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Building Supply Chain Resilience Capabilities during Pandemic Disruption

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Abstract
Supply chain resilience is used to mitigate and deal with the unexpected disruptions of supply chains in the past decades. The sudden catastrophes such as epidemic of Coronavirus disease has led to the lockdowns globally and caused harsh economic consequences. The immediate global supply chain disruption has initiated a sharp plunge in all business activities, demand, and production interruption. This unstable, challenging, and vulnerable market environment highlights the necessity of investigating the supply chain resilience (SCRes) which has regained academicians' and practitioners' attention from various industries recently. This study aims to find the limitations and new developments in conceptualizing SCRes in the discipline of supply chain risk management. Hence, a total of 597 articles in the theme of SCRes are collected and adopted the content analysis to screen in this study.87 papers are final investigated via refining the research of SCRes to each stage according to the pre/in/after the disruption. In this perspective, different phases were included to value and replenish the notable limitations in conceptualizing SCRes, which emphasizes the significance of the stage of "Growth" and the "dynamic" perspective (not only return to the original level after the disruption but also develop into a novel, more desirable condition). The outcomes of the review indicate that SCRes is a significant dynamic capability for supply chains to prepare, adjust, response, recover and grow (which has ignored by many scholars) before or after the unexpected interruption including the outbreak of coronavirus disease (COVID-19).
Keywords: Supply Chain Resilience, Supply Chain Resilience Capabilities, Dynamic Capabilities, Content Analysis, Disruption

Introduction

Progressively multifaceted supply networks, globalization, and external properties (e.g., force majeure, all-inclusive diseases, and political interferences) have repetitively initiated supply chain disruptions during the last decade especially for these years (Fan and Stevenson, 2018; Chen et al., 2019; Lechler et al., 2019; Spieske and Birkel, 2021) including the recent unpredictable global disaster. A worldwide pandemic is considered as an unconvincing event (Francis, 2020; Hilderink, 2020), such as the outbreak of the Coronavirus disease (COVID-19) announced by the World Health Organization (WHO) in 2020, which negatively affected the

global supply chains (Araz et al., 2020; Govindan et al., 2020; Francis, 2020; Ivanov and Dolgui, 2020; Ozdemir et al., 2022).

The informed roughly calculation (October 2020) showed that the coronavirus decelerated global economic increase between the proportion of 4.5% and 6.0% in 2020, with a fractional recovery in percentage from 2.5% to 5.2% by the end of 2021, determining by whether the authorities of countries were able to control the diffusion of the COVID-19 (Orlando et al., 2021). To mitigate the spread of the COVID-19, governments had made stricter boundaries and implemented fully nationwide lockdowns around the borders as well as cities which caused disruptions to international trade and supply chains all over the world (Kumar and Managi, 2020). Jackson et al (2020) indicated that the depth and extent of this global economic downturn and massive disruptions resulted in the decrease of international trade at rate of 9.2% every year. According to the calculation of Fortune (2020), the analysis showed that over 94% of top 1000 companies were influenced by this unexpected outbreak since their supply chain are mostly lean and globalized in structures (Ivanov and Dolgui, 2020).

The pandemic is straight causing interferences in supply and demand at the global and native dimensions (Ivanov, 2020), potentially leading to business discontinuity. Global supply chains relied heavily or solely on factories in China for parts and materials were forced for halts in production (e.g., automotive industry, manufacturing industry) (Harbour, 2020). The supply chain disruption proves the inconceivable weaknesses and shortages in supply (Govindan et al., 2020; Ivanov, 2020; Francis, 2020; Pournader et al., 2020; Araz et al., 2020; El Baz and Ruel, 2021), lack of reactivity to surge in demand and production interruption. (Ivanov and Dolgui, 2020). Some of the supply chains' demand encountered a sharp increase since the supply could not cope with the sudden growth, such as global supply chains of healthcare industry (Govindan et al., 2020). Therefore, on-time shipment of healthcare services and goods are extraordinary important for customers who are at risk of infection, under curfew, lockdowns, or quarantine.

