

Impact of disruptions in agri-food supply chain due to COVID-19 pandemic: contextualised resilience framework to achieve operational excellence

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1. Introduction

Agri-food supply chain plays a significant role in the Indian economy since the agriculture sector contributes to a substantial proportion of the national GDP. As the food products pass through a vast range of supply chain processes, including packaging, distribution and other related services, the potential sources of disruptions also increase (Taylor, 2006). In the last one and a half years, the COVID-19 pandemic has severely impacted and continues to impact the ways production, distribution, and consumptions of agri-food are being managed worldwide (Barichello, 2020; Hobbs, 2020; Narayanan and Saha, 2020). Because of this unforeseen and unprecedented situation, food and beverage firms are facing significant challenges, both in terms of disrupted supply and reduced consumption (Chowdhury *et al.*, 2020; Hobbs, 2020a; Shareef *et al.*, 2021). With prolonged lockdown and prohibition on several goods and services, the agriculture food supply chain grappled with solving several supply-side and the demand-side issues (Brewin, 2020; Sharma *et al.*, 2020a). As a result, managing smooth supply chain and overcoming disruptions while maintaining operational excellence have become a necessity for practitioners. It has also given a challenge to academicians to ponder on the crucial situation and propose solution to achieve operational excellence which is crucial to enhance the essential functioning of performance parameters and attain a competitive advantage (Moktadir *et al.*, 2020). During the COVID-19 pandemic, achieving excellence has become more essential than it has ever been to ensure profitability and maximisation of the organisation's output (quality, customer experience, number of products) with a limited set of inputs. Operational excellence helps firms in offering better customer service, informed decision making and compliance with regulatory requirements.

By prioritizing supply chain resilience, a firm can well equip itself to achieve operational excellence through quick and timely response to rapidly changing business environment caused by the pandemic. As per the study conducted by the World Economic Forum and Accenture (2013), majority of the firms (80%) consider supply chain resilience as a pressing need to deal with disruptions. Resilience relies on operational excellence methodology (six-sigma, agility, lean, leagile) and helps firms to generate economic profit by enabling them to prepare, resist and respond to the disruptions happening in uncertain business environment (Adobor, 2019; Zhang *et al.*, 2021). Resilience is primarily contingent on a set of capabilities that help firms maintain and enhance vital performance parameters and competitive position during uncertainties (Birkie and Trucco, 2020). The necessity to develop and enhance supply chain resilience is augmented by the perishability aspect of the supply chain (Ali *et al.*, 2018). Gu and Huo (2017) too have posited that resilience to supply chain disruption helps firms recover from disturbances, adapt to change, and maintain uninterrupted functioning. Therefore, resilience allows firms to enhance operational performance while meeting market needs and

improving financial performance. Thus, developing resilience can be considered as a key to operational excellence in a dynamic environment.

While a substantial amount of research work illustrates the supply chain resilience concept from the pragmatic point of view (Cheng and Lu, 2017; Chowdhury *et al.*, 2020); still very few studies could establish a linkage between disruptions and resilience enhancing capabilities (El Baz and Ruel, 2020; Sabahi and Parast, 2020). The in-depth empirical investigation of supply chain resilience from a dynamic capability perspective remains to be addressed in the literature. Further, there is a paucity of research on the systematic analysis of influence of COVID-19 outbreak on the food and beverages industry and how an organisation develops supply chain resilience to mitigate the adverse impact of pandemic (Chowdhury *et al.*, 2020). Firms facing pandemic outbreaks are uncertain about sustainability of their supply chain and meet disruptions in supply chain. While the food supply chain in developed economies is automated, organised, highly integrated and resilient, the food supply chain in developing economies is largely unorganised and labour intensive (Kumar *et al.*, 2021). The severity of pandemic impact is much more disastrous in developing countries, leading to hunger problem and unavailability of safe food (Mangla *et al.*, 2021).

In India, improper management of food supply chain causes wastage of grains worth \$1 billion annually (Balaji and Arshinder, 2016). Inadequate financial and government support, lack of transparency and improper technical infrastructure are some of the major factors that cause increased supply chain risks (Kumar *et al.*, 2020). Consequently, Indian food supply chains are more vulnerable and terribly affected by pandemic compared to those in the developed nations. In India, in 2020, initially lockdown was implemented for 21 days, thereafter three subsequent extensions of 14 days each were implemented. The lockdown impacted food arrivals in wholesale markets with a significant drop of 64% in the month following the lockdown and increase in wholesale prices by 10% (Lowe *et al.*, 2021). Initial estimates reported that approximately 6.7 million migrant labours from just six states returned to their native places that led to shortage of workers in supply chain. Indian food supply chain is labour intensive and informal in nature; thus, shortage of workers further exacerbated the situation. Ensuring consumers' access to food rather than food availability became essential for Indian firms to ensure food safety and security (Mangla *et al.*, 2021). Therefore, it is essential to address these issues by critically analysing the present food supply chain situation, various supply chain actors, and the supply chain process in the Indian context. More specifically, it is needed to propose capabilities for developing supply chain resilience using a holistic Situation Actor Process- Learning Action Performance (SAP-LAP) methodology (Sushil, 2000). Although some studies are available on supply chain resilience and disruptions, the recent COVID-19 outbreak has brought a unique and unexpected challenge in the Indian supply chain. Stemming from existing literature review and preliminary fields investigations, the present study aims to synthesise the fragmented knowledge of supply chain resilience by addressing the current food supply chain situation and proposing various capabilities that need to be developed to tackle the disruptions caused by coronavirus pandemic. More specifically, the study aims to answer the following research questions:

- RQ1. What are the various sources of disruptions faced by the Indian food supply chain to achieve operational excellence during the pandemic?
- RQ2. How do members of the supply chain adopt different measures and develop resilience to derive operational excellence?
- RQ3. How would the SAP-LAP framework help to analyse and propose solutions to achieve operational excellence during the pandemic?

Mainly this study is trying to analyse the disruptions caused by the pandemic in food supply chain and assess the capabilities needed to enhance supply chain resilience for achieving operational excellence during the pandemic. The theoretical argument of this study relies on the integration of dynamic capability theory with SAP-LAP framework to understand when and how firms can create supply chain resilience as per the context. The dynamic capability view indicates a firm's ability to adapt to changing situations by altering and restructuring internal and external capabilities (Teece, 2007). As a means to complement the supply chain-centred research and strengthen the theoretical underpinning of the resilience concept, resilience has been viewed as a dynamic capability that facilitates firms to achieve operational excellence in the turbulent environment (Ponomarov, 2012; Singh *et al.*, 2020a). Dynamic capability refers to an organisation's capability to adjust to the changing market requirements by integrating and redesigning internal and external capabilities in order to maintain competitiveness in an uncertain environment. Therefore, understanding supply chain resilience through dynamic capability lens helps firms to answer how supply chain resilience can be developed to achieve operational excellence in the dynamic environment. The dynamic capability view was preferred over other strategic management theories, such as resource-based view and contingency theory as it is not static but dynamic in nature and overcomes the major limitations of resource based theory, when changing external conditions turns core competencies into core rigidities (Easterby-Smith *et al.*, 2009).

The present study contributes to existing literature by addressing a number of research gaps that got little or no attention by the previous researchers. First, it offers case-based evidence of difficulties and challenges faced by a firm in handling disruptions of the supply chain in the Indian context. Second, it contributes to the body of literature on supply chain resilience in terms of case evidence of the micro-level practices adopted by firms to address the issue. Finally, the study presents a series of propositions to build theory in supply chain resilience. Therefore, the significant contribution of this study lies in developing a theoretical framework using the dynamic capability theory and SAP-LAP framework to assess various disruptions in the agri-food supply chain and suggest viable solutions to overcome or mitigate the adverse impact of these disruptions.

The rest of the paper is organised as follows: Section 2 presents the theoretical background of the dynamic capability view of the firm followed by literature on agricultural food supply chain and resilience development in the supply chain. Section 3 describes the research methodology adopted for the study. Section 4 develops a conceptual framework for SAP-LAP linkages.

Discussion and implications are explained in Section 5. Finally, Section 6 presents conclusions and suggests directions for future research work.

2. Theoretical Foundation

The first part of this section presents the theoretical background of dynamic capabilities view of the firm. Later, the impact of pandemic on the agricultural food supply chain is reviewed, followed by an assessment of pertinent literature on supply chain resilience development.

2.1. Dynamic capabilities as a route to operational excellence

A firm's dynamic capability refers to its ability to integrate, improve and redesign competencies to deal with uncertainty (Teece *et al.*, 2016). It emphasises improving performance parameters and achieving competitiveness in a dynamic market that leads to operational excellence (Eisenhardt and Martin, 2000). Although there are several ways to attain operational excellence, dynamic capability is used as an operational excellence approach that boosts operational performance and mitigates challenges associated with changing environment. Therefore, dynamic capability can be considered as an approach to achieving operational excellence in an uncertain environment (Sandberg, 2021). Teece *et al.* (2016) distinguished between "ordinary capabilities" and "dynamic capabilities" and opined those ordinary capabilities enable a firm to finish defined activities, but they will not essentially contribute to firms' growth. The underlying knowledge behind ordinary capabilities is explicit; therefore, it can be outsourced. On the other hand, firms deploy dynamic capabilities to adjust in a dynamic business setting and respond quickly to customer requirements and achieve operational excellence.

