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Trends in Food Science & Technology 109 (2021) 94–102

Contents lists available at ScienceDirect

Trends in Food Science & Technology

journal homepage: www.elsevier.com/locate/tifs

Supply chain resilience reactive strategies for food SMEs in coping to COVID-19 crisis

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ARTICLE INFO

Keywords:
COVID-19
Supply chain resilience
SMEs
Food industry
Reactive strategy

ABSTRACT

Background: The ability of small- and medium-sized enterprises in the food industry (FSMEs) in cultivating resilience against the COVID-19 pandemic is vital food security. However, there is limited supply chain resilience literature to guide FSMEs in overcoming disruptions caused by pandemic.
Scope and approach: This review aims to provide a broad view of SCRes reactive strategies for FSMEs in dealing with crises in the context of COVID-19. Attention is given to the literature on resilience in other types of supply chain and situated in the context of food settings. The factors are monitored or controlled to contribute to FSME resiliency.
Key findings and conclusion: Four quadrants, i.e., (1) rapid with low cost, (2) rapid with high cost, (3) slow with low cost and (4) slow with high cost, are offered based on the limitations and the time needed to react, and the strategies of each quadrant are explained in depth. This review also provides a better understanding of and guidance on reactive strategies for SCRes as options for FSMEs in dealing with the COVID-19 pandemic. This review suggests future directions as extensions based on the logical flow of this review.

1. Introduction

The recent COVID-19 pandemic has shaken the way in which business is currently practised, making food supply chain actors more vulnerable. Before the pandemic, food firms were typically concerned with operational and food-related performance such as food safety, food quality, food integrity, and food security (Bakalis et al., 2020; Manning & Soon, 2016; Smith et al., 2016). However, the COVID-19 pandemic that has hit the global business process has heightened the concerns of many regarding the ability of food firms to survive, which may ultimately affect food security (i.e., whether food products are sustainably produced and safe for consumption), especially as it relates to availability, access, and utilization (Cappelli & Cini, 2020; Nicola et al., 2020). Governments and global organizations such as the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) are under pressure to ensure the security of the food supply to cities while dealing with the pandemic (FAO and WHO, 2020; Ivanov & Dolgui, 2020). Achieving food security for consumers is difficult if food firms are unable to respond efficiently to the pandemic (Falkowski, 2015).

In addition, the trends of consumer consumption during the COVID-19 pandemic have changed significantly, mainly due to panic buying (Addo et al., 2020; Nicola et al., 2020) and the intensified imbalance and disequilibrium between supply and demand, threatening the response of the food supply chain to tackle the vulnerabilities resulting from the COVID-19 pandemic. The food supply chain is long and to makes resilience efforts a daunting task for food firms complex (Adobor & McMullen, 2018; Ali, Tan, & Ismail, 2017; Manning, 2016). One of the most popular measures for combating the COVID-19 pandemic deployed by governments to break the chain of spread has been increased hygienic practices and social distancing, which have halted public gatherings and forced the closure of factories and food premises. Such closures have

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https://doi.org/10.1016/j.tifs.2021.01.021
Received 25 May 2020; Received in revised form 21 November 2020; Accepted 2 January 2021
Available online 13 January 2021
0924-2244/

subsequently impacted the food industry, especially small- and medium-sized enterprises (SMEs) in the food industry (FSMEs). FSMEs account for more than 70 percent of the total food industry (Bakalis et al., 2020; Tan et al., 2017). The COVID-19 pandemic is expected to impact businesses in the longer term, posing significant threats to the sustainability and survival of firms (Ivanov & Dolgui, 2020). This situation is worse for FSMEs with limited resources.

The food system needs to withstand and rebound from acute disruptions such as the COVID-19 pandemic (Béné, 2020; Hecht et al., 2019). For instance, Ambulkar et al. (2015) highlighted that resilience is the ability of a firm to be alert to, adapt to, and quickly respond to the changes brought by a supply chain disruption. Specifically, in the context of supply chain resilience (SCRes), firms meet unpredictable demand and achieve competitive advantages by anticipating, preparing for, quickly responding to and recovering faster from disturbances (Bui et al., 2020; Hohenstein et al., 2015; Sá et al., 2019; Stone & Rahimifard, 2018). Indeed, the resiliency of a firm's supply chain depends on the vulnerabilities and risks posed by the COVID-19 pandemic to reshape the constituents of the current market and the way of doing business (see FAO and WHO, 2020). Few studies have been conducted on the effects of the recent COVID-19 pandemic on the marketplace, which has made it more difficult for managers to embrace the disturbance within their firm and at the supply chain level. The literature shows that deploying strategies for SCRes is challenging due to the lack of information sharing, knowledge, risk assessment, and ineffective supplier management (Shashi et al., 2020). This review is conducted to generalize the literature that has thus far been puzzling for stakeholders as resilience profiles may be different between SMEs and large firms due to limited resources and capabilities (Polyviou et al., 2020). Furthermore, there is no empirical evidence supporting the idea that all resilience elements are relevant in all supply chains (Sá et al., 2019; Stone & Rahimifard, 2018).

This review aims to provide guidance on how FSMEs may react, transform and adopt SCRes' reactive strategies to cope with the COVID-19 disruption using resource-based theory (RBT) and contingency theory (CT) as a theoretical lens. The objective of this review is to provide a clearer context for SCRes to develop reactive strategies that correspond to the resource and time constraints to obtain the benefits of these strategies.

The information gathered from the literature is used to (1) understand the effect of the COVID-19 pandemic on the food supply chain, (2) provide a deeper understanding of the reactive strategies of SCRes and the capabilities in responding to the impacts of the COVID-19 pandemic, (3) offer strategies adapted to the impacts of the COVID-19 pandemic, and (4) suggest future study in the food industry based on this SCRes study and the post-COVID-19 food system. Section 2 highlights the COVID-19 impacts on the food supply chain and supply chain resilience in the food industry. Section 3 presents an in-depth discussion of the proposed reactive strategies as applicable to FSMEs. Section 4 concludes the review and proposes directions for future study.