Under such circumstances, if a supply chain can perform and deliver products and services would be characterized as resilient (Blackhurst et al., 2011). Supply chain resilience (SCRes) indicates the readiness and adaption of an institution's supply chain to cope up with sudden and unawares supply chain disruptions (Mubarik et al., 2021). From recent literatures, supply chain disruptions have gained popularity in the condition of the COVID-19 pandemic, which highlights the SCRes as a coordinately central position of interest from scholars today (Hosseini et al., 2019; Ivanov and Dolgui, 2020; Reeves and Whitaker, 2020; Kumar and Managi, 2020; Dolgui et al., 2020; Silva et al., 2021).

There has been increasing scholars have intensively researched SCRes to prepare (readiness), respond, adjust and growth before, in and after the disruptions, finding the new development in the domain of supply chain risk management (Hosseini et al., 2019; Alikhani et al., 2021; Spieske and Birke, 2021). Taking the view of system optimization is chosen by the existing literature in the theme of SCRes (Ivanov and Dolgui, 2020; Dixit, 2020; Govindan et al., 2020), which restricts SCRes in level of system design. Supply chain disruptions cause by complex supply networks, globalization, or external effects, especially the recent outbreaks of COVID-19, stimulate this study to review through the publishments to refine and value the evolution of SCRes (Fan and Stevenson, 2018; Lechler et al., 2019; Araz et al., 2020) to broaden the concept of SCRes. In this context, the purpose of this study is two-fold, including (i) reviewing the current existing literature on the subject of SCRes to revisit and refine its conceptualization, and (ii) illustrating the significance of SCRes in supply chain risk management across the boundary of disciplines.

Definitions and Phases of Supply Chain Resilience

Present definitions of resilience have been garnered from various fields of engineering, developmental psychology, environmental science, ecology, social, management, organizational science, and disaster relief (Ponomarov and Holcomb, 2009; Elleuch et al., 2016; Orlando et al., 2021). From the primary literature, resilience can be categorized as organizational resilience, ecological resilience, resilience engineering, psychological resilience, and system resilience (Fraccascia et al., 2018). A more comprehensive definition that can reflect the integrated multiple disciplines has described the SCRes as "the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function" (Ponomarov and Holcomb, 2009, p.131). This definition of SCRes is inspected and developed in an extensive number of publishments in the direction of the international supply chain risk management (Ali et al.,2017; Orlando et al., 2021).

The concept of resilience is not only multidisciplinary but also multidimensional conceptualized in the perspective of "static" and "dynamic" (Ponomarov and Holcomb, 2009; Annarelli and Nonnino, 2016; Simonovic and Arunkumar, 2016; Fraccascia et al., 2018; Massari and Giannoccaro, 2021).The time-independent static resilient system absorbs disturbance-defense channels and bounces back to the former balanced state (Bhamra et al., 2011),while it cannot premeditate the characteristics of the system, interaction among various individual components, and dynamic reservoir behaviors under disruptions, which takes the priority of maintaining key functions (Deloukas and Apostolopoulou, 2017). As such, the static perspective measurements are more suitable to assess pre-disturbance vulnerabilities (Simonovic and Arunkumar, 2016). Relatively, the dynamic perspective concentrated on the organization's capability to evolve over time-offence approach-moving towards the initial but even fresh, more favorable rebalance states (Vogus and Sutcliffe, 2007; Bhamra et al., 2011; Carvalho et al., 2012), which could be achieved by introducing adaptation options and offering occasions for proactive and/or reactive adaptive reply that can be chosen to maximize the resilience (Simonovic and Arunkumar, 2016). To meet the requirement of being more resilience in mitigating the interruption, this study would take the view of the "dynamic" (not only return to the original level after the disruption but also develop into a novel, more desirable condition) to conceptualize the supply chain resilience.

The definition of SCRes is comparative new, along with an extensive focus of researchers in supply chain risk management (Hosseini et al., 2019). Numerous literature reviews have tried to integrate and strengthen SCRes concepts (Ali et al., 2017; Sawyerr and Harrison, 2020; Bak et al., 2020) and metrics (Han et al., 2020; Negri et al., 2020). The available approaches of measuring resilience in supply chain include resilience and/or its enablers (Aguila and ElMaraghy, 2019). Although there are variations in SCR definitions, some similarities can be found among the various concepts (Hosseini et al., 2019). The concepts of SCRes are broadly shared with elements, for instance, readiness, withstanding, rapidly response to, and effective recovery from a disruption returning to the prior level or developing into an even preferable level of economic and/or environmental performance (Ponomarov and Holcomb, 2009; Hohenstein et al., 2015; Tukamuhabwa et al., 2015; Hendry et al., 2019). Negri et al. (2020) indicated that various research defined supply chain resilience respectively according to the different phases of resilience. Lindell et al. (2007) classified periods of emergency management into four phases, which included damage mitigation, calamity preparedness (readiness), emergency response, and recovery of disaster. Ponomarov and Holcomb (2009)