Firms that develop dynamic capability are easily adaptable, recognise changes in the external environments, and make necessary changes to respond to these changes. Teece *et al.* (1997) suggested that firms develop dynamic capabilities in their supply chain to quickly adapt to situations by incorporating and redesigning internal and external capabilities. It largely depends on the firms' ability to innovate, adapt, and make changes to benefit customers and beat the competition. An extension of resource-based theory, the dynamic capability perspective focuses on value creation and development of new capabilities that are outcome of the innovative activities (Teece *et al.*, 2007). Sabahi and Parast (2020) posited that the dynamic capability is considered as an operational excellence approach to resolve challenges and risk, scan opportunities, and lessen threats by rebuilding resources and capabilities to maintain competitiveness in the turbulent environment. A firm's ability to embrace, adopt, implement, and leverage novel ideas quickly makes it less resistant to change and maintain operational excellence. Firms need to reconfigure and realign their existing resource base to develop capabilities that enable them to respond to the changing market requirement (Sabahi and Parast, 2020). Firms create capabilities to alleviate disruptions by revamping their resources in a dynamic environment (Sandberg, 2021).

The above discussion emphasises the unquestionable role of dynamic capabilities in dealing with unforeseen changes while maintaining operational excellence. Therefore, dynamic capabilities theory is an appropriate theoretical lens to relate supply chain resilience to the

disruptions caused by the coronavirus pandemic. The extant literature has used the dynamic capability perspective to analyse the supply chain resilience concept, including scale development (Chowdhury and Quaddus, 2017), developing antecedents (Lee and Rha, 2016; Ponomarov, 2012; Sabahi and Parast, 2020), competence (Mandal, 2017) and consequences (Ponomarov, 2012). Since the dynamic capability view entails developing capabilities and reconfiguring and aligning resources within firms to maintain operational excellence during uncertainty, we argue that the disruptions in the food supply chain can be addressed by developing and managing supply chain resilience through the dynamic capability view.

2.2. Impact of COVID-19 outbreak on agricultural food supply chain

The recent coronavirus pandemic has severally impacted agricultural firms and made their supply chain particularly vulnerable to disruptions. Vulnerability in the supply chain refers to unexpected deviations from the routine and their adverse consequences. Ponomarov (2012) suggested that vulnerability implies the factors that make a firm susceptible to disruptions. Environmental uncertainty, which makes it difficult for firms to predict the future due to frequent changing conditions, can be considered as a contributing factor of vulnerability. The pandemic has adversely affected the agricultural food supply chain by bringing both demand uncertainty and supply uncertainty. Demand-side uncertainty has arisen due to social distancing norms, consumer stockpiling behaviour, and consumers' less frequent store visits. It has been widely reported that consumers' panic buying tendencies and restrictions on movement have disrupted demand management (Ramakumar, 2020). On the supply side, the current pandemic led to supply shortages in many parts of the world. It has been reported that the Indian food industry is comparatively less affected by the pandemic due to the right and timely measures taken by the government (Narayanan & Saha, 2020).

Despite the corrective and timely actions taken by the Indian government, movement restrictions, labour scarcity, and labour migration badly impacted the supply side of the food supply chain (Barichello, 2020). The impact was further worsened by the abrupt closure of wholesale markets and local *mandis* due to coronavirus's fast transmission (Rawal and Verma, 2020). Overall, every aspect of the food supply chain was affected by pandemic challenges, ranging from farmers to end consumers (Barquet *et al.*, 2020; Brewin, 2020; Food and Agriculture Organization, 2020). The logistics rate doubled due to vehicle movement restrictions within and across states (Ali *et al.*, 2018). Similarly, warehouse operations like loading, unloading, storage, and packaging had been constrained due to limited labour availability and closing of warehouses. The delivery of good and services had been halted. Firms started operating at less than their effective capacity. Loss of employment and restricted consumption of goods and services are possible factors that influenced the food supply chain (Ramakumar, 2020). The pandemic made the food supply chain vulnerable to disruptions (Hobbs, 2020; Ivanov, 2020; Ivanov and Dolgui, 2020a) and influenced all the supply chain drivers, namely sourcing, facility, information, inventory, transportation, and pricing. Sourcing is affected by farmers' difficulties in the procurement of seeds, sowing, unavailability of labour, and harvesting (Remko, 2020). The facility operations, such as processing and storage, are affected by lockdown imposition and movement restrictions (Aday and Aday, 2020).

Information management became challenging, and managing inventory became difficult due to an unexpected rise in demand and supply shortage.

To achieve operational excellence during the pandemic, firms often need to proactively develop capabilities to build supply chain resilience (Sundarakani *et al.*, 2020). The extant literature reveals three significant trends in supply resilience development during the pandemic. First, previous studies have analysed the supply chain resilience concept using a modelling approach (Table 1). There is a need for an in-depth and multi-faceted understanding of the supply chain resilience concept to tackle the disruptions and risk in real-life settings (Wiedenmann and Größler, 2020). Second, emerging economies play a significant role in global food supply chains and are more affected by supply chain disruptions due to inadequate infrastructure, lousy management, preliminary measures, and the inability to adopt the latest technologies (Ramakumar, 2020). Yet, minimal studies have been done to address these concerns in the context of developing economies. Third, the food industry is one of the fastest-growing sectors and demonstrates a high vulnerability level during pandemic (Chenarides *et al.*, 2020). Therefore, understanding and analysing the pandemic's adverse impact on the food supply chain and possible solution to overcome or mitigate the effect would be an immense value addition.

Table 1: Recent studies on supply chain resilience development during COVID-19 era

Author	Nature of Research	Context	Major Findings
Kumar <i>et al.</i> , (2021)	Modelling	Food Supply Chain, India	Collaborative management, proactive business continuity planning and financial sustainability were found to be the top risk mitigating strategies
Nandi et al. (2021)	Conceptual paper	Not applicable	Analysed the uses of the blockchain-enabled supply chain in developing localisation, agility, and digitalisation in the supply chain
Taleizadeh et al. (2021)	Modelling	Retailing, Not Specified	Highlighted the importance of the selection of a suitable ratio for backorders during supply disruptions
Baz & Ruel, (2020)	Questionnaire Survey	Multiple industries, France	Identified the mediating role of supply chain risk management in supply resilience development
Belhadi et al. (2020)	Mixed method	Multiple industries, Multiple Country	Identified the strategies adopted by airlines and automobile industries to cope with disruption caused by pandemic
Bryce et al. (2020)	Conceptual	UK.	Suggested how government and National Health Service should undergo a phase of readjustment

Chowdhury et al.(2020)	Case Study	Beauty and personal care, Bangladesh	Highlighted challenges faced by a beauty and personal care firm and proposed strategies to cope up with them
Hobbs(2020)	Conceptual	Food Industry, Canada	Assessed the long-term implications of COVID-19 on the food supply chain
Golan et al. (2020)	Literature Review	Not applicable	Provided an approach to the quantification for network resilience to address the challenges
Ivanov(2020)	Modelling	Not applicable	Developed a viable supply chain model to adapt to positive changes and to absorb negative disturbances
Ivanov & Das (2020)	Modelling (Simulation)	Not applicable	Analysed ripple effect of the pandemic in the global supply chain and evaluated COVID 19 measures for risk mitigation and recovery options.
Ivanov & Dolgui (2020)	Game-theoretic modelling	Not applicable	Conceptualised a decision-making environment for the viability of intertwined supply network
Ivanov & Dolgui (2020a)	Experiment	Not applicable	Developed computerised model for digital supply chain twin, and explore conditions to manage disruption risks in supply chain
Nikolopoulos et al.(2020)	Modelling	Not applicable	Developed a model to forecast the excess demand for products and services during pandemic using auxiliary data
Remko(2020)	Interviews	Multiple industries, USA.	Analysed the gap between research and industry effort in developing supply chain resilience
Sharma et al.(2020)	Modelling (MCDM method)	FMCG industry, India	Identified the major factors that enhance the survivability of sustainable supply chain during COVID-19
Sharma et al. (2020)	Modelling (MCDM method)	Agricultural supply chain, India	Evaluated and prioritised agricultural supply chain risk caused by pandemic
Singh et al. (2020)	Modelling (Simulation)	Food Supply Chain, India	Highlighted importance of supply chain resilience in coping up with disruptions

