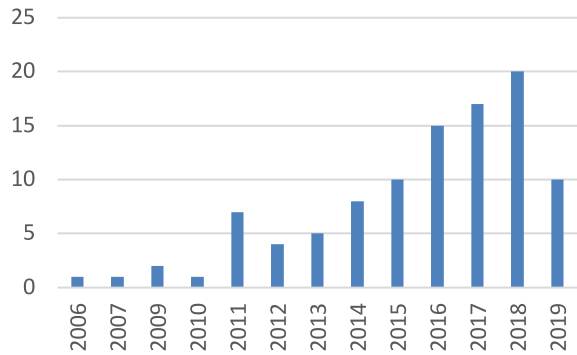

Fig. 2. Distribution of years vs. number of papers.

ecology, psychology, economy, social, and organizational, making the concept of resilience rather multidimensional and multidisciplinary [127], [117]. The number of papers has indicated a steady increase with two outliers in 2011 and 2019.

The presence of the aforementioned fields indicates the main supply chain resilience areas [61]. When looked at the overall distribution of journals and particular areas, we see that the first 20 journals which make up 54% of the journal papers indicate a high proportion of operations management and research journals (Fig. 3).

Further, as far as the information science and sectoral studies are regarded, 77% of articles published in information science journals were published after 2015, demonstrating the expansion of SME resilience research in the context of the information science, security, and information management [61], [129] (Fig. 4). This shows that system integration has become an integral element of the SME supply chain resilience agenda. The importance of IT security is expected, in order to improve the resilience where "…SMEs have started outsourcing and market diversification, which highlights the need to integrate more information technology and information systems for significant SME resilience." [83, p. 412].

TABLE IV
INDUSTRY SECTORS

Sector	Relevant sectoral studies
Aerospace	Coutinho et al. (2013); Osborn &Simpson (2017); Thomas et al. (2015)
Agriculture*	Ali et al (2017); Formentini, & Taticchi (2016); Mandal (2014); Song et al. (2016); Stevenson and Busby (2015); Martins de Sa et al. (2018); Vroegindewey et al. (2018); Yazdanparast et al. (2018).
Automotive	Arsovski et al. (2017); Bergmann et al. (2016); Calabrese & Vervaeke (2017); Lotfi & Saghiri (2018); Malek et al. (2017); Sahebjamnia et al. (2015); Stevenson and Busby (2015); Song et al. (2016); Thun et al. (2011); Thomas et al. (2015); Thun et al. (2011); Ramezankhani et al. (2018)
Construction	Bergmann et al. (2016); Formentini, & Taticchi (2016); Osborn &Simpson (2017); Mandal (2014); Thomas et al. (2015); Wedewatta et al. (2010); Abidin et al. (2018).
Electronics**	Bergman et al. (2006); Jukka et al. (2006); Lambert et al. (2013); Li et al. (2011); Mandal (2014); Thomas et al. (2015)
Manufacturing ***	Bergmann et al. (2016); Cespedes & Dominique (2017); Cole et al. (2017); Formentini, & Taticchi (2016); Hossan & Mohammed (2016); Jaruhuddin et al. (2016); Jayaram et al. (2014); Mamillo (2015); Muller et al. (2018); Osborn &Simpson (2017); Pal et al. (2014); Pathak & Ahmad (2016); Simba et al. (2017); Song et al. (2016); Stevenson and Busby (2015); Thomas et al. (2015); Todo et al. (2015); Wieland & Wallenburg (2013); Mohammed et al. (2019); Rajesh et al. (2018)
Pharmaceuticals	Aigbogun et al. (2014); Cespedes & Dominique (2017); Mandal (2017); Stevenson and Busby (2015); Thomas et al. (2015)
Services	Bergmann et al. (2016); Coles et al. (2016); Graham et al. (2015); Harwood et al. (2011); Simba et al. (2017); Lila et al. (2018); Yang et al. (2018); Zavistas et al. (2018).
Telecommunication	Battistella (2014); Bergmann et al. (2016); Song et al. (2016)
Utilities	Bergmann et al. (2016); Genus & Mafakheri (2014); Lambert et al. (2013); Marlen (2015); Urciuoli et al. (2014); Blake et al. (2019)
Wine	Conz et al. (2017); Duarte and Bressan (2015); Golilic et al. (2017)

*Includes forestry, farming, and fishing; **Includes software and hardware, ***Includes FMCG.

Li *et al.* [65, p. 7] highlighted that SMEs have limited process capability and "argue for the ability to reinvent existing processes or seek external cooperation to overcome barriers to change." However, an increasing level of information technology and its implementation with the cloud computing network within SMEs indicated an increase in organizational resilience potential [128]. Hence, cloud computing is becoming a game-changer for SMEs as it provides a scalable infrastructure and capabilities [42].

C. Geographical Context and Industry Category Setting

Categorization of papers by industry sector indicated the highest percentage in manufacturing sector research, with a generic spread across automotive and construction. Manufacturing represents a key aspect or node within any supply chain, and crucial in the supply of raw materials and production of the end product for the market. Given that SMEs play a vital role in this as suppliers, there is no surprise this has been an area of focus within the SLR. It could be argued also that manufacturing is an activity as well as an industry sector and is part of many of the other industry sectors, such as automotive or electronics. The industry category settings have been well developed with the majority of the papers (i.e., 75%) indicating the SME resilience in a specific industry category; however, the rest of the papers did not entail any relevance to industrial categories making it difficult for the researchers to contextualize and categorize in this respect (Table IV).

Considering the resilience within the context of 201 German manufacturing SMEs, similar barriers are faced by SMEs in terms of location, regulations, and challenges [50]. This also relates to the fact that SMEs' manufacturing strategy, such as volume flexibility, design flexibility, and service provision, enables better business outcomes during instances of macroeconomic shocks [68]. Similarly drawing on SME manufacturing flexibility and rapid decision-making capability, Pal *et al.* [83, p. 411] highlighted also in their study the role of economic crisis noting that SMEs "faced major threats to their financial performance and ultimately to their survival at times of economic crises, and thus economic resilience has become a prerequisite to be fostered in such firms in order to be successful."

In terms of the automotive industry, the authors' research indicated a difference between old and new SMEs [9]. The older SMEs operating over 20 years indicated an increase of resilience capacity when compared to their newer counterparts. Thun *et al.* [100] investigated supply chain risk management within the context of 67 SMEs operating in the German automotive industry. Their results show that SMEs predominantly focus on

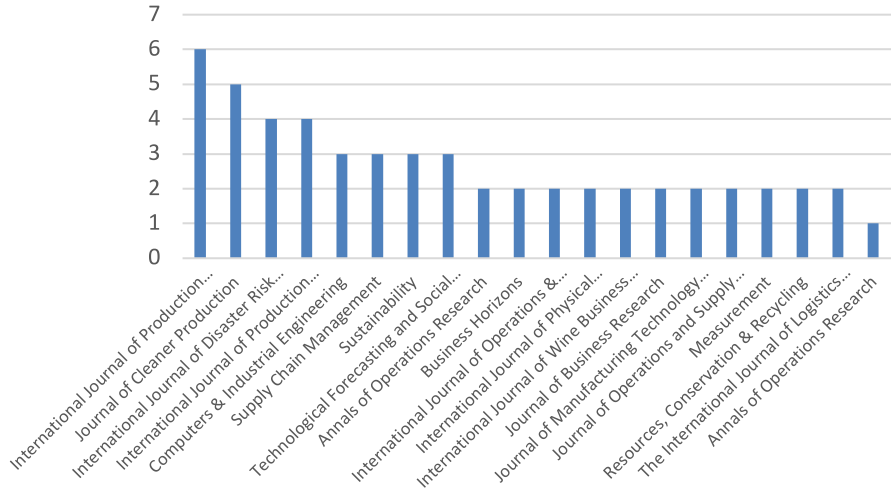

Fig. 3. SME resilience the first 20 journals (based on the journal paper numbers).