determined that SCRes was directly related to the stages of readiness, response, and recovery in terms of disruptions. Hohenstein et al (2015) illustrated that rarely studies centralized on the prospective growth after being interrupted. This phase of "Growth" reflects the developmental nature of SCRes in moving to a new condition and improving competitive advantages (Ponis and Peck, 2004; Jüttner and Maklan, 2011; Pettit et al., 2013; Wieland and Wallenburg, 2013). The conceptualization of the SCRes is extended from the competence of response and recovery from disruptions (Rice and Caniato, 2003; Christopher and Peck, 2004) to comprise the capability of the supply chain to get ready for, prevent from, adapt to, recover, learn, and growth from disruptions (Hohenstein et al., 2015; Datta, 2017; Spieske and Birke, 2021). In this context, a high SCRes contained not only the pre- and early-interruption phases but also a better acquirement in later phases (Han et al., 2020; Reeves and Whitaker, 2020).

Recently, Sawyerr and Harrison (2020) conceptualized SCRes as the capability to initiatively scheme and devise the network of supply chain to forestall unforeseen negative incidents (crisis), adaptively respond to disruptions while preserving structural and functional operations and surpassing to a post-incidents robust state. Mubarik et al. (2021) valued the resilience of a supply chain by preparedness (the readiness of a supply chain against the disruptions), response (the speed of a supply chain to cope with disruptions) and recovery (the ability of a supply chain to revival after the disruptions) to the supply chain disturbances. The sustainable and changeable perspective in long-term that includes the phase of "growth" has often been ignored which might discourage firms from achieving competitive advantages in later phase of SCRes (Hohenstein et al., 2015). Likewise, Spieske and Birke (2021) further well-defined supply chain resilience as a framework consisting of four distinct phases: readiness(preparedness), response, recovery, and growth in chronological order as shown in Figure 2.1.

Figure 1 summarizes four separate phases: readiness(preparedness), response, recovery, and growth in chronological order. In this study, to conceptualize supply chain resilience, these four stages are the fundamental dimensions to conceptualize SCRes to ensure the theoretical validity.

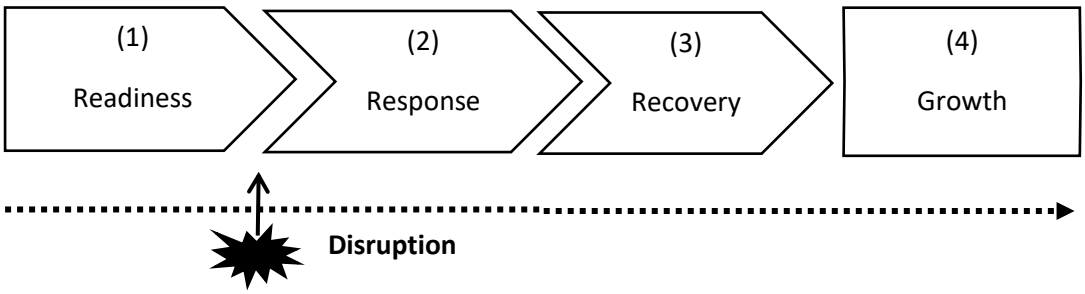

Figure 1: The Phase of SCRes. Source: Adapted from Spieske and Birke (2021)

Readiness

In the pre-disruption phase as illustrates in Figure 2.1, readiness is the initial stage of the supply chain to plan and get ready for sudden events to lessen its vulnerability against disruptions (Christopher and Peck, 2004; Jüttner and Maklan, 2011). The concept of "readiness" to mitigate the negative effects of unexpected events first proposed by Datta et al. (2007). Ponomarov and Holcomb (2009) indicated the description of SCRes highlighting

readiness (preparation dimension) for unpredicted events. Overall, this study defines readiness as all measures in the pre-disruption condition appropriate to diminish disruption's probability, its damaging scopes and impact.