2.3. Resilience development for operational excellence

The immense significance of supply chain resilience during disruptive events necessitates firms to develop capabilities to proactively improve the required level of readiness, response, and recovery-ability during the pre and post disruption phase (Birkie and Trucco, 2020; Chowdhury *et al.*, 2020; Ivanov *et al.*, 2019). Therefore, resilience can be considered as an operational excellence approach to achieve competitive advantage in a dynamic environment. Supply chain resilience depends on processes that firms use to derive operational excellence (DuPont, 2014). Resilience relies on a set of operational excellence methodologies (lean, agile, leagile, six-

sigma, lean six sigma) and a set of supply chain capabilities (e.g. collaboration, visibility, flexibility, velocity) that helps firms to maintain performance during the pandemic outbreak (Jüttner and Maklan, 2011; Kamalahmadi and Parast, 2016; Parast and Shekarian, 2019; Sabahi and Parast, 2020). Organisations using such capabilities are more adaptable and make informed decision-making in an uncertain environment due to the increased level of information sharing, transparency, and actionable insights that they produce (Sundarakani *et al.*, 2020). Collaborative activities promote information sharing and mitigate risks (Jüttner and Maklan, 2011; Parast and Shekarian, 2019). Different dimensions of collaborative activities such as information sharing, decision synchronisation, and incentive management can influence resilience differently (Parast and Shekarian, 2019). However, the impact of individual dimensions of collaborative activities on supply chain resilience is mostly unknown. Flexibility capabilities, which refer to a set of practices, improve supply chain responsiveness by assessing and taking actions quickly (Jüttner and Maklan, 2011; Parast and Shekarian, 2019; Sabahi and Parast, 2020). Firms' quick adaptability to shift from one supply chain model to another, such as flexibility to move procurement from centralised location to close to farmers, can minimise mobility and reduce supply chain risks (Kumar *et al.*, 2021; Mangla *et al.*, 2014).

The majority of the studies reported that supply chain flexibility is an essential strategy to deal with disruptions (Sandberg, 2021). Studies suggest that flexibility needs to be designed and integrated with the supply chain and reflected in its structure, processes, and strategy. One way to develop flexibility is to build redundancy that helps firms continue their operations during adverse situation and failure (Jüttner and Maklan, 2011). Agility, an operational excellence methodology, is another widely used effective capability to build supply chain resilience (Parast and Shekarian, 2019). Firms develop agility as a risk management strategy to respond to rapid market changes and disruptions caused by vulnerabilities (Kamalahmadi and Parast, 2016). Christopher and Peck (2004) suggested two dimensions of agility, namely visibility and velocity. Visibility provides identity, location, and status of supply chain entities, such as inventory, facility, transportation, suppliers, and events on time (Sabahi and Parast, 2020). Visibility can be improved through investment in information and communication technologies infrastructure (Ali *et al.*, 2017) and maintaining lean system. On the other hand, velocity, an essential capability of supply chain resilience, helps firms to do things faster. Christopher and Peck (2004, pp.10) suggested that "there are three basic foundations for improved supply chain velocity: streamlined processes, reduced in-bound lead times and reduction in non-value-added times". Recently, Gunessee and Subramanian (2020) reported three organisational coping strategies in supply chain decision-making under ambiguity: collaboration, visibility, and organisational learning. Collaboration implies doing joint activities with supply chain members, visibility implies transparency and enables information sharing, and organisational learning implies learning through experience or historical disruptions.

Further, firms' innovative capability is also positively related to supply chain resilience which remains mostly unexplored in the literature (Gölgeci and Ponomarov, 2015; Kamalahmadi and Parast, 2016). Firms can exercise their innovative capability to hedge and overcome the adverse impact of disruptions in the supply chain. Literature also reported the significant role of various moderating and intervening variables in explaining the causal links between capabilities and

supply chain resilience. For example, Sabahi and Parast (2020) proposed that firms' innovative capability is positively related to supply chain resilience and capabilities such as knowledge sharing, agility and flexibility mediate the relationship between innovative capability and supply chain resilience. Similarly, Gölgeci and Ponomarov (2015) found that supply chain uncertainty negatively moderates the relationship between innovativeness and supply chain resilience. Till now, numerous studies have reported the significance of resilience in dealing with supply chain disruptions (Chowdhury, Sarkar, Paul, *et al.*, 2020; Ponomarov and Holcomb, 2009; Sabahi and Parast, 2020). Majority of the studies either developed generic frameworks emphasising the importance of supply chain resilience (Ponomarov and Holcomb, 2009) or debating the definition of resilience (Tukamuhabwa *et al.*, 2015). The existing literature lacks theoretically grounded comprehensive research and triangulation of findings on sources of disruptions, practices intertwined with developing supply chain resilience and their overall impact on performance parameters. This paper addresses this knowledge gap in the extant literature by conducting an in-depth case study in an agricultural food supply chain firm.

2.4. Research Framework

As discussed in the previous section, the research framework of this study is based on the dynamic capability theory. The dynamic capability theory helps to understand a set of capabilities needed to develop supply chain resilience for dealing with disruptions caused by the pandemic. Supply chain resilience has been considered as a tool to achieve operational excellence that helps firms maintain productivity and flexibility through cyclical and structural alterations in supply and demand in a dynamic environment (Lelièvre *et al.*, 2019). The framework explains supply chain resilience as an operational excellence approach needed to deal with disruptions caused by COVID-19 and the capabilities required to develop supply chain resilience. The framework for this research study is shown in Figure 1.

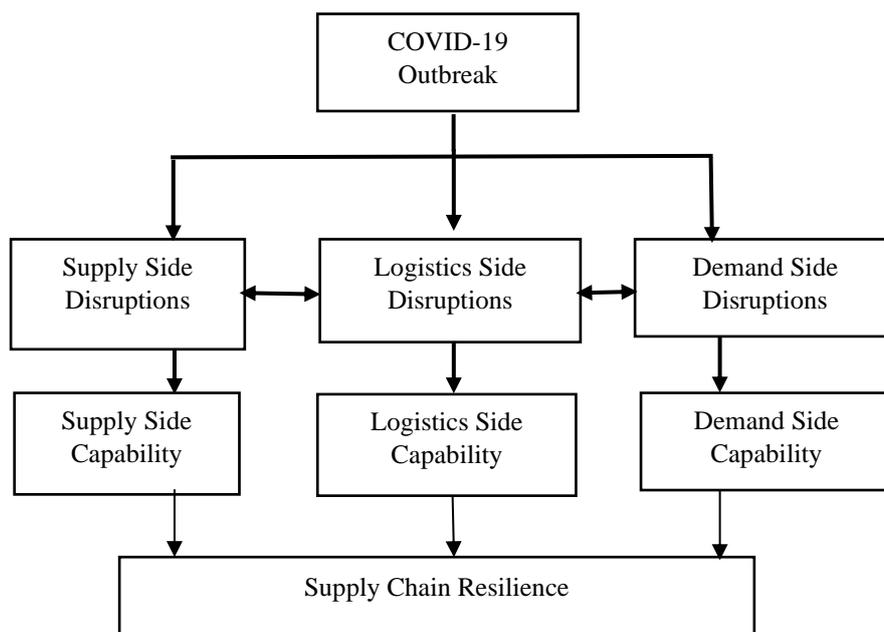


Figure1: A framework to study the supply chain resilience in a firm's supply chain

3. Methodology

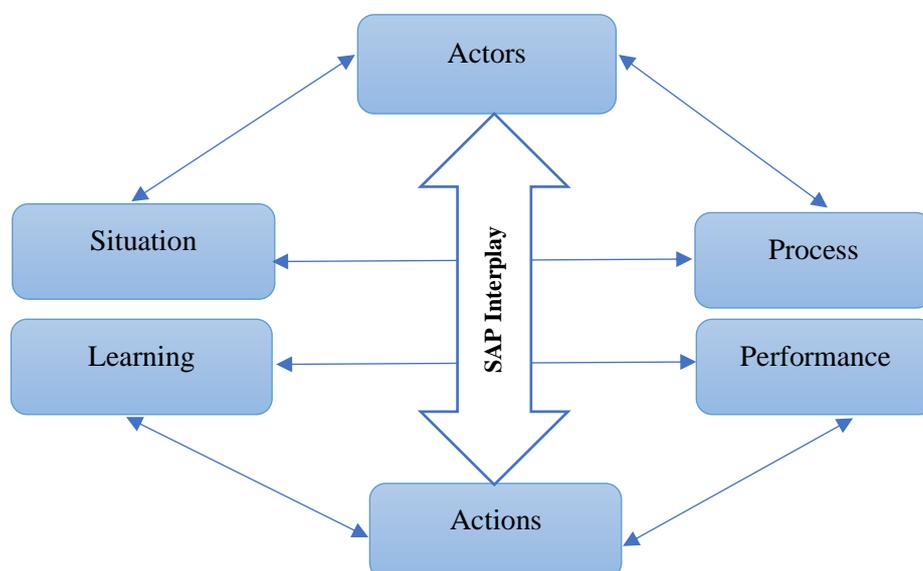
The present study adopts a case study methodology to address “how” and “why” questions related to disruptions caused by the pandemic and potential capabilities needed to develop the resilient food supply chain for maintaining operational excellence. A single-case study, which is usually exemplary or offers unusual research opportunities, is considered acceptable for theory building (Yin, 1981). It can explore a significant phenomenon under rare or extreme circumstances (Eisenhardt and Graebner, 2007). A single-case study offers an opportunity to create and explore more complicated theories than a multiple-case study as researchers can fit the theory into many details of a particular case (Mariotto *et al.*, 2014). On the other hand, a multiple-case study retains only the relationships that can be replicated across most cases (Eisenhardt and Graebner, 2007). Therefore, using a single-case study can have a valuable contribution to theory development if a single case can make further adjustments in an understanding of reality (Mariotto *et al.*, 2014).