2. Impacts of the COVID-19 pandemic on FSMEs

COVID-19 has caused an unprecedented global disruption and has thrown the world economic structure into a state of uncertainty. The COVID-19 pandemic is novel, and an effective way of controlling and recovering from the disruption is not yet available. Thus, most countries follow the safety measures outlined by the WHO in reducing the transmission of this disease. Governments are attaching the utmost importance to human health and safety, and they have forced the closure of many business sectors in support of the measures outlined by the WHO. The tough decisions made by governments to combat COVID-19, such as lockdowns and movement control, have disrupted supply chains and the production of goods and services all around the world. For example, the impact of such policies has led to a decline in the tourism sector and is anticipated to cause a deep recession in the general sector (Yang et al., 2020). For the food industry, the contingencies of the new market environment must be fully understood in terms of their impacts on the supply chain and industry. Failing to do this, the snowball effect will be expected to worsen the situation for 821 million people (i.e., a ratio of nearly one to nine people in the world) who were already suffering from severe food insecurity before the pandemic (WHO, 2018).

The increasing exponential growth of the population has broadened the non-homogenous market demand in the modern food supply chain and has made the discussion of food security more difficult and complex (Astill et al., 2019). The lockdown and movement control strategies advised in battling COVID-19 have been executed through social distancing, self-isolation, and travel restrictions, forcing FSMEs to temporarily close down. It is basically impossible for employees and supply chain participants to work from home, which makes them and the food products produced vulnerable to virus transmission (FAO and WHO, 2020). Such restrictions further decrease food production and make it difficult for people to have access to food (Cappelli & Cini, 2020). The restrictions imposed on movement have led to stock depletion as people have tended to purchase food and other products in bulk for hoarding (Addo et al., 2020; Nicola et al., 2020). The impacts from the forced closure are likely to have impacts on their sustainability as well as immediate repercussions, such as job losses and to worsen food insecurity (Béné, 2020; Chowdhury et al., 2020; Nicola et al., 2020). The economic ecosystem continues to be disrupted, leading to financial difficulties and permanent closures. In short, Chowdhury et al. (2020) highlighted that COVID-19 has significant negative short and long-term impact in the food industry. In response to disruptions, the literature has proposed SCRes for the food industry for the supply network to be capable of withstanding, adapting and recovering by aligning operations and the environment to meet consumer demand and ensure performance (Hosseini et al., 2019; Stone & Rahimifard, 2018; Tseng et al., 2020).

2.1. Supply chain resilience in the food industry

SCRes is a multidimensionality concept involving the abilities of an organization, a supply chain or a system to respond to disturbances and uncertainties (Béné, 2020; Hohenstein et al., 2015). An efficient SCRes is argued to have a positive impact on firm performance (Wong et al., 2020). In the supply chain literature, SCRes is commonly conceptualized based on many aspects of the capabilities that may sustain firms. The previous studies have shed light on building resilience capabilities upfronts such as flexibility, visibility, redundancy, collaboration, disaster readiness, financial strength, and market capability (Chowdhury & Quaddus, 2017; Shashi et al., 2020). Four SCRes principles, i.e., (1) supply chain engineering, (2) collaboration, (3) agility, and (4) risk management culture, have been established as necessary conditions for actual resilience in a supply chain. Shashi et al. (2020) discussed these four SCRes principles and translated them into business and environmental strategies by highlighting flexibility, collaborative planning, and redundancy (i.e., contingency planning and strategic inventory stock) strategies as the most important. However, the effectiveness of strategies remains unclear. Chowdhury and Quaddus (2017) proposed, developed and validated a measurement scale for SCRes that is decomposed into three components of supply chain capabilities: (1) proactive (flexibility, reserve capacity, integration, market and financial strength, and readiness); (2) design (density, complexity, and node criticality); and (3) reactive (response and recovery). Despite these studies, there is still a lack of theoretical understanding of the connotations of supply chain capabilities and resilience (Chowdhury & Quaddus, 2017; Shashi et al., 2020). This review argues that the inconclusive findings are due to the newness of the study and the nature of different industries.

There is scarce research on SCRes in the food industry (Umar et al., 2017); although the study of SCRes has become increasingly popular, the term and concept are still ambiguous, and a sufficient understanding of SCRes is lacking (Hohenstein et al., 2015). Similarly, the divergent theoretical concepts have led to inconsistent use of SCRes terminologies related to antecedents, attributes, capabilities, elements, and enhancers.

This study argues that the problem of SCRes in other industries is similarly occurring in the food supply chain and food security context. The concepts employed in the previous study on food SCRes have commonly focused on the operational capabilities that enable a disrupted or broken supply chain to reconstruct itself and to be stronger than it was before (Brusset & Teller, 2017; Hecht et al., 2019; Scholten et al., 2019; Stone & Rahimifard, 2018). Scholten and Schilder (2015) recommended considering SCRes as part of the firm strategy with regard to collaboration activities with increased visibility, velocity and flexibility in the food supply chain. Brusset and Teller (2017) analysed the multidimensionality of the higher-order SCRes construct as a hierarchical model that involves external, flexibility and integration capabilities as lower-order constructs. Hecht et al. (2019) examined the factors that may contribute to organizational resilience as bases for investigations of operational vulnerabilities and the deployment of possible strategies. Stone and Rahimifard (2018) introduced a conceptual framework of SCRes and strategy elements in the agri-food supply chain.

SCRes in the food industry is still at the embryonic stage, despite the convergence of capabilities between the food industry and other industries. An understanding on the factors and probable impacts of SCRes in the food supply chain should be established as an underlying resilient foundation when confronting any disruption (Hecht et al., 2019). Despite studies on SCRes in the food industry, the lack of clear guidance for how food firms should manage disruptions warrants further study. Concerning firm-level resilience, Stone and Rahimifard (2018) proposed five core elements of agri-food intra-firm resilience, i.e., (1) flexibility, (2) risk-aware culture, (3) redundancy, (4) early warning, and (5) security, which are supplemented by supporting elements. However, the proposed framework includes definitions that limit its applicability for firms. A similar approach has been proposed in discussions of the intra-supply chain. In particular, because SMEs constitute more than 70 percent of the food industry, Ali, Mahfouz, and Arisha (2017) and Scholten et al. (2019) argued that it is a daunting task for such SMEs to assimilate the theoretical and practical advances in SCRes. The global COVID-19 disruption has hit all types of industrial sectors and businesses of all sizes. SMEs are known for their limited resources, scale, and capabilities in responding to any changes in the marketplace (Polyviou et al., 2020; Scholten et al., 2019). This situation has created an unfavourable business condition for SMEs to manage their supply chain.