Macdonald and Corsi (2013) named all the proactive and prepared movements as readiness, such as, be prepared to implement all plans for emergencies to aid managers in responding the unexpected events. It indicates abilities of a firm in recognizing, forecasting, and preventing disruptions, emergencies, and risks at the pre-stage (Chowdhury and Quaddus, 2016). Chowdhury and Quaddus (2016) proved that this kind of capability (readiness) is crucial by framing dynamic regulations on the supply chain to mitigate disruptions. In line with Kandel et al (2020), preparedness was described as an effective paradigm of operational activities in preventing, monitoring, and reacting to unanticipated, changeable, and adverse outbreaks.

Respond

The next phase after the hit of disruption is "respond". Response was proposeed by Rice and Caniato (2003), ever since then, it has been frequently valued and investigated as an essential component of SCRes and widely explored and emphasized in conceptualizing SCRes (Hohenstein et al., 2015). Responses comprise countermeasures that are executed directly after an outage is detected or encountered. When the disruption is experienced, the instant campaign should be taken to relieve and control the crisis, limit the ripple effects, and resume normal operations in a short process to earn advantages in the market (Chen et al.,2019).

A robust and/or redundancy strategy, such as, buffer stocks, rerouting map, multisource and backup suppliers was adopted and highlighted as preventive solutions at the stage of responding in plenty studies (Tomlin, 2006; Singhal et al., 2011; Sawik, 2013; Gupta et al., 2015) to mitigate the crises in the field of risk management. The ripple effect impacts supply chain through multiple echelons which promotes the escalation of the interruption (Hosseini and Barker, 2016; Ivanov, 2018; Li et al., 2018; Ivanov et al., 2019; Chen et al., 2019). The foremost importance at this stage must be speedy for refraining from damaging consequences for the supply chain (Han et al., 2020). Clear recognizing and quick responding could prevent this effect and harvest more shares in the new and changeable market, solidify and enhance the status in the industry, significantly reduce risk and improve operations against the hit (Ponomarov and Holcomb, 2009; Juttner and Maklan, 2011; Al-Omoush et al., 2020). Under the instable environment like the global market, firms who desired to safely mitigate the disruptions even dominate bigger shares shall respond to the crisis in a timely manner and allocate resources to update competencies (Chowdhury and Quaddus, 2016). Such reconfiguration and renewal of capabilities gain the competitive advantage for winners and help them to recover from unexpected crisis (Kylaheiko and Sandstrom, 2007).

Recovery

After the respond to disruption, enterprises would concentrate on developing the capability of recovering to the original level (Li et al., 2010; Hobbs, 2020). Appropriate and effective recovery strategies in processing disrupted risks are pursued by most manufactures in producing essential items, especially in the conditions of the demand spike (Wu et al., 2020) and the disruption of supply (Harbour, 2020) inflicted by COVID-19. Chen et al. (2019) indicated that companies should concentrate on developing and execution contingency strategies which follow essential principles for recovering from disruptions, such as effective adaptation and minimize the long-term impaction, to preserve operations with stabilize

resiliency. These optimization approaches and mitigation strategies were investigated by several studies in the post-disruption stage of a resilient supply chain, focusing on safety stocks, decreased lead time, inventory level enhancement and optimizing transportation routing (Sawik, 2013; Kristianto et al, 2014; Nguyen et al., 2021). Under conditions of ripple effect (Ivanov et al, 2015), the joint efforts of pre and post tactics are essential to the recovery policies and thus measure the dynamic supply chain recovery performance (Nguyen et al., 2021).

Supply chain stabilization, energetic adjustments of allocating the scarce resources and sharing information with local manufacturers, had also been commonly suggested as important tactics in the recovery stage by scholars to ensure process continuity against the disruption of production (Sheffi and Rice, 2005; Ivanov et al., 2014, 2016, 2017; Gupta et al., 2015; Chang et al., 2019). Paul et al (2020a); Rahman et al (2021) declared multiple solutions could be adapted to mitigate interruptions of manufacturing by increasing the production, which contains recruiting additional operators, purchasing more facilities of operations, and utilizing alternate shifts to assist recovery after crisis, like COVID-19.