3.1. Steps Involved in the Case Study

3.1.1. Sample Selection and SAP-LAP framework

Selection of case studies significantly influences the research output quality (Eisenhardt and Graebner, 2007; Yin, 1981). This study finds a case firm with a complex supply chain of perishable products, severely affected by disruptions during the pandemic. During a preliminary discussion with the firm’s informants, it was found that the firm has developed capabilities to proactively and reactively implement several practices, including technologies, supplier development practices, and collaborative activities, to cope with disruptions. Therefore, the case firm makes an ideal candidate for in-depth exploration of supply chain disruptions and analysis of resilient supply chain in the perishable food and beverage industry.

The SAP-LAP framework, as developed by Sushil (2000), was applied for an in-depth understanding of problems and solutions required amidst the disruption caused by the spread of coronavirus (Figure 2). The framework considers the optimisation of processes and integrates the diverse perspective of participating actors in decision making. Thus, the framework can be effectively used to understand, analyse, and synthesise the food supply chain during the pandemic.



Source: Adapted from Sushil (2000)

Figure 2: SAP-LAP Framework

Unlike the static conventional environmental scanning methods, SAP-LAP offers insights about the case problem, expectations from it and suggests how to transform those expectations into reality, thereby offering a holistic understanding of the problem (Mangla *et al.*, 2014; Sushil, 2000). SAP-LAP model is developed by framing a set of questions related to each element of SAP-LAP framework. The SAP-LAP framework has been extensively used in a wide range of studies (Table 2).

Table 2: Studies using application areas of SAP-LAP technique

Author	Application Area
Siva Kumar and Anbanandam (2020)	To understand the development and improvement of supply chain resilience
Gupta and Singh (2020)	To study sustainability issues of a logistics service provider
Gupta <i>et al.</i> (2019)	To understand service quality from stakeholders’ point of view
Sharma & Sangal(2019)	To understand Software process improvement in SMEs
Chauhan <i>et al.</i> (2019)	To integrate Industry 4.0 practices for resolving the issues related circular economy principles
Chavan <i>et al.</i> (2019)	To evaluate the physical infrastructure and suggest future actions needed to achieve sustainable development goals
Malik <i>et al.</i> (2019)	To assess the financial inclusion in India
Chand <i>et al.</i> (2018)	To assess the drivers of supply chain complexity
Kabra(2017)	To evaluate the barriers and enablers to training in humanitarian organisations
Ghosh (2016)	To study the creative leadership development
Mangla <i>et al.</i> (2014)	To develop risk mitigation strategy in green supply chain

3.1.2. Data Collection

Data collection was done primarily through in-depth face-to-face interviews with practitioners from the case firm. Additional data sources include informal discussions with participants and a review of the firms’ website, available documents, and reports. Initially, potential informants were contacted over phone calls and the purpose, procedure and expected outcome of the study were discussed with them in detail. After that, face-to-face interviews with participants were conducted in December 2020. The informants’ profiles are given in Table 3.

Table 3: Demographic variables of respondents

Demographic Variables		No.
<i>Informants’</i>	Founder	1
<i>Profile</i>	Human Resource Manager	1
	Store Manager	2

	Purchase Executives	1
	Operations Manager	1
	Accountant	1
	Logistics partners	2
	Suppliers	2
<i>Total</i>	5-10 Years	3
<i>Experience</i>	More than 10 years	8
<i>Education</i>	Diploma	1
	Graduate	3
	Masters	7

The interview protocol, which consists of open-ended questions, was developed to systematically gather required information through semi-structured interviews (Table 4). The primary data was supplemented with secondary data, such as company reports, company documents, website etc., and ambiguity in responses were clarified in subsequent meetings. Data analysis was done by converging the evidence from multiple sources as well as cross-checking the emerging patterns from various sources of evidence. Therefore, the study concludes by analysing multiple sources and comparing them with existing literature (Voss *et al.*, 2002; Yin, 1981).

Table 4: Interview Questionnaire used in the study

Elements of SAP-LAP Framework	Questions
Situation	<p>What are the several types of disruptions faced by the food supply chain during the coronavirus pandemic?</p> <ul style="list-style-type: none"> - Explain various demand-side, supply-side, and logistics-related uncertainties faced by the case firm.
Actors	<p>Who are the participants of present situations, and what is their role in dealing with current situations?</p> <ul style="list-style-type: none"> - Explain the commitment of top management in developing a resilient supply chain to overcome or mitigate disruptions? - Explain stakeholders' role (farmers, suppliers, distributors, logistics providers) in developing supply chain resilience.
Process	<p>What is being done to manage the present situation, and what are the changes required to address present situations?</p> <ul style="list-style-type: none"> - Explain logistics and supply chain practices adopted by the case firm in dealing with the changing market dynamics. - Explain the role of customers and suppliers in handling the current situation.
Learnings	<p>What are the key opportunities to develop supply chain resilience, and what are the key challenges in developing supply chain resilience?</p> <ul style="list-style-type: none"> - Explain the challenges faced by the case firm to deal with the pandemic. - Explain the essential learnings concerning the pandemic. - Explain the different types of practices needed to develop resilient supply chain.

	How to improve the situations with respect to supply chain resilience, and what should actors do to enhance supply chain resilience?
Actions	<ul style="list-style-type: none"> - Explain the practices that the case firm adopts to develop and maintain resilience in the supply chain. - Explain the potential roles that actors should play to improve supply chain resilience.
	How can the performance of supply chain be improved by implementing actions?
Performance	<ul style="list-style-type: none"> - Explain the potential changes in the existing performance in firms. - Explain the potential changes in the supply chain resilience of the firms.

Sources: Adapted from Chand *et al.* (2018), Siva Kumar and Anbanandam (2020) Sushil (2000)

3.1.3. Error and Biases control procedure

In this study, appropriate steps were taken to avoid biases in data collection, analysis and reporting of qualitative data. Information bias was avoided during the data collection phase by taking data from multiple sources, such as interviews, website, organizational reports and order summaries. Further, interview protocol and audio-taped devices were used to structure and record the responses accurately. The selection bias was avoided by selecting a wide range of appropriate participants from the case firm, using purposive and snowball sampling methods. Further, preliminary analysis report was shared with key informants to minimise the reporting bias. Informants were asked to provide their opinion on the reporting of the results, and if any key information was missing or interpreted differently by authors, then it was corrected.

Common method bias was eliminated or minimised in data collection through the design of the study procedure (Podsakoff *et al.*, 1990). The response anonymity was maintained to minimise apprehension in evaluation. During the data collection, participants were assured that no response is either right or wrong, and therefore, they must respond to the questions honestly without any hesitation. Following the guidelines of Tourangeau *et al.*(2000), the error and biases associated with the response process were eliminated by describing vague questions, avoiding ambiguous term and rephrasing double-barrelled questions. The interview process was made simple by asking simple questions and avoiding the use of complicated terms.

3.1.4. Data Tabulation and analysis

Careful documentation and tabulation of data are required to address the research questions (Voss *et al.*, 2002; Yin, 1981). The responses from the key informants were noted and carefully analysed to understand the key phenomena. The analysis helped to understand the causes and effects of the phenomenon and the rationale behind the firm's decisions. The data analysis was based on the report, which was developed by transcribing the recorded interviews. Both the primary researcher and the secondary researcher engaged in data analysis. The pattern and emerging themes were discovered from the interview results. The preliminary analysis report was shared with key informants to get their feedback on findings and ensure the correct interpretations. Any ambiguity related to the interpretation of the results was clarified in a subsequent discussion with key informants.

3.2. Reliability and Validity Assessment

The reliability and validity largely determine the quality of the case study (Voss *et al.*, 2002; Yin, 1981). The reliability of the case study was maintained by developing a case study protocol and developing the database (Yin, 1981). Inter-rater reliability was established as the two researchers independently did the classification, and disagreements were resolved by involving the third researcher, who had experience in qualitative research. The content validity was maintained by taking appropriate measures from the literature and carefully framing the questions for interviews. Construct validity was addressed using triangulation method. Multiple data sources, such as direct observation, formal and informal discussions with key informants, and secondary data sources (annual reports, websites, internal reports) were used in the study. Internal validity was established by doing pattern matching and building explanations from the available literature. Therefore, the results of the case study were compared with the existing literature to demonstrate consistency and contrast with the literature. The external validity of the case study was difficult to establish, as the study was limited to a single case. However, no empirical studies can give the certainty of generalisation to other populations.