3. Strategy guidance for the resilience of FSMEs

The most common SCRes strategy that has been discussed in the previous literature is decomposed into four stages: (1) readiness, (2) response, (3) recovery, and (4) adaptation (e.g. Adobor & McMullen, 2018; Stone & Rahimifard, 2018). Using the same line of argument, Hohenstein et al. (2015) classified SCRes based on ex-ante and post-ante disruptions. Specifically, an ex-ante strategy is a proactive approach that consists of elements of collaboration, human resource management, inventory management, predefined plans, redundancy and visibility to create readiness. In contrast, a post ante strategy is a reactive strategy that is employed in response to a disturbance and involves the elements of agility, collaboration, flexibility, human resource management and redundancy to recover and grow. Within the context of an organization, resilience is defined as the ability to anticipate, avoid, and adjust to disruptions and changes (Ortiz-de-Mandojana & Bansal, 2015). Resilience elements are management practices that support SCRes capabilities such as agility, flexibility, redundancy, collaboration, and human resource management (Hohenstein et al., 2015; Sá et al., 2019; Tukamuhabwa et al., 2015).

The novel COVID-19 pandemic is unlike other disruptions previously experienced by firms and supply chains. As the COVID-19 pandemic has caused an unprecedented global disruption, this review argues that most firms are unprepared. Its impact has been rapid and affected each echelon of the supply chain (Cappelli & Cini, 2020; Ivanov & Dolgui, 2020). The rapidity of the COVID-19 disruption renders inappropriate a proactive SCRes strategy such as readiness. Furthermore, inadequate data on how to respond to such conditions limit firm readiness and the ability of firms to react and embrace the changes in the supply chain. Referring to the four phases of SCRes (readiness, recovery, adaptation and recovery) set forth by Stone and Rahimifard (2018), food firms are one step behind the actual situation of the COVID-19 context. Therefore, in proposing a resilience strategy to respond to the COVID-19 pandemic, this review focuses on the reactive strategy proposed by Hohenstein et al. (2015).

In addition, Annarelli and Nonino (2016) highlighted that resilience strategy applied in management literature focused on the notions of recovery ability, recovery times, and costs of recovery. Most studies on the reactive facet of SCRes have addressed the time and cost involved, and successful resilience depends on how fast a firm responds to disruptions (Chowdhury & Quaddus, 2017). This review acknowledges that apart from time element, limited resources and firm size may impede a firm's ability to respond and recover from the unprecedented COVID-19 pandemic (Béné, 2020; Essuman et al., 2020; Polyviou et al., 2020). Furthemore, managing disruption requires a greater investment in resilience building, which can increase the operational cost (Ivanov & Dolgui, 2020). Governments worldwide have observed these limitations of SMEs and provided monetary stimulus packages to help SMEs survive. In light of that, this review underscores cost as another major factor that influences the resilience involved in responding to disruptions.

This review proposes a new conceptual reactive strategy for SCRes for SMEs, as depicted in Fig. 1. The framework categorizes the reactive strategy into the four quadrants of time (x-axis) and cost (y-axis). However, that categorization does not represent the hierarchical importance of each quadrant in the strategy since there is a lack of empirical evidence to determine the efficiency level of SCRes strategy (Shashi et al., 2020). The arguments are based on CT and RBT. The CT lens is used based on the argument that a firm should match its strategy or resources with the environment (Lawrence & Lorsch, 1999). Instead, based on RBT, Barney (2001) and Ali et al. (2018) argued that firms use resources and capabilities to create resilience. Firms depend on individuals, processes and organizational culture to build resilience (Kamalahmadi & Mellat-Parast, 2016; Sá et al., 2019).

3.1. Rapid with low cost

3.1.1. Agility in rapid with low cost

This review argues that the agility strategy elements of SCRes are the most dominant in the rapid with low-cost quadrant. Agility encompasses a higher-level concept in the supply chain that should include flexibility as one of its factors. Agility consists of elements such as communication, information sharing, and quick supply chain design to facilitate a quicker response to a disruption (Adobor & McMullen, 2018; Lotfi & Saghiri, 2018). The agility elements under the reactive strategy are considered to support higher-level strategic planning for the daily tasks embedded in the ability of any FSME supply chain. Strategic planning should rely on the foundation and/or facilities of firms that are readily available for deployment. For example, communication (A1) and information sharing (A2) have been identified as necessities in the FSME supply chain, and they have been driven by digital technology in the era of the Internet of Things (e.g. Astill et al., 2019; Kamilaris et al., 2019; Zhong et al., 2017). However, quick design supply chain (A3) elements require more attention from FSMEs and must quickly redesign their supply chain at a tactical level based on unpredictable changes in supply and demand volatility (Hasani & Khosrojerdi, 2016; Hohenstein et al., 2015; Purvis et al., 2016).