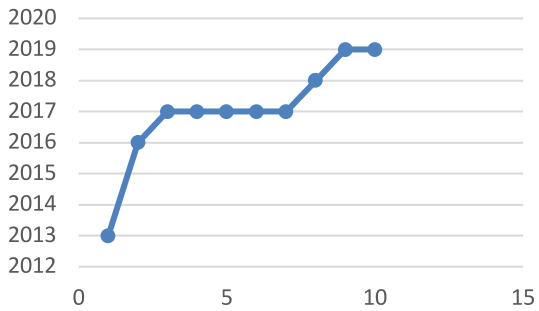

Fig. 4. SME resilience papers in information science.

reactive or short-term measures to mitigate risks after the occurrence of a negative event. Hence, in both studies, proactive and reactive measures seem to be valid responses in SME resilience agenda.

In terms of the healthcare industry, Aigbogun *et al.* [4, p. 220] investigated the pharmaceutical industry in Malaysia, which included SMEs producing "generic drugs, traditional medicines, and herbal supplements …[as well as act] as a contract manufacturer for foreign multinational corporations … worth RM4.4 billion." Group and rational cultures in the healthcare supply chain were dominant enablers of resilience and managers therefore focused on enriching these specific cultures in their respective organizations for enhanced resilience [73]. One of the key challenges for resilience in the pharmaceutical SMEs was countermeasures for improving the counterfeit products [94]. For the pharmaceutical SMEs, they suggested that it is just as important to develop resilience to counterfeiting as it is to develop resilience to natural disasters, terrorist attacks, and other fundamental threats to supply chains [94].

Most of the remaining sector studies indicate vulnerabilities as well as strengths of SME resilience based on SMEs' size and scope. For example, Hui-Hong *et al.* [53] found that some SMEs suffered negatively by the global recession. Some overseas Japanese SMEs in the electronic manufacturing sector thrived and grew either because they adopted new technology, developed negotiation powers to achieve economies of scale through acquisitions, or reorganized their manufacturing. Other studies highlighted the impact of product type and resilience: for example, fresh produce SMEs compared to other sectors were more complex in terms of perishability and limitations of shelf life [75], whereas others highlighted the contextual setting of SMEs, for example, the construction industry being overwhelmingly comprised of SMEs and highly dependent upon SMEs' resilience [108].

There are also commonalities across SME vulnerabilities explored in multiindustry study that included 38 cases from the construction industry, energy supply industry, food industry including tobacco, mechanical engineering industry, tourism industry, and water and sewage supply industry highlighted that extreme weather events can affect SMEs financial performance [17]. This is especially important as SMEs face problems in obtaining financing from banks as well as have a lack of familiarity with investors and project risks, which does impact the transaction costs for SMEs [40].

D. Research Methods Utilized

The analysis indicated that case study, surveys, and interviews were often used reflecting the inherent complexity of SMEs' supply chain (Table V). Case studies provide a good insight into SME supply chain resilience to understand its challenges, tools, and strategies utilized. However, some researchers did not mention the methods utilized when discussing conceptual papers which reflected 17% of the overall papers indicating high reliance upon a theoretical discussion of SME resilience. Surveys, case studies followed by interviews, indicated the most used research methods highlighting the need for understanding the impact of either standalone SME resilience elements or differences between SMEs [58], [48]. For example, an analysis of wide-ranging issues and its interlinkages into SME resilience profile has been reported in the form of survey results involving 72 companies in the U.K. [99] that reported that SMEs can overcome the disadvantages of limited resources and be resilient

TABLE V
RESEARCH METHODS UTILIZED

Case study	Abe and Ye (2012); Ali et al (2017); Battistella (2014); Conz et al. (2017); Formentini, & Taticchi (2016); Graham et al. (2015); Haraguchi et al. (2016); Jayaram et al. (2014); Li et al. (2011); Muller et al. (2018); Rehm and Goel (2017); Urciuoli et al. (2014); Hou et al.(2018); Carden et al. (2018); Mari et al. (2019); Mohammed et al.(2019); Rajagopal et al.(2019); Rajesh et al.(2018); Ramezankhani et al.(2018); Ravulakollu et al. (2018); Zavitsas et al.(2018)
Interviews	Aigbogun et al. (2014);.Agrawal ey al. (2012); Bergmann et al. (2016); Calabrese & Vervaeke (2017); Coles et al. (2016); Mamillo (2015); Osborn & Simba et al. (2017), S.Simpson (2017); Pal et al. (2014); Pathak & Ahmad (2016); Muller et al. (2018). Abidin et al.(2018); Blake et al.(2019); Martins de Sá et al.(2018)
Secondary	Ahi and Searcy (2013); Annarelli and Nonnino (2016); Bak (2018); Bhamra et al. (2011); Bucher et al. (2016); Kumar and Sosnoski (2011); Linnenluecke & Griffiths (2017); Mandal (2014); Markovic and Parasat (2016); Silke Stevenson and Spring (2007); Thukamuhabwa et al. (2015); Vroegindewey et al. (2018)
Survey	Ali et al (2017); Bergman et al. (2006); Bergmann et al. (2016); Cole et al. (2017); Coles et al. (2016); Conz et al. (2017); Coutinho et al. (2013); Harwood et al. (2011); Hossan & Mohammed (2016); Jaruhuddin et al. (2016); Lotfi & Saghiri (2018); Lorentz et al (2016); Mamillo (2015); Mandal (2014); Pal et al. (2014); Song et al. (2016); Thomas et al. (2015); Thun et al, 2011; Todo et al. (2015); Wieland & Wallenburg (2013); Gölgeci et al.(2019); Sáenz et al.(2018); Salisu et al. (2019); Yang et al.(2018); Yazdanparast et al.(2018)
Modelling	Arsovski et al. (2017); Sahebjamnia et al. (2015); Ivanov (2019); Kaur et al.(2018); Mancheri et al.(2019); Min et al.(2019); Paul et al.(2018); Sokolinskiy et al.(2018).

through diverse customer portfolio, detailed understanding of manufacturing processes, highly motivated leaders, new and advanced technology, and seamless communication systems.

Another finding from our SLR was that the limited availability of modeling and simulation studies also indicates the lack of quantitative measures and assessment tools within the SME supply chain resilience agenda. For example, in a context of constrained resources, a mathematical model to determine the required resources to cope with disruptions has been proposed to manage recovery plans and increase supply chain resilience [131].

IV. CONTEXT OF SUPPLY CHAIN RESILIENCE IN SMES

Due to SMEs context, size, and scope, supply chain resilience has different connotations to SMEs in comparison to large and multinational corporations, as the capacity and scope of SMEs to resilience externally and internally is positively related to the size of the firm, its resources, and location [132]. Considering that resilience can be triggered by different contextual factors, "cultural variances, the complex nature of communities, and existing and future networks," it becomes difficult to understand how to meet future challenges [44]. Hence, the challenge remains that "resilience can only truly be tested in times of adversity or crisis" [54, p. 2]. Hence, it is important to understand the contextual relevance of SME resilience as SME development requires a good balancing act between resilience and growth [78]. Our SLR on supply chain resilience in SMEs context highlighted four focal areas to balance for supply chain resilience impact as follows:

1) Supply chain resilience and the role of collaboration;
2) Supply chain resilience and SMEs' capabilities;
3) Supply chain resilience and the role of Information Systems;
4) Supply chain resilience and the role of cost and financing.