4. Case Analysis

4.1. Problem description

An illustrative case study on a fruit and vegetable online B2B retailer (hereafter referred to as XYZ) was performed in the present study. XYZ was considered to investigate current supply chain situations and the various initiatives taken by the firm to develop a resilient supply chain. Fresh fruit and vegetable business is a labour-intensive business, and the effects of lockdown took a heavy toll on the labour market. The labour market shocks that arose from the movement restrictions on migrant labourers affected their ability to harvest, process, and produce agricultural products (Narayanan and Saha, 2020). Along with the labour market issues, horticultural produce, which makes up a substantial part of the fresh food supply chains, suffered heavily (Aday and Aday, 2020; Rizou *et al.*, 2020). Therefore, an in-depth analysis of current supply chain situation and steps needed to develop supply chain resilience is considered critical to address disruptions in the food supply chain caused by the pandemic.

4.2. Background of the case firm

XYZ is a B2B retailer of fruits & vegetables based in the northern part of India. It creates value for the retailers, hotels & restaurants and offers numerous services like contract farming and agricultural consultancy. It supports farmers by giving them a reasonable product price by procuring directly from farmers. XYZ assists small retailers in increasing their business reach to customers who are difficult to reach otherwise. Overall, XYZ aims to achieve consistent growth through continuous improvement and the active involvement of stakeholders. XYZ's supply chain encompasses over 350 farmers, 40 interstate wholesalers, 45 imported fruit suppliers, 8 logistic partners, 200 B2B customers (hotels, restaurants, and retailers) and 13000 retail customers spread across northern India with a significant concentration in Delhi, Himachal Pradesh, Punjab, and Chandigarh.

4.3. SAP-LAP analysis for XYZ company

4.3.1. Situation

The situation signifies the various supply chain disruptions faced by firms that necessitate developing and maintaining a resilient supply chain in XYZ. The disruption caused by the COVID-19 pandemic has brought vulnerability in the perishable supply chain. Therefore, developing a resilient supply chain is essential to cope with supply and demand disruptions, consumer panic-buying and government rules and impositions. The situation factors can be classified into three categories: demand-side situations pertaining to customers, supply-side situations pertaining to procurement of fresh fruits & vegetables, availability of workforces and access to market, and logistics side situation pertaining to vehicle movement and shipments. Table 5 summarises situational factors related to XYZ.

Table 5: Situation factors related to XYZ firm

Situation Type & Details	Impact of Situation
<i>Demand Situations</i>	
<ul style="list-style-type: none"> ▪ Limited availability of fresh fruits and vegetables to end consumers ▪ Unplanned and one-time large purchase ▪ Less frequent purchasing and preference for a no-touch payment mode 	<ul style="list-style-type: none"> ▪ Shortage of food supplies leading to price rise and panic buying ▪ Hoarding tendencies for buyers leading to high holding cost and increased risk of obsolescence ▪ Focus on the inclusion of various no-touch payment mode on the website
<i>Supply Side Situation</i>	
<ul style="list-style-type: none"> ▪ Limited availability of labour due to movement restrictions ▪ Bottlenecks in Interstate transport ▪ Shortage of imported fruit and vegetables that led to increased price ▪ Limited access to a wholesale market, mandis and other markets ▪ Adherence to local health measures by producers, processors, distributors, and monitoring of the virus disrupts supply chain ▪ Issue in packaging and picking the farm produce from fields because migrant workers left, and unavailability of workforce led to over ripening of fruits and vegetable 	<ul style="list-style-type: none"> ▪ Confusion amongst farmers regarding reaping of the harvest ▪ Access to market has become difficulties for farmer ▪ Limited supply to imported fruits and vegetables, leading to restricted supply chain responsiveness. ▪ Extra efforts to be taken by buyers for procurement of supplies ▪ Untimely and unplanned arrivals of raw materials made inventory planning and management challenges ▪ The pandemic has shown the pitfalls of the industry, which was historically reliant on manual labourers ▪ Decreased shelf life of fresh fruits and vegetables and decrease in quality
<i>Logistics Side Situations</i>	
<ul style="list-style-type: none"> ▪ The imposition on movement restriction that raised connectivity problem with farmers ▪ Delay and postponement in permits for transportation of essential items 	<ul style="list-style-type: none"> ▪ Loss in farmer's income as they are unable to bring their produce to the market ▪ Increase in farm to fork duration by 4 to 5 times from 12 hours to around 50 hours

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|---|--|
| <ul style="list-style-type: none"> ▪ Tardy processes for issue of phytosanitary certificates for exports and imports | <ul style="list-style-type: none"> ▪ Increase in transportation cost due to unplanned movement of goods |
|---|--|
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4.3.2. Actors

Actors are the people who are responsible for handling the situation. Considering the complex nature of the perishable supply chain and multiple organisations’ involvement, actors of perishable supply chains may have dissimilar viewpoints about supply chain resilience. Therefore, actors may be involved in doing diverse operations and activities. To build a resilient supply chain, the actors need to be cooperative and flexible to know and embrace others’ perception of resilience. Understanding the different actors’ viewpoints and resilience also requires a “good understanding of the flexibility associated with the situation” and the resilience-building processes in place. Table 6 summarises the role of actors in managing the current situation.

Table 6: Actors and their role in handling the current situation

Actors Type & Details	Implications for Actors
<i>Demand Side Actors</i>	
<ul style="list-style-type: none"> ▪ Retailers (large and small) ▪ End consumers, ▪ Hotels and restaurants 	<ul style="list-style-type: none"> ▪ Limited times for which the shops can be opened amidst strict curfews ▪ Untimely fulfilment of inventory ▪ Panic buying
<i>Supply Side Actors</i>	
<ul style="list-style-type: none"> ▪ Farmers, ▪ Interstate wholesalers ▪ Importers ▪ Employee of XYZ. ▪ Information technology consultant 	<ul style="list-style-type: none"> ▪ Difficulty in reaping of ripened fields due to lack in clear guidelines ▪ Complexity in selling and procuring of farm produce due to non-functional APMC Mandis
<i>Logistics Side Actors</i>	
<ul style="list-style-type: none"> ▪ Third-party logistics provider ▪ Drivers ▪ Labourers involved in loading, unloading & handling goods ▪ Packaging company 	<ul style="list-style-type: none"> ▪ Making transportation of farm produce hassle-free ▪ Used out of box ideas to help XYZ to supply good quality fresh fruits and vegetables ▪ Used GPS tracking to route planning, improve safety, productivity and minimise operational cost

4.3.3. Processes

Process refers to how a firm handles the situation. XYZ majorly focused on efficient customer response; therefore, it took several initiatives to make supply chain resilient. Redundancy was built by ensuring sourcing from local suppliers. Further, firms initiated collaborative activities by developing trust, improving visibility, and developing flexibility in sourcing. For example, digital platforms helped decrease order booking and processing time, facilitated online tracking and forecasting orders. However, these capabilities should be improved further to enhance

supply chain resilience. Table 7 summarises the processes involved in handling current situations.

Table 7: Process involved in XYZ

Process Type & Details	Implications on capabilities
<i>Demand Side Process</i>	
<ul style="list-style-type: none"> ▪ Initiated online tracking of orders and contactless delivery ▪ Safe and hygienic products to avoid the spread of COVID-19 ▪ Introduced and linked various mode of payment with the current online platform, such as Google payment, Paytm, UPI. 	<ul style="list-style-type: none"> ▪ Improved Visibility ▪ Developed risk management capability ▪ Build flexibility capability
<i>Supply Side Process</i>	
<ul style="list-style-type: none"> ▪ Government gave preferential treatment to agricultural supplies ▪ Reliance on multiple local suppliers ▪ Flexibility was an essential criterion for supplier selection ▪ Despite mandis not being operational, procurement was ensured, and farmers were still able to sell their produce 	<ul style="list-style-type: none"> ▪ Ensured supplier flexibility ▪ Maintained redundancy in sourcing ▪ Emphasised on risk management
<i>Logistics Side Process</i>	
<ul style="list-style-type: none"> ▪ Digital modes to track movement ▪ Use of reefer trucks because of increased time in transportation ▪ Ensuring faster transportation through issue of certificates 	<ul style="list-style-type: none"> ▪ Improved transparency ▪ Improved logistics flexibility ▪ Improved risk management

4.3.4. Learning

Learning from the current situations signifies “why” the current state of the system exists. It suggests the significance of supply chain resilience in XYZ and the potential to change process to enhance resilience. The learning can facilitate XYZ to take several initiatives and develop capabilities for improving resilience that eventually impacts its overall performance. Table 8 summarises learning for XYZ from the current situation.

Table 8: Learnings involved in XYZ.