The supply chain is redesigned based on the simplest and cheapest means and FSMEs practices, for example, by improvising flexibility, revisiting collaborations with suppliers and retailers, and eliminating redundancy in production to suit current conditions and the situation of firm supply chains. From the RBT perspective, the agility strategy is

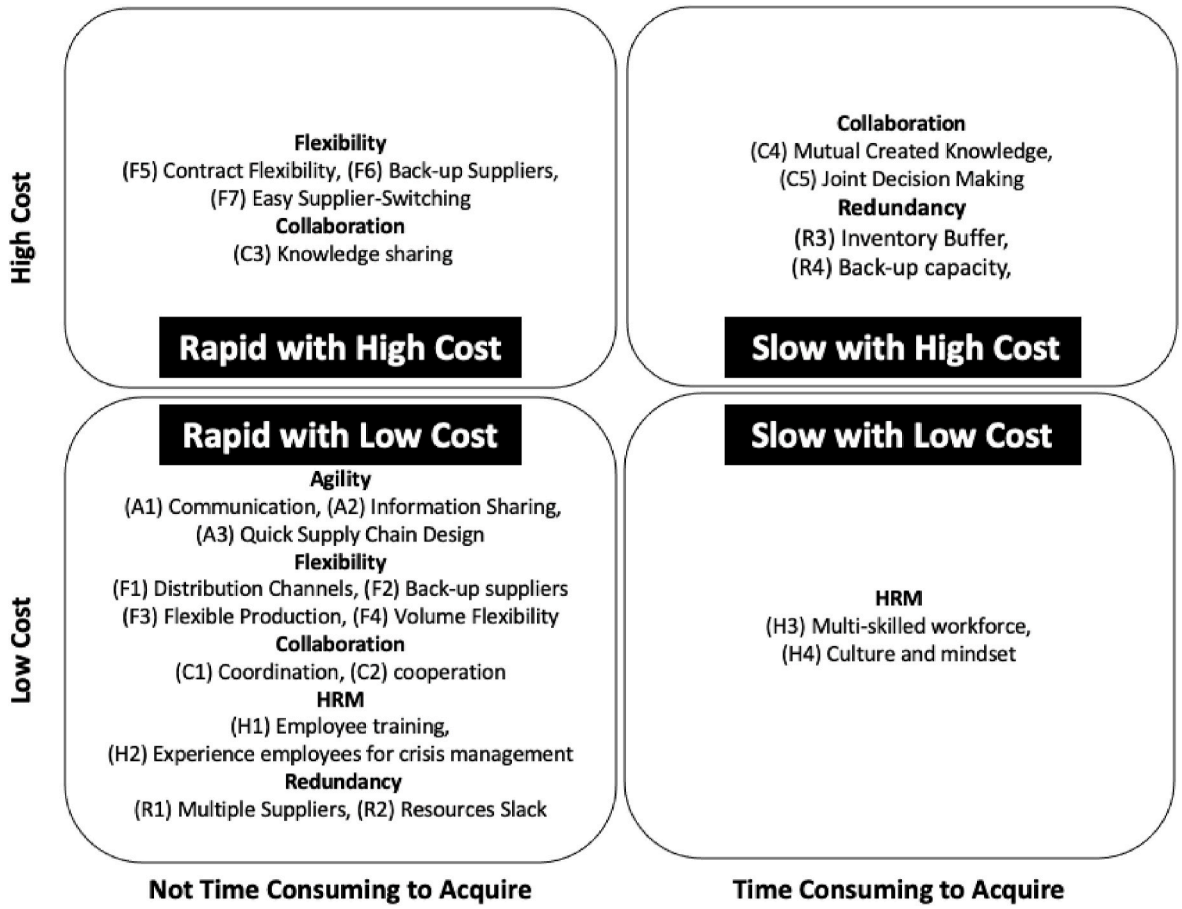

Fig. 1. Proposed SME SCRes reactive strategy time/cost matrix.

rapid and low cost because resources such as processes, individuals, and organizational culture are developed at the business-wide level of the firm. In addition, agility is argued to be the most basic strategy for matching firm resources and strategy in the current COVID-19 environment, as underscored under CT. Furthermore, Shekarian et al. (2020) argues that by investing into agility will increase the responsiveness of the supply chain. However, the lack of strategic planning and the focus on short-term benefits are the common weak links of SMEs when responding to a crisis (Alberti et al., 2018) and such weak links may exist in FSMEs and must be mitigated (Ali, Mahfouz, & Arisha, 2017).

3.1.2. *Flexibility in rapid with low cost*

In the context of a reactive strategy for SCRes, flexibility is the opposite of agility, although flexibility is an option for tactical implementations of agility to recover lost functionality (Shekarian et al., 2020). Flexibility is defined as the ability to have alternative options to deploy during a disruption to rapidly adapting to changes in the supply chain (Shashi et al., 2020). Examples include flexible production systems, flexible transportation systems, flexible labour arrangements, flexible capacity, and flexible supply chains (Kamalahmadi & Mellat-Parast, 2016). Purvis et al. (2016) highlighted that a flexibility strategy is at a firm's operational level in satisfying demand. Therefore, a higher level of flexibility in a firm enables a quick operational adaptation to change during a disruption and is considered an advantage in operational efficiency during normal conditions. Flexibility allows firms to embrace changes in the supply chain by revisiting and adjusting the targeted capacity rather than dealing with the head-on impact of the disruption (I. Ali, Nagalingam, Gurd, 2017). Since flexibility is at the disposal of the operational level of a firm, a rapid reactive strategy for SCRes is deployed. However, this review argues that in terms of cost, the practice of flexibility should be divided into two groups. As suggested by Stone and Rahimifard (2018), the flexibility that is utilized by FSMEs is obtained in the distribution stages by alternating distribution channels (F1) and modes of delivery (F2). On the production side, production outputs are changed through flexible production (F3) and volume flexibility (F4). In fact, for the purposes of sustainable SCRes, firms should use system-wide flexibility and not focus on the choices of individual stages of the supply chain.

FSMEs are commonly more integrated with customers and downstream supply chain actors because they focus on fulfilling local demand. Moreover, the business nature of SMEs is limited to its expansion and resources, impeding product exports. This characteristic enables firms to be more responsive in reaction to demand volatilities. As the COVID-19 pandemic requires consumers to practise social distancing and self-isolation, food processing and distribution and delivery modes have changed tremendously (FAO and WHO, 2020). For foods with a longer shelf life and fresh foods such as fruits and vegetables, FSMEs should maintain normal distribution, provided that the entire supply chain network is operating as usual and distributors and retailers are allowed to run their business.