A. Supply Chain Resilience and the Role of Collaboration

The role of collaboration in terms of achieving supply chain resilience in SMEs is one of the main contributing factors for SMEs, as SME employees have multiple roles and tasks leading to "[Resilience] frequently plummeting down the list of priorities day-to-day running of the business" [28 p. 13]. Hence, the collaboration with a network of specialized partners allows SMEs to "…maintain… the focus on their core competences and [to] get… support" when and if needed [30, p. 925]. SMEs, due to their small size, volume, and scale, have less influence in collaborating with other supply chain partners to improve visibility and resilience, thus making them vulnerable [86]. SMEs to be more resilient need to collaborate, in order to withstand against disturbances, which are seen as typical characteristic of an SME environment [130]. Collaboration allows SMEs to develop resilience where "close relationships with customers and suppliers [can help] the SMEs sector [which possesses] …. a weak technological base, limited use of information technologies, as well as [a lack of] manpower" [26, p. 617]. Especially "given scarce resources to invest in building relationships, the important question of how tight a relationship should optimally be with respect to resilience is addressed for the first time." [109, p. 311]. Hence, studies proposed a comprehensive model to evaluate green resilience and stress the importance of supplier collaboration in creating organizational resilience [71], [72].

Despite this need, a high level of supply chain uncertainty does not always lead to a high degree of collaboration with the supply chain members [72]. Especially, organizational culture is seen as the key driver of a successful collaboration and also resilience [107].

Further, studies [11], [89] discussed the role of collaboration among SMEs in the form of complementarity, i.e., alignment of resources within a network of organizations, to increase the level of resilience of their supply chain. Traditionally, outsourcing has been seen as a valuable tool for supply chain resilience [155]. Hence, we also observe a shift in SMEs from only buying the resources, to SMEs outsourcing their key operations due to the competitive market environment [63]. However, utilizing outsourcing as one of the key strategies might mean high dependency upon the vendors [156]. This is especially important for competitiveness where "business success now depends on the sum of both the SME's and its partners' performances" [30, p. 295]. Day [32, p. 1983] included the notion of collaborative resilience, in which he stated that "the number and distance of different routes that resources or information must travel through various intermediate entities can be important to collective resilience." Therefore, resilience is not solely related to SMEs resilience, but rather the collaborative resilience performance of its collaboration partners.

B. Supply Chain Resilience and SMEs' Capabilities

Jayaram *et al.* [57, p. 472] note that SMEs are managed in family business contexts and utilize limited resources and are "less advanced in their supply chain management (SCM) capabilities compared to large organizations," which may limit their access to technical support and finances as such [25], [93]. On the other hand, SMEs' size allows for advantages such as agility, flexibility, quick response in responding to the supply chain disruptions than their counterparts [26], [133]. According to the results of a survey [99] involving 72 companies in the U.K., SMEs can overcome the disadvantages of limited resources and be resilient through diverse customer portfolio, detailed understanding of manufacturing processes, highly motivated leaders, new and advanced technology, and seamless communication systems. Nevertheless, the impact of SME resilience can also trigger "substantial disruptions in supply chains in the manufacturing sector, called a Single Point of Failure (SPOF). A SPOF is originally used in the field of information systems and refers to a system component which, upon failure, renders an entire system inoperable" [47, p. 538]. Hence, SME resilience is in the interest of the wider supply chain networks in this sense.

Still, due to the limitations of SMEs, such as limited access to international markets, they heavily rely on national and local markets with often highly volatile economic cycles, which may make them vulnerable to financing and project risks [40] [93]. Gilinsky *et al.* [157], based on their research on the wine sector, noted that SMEs try to overcome their traditional financing disadvantages through the use of innovative new technologies. However, the capabilities of SMEs may differ based on company setting, as Agrawal *et al.* [2, p. 164] noted that "the growth of the Indian IT industry has largely been enabled by the availability of skilled and economical manpower." The lack of investment and budgetary constraints has also been highlighted by Ali *et al.* [7, p. 1242] in Australian fresh produce SMEs which led to "… inhibiting these firms in achieving resilience [and have an impact upon] …. continuous learning, innovation, and improvement opportunities at a firm as well as supply chain level." Similarly, Cespedes *et al.* [25] indicate the lack of competitiveness to absorptive capacity which seems to be underdeveloped especially in Latin American SMEs. For example, in the case of Bolivia, Cespedes *et al.* [25] noted this as a poverty resilience strategy for SMEs. The lack of resources was also reported in the CSR activities of SMEs especially when it came to environmental resilience with "the number of environmental activities [being] significantly lower for SMEs than for large organisations" [48, p. 385]. Thomas *et al.* [99] study noted that SME capabilities did play an important role on U.K. manufacturing SMEs, however manufacturing SMEs which held a diverse product and service portfolio were not always as affected by the lack of skill, knowledge, and financial capacity, traditionally cited as impediments to SME resilience.

C. Supply Chain Resilience and the Role of Information Systems

Hui-Hong *et al.* [53] found that although some SMEs suffered negatively from the impacts of the global recession, some Japanese SMEs in the electronic manufacturing sector thrived and grew either because they adopted IT technology to overcome this, developed negotiation powers to achieve economies of scale through acquisitions, or by reorganizing their manufacturing supply chain. Some authors discussed the potential of using information systems to build resilience in a network of SMEs. By developing a shared repository of technical content and market knowledge, organizations are able to develop shared modes of working and ultimately enhance their resilience to changes in external conditions [89]. Also, information sharing can have a positive influence on SMEs' credit quality [93]. While it is important to exploit the opportunities related to the sharing of information, new risks arise.

Lambert *et al.* [64] recommend a multiscale approach in improving security from cybercrime and counterfeiting in hardware supply chains, with a focus on resilience, systems analysis, and energy and environmental sustainability rather than just technology. Considering that ".. approximately 72% of cyber breaches occur at SMEs" the impact of information management on resilience in the supply chain context is not surprising (Mieland *et al.*, 2015 as cited in Fieldler et al. 2016, p. 13) especially wherein the SMEs lack available funding for cybersecurity, thus providing insufficient cover for system vulnerabilities [38].

One way to deal with the SME information system improvement was "…outsourcing …. which highlight[ed] the need to integrate more information technology and information systems for significant SME resilience." [83, p. 412]. However, in SMEs, "measures such as resilience are more likely to be implemented after an attack, once the organisation realises how much they have grown to rely on technology for business continuity."

[81, p. 34]. In this way, organizations have to make trade-offs with regard to how they defend their systems, especially considering the cost and financing of such a system and its potential trade-offs.

D. Supply Chain Resilience and the Role of Cost and Financing

It is important for an SMEs' supply chain to have the capability to be resilient; however, the studies highlighted the additional cost attached to the resilience agenda as well as the investment necessary for an SMEs' supply chain to be resilient. Cost can be an element of any SMEs resilience agenda. For example, Bergman *et al.* [17] explored 38 cross-industry cases (including the construction industry, energy supply industry, food industry including tobacco, mechanical engineering industry, tourism industry, and water and sewage supply industry) and highlighted that any SME can be affected by extreme weather events that can affect SMEs financial performance. This is especially important as SMEs face problems in obtaining financing from banks already due to high-risk profiles [40].

In cases of investment necessity, Agrawal *et al.* [2, p. 169] noted that SMEs may "stay away from IT adoption due to perceived high costs and unclear return on investments." Therefore, the supply chain resilience of SMEs can be enabled by the capability of how and to what extent SMEs can generate capital [35]. The lack of investment and budgetary constraints has been also highlighted by Ali *et al.* [7, p. 1242] in Australian fresh produce SMEs which led to "… inhibiting these firms in achieving resilience [and have an impact upon] …. continuous learning, innovation, and improvement opportunities at a firm as well as supply chain level." Due to the inherent scarcity in terms of financial resources and budgetary constraints in SMEs "…national industry associations in collaboration with government departments organise intensive training and education programmes" [7, p. 5] to provide continuous learning opportunities. However, the financial limitations in SMEs are not solely internal but also can be external such as limited access to international markets, which makes them heavily reliant on national and local markets with often highly volatile economic cycles. This may make them vulnerable to financing and project risks [40], [93]. Gilinsky *et al.* [157] based on their research on the wine sector report that SMEs try to overcome their traditional financing disadvantages through the use of innovative new technologies. However, on the same token, they note that the benefit-cost trade-off in the short-term may hinder preparedness for any disruption and risk in the long-term impacting the SME resilience as such [157].