Growths

The final phase of the SCRes is "Growth". Some of the primary studies about SCRes limitedly related to quantify the level of a specific resilient supply chain by developing strategies in both aspect of preparedness, response, and recovery (Chowdhury and Quaddus, 2016; Ivanov et al., 2017; Graveline and Grmont, 2017; Hosseini et al., 2019). Likewise, numerous definitions of SCRes have emerged with notable limitations from these studies. Some studies under-examined the steps on what the enterprise could learn and improve from the sudden disruption (Hohenstein et al., 2015; Han et al., 2020; Spieske and Birke, 2021). Essentially, the interactions of the several drivers and the competences developed to diminish the negative influences of disruptions (vulnerabilities) are investigated by increasing researchers for supply chains' adaptation and growth after disruption (Pettit et al., 2010; Zhao et al., 2011; Scholten and Schilder, 2015; Ribeiro and Barbosa, 2018; Pettit et al., 2019; Alfarsi et al., 2020). There are many researchers have developed the concept of SCRes and focused on how to survive disruptions as well as on adaptation and development (Zhang et al., 2011; Ivanov et al., 2014; Fiksel, 2015; Gabler et al., 2017; Pettit et al., 2019). Due the popularity of "Growth" stage, the definition of resilient supply chain is more encompassing now.

Methodology

The content analysis refers to an inference about any type of text to tell whether its production process is effective and trustworthy. To make systematic analyze literature objectively in quantitative ways, the content analysis was selected as the research method in this study. The aim at adopting the content analysis to review literature in this study is to reveal the implicit information, clarify and assess the essential primary facts and developing trends to provide intelligence predictions for the development of supply chain resilience.

For this study, papers were selected based on the English-language academic journals and conference articles published between 2000 and 2022. This review was concentrated on one single language. The database was from Scopus, Science Direct Journal, and Google Scholar to systematically review literature which is associated with supply chain resilience. Description of review results, descriptive analysis, thematic categorization, and specific industry application are the standards of searching articles. The process of reviewing is shown in Table 1. After searching and screening on the database,597 papers were accumulated after

being confirmed by substance and relevance, and 87 papers were selected and investigated in final stage.

Table 1 Review process

STEPS	PROCESS	COUNT.
State Research Problem and Confirm Keywords	Defined research topic of supply chain resilience	
Searching Articles	Searched articles in the database of Scopus, Science Direct Journal, and Google Scholar with keywords.	597
Screening	The search included both journal and peer-reviewed conference publications to illustrate the history of developing the topic and new findings.	549
Exclusion	The subject regions of the database focused on the field of supply chain management, supply chain risk management, economics, logistics, industry engineering, social sciences, and decision science.	389
Inclusion	Searched Sequence with Article Inclusion Standard: a) Full-text articles published in journals only. b) The article should include the research subject: supply chain resilience c) Conclusions of the paper should indicate responses to the stated problem or research questions.	198
Critical and Comprehensive Content Selection	Based on synthesis and comparisons, reviewing thorough all articles after screening, papers not related to objectives were excluded.	151
Final Article Assessment	Decided the articles to do the investigations.	87

Results and Discussion

Classification of Journals

Reviewing thorough all articles and checking the titles, abstract, and objectives based on synthesis and comparisons brings about the rejection of 151 papers. Unquestionably, increasing scholars are doing the investigation of SCRes in the field of supply chain risk management in the last 20 years. The final decided articles at the amount of 87 are classified according to the published journals as shown in Table 2. The 87 publications are published in 34 journals. International Journal of Production Research (10 publications), International Journal of Production Economics (9 publications), Journal of International Management (9 publications), Supply Chain Management: An International Journal (7 publications), International Journal of Physical Distribution and Logistics Management (6 publications) are the top five published journals of the selected articles, which cover 47% of publications.