The food market is considered an essential service in many parts of the world to allow the businesses in this network to operate. Instead, an alternative solution is needed for FSMEs if the network suffers from supply chain disruptions. In a recent case in Malaysia, tonnes of fresh fruits and vegetables went to waste due to the unavailability of last-mile transportation; and an innovative solution for food distribution was provided by a Malaysian online marketplace firm known as Lazada (Lazada.com). Although consumers in other parts of the world are used to purchasing fresh food online (Suhartanto et al., 2019), this case identifies the alternatives that are available and that are used by food

firms during a disruption. There is a growing number of Internet of Things-driven, third-party last-mile logistics firms such as Grabfood and Foodpanda that assist with delivery and represent a shift in delivery mode.

As argued in CT, firms should match their resources and capabilities with the environment, suggesting that flexibility during production is important in dealing with disruption. FSMEs should strategically leverage their internal resources and capabilities to meet demand and yield an increase in performance. A firm's ability to utilize its resources based on the unique characteristics of consumer demand to operate faster than competitors during a disruption constitutes a competitive advantage and can even be a sustainability strategy (Hendry et al., 2019; Hohenstein et al., 2015). Internal resources and capabilities differ from one firm to another depending on the firm's setup and foundation. However, the demand for food increases tremendously during a disruption. The demand for food is tied to food safety and quality; however, during a disruption, food security and availability have an even greater negative impact than they had before (Cappelli & Cini, 2020). This effect has been demonstrated by the stockpiling behaviour of consumers and the shortage of food supplies at the retailer stages (Cappelli & Cini, 2020; Chowdhury et al., 2020). In light of this situation, there are gaps in supply within the supply chain that have shown a production signal for food firms to deploy flexible manufacturing (F3) and volume flexibility (F4).

To cope with flexibility strategy under COVID-19 situation and its impacts, such as social distancing, extra health precautions, and disrupted supplies, FSMEs should decentralize decision-making to allow a greater focus on environmental issues that differ geographically. Although the impact of COVID-19 has a global reach, the intensity of the pandemic is not uniform and requires a region-wide and specific assessment of its impact on operations and the available resource capacity (mainly employees). A low-level formalization within firms should be established; for example, firms should form a designated disruption task force team to specifically manage their decisions and reactions to the disruption by suspending the bureaucracy that may slow the velocity of resiliency. SMEs and their task force are encouraged to perform analytical scenario planning in a forecast of the impact of available resources on operations and demand fulfilment. Although controversial, FSMEs should reduce production that requires cross-dependency between product lines and work as a different unit.

This review argues that a strategy allows production to be more focused on food products that have been identified as having a higher demand and higher profit margins during the disruption. Focusing on high-value products permits an optimum profit mix and operational optimization when overwhelmed by issues of a scarcity of supplies and employees, opportunity costs, penalties, profit margins, and impacts on stakeholder heath (Purvis et al., 2016). FSMEs should revisit the applicability and suitability of their macro-culture and collaborative partnerships during such a challenging time. The literature shows that a flexibility strategy is cost-effective and generates competitive advantage (Ali, Mahfouz, & Arisha, 2017). However, without a proper understanding of the uniqueness of the disruption, the mismatch between available resources and the changing environment, as highlighted by CT, the purpose of this strategy will not be met, and, ultimately, firms will find themselves in even greater trouble.

3.1.3. Collaboration in rapid with low cost

In general, collaboration enhances the reactive strategy for SCRes in almost every respect (Scholten & Schilder, 2015). According to the SCRes review by Stone and Rahimifard (2018), collaboration refers to work that is carried out by two or more actors in the supply chain and has a wide range of applications, that is, from the intra-organization to intra-supply chain. The collaboration includes coordination (C1), cooperation (C2), knowledge sharing (C3), supplier certification (C4), joint decision-making (C5), and supplier development (C5) (Shashi et al., 2020; Stone & Rahimifard, 2018). Despite the myriad numbers of collaboration types available, the activities discussed from the perspective of SCREs concern the unifying factors for maintaining the core functions of firms while responding to the new demand and new environment after a disruption (Stone & Rahimifard, 2018). The success of a reactive strategy for SCRes requires action on the part of supply chain players to deal with a disruption that is almost impossible to tackle by firm in silo (Jia et al., 2020). Moreover, Brusset and Teller (2017) highlighted that the ability to work effectively with other firms is a very important tool for SCRes. Moreover, in collaboration, supply chain actors support each other during a disruption.

Collaboration is an effective tool in a reactive strategy for SCRes. For example, empowered flexibility in the production system, decreased lead time, increased rapidity, and eliminated non-value-added costs and waste in inventories suggest that the existence of collaboration along with agility and flexibility aids in the rapidness of response at a lower cost. Collaboration involves the catalyst of a reactive strategy, and this review highlights the most basic types of collaboration, such as coordination and cooperation, in the rapid and low-cost quadrant. Communication and information sharing are important for improving supply chain resilience, just as the type and availability of information between firms improves the supply chain (Scholten & Schilder, 2015). FSMEs products are commonly an output of minimal research and are based on technology that is easily imitated, and there is a preference for communication and information sharing to be simple and surface-level. This preference may be due to the threat of information leakage to supply chain partners and the loss of competitive advantage posed by production. Furthermore, during a disruption, other firms redesign their supply chain, and losing valuable information through collaboration with irresponsible supply chain partners is disastrous for FSMEs.

Unless trust exists between supply chain partners, collaboration with suppliers that are carried out in a more authoritative manner, such as coordination (C1) and cooperation (C2), are deployed. Coordination can help FSMEs align their agility and flexibility strategies with external parties that fit their newly designed supply chain. This further supports the CT contention regarding the need to realign resources with the environmental context. However, cooperation with suppliers enhances the flow of information regarding changing customer demand, resulting in an improved quality focus on the part of suppliers (Zsidisin et al., 2016). Nonetheless, consumers are vulnerable to the health risk posed by the food products that they consume, meaning that issues of safety, quality, and integrity within the food supply chain must be prioritized (Ali & Suleiman, 2018; Astill et al., 2019). Through coordination and cooperation, a quick adaptation to changing consumer demand while maintaining the status quo is achieved, and trust from supply chain actors and market share is increased (Ali, Mahfouz, & Arisha, 2017). The increased trust within the newly designed supply chain during a disruption creates a valuable resource. In addition, firms' public-private collaboration and information sharing are crucial (Ali et al., 2018), especially when the lengthy, unprecedented COVID-19 pandemic has yet to find an ultimate solution.