Learnings Type & Details	Implications on capabilities
<i>Demand Side Learnings</i>	
<ul style="list-style-type: none"> ▪ Significant and unanticipated changes in consumer behaviour ▪ Reduce consumption of fresh fruit and vegetables and instead increased consumption of pulses due to fear of spread 	<ul style="list-style-type: none"> ▪ Restricted supply chain responsiveness ▪ Responsiveness compromised due movement restrictions of goods.

of coronavirus

- Closing of physical retail stores that prevented last mile availability of supplies and replenishment
- Stocking of warehouses but goods not being able to move out

Supply Side Learnings

- Lack of top-level management commitment towards handling disruptions
- Low level of training and lack of employee understanding about management of disruption
- Shortage of labourers for harvesting season and need to manage supply with local workforce
- Post-harvest of Rabi crops, the procurement of seeds got delayed because of which harvesting time of vegetables got delayed which led to an increase in the retail price and decrease in efficiency of supply chain
- Lack of supply chain risk management culture
- Lack of flexibility in the existing system to manage supply chain
- Lack of redundant resources to provide buffer for the current operations

Logistics Side Learnings

- Need to ensure safety of transportation as a possible means to limit transfer of disease
 - Need to provide timely availability of raw materials to farmers
 - Need to timely procure supplies from farmers so that 8-9 hours storage can be done to avoid coronavirus spread
 - Lack of collaborative activities to ensure on-time and safe delivery to products
 - Lack of visibility in the supply chain process should be increased
 - Lack of velocity in the supply chain
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4.3.5. Action analysis

Actions refer to the capabilities that XYZ should develop to enhance supply chain resilience. Sushil (2000) suggested that actions should be derived from the learning, which is defined in terms of “when” the actions are to be carried out and “where” to be implemented. The notion of supply chain resilience-building may start from the primary form of risk management culture and extend this practice from the organisational level to the inter-organisational and supply chain levels. The capabilities like collaboration, flexibility, agility, risk management should be enhanced across the supply chain. Firms can implement advanced information management tools to improve visibility, velocity, information sharing and support collaborative activities among supply chain members. In addition to these factors, efforts are also needed to devise innovative practices to cope with probable and unforeseen events. Table 9 presents the actions involved in XYZ.

Table 9: Actions involved in XYZ.

Action Type & Details	Implications on capabilities
<i>Demand Side Actions</i>	
<ul style="list-style-type: none"> ▪ Increasing reach for end consumers through free online delivery of bulk order ▪ Increasing reach for end consumers through online delivery of small order at low delivery charges ▪ Increasing workforce for home delivery of fruits and vegetables through hiring local part-time and contractual workers ▪ Differential pricing can be used to meet every segment ▪ Advance order needs to be introduced so that demand management would be easy ▪ Fixed delivery date and timing needs to be introduced to manage uneven demand 	<ul style="list-style-type: none"> ▪ Focus should be on increasing velocity in supply chain ▪ Focus on enhancing redundancy in the supply chain ▪ Focus on enhancing flexibility capability in the supply chain
<i>Supply Side Actions</i>	
<ul style="list-style-type: none"> ▪ Support and commitment from top management will be required to develop supply chain resilience culture ▪ Employing locally available labourers ▪ Availability of machines from private and government sector to offset the limited availability of workers ▪ Relaxation of the norms by Agricultural Produce Market Committees to ease the burdens of farmer ▪ Need to enter into risk management contract with suppliers ▪ Frequent review policy needs to be implemented ▪ Training related to e-learning and change management needs to be provided ▪ Innovative practices, such as risk-reward sharing with supply chain partners need to be introduced ▪ The machinery can be provided to the farmers for fast harvest without much need of labourer. The locally available labourers should be utilised while adhering to government guidelines. ▪ IT-based solutions for coordination should be used for mapping and making supplies available 	<ul style="list-style-type: none"> ▪ Need to develop supply chain risk management culture ▪ Need to develop redundancy in the supply chain ▪ Focus should be on improving collaborative activities in supply chain ▪ Focus should be on building risk management culture ▪ Leadership supports are needed ▪ Need to improve visibility across supply chain ▪ Innovative capability needs to be enhanced ▪ Focus should be on improving agility in the system
<i>Logistics Side Actions</i>	

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- Ensuring the timely and hassle-free movement of trucks/mini trucks for transportation
 - Roadways buses for connecting authorities to the ground
 - Specialised training to logistics personnel for managing disruptions in logistics
 - Flexibility should be prime criteria for the selection of third-party logistics provider
 - Focus on integrating advanced technology management tools in transportation
 - Faster and rapid pickup of farm produce from the fields through the mobile app-based application
 - The RFID based FASTags can be utilised to increase visibility and velocity of supply chain
 - The online-based pass can be scanned through barcode while RFID tags give information about the genuinely of the transport assuring easy and timely logistics.
- Focus should be on building redundancy in the logistics
 - Focus should be on building risk management culture
 - Focus should be on developing flexibility capability
 - Need to improve velocity in the logistics
 - Need to improve visibility in logistics
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4.3.6. Performance

Performance implies “what” is to be achieved after implementing actions derived from the learning. Table 10 summarises performance analysis of XYZ firm.

Table10: Performance analysis of XYZ firm

Performance Type & Details	Implications
<i>Demand Side Performance</i>	<ul style="list-style-type: none"> ▪ Improved volume flexibility due to better demand management ▪ Improved risk management due to risk mitigation in demand management
<i>Supply Side Performance</i>	<ul style="list-style-type: none"> ▪ Improved supplier flexibility to anticipate, respond and recover from disruptions ▪ Improved agility due to the implementation of advanced IT tools ▪ Enhanced visibility and velocity across the supply chain ▪ Improved risk management due to <ol style="list-style-type: none"> i. an alternate arrangement of machinery and ease of norms for farmers ii. adoption IT tools iii. sourcing from local suppliers for in-season fresh produces
<i>Logistics Side Performance</i>	

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- Improved visibility
 - Improved logistics flexibility
 - Risk management and improved adaptability due to implementation of RFID, FASTags and mobile applications
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The multiplicity of interdependent vulnerabilities has amplified the food supply chain's complexity, and efforts are required to deal with supply chain disruptions caused by the pandemic. Firms need to introduce novel tools, techniques, and practices and develop capabilities in the food supply chain to meet various supply chain requirements. The study systematically analyses the impact of COVID-19 outbreak on food supply chain and various resource and capabilities used to develop supply chain resilience for meeting various supply chain requirements. Findings of this study are summarised in Figure 3.

