International Journal of Business and Economic Affairs (IJBEA)
7(4), 54-72 (2022)
DOI: 10.24088/IJBEA-2022-74005
ISSN: 2519-9986

Officiating Supply Chain Uncertainties due to COVID-19 Disruptions: Evidences Using Contingency Approach

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Abstract: This paper examines how firms achieve strategic fit with the external environment disrupted by the Covid 19 pandemic. The strategy formulation phase is studied concerning the firm's size for short-term and long-term time horizons. The context of this study is Covid 19 disruptions and how firms from the Construction industry manage supply chain uncertainties. The qualitative interview technique is used to collect data from 13 contracting firms operating in the construction industry of the United Arab Emirates. The contingency theory approach is used to analyze the strategy formulation of firms during Covid 19 pandemic. Results indicate that while developing strategies to manage supply chain disruptions, medium-size firms tend to be more secure and safe. At the same time, large organizations can deploy their resources to reduce risks caused by supply chain uncertainties. However, for a more extended time, medium-size firms adopt a wait-and-see strategy compared to large firms' Reactive or Proactive strategies. The use of contingency theory elaborated how construction firms achieve strategic fit to cope with Covid 19 disruptions. Organizations with more resources can opt for more reactive strategies, while most firms wait before taking any particular actions. The disruptions caused by Covid 19 are the first time phenomenon and thus require more detailed knowledge to proactively deals with it. Furthermore, an empirical model to reduce risks caused by Covid 19 disruptions is provided in the end.

Keywords: Covid 19 disruptions, Supply chain risk management, Supply chain uncertainties, Construction industry, Contingency theory

Received: 24 March 2022/ Accepted: 19 June 2022/ Published: 11 October 2022

INTRODUCTION

Epidemic outbreaks are one of the prominent reasons for Supply Chain disruptions. There can be multiple supply chain disruptions like war, natural weather hazards, and geopolitical tensions. Still, an epidemic outbreak is a commotion that starts from a minimal level but spreads fast across borders (Ivanov, 2020). Recent examples of epidemic spate are Swine Flu, SARS, Ebola, and the most topical, COVID-19. Covid -19 originated from Wuhan-China, and it immediately affected the Chinese economy, especially exports, and within no time, it adversely disturbed the global supply chain. It is considered the most stimulating dilemma of modern history, resulting in the nastiest economic downfall after the great depression (IMF, 2020). As of 7th April 2021 total number of infected cases rose to 133M globally while the USA, Brazil, and India ranked top three with 31M, 13M, and 12M cases, respectively (Worldometer, 2021). This novel coronavirus has upset Supply chains by creating vulnerabilities in-stock requirements and lead times and disrupting network structures.

Operational and disruption risks are the two main multifaceted menaces of supply chains (Choi et al., 2019). These threats of day-to-day disturbances in lead time and demand fluctuations may lead to operational risks (Ivanov et al., 2017). Furthermore, Disruptions are rare events with huge impacts on supply chains (Hosseini et al., 2019). Covid-19 is such disruption because the supply chain network got damaged as some manufacturing facilities, distribution centers, and transportation links like air cargo become inaccessible immediately and temporarily. Thus, causing the shortage and material delays, the supply chain's performance tainted in revenue, production, and service level rapports due to the ripple effect (Dolgui et al., 2020). Global supply chains get affected immediately by the emergence of Covid-19 because Wuhan has tier-one or tier-two suppliers of 983 companies of fortune 1000 (Braw, 2020). The mammoth impact of Covid-19 can be proven as statistics acquired by the resilience system shows that

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1000 world's largest supply chains have more than 12,000 manufacturing facilities, distribution centers, warehouses, or other operational centers in quarantined regions due to Covid-19 (Linton & Vakil, 2020).

Pandemics are unpredictable events whose disruptions could be on a large scale. Under such conditions, companies prioritize formulating and implementing strategies to create a strategic fit between organizational objectives and an undefined peripheral business environment (Miller, 1992; Venkatraman, 1989). Supply chain disruptions are not confined to organizational boundaries. Instead, all supply chain players, including buyers and exporters, are exposed to such happenings. While many disruptions are not under managers' direct control, anticipated adjustments in the external environment can produce- an attempt to mitigate disruptions by arraying resources (Luthans & Stewart, 1977). Collaborating with suppliers who have expertise in managing the uncertain environment and emerging technologies (Lawson & Potter, 2012) or hiring academic staff capable of understanding changing market dynamics can be an example of some solutions for disruption problems (Burns & Stalker, 1994).

Other solutions involve the deployment of resources, but resources like cash, machinery, and intellectual property are bound to current projects; therefore, it is difficult for companies to deploy assets/resources at the warning of a disruption (George, 2005). The deployment of resources in a short time is facilitated by organizational slack maintained by the company in response to external disruptions (Sharfman et al., 1988). However, It is studied that the amount of slack available by the organization is directly correlated with firm size, as - large companies have more financial and managerial capacity to hold enough resource slack compared to small firms (George, 2005; Sharfman et al., 1988). Despite limitations associated with resource deployment, many studies render it an efficient way of dealing with Supply chain disruptions by creating resilience and reconfiguration. (Ambulkar et al., 2015; de Sa et al., 2019; Hendry et al., 2019). Supply Chain Risk Management (SCRM) literature also highlights the process by which firms use resources to mitigate risks that can be financial (Blome & Schoenherr, 2011), supplier liquidations (Thun et al., 2011), or terrorism (Knemeyer et al., 2009). However, less is available on how firms respond to the epidemic outbreak, specifically to an intense pandemic like Covid-19. It is essential to develop this understanding because still, it has not known when global business economies will return to the previous pace of operations, as Covid-19 shocked the globe with surprise. This research study is conducted to know the answers to the following research questions (RQ):

RQ1: Which strategies are formulated and implemented by firms to manage supply chain disruptions arising from Covid-19?