3.1.4. Human resource management in rapid with low cost

Another important component for FSMEs to take into account during the COVID-19 disruption is the health of all of their stakeholders. The FSME supply chain is short, and the interface with consumers is high. The nature of the supply chain may impact food safety and, ultimately, consumers due to improper food handling. FSMEs should train and educate their employees (H1) on how to accommodate the uniqueness of the COVID-19 disruption relative to other risk events. Myriad of research suggesting training and education to be positively related to firm resilience (e.g. Ortiz-de-Mandojana & Bansal, 2015; Ali et al., 2018). FSMEs should not only focus on how to embed COVID-19 mitigation in their operations by having the most experienced employees for crisis management (H2), as suggested above in regard to forming a "task force". Quickly cross-train (H3) employees is crucial for vital business operations (Koonin, 2020). This situation will be beneficial when prior

manufacturing settings must be reoptimized due to the application of social distancing, sickness or absenteeism. Therefore, having cross-trained workers may help firms quickly react to operational changes and minimize operational failures. Appropriate actions in regard to managing human resources increase the value of those resources, especially in regard to gaining efficiency and productivity when the availability of raw materials is low.

3.1.5. Redundancy in rapid with low cost

Kamalahmadi and Mellat-Parast (2016) highlighted that in SCRes, the elements that fall under the category of redundancy are a beneficial tool for a firm to quickly achieve resilience in the supply chain during a disruption. Redundancy is defined by Shashi et al. (2020) as "the extent to which elements, systems, or other units of analysis exist that are substitutable, i.e., capable of satisfying functional requirements in the event of a disruption, degradation, or loss of functionality" (Adobor & McMullen, 2018). suggested that a firm incorporates a redundancy strategy without significant costs through flexible contracts and standardized parts rather than specialized parts. Specifically, redundancy aspects such as multiple suppliers (R1) and slack resources (R2) in production or transport capacity are implemented (Hohenstein et al., 2015; Kamalahmadi & Mellat-Parast, 2016; Mackay et al., 2019). Multi-sourcing will be difficult and must be carefully executed, especially for FSMEs where raw materials, processes, transportation and products along the supply chain are heavily regulated (Tan et al., 2017; Yunan et al., 2019). Firms in the food industry are commonly involved with audits and certifications to meet a certain standard, e.g., kosher, halal, vegan, and vegetarian. FSMEs have been certified to be protected where the involvement of multi-sourcing from uncertified firms may taint the end product. The scarcity of supplies during disruption limits the available numbers of credible suppliers, which shrinks the options of available suppliers.

3.2. Rapid with high cost and slow with low cost

3.2.1. Flexibility in rapid with high cost

Myriad studies have suggested that sourcing flexibility is an important element in SCRes (e.g. Chowdhury & Quaddus, 2017; Purvis et al., 2016; Shashi et al., 2020). For example. Shashi et al. (2020) indicated that sourcing flexibility is a major strategy within the realm of flexibility. Sourcing flexibility entails the ability to rapidly and efficiently access capabilities within the supply network in order to increase its flexibility (Purvis et al., 2016). Stone and Rahimifard (2018) highlighted that the sourcing flexibility enable the firms to change inputs using common product platforms, product modularity, multiple pathways, supply contract flexibility and alternative suppliers. Nevertheless, sourcing flexibility cannot be completely applied in the food industry. For example, there is a minimal application of common product platforms and product modularity. Food is a fusion-type and processed-based product where modularity and grouping into a common functional module on a platform during production are impossible. This example indicates that not all aspects of sourcing flexibility in these nodes will be largely applicable in the food industry. This review argues that under the Rapid with High Cost quadrant, FSMEs should consider supply contract flexibility (F5), back-up suppliers (F6) and easy supplier switching (F7).

Firms are encouraged to utilize supplier contract flexibility to remain relevant in the supply chain ecosystem and to effectively manage SCRes (Adobor & McMullen, 2018). Contract flexibility, including partial orders, partial payment, and partial shipment, has been empirically shown to be an important measure (Chowdhury & Quaddus, 2017). Therefore, FSMEs should consider embracing this strategy but with caution because of the business environment that has been disrupted by COVID-19. First, many FSMEs may suffer from insufficient financial funds during the disruption due to restrictions on conducting business. In fact, due to the pandemic control measures imposed by governments, SMEs are commonly the hardest hit, and the nature of expansion is profit maximization rather than resource strengthening. Second, the spike in demand during a disruption leaves a huge gap and scarce supplies. One could argue that this spike affects only the last-mile availability at the beginning of the disruption and will not be prolonged; however, the imbalance of supply and demand commonly has a significant impact resulting in a price hike that influences contract flexibility (Brusset & Teller, 2017). Third, if an FSME's aim is to deploy contract flexibility to shorten the supply chain and reduce costs and lead time, such SCRes efforts are argued to have longer-term undesirable results (Gunasekaran et al., 2015). Simply put, contract flexibility may seem to provide benefits for firms in the sense of how quickly it is implemented. However, unprecedented disruptions such as the COVID-19 pandemic may hinder the willingness of supply chain members to be flexible, and they may prefer the existing contract rather over uncertainty unless FSMEs are willing to exchange some of their advantages.

For SCRes, other components of flexibility include back-up suppliers (F6) and easy supplier switching (F7) (Hohenstein et al., 2015). Back-up suppliers and easy supplier switching enable firms to have more options in supplier and supply selection when reacting to a supply shortage during a disruption in the supply chain. To obtain the best results from this strategy, it should be implemented for substitutable core materials. FSMEs should identify the core components of their products and their origins. Traceability has been an important element in the food system for many years (Hastig & Sodhi, 2019; Tan et al., 2017), and it has been utilized to triangulate the risk of disruption to suppliers at tier 2 and above. Regarding the flow of raw materials from different states, FSMEs may consider multi-sourcing options to maintain the continuity of supply in case of a sudden supply failure on the part of the main supplier (Ali, Mahfouz, & Arisha, 2017). A traceability system provides clear visibility of the new environment of the supply chain for component substitutions. Substitution should be performed carefully due to the nature of food products, and it is difficult to achieve because the combination of different elements may yield different levels of product quality and output. For example, in the case of chili peppers, non-uniformity will impact the hotness level of products and therefore may not meet market preferences.