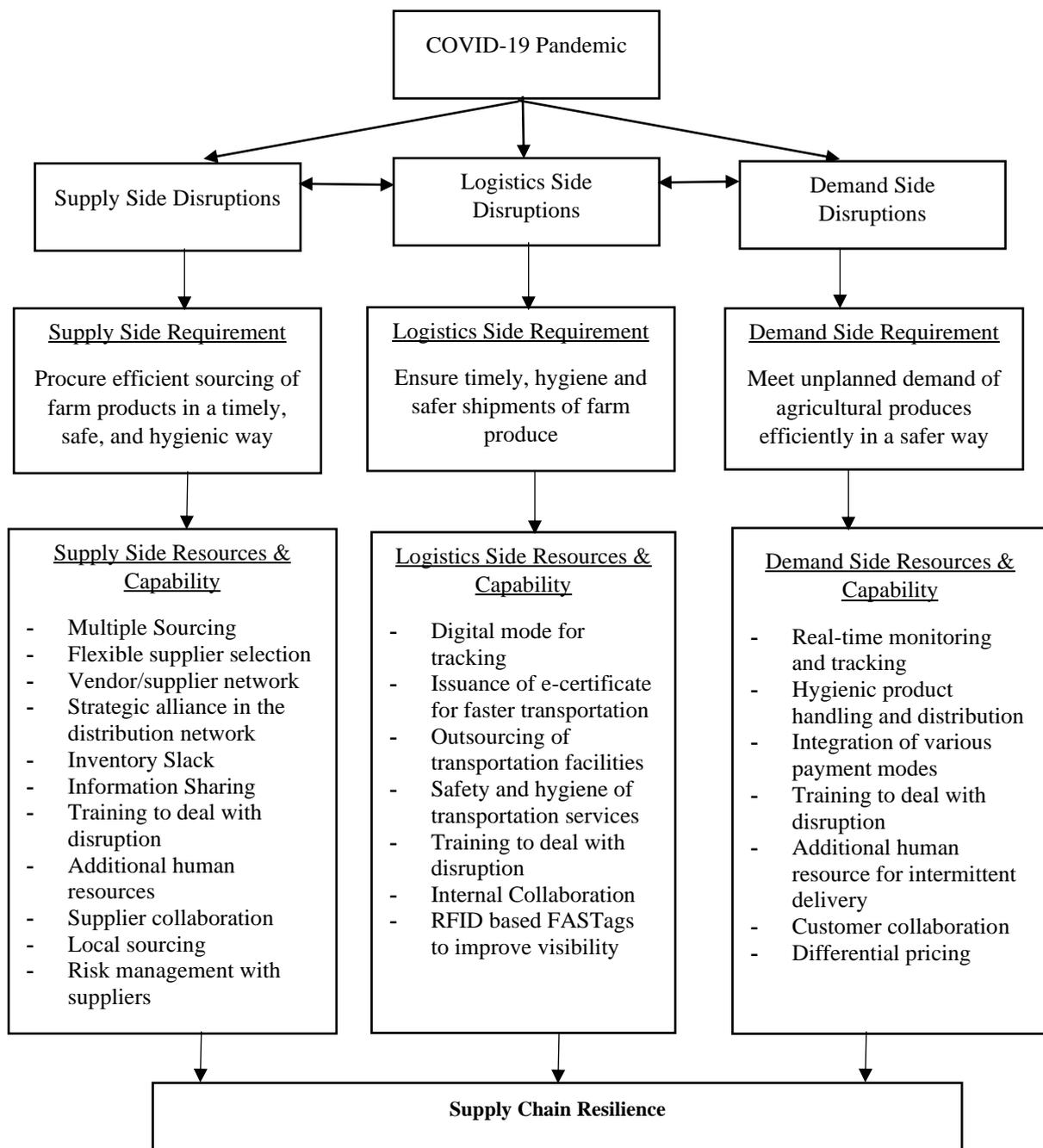


Figure 3: Mapping supply chain disruptions, market requirements and capability

5. Discussion and Implications

5.1. Discussion

The present study assesses the supply chain disruptions caused by pandemic and analyses the potential capabilities needed to build resilience from the dynamic capability perspective. The mapping of supply chain disruptions, market requirements and capability, and developed propositions are the study's main contribution. The mapping of supply chain disruptions, market requirement and capability offers a better explanation of the supply chain resilience, which has led to the development of propositions. These propositions can be tested through empirical survey methodology with a larger sample of the study.

Despite the several strengths and weaknesses linked with case research methodology, the study contributes to our understanding by representing the actual conditions of the food supply chain of an Indian firm during the pandemic. The main drivers of supply chain resilience and resources and capabilities needed to supply chain resilience have been explicated from the interviews' findings. Moreover, the analysis of the interview results clearly showed that the firms need to develop and enhance capabilities to implement proactive and reactive strategies to build, maintain, and improve supply chain resilience. Firms aiming at operational excellence must develop capabilities for implementing a few proactive strategies to promote supply chain resilience in the firm. Following prior studies (Christopher and Peck, 2004; Pettit *et al.*, 2019; Sabahi and Parast, 2020), the present study postulates that flexibility to redirect logistics and improve visibility is essential to develop supply chain resilience. Novel technologies can significantly enhance visibility and information sharing in the supply chain, thereby corroborating earlier studies (Gunessee and Subramanian, 2020; Muduli *et al.*, 2013) that suggest novel digital technologies improve visibility, information sharing and collaboration across the supply chain. Adopting RFID technology and GPS technology can facilitate tracking of shipments and smooth movement of goods during the pandemic (Ali *et al.*, 2018; Hobbs, 2020). Also, a robust digital payment system and integration of various payment systems can enable flexibility in order processing. The firms should develop several "what-if" scenarios by considering a range of factors, including shortage, government regulations, strikes, and increased petroleum prices. Similarly, firms can develop capabilities for implementing reactive strategies to tackle supply, demand, and logistics side vulnerabilities. It was observed that supplier development practices, including offering access to seeds and encouraging adoption of technological solutions, can enhance information sharing, connectivity, and visibility in firms' supply chain.

To manage the demand-supply disruptions, firms can also come up with short-term strategies, such as fixing the purchase limits on essential items, restricted shopping hours and selected delivery dates. Fixed pricing of fresh fruits and vegetables is another criterion that can be applied to restrict customers' bulk purchasing and ease short-term shortages and stockouts. Redundancies were developed by relying on multiple third-party logistics service providers and

entering into an agreement with local suppliers. Manning & Soon (2016) also suggested the importance of having a contingency plan to safeguard against failure, natural disaster, animal disease outbreak, product quality, and other disturbances. Thus, it is essential for firms to create a contingency plan as a part of a risk management strategy. For example, local sourcing for fresh fruits and vegetables can minimise supply chain vulnerability to cross-border disruptions (Hobbs, 2020). Other capabilities needed to implement generic strategies include adopting the latest ICT tools, developing risk management culture, and building social, capital, and relational competence. Innovative solutions need to be incorporated to manage all sources of vulnerabilities and mitigate their adverse impact on supply chain design, development, and operations (Brandon-Jones *et al.*, 2014). The findings also indicated that digitalisation could minimise the severity of supply chain shocks and bullwhip effects. It would also facilitate tracking and on-time delivery. The ICT tools facilitate information sharing, integrate diverse tasks, develop strong buyer-supplier relationships, and improve supply chain performance (Remko, 2020; Sharma *et al.*, 2020a).

Based on the empirical investigation, a generic framework is shown in Figure 4. The framework suggests that disruptions caused by pandemic necessitate firms to develop several capabilities for implementing proactive and reactive strategies, which in turn lead to the development of resilience in firms' supply chain. However, supply chain resilience can be contingent on several contextual factors, such as size of the firm, industry type, firms' position in the supply chain, organisational readiness (Min, 2019). Further, several facilitating factors, such as top management commitment, digitalisation practices, resilience culture, positively influence firms' capability to implement a proactive and reactive strategy for developing supply chain resilience.

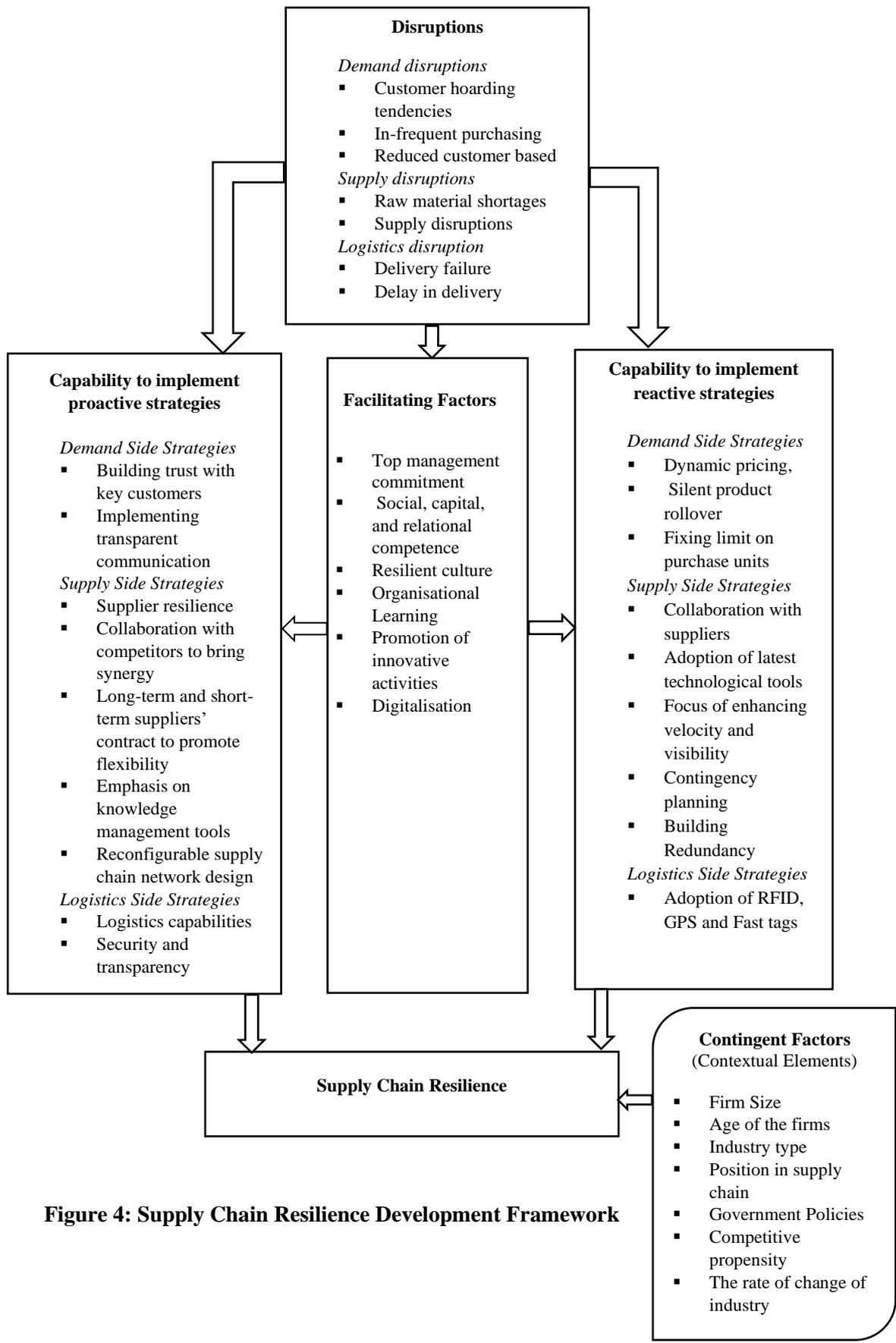


Figure 4: Supply Chain Resilience Development Framework

Based on the generic framework, the following propositions have been proposed:

- P.1.1. The greater the level of disruptions in the supply chain, the greater the need for firms to develop capability to implement proactive strategy for supply chain resilience
- P.1.2. The greater the level of disruptions in the supply chain, the greater the need for firms to develop capability to implement reactive strategy for supply chain resilience
- P.2.1. The greater the level of disruptions in the supply chain, the greater the need for firms to work on facilitating factors to implement proactive strategy for supply chain resilience
- P.2.2. The greater the level of disruptions in the supply chain, the greater the need for firms to work on facilitating factors to implement reactive strategy for supply chain resilience
- P.3.1. The greater the capabilities to implement proactive strategies, the greater the level of supply chain resilience in the firm.
- P.3.2. The greater the capabilities to implement reactive strategies, the greater the level of supply chain resilience in the firm.
- P.4.1. The greater the degree of facilitating factors in the supply chain, the greater the support of a firm's capability to implement proactive strategy for supply chain resilience.
- P.4.2. The greater the degree of facilitating factors in the supply chain, the greater the support of a firm's capability to implement reactive strategy for supply chain resilience.
- P.5. The firms' ability to deploy supply chain resilience is affected by several contextual factors (e.g., firm size, scale of operations, government policies, position of a firm in the supply chain).