V. Conclusion

This article has provided a comprehensive structured review of academic literature on SME supply chain resilience by contributing to the definition of SME supply chain resilience and by identifying in the literature four focal areas: 1) SME supply chain resilience and the role of collaboration, 2) SME supply chain resilience and SMEs' capabilities, 3) SME supply chain resilience and the role of Information Systems, and 4) SME supply chain resilience and the role of cost and financing.

As far as collaboration was concerned in the context of SME supply chain resilience, future research efforts were needed to first investigate the barriers and drivers of effective collaboration with key partners of the same supply chain, taking into account specific challenges for collaboration for SMEs due to their size and bargaining power. Second, different implementation strategies of collaboration and collaborative practices needed to be investigated, in terms of contractual agreements, security, collaborative planning and operations, integration of processes, and level of collaboration (depth of the relationship). This should be further complemented by quantitative studies and empirical evidence on the relationships between collaboration in the supply chain and achieved performance of single organizations and the supply chain in its entirety.

A second main area of research focused on the role of SMEs' capabilities to achieve supply chain resilience. Even though it was well acknowledged that SMEs can often be more agile and flexible, which were key elements of resilience, on the other hand, they could have difficulties in implementing mitigation actions and recovery plans in case of disruptions due to the limited availability of resources. Hence, the findings of this article were of significant benefit to practitioners. The study emphasizes that owner managers of SMEs should pay a great deal of attention to establishing strong collaboration with a network of specialized partners to develop resilience. We argue that most SMEs need to review and adapt their organizational processes, structures, culture, leadership, and social interactions in order to ensure a strong motivation and commitment to build resilience through the establishment of long-term and trusted relationships with their partners. The motivation of owner managers of SMEs played a central role in establishing resilience which can be further strengthened by establishing a diverse customer base and the use of new advanced technologies. Our study also suggested that establishing a secure information system can help build resilience in a network of SMEs, however as most SMEs lack adequate financial resources for cybersecurity they have to make trade-offs with regard to how they defend their systems. One tool that can be used was the modeling of potential risks and disruptions to assess the extent of the impact on SME resilience. Our review indicated that modeling and simulation have been not widely used by SMEs as well as studies indicated the lack of quantitative measures and assessment tools within the SME supply chain resilience agenda [131]. Therefore, decision support tools and optimizations models can also be beneficial to understand how to optimize the use of limited resources of SMEs.

This article thus provided owner managers of SMEs with a comprehensive understanding of the complexities of building resilience. Hence, future research was needed to investigate how knowledge management in the supply chain and absorptive capacity can be leveraged to support SMEs in order to overcome the mentioned resource limitations with key partners presenting an aligned organizational strategy and culture regarding resilience. This could include the use of technology to share and use know-how in a network of companies including SMEs,

as well as entail outsourcing. Especially further research needs to be conducted to understand the interrelationship between outsourcing, collaboration, and SME supply chain resilience, as high dependency on the outsourcing partners/collaborators may have an impact on SME supply chain resilience.

Another key theme in the literature was the role of Information Systems to enable SME supply chain resilience. Information sharing was recognized in the literature as an enabler of supply chain resilience and robustness of complex supply chains. When SMEs were involved, future research was needed to investigate issues related to trust and asymmetric information (when information in terms of quantity and quality was not equally shared among parties) and how to manage them to be able to effectively and efficiently use the information to cope with disruptions. On the other hand, sharing information entailed an increased level of cyber and information risk that SMEs should manage in collaboration with their partners and future research was needed in this area.

Finally, the literature had revolved around the role of cost and financing as this seemed to be one of the underlying issues faced by SMEs, in terms of budgetary constraints and lack of investment. SMEs' impact on economic growth also needed closer attention by the policymakers as the research presented indicates the overarching impact of SME supply chain resilience on economic growth and multinational corporations' performance. Hence, policymakers must consider tools and strategies as a means of supporting SMEs' development for the resilience agenda.

In addition, researchers may conduct longitudinal case studies to understand how these four areas of resilience have been observed and strategies have been developed to respond to disruptions over time. Moreover, future work focusing on literature review on SME resilience may investigate evolutionary patterns, trends, and knowledge creation over time in the field and identify focal areas through the use of citation analysis, as different resilience themes are evolving at different speeds, and may have positive or negative influences on each other.

REFERENCES

[1] M. Abe and L. Ye, "Building resilient supply chains against natural disasters: The cases of Japan and Thailand," *Global Bus. Rev.*, vol. 14, no. 4, pp. 567–586, 2013.

[2] N. M. Agrawal, R. Pandit, and D. Menon, "Strategy to usher in the next phase of growth in the Indian IT industry," *IIMB Manage. Rev.*, 24, no. 3, pp. 164–179, 2012.

[3] P. Ahi and C. Searcy, "A comparative literature analysis of definitions for green and sustainable supply chain management," *J. Cleaner Prod.*, vol. 52, pp. 329–341, 2013.

[4] O. Aigbogun, Z. Ghazali, and R. Razali, "A framework to enhance supply chain resilience the case of Malaysian pharmaceutical industry," *Global Bus. Manage. Res.*, vol. 6, no. 3, pp. 219–228, 2014.

[5] A. Aleksić, M. Stefanović, S. Arsovski, and D. Tadić, "An assessment of organizational resilience potential in SMEs of the process industry, a fuzzy approach," *J. Loss Prevention Process Ind.*, vol. 26, no. 6, pp. 1238–1245, 2013.

[6] A. Aleksić, M. Stefanović, D. Tadić, and S. Arsovski, "A fuzzy model for assessment of organization vulnerability," *Measurement*, vol. 51, pp. 214–223, 2014.

[7] I. Ali, S. Nagalingam, and B. Gurd, "Building resilience in SMEs of perishable product supply chains: Enablers, barriers and risks," *Prod. Planning Control*, vol. 28, no. 15, pp. 1236–1250, 2017.

[8] A. Annarelli and F. Nonino, "Strategic and operational management of organizational resilience: Current state of research and future directions," *Omega*, vol. 62, pp. 1–18, 2016.

[9] S. Arsovski, Z. Arsovski, M. Stefanović, D. Tadić, and A Aleksić, "Organisational resilience in a cloud-based enterprise in a supply chain: A challenge for innovative SMEs," *Int. J. Comput. Integr. Manuf.*, vol. 30, no. 4–5, pp. 409–419, 2017.

[10] A. Asgary, M. I. Anjum, and N. Azimi, "Disaster recovery and business continuity after the 2010 flood in Pakistan: Case of small businesses," *Int. J. Disaster Risk Reduction*, vol. 2, pp. 46–56, 2012.

[11] A. Ates and U. Bititci, "Change process: A key enabler for building resilient SMEs," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5601–5618, 2011.

[12] K. B. Aviso *et al.*, "Allocating human resources in organizations operating under crisis conditions: A fuzzy input-output optimization modeling framework," *Resour., Conservation Recycling*, vol. 128, pp. 250–258, 2018.

[13] O. Bak, "Supply chain risk management research agenda: From a literature review to a call for future research directions," *Bus. Process Manage. J.*, vol. 24, no. 2, pp. 567–588, 2018.

[14] C. Battistella, "The organisation of corporate foresight: A multiple case study in the telecommunication industry," *Technol. Forecast. Social Change*, vol. 87, pp. 60–79, 2014.

[15] M. M. Ballesteros and S. N. Domingo, "Building Philippine SMEs resilience to natural disasters," PIDS Discussion Paper Ser. (no. 2015-20)., 2015.