3.2.2. Collaboration in rapid with high cost

Food ingredients and processes are certified by certification bodies (i.e., halal, kosher, vegetarian) to qualify products for trade in the market (Tan et al., 2017; Tieman & Hassan, 2015). Certifications require that any deviation in product components will be avoided at all times. Firms and end consumers in the food supply chain are highly dependent on the certification of their members (Ali & Suleiman, 2018; Kendall et al., 2019). Since food production requires getting it right from the beginning due to the inability to modularize components after starting the production process, firms in the supply chain must be more integrated rather than relying too much on certification to yield higher performance (Ali, Zhan, et al., 2017). Lu et al. (2020) postulated that a collaboration between firms in the to achieve mutual goals require resource investment and information sharing. Scholten and Schilder (2015) highlighted a reactive SCRes strategy for supply chain members to learn from each other's process of implementing a reactive strategy and obtain improved visibility and velocity. To smooth the creation and sharing of knowledge in a supply chain firms may need to share crucial information and valuable knowledge and establish joint efforts (Brusset & Teller, 2017; Hohenstein et al., 2015). Adobor and McMullen (2018) argued that collaboration has the potential to cause skirmishes and increased risk when interdependence is high and sensitive information is freely available. As mentioned regarding the characteristics of FSME products, this review argues that knowledge sharing (C3) should focus only on increasing velocity, as suggested by Scholten and Schilder (2015), during the COVID-19 pandemic.

3.2.3. Human resource management in slow with low cost

According to RBT, humans are one of the most valuable resources in determining the success of a firm. A multi-skilled workforce (H3) is considered to be an important factor in determining firms' resilience capabilities (Ali et al., 2018), indicating that FSMEs should focus on developing a multi-skilled workforce. However, it is difficult to handle the combination of the COVID-19 disruption and its mitigation (i.e., social distancing) and the high interface of humans in food production. Moreover, the food industry is well known for the stigma attached to the workforce, leading to a high turnover rate (Ali & Suleiman, 2016). Thus, retaining and building a multi-skilled workforce is difficult. One of the aftereffects of the COVID-19 disruption is the increasing unemployment rate, and FSMEs may benefit from workforce availability. However, benefitting in this regard should be done carefully, as a greater investment of time is incurred for skills development and firm culture embedment. In addition, COVID-19 requires a new food production culture in the food industry, as suggested by the WHO and FAO (FAO and WHO, 2020). FSMEs should take this issue of establishing the workforce culture and mindset (H4) very seriously to curb the pandemic. However, instilling a new environmental culture and mindset is time-consuming for FSMEs given the high turnover rates in the food industry; however, firm failure to confront this contingency will ultimately impact food quality.

3.3. Slow with high cost

3.3.1. Redundancy in slow with high cost

In profit-maximizing production, firms commonly consider decisions to have a higher level of inventory, a safety stock, overcapacity, and a non-strategic supplier to be waste that will yield poor firm performance. Under normal conditions, these approaches are unfavourable because they incur increased costs and reduced efficiency unless they are supported by specific risk mitigation measures. Since food demand is commonly constant, the food industry is keen on lean management to reduce waste, and there is evidence in the literature of the benefits of such management (e.g. Costa et al., 2018, 2020). This review argues that redundancy capabilities are a long-term strategy archetype. Although the literature has highlighted that redundancy is regarded as a reactive type of SCRes, this review shows that redundancy will be considered to be a form of readiness planning post-COVID-19. This claim is made based on the following compelling reasons. First, according to the lens of RBT, redundancy is regarded as an underutilization of resources, especially under normal conditions (Adobor & McMullen, 2018). The decision to employ resource duplication falls beyond the capabilities characterized by limited resources. Therefore, redundancy should be incorporated with a longer-term strategy during the expansion of SMEs. Second, based on the unprecedented COVID-19 environment, there is little room for firms to expand, for example, in terms of resource duplication.

Firm-level redundancy, as highlighted by Stone and Rahimifard (2018), concerns capacity that is in excess of what is normally required to act as a buffer for normal activities. For example, an inventory buffer (R3) functions as an effective strategy to meet increasing demand (Adobor & McMullen, 2018). An inventory buffer is not a cheap solution since food is produced in bulk, is perishable, and has a short shelf life, which impedes high inventory buffers. The prior research sheds some light on other industries; however, it is difficult for FSMEs to apply the suggestions made by the literature such as spare inventory capacity and emergency backup/storage facilities (R4) (Ali, Mahfouz, & Arisha, 2017). This is especially the case when excess storage facilities that are works in progress may need to meet special requirements, such as cold rooms, to maintain freshness and quality. The long lead time and scarce source materials and capable suppliers hinder flexible contracting, especially after disruptions.

In this respect, we agree with Liu et al. (2016) that a redundancy-based strategy can lead to a higher value of SCRes, especially when implementing a reactive strategy. However, extra careful planning should be taken into account by FSME managers when redundancy is perceived as an expensive strategy that should be used as temporary action under conditions of a predictable disruption. Under supply shortages and increased demand for food products, a redundancy strategy will not fit well with the resources and strategy, nullifying the CT perspective. The applicability of redundancy notwithstanding, the COVID-19 pandemic is novel, and there is very little understanding available that would expand the horizon of targeted risk sources from beyond the boundaries of the supply chain such that the deployment of a redundancy strategy would be a better option to meet longer-term aims (Stone & Rahimifard, 2018), and such a strategy may have a higher cost-related impact on FSMEs.