Table 2 Classification of journals

Journals	**International journal of production research**	**10**
	International Journal of Production Economics	9
	Journal of International Management	9
	Supply Chain Management: An International Journal	7
	International Journal of Physical Distribution and Logistics Management	6
	Computers and Industrial Engineering	4
	Journal of Business Logistics	4
	Omega	4
	Transportation Research Part E: Logistics and Transportation Review	4
	Decision Sciences	2
	Heliyon	2
	IFAC-PapersOnLine	2
	Journal of Cleaner Production	2
	Management science	2
	Business Strategy and the Environment	1
	Canadian Journal of Agricultural Economics	1
	Complexity	1
	Expert systems with applications	1
	Harvard Business Review	1
	International Journal of Business Science and Applied Management	1
	International journal of disaster risk reduction	1
	International Journal of Information Management	1
	International Journal of Operations and Production Management	1
	Journal of Manufacturing Technology Management	1
	Journal of transportation security	1
	Journal of operations Management	1
	MIT Sloan management review	1
	Procedia CIRP	1
	The International Journal of Logistics Management	1
	Transportation Research Procedia	1
	Water Resources Research	1
	International Conference on Dynamics in Logistics	1
	Industrial and corporate change	1
	Resilient by design	1
	Total	87

Evolution of CSRes

From the primary literature, the objective to strengthen SCRes is let the supply chain swiftly recover from unforeseen supply chain disruptions and recapture the original performance or even obtain an improvement afterwards (Sheffi and Rice, 2005; Ponomarov and Holcomb, 2009; Hohenstein et al., 2015; Alfarsi et al., 2020; Spieske and Birkel, 2021). In this study, four different stages of SCRes are discussed with proactive and/or reactive competences to diminish the influential of the unexpected disruptions. Likewise, scholars indicated that the capabilities of SCRes in mitigating sudden disturbances and returning the supply chain to its

former or an even better state might lead to competitive advantages (Kamalahmadi and Parast, 2016; Yu et al., 2019; Al-Hakimi et al., 2021). SCRes was considered as a dynamic capability (Yu et al., 2019; Simonovic and Arunkumar, 2016) for supply chains to prepare, adjust, response to (answer), recovery and growth before or after the sudden interruption (e.g., the outbreak of coronavirus disease (COVID-19)) in this study.

The concept of "Resilience" could be discovered in ecological, socio-ecological, and physical systems, economy, organizational, network engineering, and disaster management research (Ponomarov and Holcomb, 2009). For examples, ecologists defined resilience as the capability of living systems absorbing change and bouncing back from a distribution and/or changing conditions (e.g., Holling 1973; Jia et al., 2020). In addition, material scientists examined the ways objects revert to their initial structures after being deformed, whereas psychologists and sociologists conceptualized resilience as the capabilities of individuals, organizations, or communities to handle outside pressures and interrupts because of political, social, and/or environmental changes, and scholars of management investigated the function of personal resilience in leadership (Adger, 2000; Bonanno, 2004).

The late 1990s witnessed the emergence of supply chain resilience's concepts, with a surge of progress in the early 2000s and its widespread applications' generation in 2010s (Pettit et al., 2019). Themes chosen by scholars concentrated on sustained refinement of the conceptualizations and parameters/dimensions of SCRes (Chowdhury and Quaddus, 2017; Brusset and Teller, 2017), network constructions or topologies in building network resilience (Kim et al., 2015; Dixit, 2020; Tsolakis et al., 2021), depth and wideness of resilience and additional practical evaluations (Chowdhury and Quaddus, 2017; Scheibe and Blackhurst, 2018; Pettit et al., 2019) as well as strategies in managing resilience of a specific supply chain (Autry et al., 2013; Silva et al., 2021). For supply chain managers, successfully manipulating sudden disruptions depends on whether they choose the suitable strategy when designing their supply chain (Chowdhury and Quaddus, 2017). Scholars deployed the concept of dynamic supply chain capabilities to explain how supply chain partners mobilize processes beyond organizational boundaries in building or/and revising capacities due to market turbulences (Defee and Fugate, 2010; Beske, 2012; Aslam et al., 2020). Instead of analyzing the SCRes in the development of designing network (Kim et al., 2015; Alikhani et al., 2021), this study defined SCRes from the perspective of dynamic capabilities which provides a new angle for companies' supply chain risk management. Winners in overcoming disruptions can effectively resist unexpected outbursts inside and outside the supply chain by building capabilities and shaping resilience to mitigate the impact of interruptions caused by unexpected global crisis (i.e., COVID-19) on the daily operations.