[16] J. Bergman, S. Viljainen, T. Kässi, J. Partanen, and P. Laaksonen, "Managing the exploration of new operational and strategic activities using the scenario method—Assessing future capabilities in the field of electricity distribution industry," *Int. J. Prod. Econ.*, vol. 104, no. 1, pp. 46–61, 2006.

[17] A. Bergmann, K. Stechemesser, and E. Guenther, "Natural resource dependence theory: Impacts of extreme weather events on organizations," *J. Bus. Res.*, vol. 69, no. 4, pp. 1361–1366, 2016.

[18] R. Bhamra, S. Dani, and K Burnard, "Resilience: The concept, a literature review and future directions," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5375–5393, 2011.

[19] S. E. Birkie, "Operational resilience and lean: In search of synergies and trade-offs," *J. Manuf. Technol. Manage.*, vol. 27, no. 2, pp. 185–207, 2016.

[20] F. Böhle, E. Heidling, and Y. Schoper, "A new orientation to deal with uncertainty in projects," *Int. J. Project Manage.*, vol. 34, no. 7, pp. 1384–1392, 2016.

[21] V. Brenner, *Causes of Supply Chain Disruptions: An Empirical Analysis in Cold Chains for Food and Pharmaceuticals*. New York, NY, USA: Springer, 2015.

[22] S. Bucher, U. P. Jäger, and G. Cardoza, "FUNDES: Becoming a strategically mindful non-profit," *J. Bus. Res.*, vol. 69, no. 10, pp. 4489–4498, 2016.

[23] G. G. Calabrese and M. Vervaeke, "Strategies for facing the crisis: The case of the car design/style supply chain in France and in Italy," *Int. J. Product Develop.*, vol. 22, no. 1, pp. 21–37, 2017.

[24] P. Carla Roberta, C. Martin, and S. A. L. Da, "Achieving supply chain resilience: The role of procurement," *Supply Chain Manage.: Int. J.*, vol. 19, no. 5–6, pp. 626–642, 2014.

[25] C. Q. Mauricio and D. P. Martin, "Technology foresight in traditional Bolivian sectors: Innovation traps and temporal unfit between ecosystems and institutions," *Technol. Forecast. Social Change*, vol. 119, pp. 280–293, 2017.

[26] T. A. Chin, A. B. A. Hamid, A. Rasli, and R. Baharun, "Adoption of supply chain management in SMEs," *Procedia - Social Behav. Sci.*, vol. 65, pp. 614–619, 2012.

[27] M. A. Cole, R. J. Elliott, T. Okubo, and E. Strobl, "Pre-disaster planning and post-disaster aid: Examining the impact of the great East Japan Earthquake," *Int. J. Disaster Risk Reduction*, vol. 21, pp. 291–302, 2017.

[28] T. Coles, C. Dinan, and N. Warren, "Energy practices among small- and medium-sized tourism enterprises: A case of misdirected effort?" *J. Cleaner Prod.*, vol. 111, pp. 399–408, 2016.

[29] E. Conz, S. Denicolai, and A. Zucchella, "The resilience strategies of SMEs in mature clusters," *J. Enterprising Commun.*, vol. 11, no. 1, pp. 186–210, 2017.

[30] C. Coutinho, A. Cretan, and R. Jardim-Goncalves, "Sustainable interoperability on space mission feasibility studies," *Comput. Ind.*, vol. 64, no. 8, pp. 925–937, 2013.

[31] J. C. Cuaresma, J. Hlouskova, and M. Obersteiner, "Natural disasters as creative destruction? Evidence From developing countries," *Econ. Inquiry*, vol. 46, no. 2, pp. 214–226, 2007.

[32] J. M. Day, Fostering emergent resilience: The complex adaptive supply network of disaster relief," *Int. J. Prod. Res.*, vol. 52, no. 7, pp. 1970–1988, 2015.

[33] P. P. Datta, "Supply network resilience: A systematic literature review and future research," *Int. J. Logistics Manage.*, vol. 28, no. 4, pp. 1387–1424, 2017.

[34] W. A. Demmer, S. K. Vickery, and R. Calantone, "Engendering resilience in small-and medium-sized enterprises (SMEs): A case study of Demmer corporation," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5395–5413, 2011.

[35] A. D. Alonso and A. Bressan, "Resilience in the context of Italian micro and small wineries: An empirical study," *Int. J. Wine Bus. Res.*, vol. 27, no. 1, pp. 40–60, 2015.

[36] B. S. Eshetu, "Operational resilience and lean: In search of synergies and trade-offs," *J. Manuf. Technol. Manage.*, vol. 27, no. 2, pp. 185–207, 2016.

[37] "What is an SME?" European Commission. 2012. [Online]. Available: https://ec.europa. eu/growth/smes/business-friendly-environment/sme-definition_en; Accessed on: Apr. 03, 2018

[38] A. Fielder, E. Panaousis, P. Malacaria, C. Hankin, and F. Smeraldi, "Decision support approaches for cyber security investment," *Decis. Support Syst.*, vol. 86, pp. 13–23, 2016.

[39] M. Formentini and P. Taticchi, "Corporate sustainability approaches and governance mechanisms in sustainable supply chain management," *J. Cleaner Prod.*, vol. 112, pp. 1920–1933, 2016.

[40] A. Genus and F. Mafakheri, "A neo-institutional perspective of supply chains and energy security: Bioenergy in the UK," *Appl. Energy*, vol. 123, pp. 307–315, 2014.

[41] S. L. Golicic, D. J. Flint, and P. Signori, "Building business sustainability through resilience in the wine industry," *Int. J. Wine Bus. Res.*, vol. 29, no. 1, pp. 74–97, 2017.

[42] R. Gomes, "Resilience and enterprise architecture in SMEs," *J. Inf. Syst. Technol. Manage.*, vol. 12, no. 3, pp. 525–540, 2015.

[43] J. E. Gould, C. Macharis, and H.-D. Haasis, "Emergence of security in supply chain management literature," *J. Transp. Secur.*, vol. 3, no. 4, pp. 287–302, 2010.

[44] G. Graham, R. Mehmood, and E. Coles, "Exploring future cityscapes through urban logistics prototyping: A technical viewpoint," *Supply Chain Manage.*, vol. 20, no. 3, pp. 341–352, 2015.

[45] A. Gunasekaran, N. Subramanian, and S. Rahman, "Supply chain resilience: Role of complexities and strategies," *Int. J. Prod. Res.*, vol. 53, no. 22, pp. 6809–6819, 2015.

[46] A. Gunasekaran, B. K. Rai, and M. Griffin, "Resilience and competitiveness of small and medium size enterprises: An empirical research," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5489–5509, 2011.

[47] M. Haraguchi, U. Lall, and K. Watanabe, "Building private sector resilience: Directions after the 2015 Sendai framework," *J. Disaster Res.*, vol. 11, no. 3, pp. 535–543, 2016.

[48] I. Harwood, S. Humby, and A. Harwood, "On the resilience of corporate social responsibility," *Eur. Manage. J.*, vol. 29, no. 4, pp. 283–290, 2011.

[49] B. Herbane, "Rethinking organizational resilience and strategic renewal in SMEs," *Entrepreneurship Regional Develop.*, vol. 31, pp. 476–495, 2018.

[50] J. Herrmann and E. Guenther, "Exploring a scale of organizational barriers for enterprises' climate change adaptation strategies," *J. Cleaner Prod.*, vol. 160, pp. 38–49, 2017.

[51] E. Hofmann, "Natural hedging as a risk prophylaxis and supplier financing instrument in automotive supply chains," *Supply Chain Manage.*, vol. 16, no. 2, pp. 128–141, 2011.

[52] N. O. Hohenstein, E. Feise, E. Hartmann, and L. Giunipero, "Research on the phenomenon of supply chain resilience: A systematic review and paths for further investigation," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 45, pp. 90–117, 2015.