3.3.2. Collaboration in slow with high cost

A collaborative supply chain relationship between firms is an important basis for fostering SCRes. Scholten and Schilder (2015) highlighted that mutually created knowledge (C4) between firms in a supply chain leads to better SCRes. Similarly, one effective way of dealing with disruption is through joint decision-making (C5) (Adobor & McMullen, 2018; Stone & Rahimifard, 2018). The collaboration between firms in the supply chain is known as supply chain integration (Ramirez et al., 2020). Under similar line of argument, a more extensive integration of firms with suppliers and customers will result in better performance. In the context of the food industry, the literature has provided extensive evidence on the relationship between supply chain integration and firm performance (Ali, Zhan, et al., 2017; Ramirez et al., 2020; Tan et al., 2017).

Hohenstein et al. (2015) postulated that a shorter response time and better firm performance is achieved by firms after a disruption if the level of collaboration between partners is high. From the RBT perspective, the integration between two firms merges two types of resources of the firms. Mutually created knowledge and joint decision-making may be capitalized through the synergies of combined resources. However, FSMEs should note that mutually created knowledge intended to achieve SCREs is not particularly related to the output of disruption but the length of time taken by firms when working together in day-to-day practices (Scholten & Schilder, 2015). This review argues that joint decision-making should share similar characteristics with mutually created knowledge. The reason is that joint decision-making is an output of mutually created knowledge. From the context food industry, integration efforts in the supply chain are difficult to established (Ramirez et al., 2020). In fact, establishing supply chain integration may involve more strategic information sharing with a long-term objective. A novel designed supply chain that reflects the post-COVID-19 environment is a better point of departure from which FSMEs can deploy this strategy (Bakalis et al., 2020; Wong et al., 2020).

4. Conclusion and implications for future study

Different resilience strategies may be adopted by firms depending on the supply chain context, disruption and the new environment (Sá et al., 2019; Stone & Rahimifard, 2018). Although it is true that competition currently lies in the intra-supply chain rather than the intra-firm, SCRes depends on the strategic action of some key players rather than the total transformation of the supply chain (Sá et al., 2019). Specifically, this review notes that SCRes highly depends on the ability of firms to strategically respond to and control unexpected events that happen at each echelon of the supply chain. Taking the COVID-19 disruption as an example, changes in food demand are expected, and such changes are commonly an increase. However, the strategies must address which important elements are contingent in reconfiguring, realigning, and reorganizing firm resources to suit the disrupted environment (Ali et al., 2018; Ambulkar et al., 2015). This review decomposes the reactive strategy for FSMEs into four quadrants by using two major important elements, i.e., time and cost; namely: rapid with low cost, rapid with

high cost, slow with low cost and slow with high cost. Using RBT and CT, this review highlights and triangulates the considerations in implementing SCRes. The possible limitations on time taken and associated cost in reacting to environmental conditions under COVID-19 is matched with the findings of the extant research.(

This review provides important practical insights to help FSMEs managers obtain a deeper understanding of the effect of disruption to the food supply chain. It is important for managers to understand the food-specific supply chain context to obtain better resource allocation carried out in the most appropriate and timely manner to minimize vulnerabilities. The novel decomposition of reactive SCRes strategies is a valuable decision-making guideline for managers. For example, managers can use the SCRes strategy cost/time matrix as a tool for multiple layers of consideration for strategy deployment during a disruption. First, managers' most important deliberation is on whether the firm should employ cost- or quickness-based strategy development. Second, managers must select the exact strategy to be deployed with careful reasoning assisted by in-depth discussion of the proposed strategy. Similarly, this review is limited to FSMEs and extends the concept to other sizes and statuses of firms in the food industry. This review fills the gap of the relevancy of SCRes elements, which shed some light beyond the scope of food industry managers.

This review represents an in-depth discussion and an exploration of the dynamics of a reactive strategy for SCRes in the food supply chain and FSMEs. Several future study trends and possibilities are considered to extend the logical flow of this review. First, this review found that most of the literature is still at the stage of conceptualization, especially in the context of the food supply chain and FSMEs. SCRes has been decomposed into four different phases, i.e., readiness, response, recovery, and growth, and two types of strategies, i.e., proactive strategy and reactive strategy. The broadness of SCRes limits this review to focus on the response phase and reactive strategy. Future research should examine other phases and strategies in the food industry and other types of samples. Second, one could argue about the limited number and examples of disruptions used as the context for investigating SCRes that the food industry may use beyond the humanitarian supply chain. To attempt to consider the COVID-19 pandemic in a positive light, it can be framed a perfect phenomenon that future research can use to validate conceptualization and its relationship to performance. The relationship of a reactive strategy is used as a measurement for future empirical research in the food supply chain. Future study should explore the detection and activation of not only FSMEs but also companies of other types and sizes, such as multi-national corporations and micro-firms, in regard to how they react to disruptions.

Third, this review develops and categorizes a reactive strategy for FSMEs based on the cost and time taken to react to the COVID-19 disruption. This study provides a new theoretical lens and opens up opportunities for the development of more rigorous studies, both quantitative and qualitative, on the question of efficiency, which must be further explored. There have been very few clear guidelines for firms in the food supply chain to effectively address SCRes. The concepts and propositions within the area of SCRes in the food industry that are available, notwithstanding the absence of empirical support, limit any potential application and knowledge extension. Fourth, cultivating SCRes in the food supply chain and FSMEs are explored and refined. The review framework is exemplary for the characterization of strategy under two considerations of a complex issue that covers several areas. To that end, future study should focus on different aspects of performance that are also important measures in the food industry such as food quality, food safety, food security and food integrity. Therefore, future study should examine the indicators and identification of the strategies and capabilities that will be needed in terms of SCRes to respond to food-related performance. Consequently, many other aspects, such as risk management, competitive advantage, infrastructure, food preparation and handling and food technology, can be explored and combined to gain a more holistic understanding of a post-COVID-19 food system.

Acknowledgement

We would like to thank Universiti Kebangsaan Malaysia (UKM) for funding the research via grant number: EP-2020-058. We would also like to thank anonymous reviewers for their helpful comments and suggestions, which have resulted considerable improvement of this manuscript.

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