5.2. Theoretical Implications

The study sheds light on the concept of supply chain resilience. By drawing on dynamic capability view of the firms, the study recognises various proactive and reactive strategies to develop supply chain resilience. The researchers offer an appropriate theoretical context to discuss the ways in which supply chain resilience can be used to maintain operational performance and address disruptions, enabling firms to reconcile the divergent views of supply chain resilience that can be found in the supply chain management literature (Ali *et al.*, 2017; Gölgeci and Ponomarov, 2015; Zhang *et al.*, 2021). The study provides useful theoretical implications. First, the findings of a qualitative case study add knowledge to supply chain resilience literature and suggest developing resilience. While the theory around supply chain disruptions and supply chain resilience have been evolving separately (Ali *et al.*, 2018; Hobbs, 2020b; Ivanov *et al.*, 2019; Shareef *et al.*, 2021; Sharma *et al.*, 2020b; Singh *et al.*, 2020b), research on integration of these topics is limited. Consequently, the primary contribution of the study is to understand various types of supply chain disruptions, role of supply chain resilience in mitigating the severity of the impact of these disruptions and practices applied to develop resilience capability in an agricultural food supply chain.

So far, earlier studies have modelled the disruptions of the supply chain during the pandemic and demonstrated the significance of supply chain resilience to deal with disruptions (Ivanov *et al.*, 2019; Ivanov and Das, 2020; Nikolopoulos *et al.*, 2020; Sharma *et al.*, 2020; Taleizadeh *et al.*, 2021). However, few scholarly studies have thoroughly examined the supply chain of agricultural food products in the light of dynamic capability theory. The present study applies a dynamic capability perspective within SAP-LAP framework to deduce insights from interviews with practitioners. Thus, the study offers distinctive empirically and theoretically grounded insights of practices used to develop supply chain resilience to achieve operational excellence in firms. Further, the study proposes a set of propositions related to development of supply chain resilience in firms. These propositions constitute an original contribution to the state of the art. The propositions offer a wealth of opportunity for assessing numerous linkages and relationship among constructs. The study recognises a broad research agenda in the propositions and invokes usages of a range of methodologies to evaluate these propositions. The conceptual framework presented in Figure 4 provides a valuable insight for academicians and researchers on how to develop resources and implement practices for developing supply chain resilience and act as a foundation for carrying out advanced research on this topic.

5.3. Managerial Implications

The findings of the study offer important insights for supply chain practitioners of the food supply chain industry. First, the proposed resilience framework will enable practitioners to understand the potential resources and practices that need to be harnessed to develop resilience and achieve operational excellence during the pandemic. The study indicates various disruptions in the supply chain that a firm can face during the pandemic and suggests how a firm's ability to acquire resources or reconfigure existing resources and implement new practices leads to distinctive capability, which offers a competitive advantage and helps the firm to maintain operational excellence. Second, the propositions developed in this study facilitate supply chain practitioners to develop capability to integrate proactive and reactive strategies for supply chain resilience. Expanding the focus of resilience from the focal firm to supply chain provides opportunity to achieve operational excellence in the face of disruption caused by the pandemic. To develop the supply chain resilience, the importance of facilitating factors like top management, resilient culture, digitalisation has been highlighted. From a practical standpoint, firms facing disruption in the supply chain need to develop resilience to achieve operational excellence during the pandemic. Practitioners need to work towards facilitating conditions, such as improving commitment from top management, implementing digital technologies, promoting innovation for developing capability to implement strategies for supply chain resilience.

Third, as disruption caused by a pandemic is multidimensional, practitioners need to have a holistic understanding of the current situation, members, and activities required to develop resilience in the supply chain to sustain and grow operational activities. Given the importance of collaborative activities in a firm's supply chain (Zhang *et al.*, 2021), more collaborative activities are needed between farmers, suppliers, logistics service provider and customers to maintain delivery consistency, reliability and flexibility. Practitioners can engage themselves in collaborative activities with private sectors to deploy machinery to offset the shortage of labourers during the pandemic. At the ground level, the farmers need inputs for their farm

operations which can be fulfilled by developing collaborative activities among various government authorities and the humanitarian supply chains.

Fourth, owing to increasing importance of flexibility to improve operational performance in the face of uncertainty (Butt, 2021; Mishra, 2020), practitioners need to develop flexibility by building redundancy in the supply chain using local sourcing practices, multiple suppliers and local labourers. Firms need to build visibility and encourage knowledge sharing to support collaborative activities. Using FASTages to identify vehicles and online-based permissions from a government portal can overcome the limited availability of physical passes for transportation, thereby overcoming transportation delay. Further, sharing sales data, ordering patterns, and inventory level is essential for more effective and integrated demand management (Taylor, 2006). Therefore, real-time information sharing is needed to manage demand and supply to facilitate efficient agricultural food supply chain management. Firms need to develop resilience in the supply chain to maintain and enhance operational activities, contributing to operational excellence. Practitioners need to simultaneously work on several capabilities that require support and commitment from top management to develop a resilient supply chain. To develop a resilience culture and build agility, practitioners should encourage knowledge sharing and improve visibility across the supply chain.

Overall, a more structured and comprehensive approach is needed across the supply chain to improve service level, minimise disruptions in the supply chain, and help achieve operational excellence during the pandemic. An integrated approach will also lower costs by reducing product waste, inventory and offering a basis for more efficient production and delivery processes.

6. Conclusion, limitations and future scope

The disruption caused by the coronavirus pandemic made it challenging for firms to achieve and maintain operational excellence in their supply chain. Government social distancing norms, retailers' stockpiling, and consumer panic buying tendencies amplified the necessity to develop supply chain resilience in firms (Narayanan & Saha, 2020). This study has analysed the impact of pandemic disruptions on agri-food supply chains and possible strategies adopted by a firm using a case study. The study has applied a dynamic capability view within SAP-LAP framework to examine the current situation that hindered day to day operations and created difficulty in achieving operational excellence. The learnings from the current situation are used to assess the possible actions which can be taken to improve performance. Based on the findings of study, it can be concluded that collaborative activities, transparency, flexibility, and redundant resources can make the food supply chain robust to deal with disruptions. Recommendations are then provided based on the learnings derived from the current situation, actors, and processes.

The study offers future research avenues in the intersection between supply chain resilience and dynamic capability view. First, the present study has applied a single-case study of India's agricultural food supply chain. Yin (1981) reported that dependency on a single case makes scientific generalisation difficult. Also, the study may suffer from researchers' bias. Since the case study was based on quality data, findings largely depend on researchers' interpretation,

thereby opening a lot of scope for biases. Although many precautionary measures were taken during the distinct phases of the case study, it is possible that subjective feeling may have influenced the findings. Thus, the results of the study may not be universally applied across diverse industries in various countries. Therefore, cross-cultural/ multi-national investigation of generic dynamic capability applicable in industries other than agricultural industry and supply chain members other than retailers can be made. The use of multiple case study approach and questionnaire-based survey approach is required in order to test empirically the conceptual framework derived from the case study. Therefore, future research can focus on the rigorous analysis of large samples of data on supply chain resilience and operational excellence.

Second, more explanatory studies are needed to understand the impact of contextual variable such as firm size, type of industry, leadership style, degree of external uncertainty on organisations' ability to develop supply chain resilience to maintain operational excellence. For example, the future study can address the broad questions of "How do organisations utilise their capabilities for developing supply chain resilience to address various degree of uncertainty? How does a firm achieve and maintain organisational excellence during COVID-19?" Third, future research topic concerns the complexity perspective of the supply chain. Therefore, future studies can address complexity of supply chain network and interdependency among supply chain members to thoroughly understand the effective response to possible adversities and enablers of supply chain resilience. Fourth, while the present study applies the dynamic capability view to analyse supply chain resilience, future studies can apply other strategic management theories, such as resource-based theory, contingency theory, to explore and analyse resilience phenomenon in the supply chain.

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