[53] G. Hong, "The risk elasticity measure index exploration of supply chain and mechanism research," *Open Cybern. Systemics J.*, vol. 9, no. 1, pp. 2497–2502, 2015.

[54] T. Hooks, Á. Macken-Walsh, O. McCarthy, and C. Power, "The impact of a values-based supply chain (VBSC) on farm-level viability, sustainability and resilience: Case study evidence," *Sustainability*, vol. 9, no. 2, 2017, Art. no. 267.

[55] C. M. M. Hossan and Q. Mohammed, Supply chain readiness, response and recovery for resilience," *Supply Chain Manage., Int. J.*, vol. 21, no. 6, pp. 709–731, 2016.

[56] C. Jao-Hong and L. Kuo-Liang, "Enhancing effects of supply chain resilience: Insights from trajectory and resource-based perspectives," *Supply Chain Manage., Int. J.*, vol. 22, no. 4, pp. 329–340, 2017.

[57] J., Jayaram, M., Dixit, and J. Motwani, "Supply chain management capability of small and medium sized family businesses in India: A multiple case study approach," *Int. J. Prod. Econ.*, vol. 147, pp. 472–485, 2014.

[58] N. S. Jaharuddin, Z. D. Mansor, and S. Yaakob, "Barriers of supply chain intelligence practices in SMEs: Case of Malaysia," *Social Sci.*, vol. 11, no. 31, pp. 7418–7422, 2016.

[59] A. L. Jorgensen and J. S. Knudsen, "Sustainable competitiveness in global value chains: How do small Danish firms behave?" *Corp. Government Int. J. Bus. Soc.*, vol. 6, no. 4, 2006, Art. no. 449e462.

[60] G. Jury and K. Matteo, "Supply risk management and competitive advantage: A misfit model," *Int. J. Logistics Manage.*, vol. 26, no. 3, pp. 459–478, 2015.

[61] M. Kamalahmadi and M. M. Parast, "A review of the literature on the principles of enterprise and supply chain resilience: Major findings and directions for future research," *Int. J. Prod. Econ.*, vol. 171, pp. 116–133, 2016.

[62] S. Kumar and M. Sosnoski, "Decision framework for the analysis and selection of appropriate transfer pricing for a resilient global SME manufacturing operation—A business case," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5431–5448, 2011.

[63] S. Kumari, A. Singh, N. Mishra, and J. A. Garza-Reyes, "A multi-agent architecture for outsourcing SMEs manufacturing supply chain," *Robot. Comput.-Integr. Manuf.*, vol. 36, pp. 36–44, 2015.

[64] J. H. Lambert, J. M. Keisler, W. E. Wheeler, Z. A. Collier, and I. Linkov, "Multiscale approach to the security of hardware supply chains for energy systems," *Environ. Syst.* Dec., vol. 33, no. 3, pp. 326–334, 2013.

[65] H. H. J. K. Li, K. H. Tan, and A. Hida, "Sustaining growth in electronic manufacturing sector: Lessons from Japanese mid-size EMS providers," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5415–5430, 2011.

[66] M. Linnenluecke and A. Griffiths, "Beyond adaptation: Resilience for business in light of climate change and weather extremes," *Bus. Soc.*, vol. 49, 2010, Art. no. 477.

[67] M. K. Linnenluecke, "Resilience in business and management research: A review of influential publications and a research agenda," *Int. J. Manage. Rev.*, vol. 19, no. 1, pp. 4–30, 2017.

[68] H. Lorentz, O.-P. Hilmola, J. Malmsten, and J. S. Srai, "Cluster analysis application for understanding SME manufacturing strategies," *Expert Syst. Appl.*, vol. 66, pp. 176–188, 2016.

[69] M. Lotfi and S. Saghiri, "Disentangling resilience, agility and leanness: Conceptual development and empirical analysis," *J. Manuf. Technol. Manage.*, vol. 29, no. 1, pp. 168–197, 2018.

[70] V. Maksimov, S. L. Wang, and Y. Luo, "Reducing poverty in the least developed countries: The role of small and medium enterprises," *J. World Bus.*, vol. 52, no. 2, pp. 244–257, 2017.

[71] A. Malek, S. Ebrahimnejad, and R. Tavakkoli-Moghaddam, "An improved hybrid grey relational analysis approach for green resilient supply chain network assessment," *Sustainability*, vol. 9, no. 8, 2017, Art. no. 1433.

[72] D. Mamillo, "Supply chain collaboration under uncertainty in the albanian beer market," *Manage. Dyn. Knowl. Econ.*, vol. 3, no. 1, pp. 99–117, 2015.

[73] S. Mandal, "Supply chain resilience: A state-of-the-art review and research directions," *Int. J. Disaster Resilience Built Environ.*, vol. 5, no. 4, pp. 427–453, 2014.

[74] S. Mandal, "The influence of organizational culture on healthcare supply chain resilience: Moderating role of technology orientation," *J. Bus. Ind. Marketing*, vol. 32, no. 8, pp. 1021–1037, 2017.

[75] S. Mark and B. Jerry, "An exploratory analysis of counterfeiting strategies: Towards counterfeit-resilient supply chains," *Int. J. Oper. Prod. Manage.*, vol. 35, no. 1, pp. 110–144, 2015.

[76] M. R. Marković, M. S. Farooq, and D. Marković, "Strengthening the resilience of small and medium-sized enterprises," in *Proc. Manage., Enterprise Benchmarking 21st Century*, 2017, pp. 345–356.

[77] C. Martin and M. Holweg, "Supply chain 2.0": Managing supply chains in the era of turbulence," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 41, no. 1, pp. 63–82, 2011.

[78] S. B. Moore and S. L. Manring, "Strategy development in small and medium sized enterprises for sustainability and increased value creation," *J. Cleaner Prod.*, vol. 17, no. 2, pp. 276–282, 2009.

[79] C. K. Monsson, "Vulnerability and adaptability: Post-crisis resilience of SMEs in Denmark," in *Creating Resilient Economies*. Cheltenham, U.K.: Edward Elgar Publishing, 2017.

[80] J. M. Müller, O. Buliga, and K.-I. Voigt, "Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0," *Technol. Forecast. Social Change*, vol. 132, pp. 2–17, 2018.

[81] E. Osborn and A. Simpson, "On small-scale IT users' system architectures and cyber security: A UK case study," *Comput. Secur.*, vol. 70, pp. 27–50, 2017.

[82] S. Ozar, G. Ozertan, and Z. B. Irfanoğgu, "Micro and small enterprise growth in Turkey: Under the shadow of financial crisis," *Develop. Econ.*, vol. 46, no. 4, pp. 331–362, 2008.

[83] R. Pal, H. Torstensson, and H. Mattila, "Antecedents of organizational resilience in economic crises—An empirical study of Swedish textile and clothing SMEs," *Int. J. Prod. Econ.*, vol. 147, pp. 410–428, 2014.

[84] S. Pathak and M. M. Ahmad, "Flood recovery capacities of the manufacturing SMEs from floods: A case study in Pathumthani province, Thailand," *Int. J. Disaster Risk Reduction*, vol. 18, pp. 197–205, 2016.

[85] F. T. Piller and F. Steiner, "Mass customization as an enabler of network resilience," in *Intelligent Non-Hierarchical Manufacturing Networks*. Hoboken, NJ, USA: Wiley, 2013, pp. 3–22.

[86] M. Polyviou, K. L. Croxton, and A. M. Knemeyer, "Resilience of medium-sized firms to supply chain disruptions: The role of internal social capital," *Int. J. Oper. Prod. Manage.*, vol. 40, pp. 68–91, 2019.

[87] S. T. Ponis and E. Koronis, "Supply chain resilience: Definition of concept and its formative elements," *J. Appl. Bus. Res.*, vol. 28, no. 5, pp. 921–929, 2012.