Golgeci and Ponomarov (2013) used the SCRes as an effective approach for risk mitigation and management. SCRes have been conceptualized in several studies on companies responding to risk by enhancing their dynamic adaptabilities (Scholten et al., 2019; Pettit et al., 2019; Dolgui et al., 2020). Fiksel (2006) proposed the characteristic of a supply chain as the resilient if the network could operate and distribute products and/or services under the situations of upheavals, disruptions, and unforeseen events. Using the theory of Fiksel (2006) and Ponomarov and Holcomb (2009), Pettit et al. (2013) and Sawik (2013) defined the resilient supply chain as the competence against the turbulence environment.

Extensive research has proposed SCRes as a dynamic capability (Sheffi and Rice, 2005; Ponomarov and Holcomb,2009; Golgeci and Ponomarov, 2013) which allows the supply chain to rapidly and efficiently prepared, respond, adapt, and recover from disruptions (Juttner and Maklan, 2011; Blackhurst et al., 2011; Chen et al., 2019). Likewise, Hohenstein et al. (2015)

indicated SCRes as a multidimensionality concept which involved the sub-abilities of a supply chain (abbreviated as subject in this study) in responding and adapting uncertainties. In this study, definitions of SCRes are divided into three dimensions based on the research of Hosseini and Barker (2016), which named restorative capacity, adaptive capacity, and absorptive capacity separately. Absorptive capacity is the degree of which a subject could assimilate impacts from disruptive events via proactive planning for resilience (Cheng and Lu, 2017) or the strategic exploitation in the pre-stage that could be regarded as the first line of defense. Vugrin et al. (2011) and Rose (2009) viewed this capability as being ordinary and endogenous to systems. Adaptive capacity is defined as to what extent a subject could complete adaption in the post-stage for minimizing negative consequences in performance (Tukamuhabwa et al., 2015; Adobor, 2020), which could be a component of a temporary strategy after the interruptions as the second line of defense. Restorative capacity is described as the extent of which a subject could recover permanently from disruption (Hosseini et al., 2019). Unlike adaptive capacity, capabilities of restorative strategies can be considered as the last line of defense because of its longer-term nature (Hosseini and Barker, 2016).

Kochan and Nowicki (2018) argued the primary authors mainly define SCRes as an ability. Since then, the SCRes capabilities were investigated as the antecedents of SCRes to create the competitive advantages and meet a higher performance under the new industry environment against the sudden interruptions. Fundamental aspects of resilience comprise preparedness and emergency management from the perspectives of pre-disruption (readiness/preparedness) and post-disruption (response, recovery with adaptation, and growth) (Ivanov et al., 2014; Pettit et al., 2019; Spieske and Birke, 2021). Consistent with the existing literature, this study asserts that supply chains managers require developing proper strategies according to the four phases of SCRes to strength both proactive and reactive capabilities of enterprises to prepare, respond, reconfigure, adapt, learn and growth surrounding disruptive events.

Conlusions

As found in different stages of SCRes and the nodes of supply chains, disruptions may occur, and it requires the continuous and creative operations by participators of the supply chain to maintain the functions and performance. After reviewing through all the selected articles, the phase of “Growth” was ignored by most of the existing literatures. Hence, this study refined SCRes according to different stages of SCRes (i.e., absorptive capability in the stage “readiness”, restorative capacity in stage “response” and restorative capacity in stage “recovery”) and develops the dimensions from three to four by adding the resilient abilities in the stage “Growth”.

Under the new circumstance of the COVID-19, the challenges caused by the global disruptions have forced corporations to swiftly respond and innovate operational patterns to maintain functional business to keep their supply chains effective and efficient (Al-Omoush et al., 2020). The existing literature basically analyzes SCRes from the perspective of system optimization (Hosseini and Barker, 2016; Fraccascia et al., 2018; Dixit, 2020; Ivanov and Dolgui, 2020; Govindan et al., 2020), which restricts SCRes to the system design level. The improvement of resilient supply chains would become limited. The meaningful contributions of this study emerge. The new perspective in conceptualizing SCRes as the dynamic capabilities motivates the future researchers to explore SCRes capabilities in which conditions would be more effective in mitigating disruptions. This study reorients the SCRes reviewing

from the main broad discussion area of network engineering, which revisits the problem of SCRes from the perspective of dynamic capabilities to address disruptions and provides a new research approach for future researchers by combining the fields of strategy and supply chain risk management.

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