[88] R. Rajesh and V. Ravi, "Supplier selection in resilient supply chains: A grey relational analysis approach," *J. Cleaner Prod.*, vol. 86, pp. 343–359, 2015.

[89] S.-V. Rehm and L. Goel, "Using information systems to achieve complementarity in SME innovation networks," *Inf. Manage.*, vol. 54, no. 4, pp. 438–451, 2017.

[90] N. Sahebjamnia, S. A. Torabi, and S. A. Mansouri, "Integrated business continuity and disaster recovery planning: Towards organizational resilience," *Eur. J. Oper. Res.*, vol. 242, no. 1, pp. 261–273, 2015.

[91] M. Salles, "Decision making in SMEs and information requirements for competitive intelligence," *Prod. Planning Control*, vol. 17, no. 3, pp. 229–237, 2006.

[92] S. Simba, W. Niemann, T. Kotzé, and A. Agigi, "Supply chain risk management processes for resilience: A study of South African grocery manufacturers," *J. Transp. Supply Chain Manage.*, vol. 11, pp. 1–13, 2017.

[93] H. Song, K. Yu, A. Ganguly, and R. Turson, "Supply chain network, information sharing and SME credit quality," *Ind. Manage. Data Syst.*, vol. 116, no. 4, pp. 740–758, 2016.

[94] M. Stevenson and J. Busby, "An exploratory analysis of counterfeiting strategies: Towards counterfeit-resilient supply chains," *Int. J. Oper. Prod. Manage.*, vol. 35, no. 1, pp. 110–144, 2015.

[95] M. Stevenson and M. Spring, "Flexibility from a supply chain perspective: Definition and review," *Int. J. Oper. Prod. Manage.*, vol. 27, no. 7, 2007, Art. no. 685.

[96] G. T. Stewart, R. Kolluru, and M. Smith, "Leveraging public-private partnerships to improve community resilience in times of disaster," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 39, no. 5, pp. 343–364, 2009.

[97] N. Strobel and J. Kratzer, "Obstacles to innovation for SMEs: Evidence from Germany," *Int. J. Innov. Manage.*, vol. 21, no. 3, pp. 1–28, 2017.

[98] F. Testa, B. Nucci, F. Iraldo, A. Appolloni, and T. Daddi, "Removing obstacles to the implementation of LCA among SMEs: A collective strategy for exploiting recycled wool," *J. Cleaner Prod.*, vol. 156, pp. 923–931, 2017.

[99] A. Thomas, P. Byard, M. Francis, R. Fisher, and G. R. T. White, "Profiling the resiliency and sustainability of UK manufacturing companies," *J. Manuf. Technol. Manage.*, vol. 27, no. 1, pp. 82–99, 2015.

[100] J. H. Thun, M. Drüke, and D. Hoenig, "Managing uncertainty—An empirical analysis of supply chain risk management in small and medium-sized enterprises," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5511–5525, 2011.

[101] Y. Todo, K. Nakajima, and P. Matous, "How do supply chain networks affect the resilience of firms to natural disasters? Evidence from the great east Japan Earthquake," *J. Regional Sci.*, vol. 55, no. 2, pp. 209–229, 2015.

[102] M. Tokman, R. G. Richey, T. R. Jr Morgan, L. Marino, and P. H. Dickson, "SME supply chain portfolios: Firm satisfaction and organization resources," *Int. J. Logistics Manage.*, vol. 24, no. 2, pp. 271–300, 2013.

[103] H. Treiblmaier, "Optimal levels of (de)centralization for resilient supply chains," *Int. J. Logistics Manage.*, vol. 29, no. 1, pp. 435–455, 2018.

[104] B. R. Tukamuhabwa, M. Stevenson, J. Busby, and M. Zorzini, "Supply chain resilience: Definition, review and theoretical foundations for further study," *Int. J. Prod. Res.*, vol. 53, no. 18, pp. 5592–5623, 2015.

[105] L. Urciuoli, S. Mohanty, J. Hintsa, and B. E. Gerine, "The resilience of energy supply chains: A multiple case study approach on oil and gas supply chains to Europe," *Supply Chain Manage.*, vol. 19, no. 1, pp. 46–63, 2014.

[106] P. Valckenaers, H. V. Brussel, H. Bruyninckx, B. S. Germain, J. V. Belle, and J. Philips, "Predicting the unexpected," *Comput. Ind.*, vol. 62, no. 6, pp. 623–637, 2011.

[107] J. Vargo and E. Seville, "Crisis strategic planning for SMEs: Finding the silver lining," *Int. J. Prod. Res.*, vol. 49, no. 18, pp. 5619–5635, 2011.

[108] G. Wedawatta, B. Ingirige, and D. Amaratunga, "Building up resilience of construction sector SMEs and their supply chains to extreme weather events," *Int. J. Strategic Property Manage.*, vol. 14, no. 4, pp. 362–375, 2010.

[109] A. Wieland and M. C. Wallenburg, "The influence of relational competencies on supply chain resilience: A relational view," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 43, no. 4, pp. 300–320, 2013.

[110] S. A. Melnyk, D. J. Closs, S. E. Griffis, C. W. Zobel, and J. R. Macdonald, "Understanding supply chain resilience," *Supply Chain Manage. Rev.*, vol. 18, no. 1, pp. 34–41, 2014.

[111] J. Thakkar, A. Kanda, and S. G. Deshmukh, "Supply chain management in SMEs: Development of constructs and propositions," *Asia Pacific J. Marketing Logistics*, vol. 20, no. 1, pp. 97–131, 2008.

[112] M. Terziovski, "Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: A resource-based view," *Strategic Manage. J.*, vol. 31, no. 8, pp. 892–902, 2010.

[113] F. Strozzi and C. Colicchia, "Literature review on complex network methods applied to measure robustness in supply chain design," *Serie Metodi Quantitativi*, vol. 20, pp. 1–35, 2012.

[114] D. Tranfield and D. Denyer, "Linking theory to practice: A 'Grand challenge' for management research in the 21st century?" *Org. Manage. J.*, vol. 1, no. 1, pp. 10–14, 2004.

[115] C. Wohlin, "Guidelines for snowballing in systematic literature studies and a replication in software engineering," in *Proc. 18th Int. Conf. Eval. Assessment Softw. Eng.*, 2014, pp. 1–10.

[116] C. R. Pereira, M. Christopher, and A. L. D. Silva, "Achieving supply chain resilience: The role of procurement," *Supply Chain Manage.: Int. J.*, vol. 19, no. 5–6, pp. 626–642, 2014.

[117] A. Huff, T. David, and J. E. V. Aken, "Management as a design science mindful of art and surprise a conversation between Anne Huff, David Tranfield, and Joan Ernst van Aken," *J. Manage. Inquiry*, vol. 15, no. 4, pp. 413–424, 2006.

[118] A. Norrman and U. Jansson, "Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 34, no. 5, pp. 434–456, 2004.

[119] C. Pilbeam, G. Alvarez, and H. Wilson, "The governance of supply networks: A systematic literature review," *Supply Chain Manage.: Int. J.*, vol. 17, no. 4, pp. 358–376, 2012.

[120] A. Marlen, "The lack of strategic sustainability orientation in German water companies," *Ecol. Econ.*, vol. 117, pp. 39–52, 2015.

[121] S. Bondar, J. C. Hsu, A. Pfouga, and J. Stjepandić, "Agile digital transformation of system-of-systems architecture models using Zachman framework," *J. Ind. Inf. Integr.*, vol. 7, pp. 33–43, 2017.

[122] J. Gualandris and M. Kalchschmidt, "Supply risk management and competitive advantage: A misfit model," *Int. J. Logistics Manage.*, vol. 26, no. 3, pp. 459–478, 2015.

[123] F. Joseph, "From risk to resilience," in *Resilient by Design*. Washington, DC, USA: Island Press, 2015, pp. 19–34.

[124] C. Jordan and O. Bak, "The growing scale and scope of the supply chain: A reflection on supply chain graduate skills," *Supply Chain Manage.: Int. J.*, vol. 21, no. 5, pp. 610–662, 2016.

[125] T. J. Pettit, K. L. Croxton, and J. Fiksel, "Ensuring supply chain resilience: Development and implementation of an assessment tool," *J. Bus. logistics*, vol. 34, no. 1, pp. 46–76, 2013.

[126] S. Seuring and M. Müller, "From a literature review to a conceptual framework for sustainable supply chain management," *J. Cleaner Prod.*, vol. 16, no. 15, pp. 1699–1710, 2008.

[127] S. Y. Ponomarov and M. C. Holcomb, "Understanding the concept of supply chain resilience," *Int. J. logistics Manage.*, vol. 20, no. 1, pp. 124–143, 2009.

[128] S. Arsovski *et al.*, "Organisational resilience in a cloud-based enterprise in a supply chain: A challenge for innovative SMEs," *Int. J. Comput. Integr. Manuf.*, vol. 30, no. 4–5, pp. 409–419, 2017.

[129] A. Ghadge, S. Dani, and R. Kalawsky, "Supply chain risk management: Present and future scope," *Int. J. Logistics Manage.*, vol. 23, no. 3, pp. 313–339, 2012.

[130] B. Andrés and R. Poler, "Enhancing enterprise resilience through enterprise collaboration," *IFAC Proc.*, vol. 46, no. 9, pp. 688–693, 2013.

[131] N. Sahebjaminia, S. A. Torabi, and S. A. Mansouri, "Integrated business continuity and disaster recovery planning: Towards organizational resilience, European journal of operational research," vol. 242, pp. 261–271, 2015.

[132] A. S. Garmestani and M. H. Benson, "A framework for resilience-based governance of social-ecological systems," *Ecol. Soc.*, vol. 18, no. 1, 2013, Art. no. 9.

[133] Y. Chang, S. Wilkinson, R. Potangaroa, and E. Seville, "Donor-driven resource procurement for post-disaster reconstruction: Constraints and actions," *Habitat Int.*, vol. 35, no. 2, pp. 199–205, 2011.

[134] M. Vaismoradi, H. Turunen, and T. Bondas, "Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study," *Nursing Health Sci.*, vol. 15, no. 3, pp. 398–405, 2013.

[135] L. J. Branicki, B. Sullivan-Taylor, and S. R. Livschitz, "How entrepreneurial resilience generates resilient SMEs," *Int. J. Entrepreneurial Behav. Res.*, vol. 24, pp. 1244–1263, 2018.

[136] S. Kot, I. R. Goldbach, and B. Ślusarczyk, "Supply chain management in SMEs-polish and romanian approach," *Econ. Sociol.*, vol. 11, no. 4, 2018, Art. no. 142.

[137] F. G. Alberti, S. Ferrario, and E. Pizzurno, "Resilience: Resources and strategies of SMEs in a new theoretical framework," *Int. J. Learn. Intellectual Capital*, vol. 15, no. 2, pp. 165–188, 2018.

[138] G. Hariharan, P. Suresh, and S. Nagarajan, "Supply chain risk mitigation strategies and its performance of SMEs," *Int. J. Pure Appl. Math.*, vol. 119, no. 15, pp. 3545–3553, 2018.

[139] S. Sabahi and M. M. Parast, "Firm innovation and supply chain resilience: A dynamic capability perspective," *Int. J. Logistics Res. Appl.*, vol. 23, pp. 254–269, 2019.

[140] M. S. Shahbaz *et al.*, "The impact of supply chain collaboration on operational performance: Empirical evidence from manufacturing of Malaysia," *Int. J. Adv. Appl. Sci.*, vol. 5, no. 8, pp. 64–71, 2018.

[141] N. A. Z. Abidin and B. Ingirige, "Identification of the "Pathogenic" effects of disruptions to supply chain resilience in construction," *Procedia Eng.*, vol. 212, pp. 467–474, 2018.

[142] M. Z. Alvarenga, M. P. V. D. Oliveira, and W. R. D. Santos, "Analytical supply chains: Are they more resilient? A model's proposition," *J. Oper. Supply Chain Manage.*, vol. 11, no. 2, pp. 46–58, 2018.

[143] D. M. Blake, J. Stevenson, L. Wotherspoon, V. Ivory, and M. Trotter, "The role of data and information exchanges in transport system disaster recovery: A New Zealand case study," *Int. J. Disaster Risk Reduction*, vol. 39, 2019, Art. no. 101124.

[144] I. Gölgeci, F. Karakas, and E. Tatoglu, "Understanding demand and supply paradoxes and their role in business-to-business firms," *Ind. Marketing Manage.*, vol. 76, pp. 169–180, 2019.

[145] Y. Hou, X. Wang, Y. J. Wu, and P. He, "How does the trust affect the topology of supply chain network and its resilience? An agent-based approach," *Transp. Res. Part E: Logistics Transp. Rev.*, vol. 116, pp. 229–241, 2018.

[146] H. Kaur, S. P. Singh, J. A. Garza-Reyes, and N. Mishra, "Sustainable stochastic production and procurement problem for resilient supply chain," *Comput. Ind. Eng.*, vol. 139, 2018, Art. no. 105560.

[147] L. L. Carden, T. Maldonado, and R. O. Boyd, "Organizational resilience: A look at McDonald's in the fast food industry," *Org. Dyn.*, vol. 47, no. 1, pp. 25–31, 2018.

[148] N. A. Mancheri, B. Sprecher, G. Bailey, J. Ge, and A. Tukker, "Effect of Chinese policies on rare earth supply chain resilience," *Resour., Conservation Recycling*, vol. 142, pp. 101–112, 2019.

[149] N. A. Mancheri *et al.*, "Resilience in the tantalum supply chain," *Resour., Conservation Recycling*, vol. 129, pp. 56–69, 2018.

[150] M. D. S. Marcelo, P. L. D. S. Miguel, R. P. d. Brito, and S. C. F. Pereira, "Supply chain resilience: The whole is not the sum of the parts," *Int. J. Oper. Prod. Manage.*, vol. 40, pp. 92–115, 2019.

[151] S. I. Mari, M. S. Memon, M. B. Ramzan, S. M. Qureshi, and M. W. Iqbal, "Interactive fuzzy multi criteria decision making approach for supplier selection and order allocation in a resilient supply chain," *Mathematics*, vol. 7, no. 2, 2019, Art. no. 137.

[152] H. Min, "Blockchain technology for enhancing supply chain resilience," *Bus. Horizons*, vol. 62, no. 1, pp. 35–45, 2019.

[153] A. Mohammed, I. Harris, A. Soroka, M. Naim, T. Ramjaun, and M. Yazdani, "Gresilient supplier assessment and order allocation planning," *Ann. Oper. Res.*, vol. 0, pp. 1–28, 2019.

[154] S. K. Paul, R. Sarker, and D. Essam, "A reactive mitigation approach for managing supply disruption in a three-tier supply chain," *J. Intell. Manuf.*, vol. 29, no. 7, pp. 1581–1597, 2018.

[155] M. Sugimoto and Y. Tanimizu, "Outsourcing strategy for supply chain resilience to unexpected production disruptions," in *Proc. Int. Symp. Flexible Automat.*, 2018, pp. 414–419.

[156] R. González, J. Gascó, and J. Llopis, "Information systems outsourcing reasons and risks: Review and evolution," *J. Global Inf. Technol. Manage.*, vol. 19, no. 4, pp. 223–249, 2016.

[157] A. Gilinsky, S. K. Newton, and R. F. Vega, "Sustainability in the global wine industry: Concepts and cases," *Agriculture Agricultural Sci. Procedia*, vol. 8, no. 1, pp. 37–49, 2016.