RQ2: Is the firm's size important to affect firms' strategic decisions to tackle supply chain disruptions arising from Covid-19?

Studying Covid-19 as a disruption is crucial because it has affected all industries around the globe and highlighted the need to think about whether the business world is moving toward the era of more supply chain disruptions or a chaotic economy of "de-globalization." This study will examine how the construction industry in the United Arab Emirates responds to supply chain disruptions caused by Covid-19. The region of the United Arab Emirates is protuberant, especially for the Construction sector, due to huge investments and its unique architectural designs that remain an attraction for tourists around the globe. Although Covid 19 showed immense effects on construction projects and potential investment plans despite this pandemic situation, the construction industry of the United Arab Emirates is estimated to have a value of $101.45 billion in 2020 and more positive growth patterns are expected to come years too (Intelligence, 2021). We limit our research to the Construction sector to eliminate industry effects and because it is also among those profoundly affected by Covid-19.

THEORETICAL BACKGROUND AND LITERATURE REVIEW

Supply Chain and Covid 19

The impact of the Covid 19 pandemic on global business can last for both the short and long term (Clarke & Boersma, 2020). The long-term effects are reasoned by including direct and indirect impacts of Covid 19 on the Global Supply Chain (Sing et al., 2020; Lalon, 2020) and will ultimately result in a long-term financial crisis (Cui et al., 2020). Due to this financial crisis, it is expected to witness a downfall in demand for non-essential products, including luxury and electronic items (Guan et al., 2020; Majumder et al., 2020; Yuen et al., 2020). And thus, these businesses will experience payment delays along with order cancellation from buyers during the phase of pandemic recovery (Sen, 2020). However, on a holistic level, organizations need to depend on resource allocation to manage

disruptions, but supply chains suffer from resource constraints during the pandemic due to financial instability (Xu et al., 2020), making the recovery process slow for supply chains (Laing, 2020).

There are various studies available that focus on exploring the impacts of Covid 19 on supply chain operations. These studies concluded that a simultaneous pandemic effect is found on supply chain operations, patterns of production and demand, along with challenges in logistics schedules (Ivanov, 2020). And to cope with these challenges, a multidimensional approach needs to adopt to address all these issues simultaneously (Paul & Chowdhury, 2020). Organizations will also plan for horizontal coordination and collaboration to mitigate the pandemic impressions. Lockdowns have added to the problems, especially for businesses with their main suppliers in the region of complete lockdown, leading to shutdown threats (Laing, 2020). Those businesses with more dependence on supply chain partners can only survive and recover from the pandemic in the long term if they can absorb the worse effects of temporary lockdowns (Majumder et al., 2020). Once supply chains move into the recovery phase, the challenge of an increase in price due to fewer sourcing options could be another contest for a firm's survival (Sen, 2020). This will construct a need for searching and creating new sourcing and supply chain collaborations, thus impacting existing supply chain relationships (Paul & Chowdhury, 2020). This reestablishing of supply chain partnerships can be a prominent need in the era of post covid 19 (Ishida, 2020).

The impact of Covid 19 affected several supply chains around the globe; as the topic is very recent, it is impossible to measure all impacts, yet some authors presented studies about Covid 19 effects on the Supply chain - SCOR Processes. The Summary of these studies is as follows:

1. Plan: Cash Flow Problems, new partnerships, inappropriate demand forecasting models (Fonesca, 2020; Omar et al., 2020).

2. Source: Supplier's inability to meet inventory requirements, increased prices, shortage of labor (Fonesca, 2020; Zhu et al., 2020).

3. Make: Technological hitches, more dependence on Local supplies (Ayati et al., 2020; Hilmola et al., 2020).

4. Deliver: Change of distribution channels, Export Restrictions (Fonesa, 2020; Ayati et al., 2020; Singh et al., 2020).

It must be noted that the world has witnessed various major outbreaks in the past, but the intensity of Covid 19 was significantly high, and businesses were not prepared for it. As a consequence, studies report a lack of pro-activeness in dealing with the pandemic (Sharma et al., 2021), thus causing delays in decision making about developing the strategies to cope with this challenge (van Hoek, 2020). The diversity of Covid 19 challenges and disruptions makes it a phenomenon that needs thoughtful strategic formulation based on exploring and investigating the resource capitalization and risk management stratagems.

The pandemic of COVID 19 has had significant impacts on the United Arab Emirates Construction industry as well. As per global practices, many project managers in UAE also worked from home during the lockdown starting from March 2020, which slightly started reducing restrictions by the last quarter of 2020. This approach of working from home shifted the dependence on digital technology for achieving the goals of operational efficiency and supplier management. According to one study, 90% of managers performed their duties from the boundaries of their homes due to the widespread pandemic (Baldwin & Mauro, 2020). Out of all project activities, only the ones with high urgency were carried out during the pandemic. The significant reason behind this is the reduction of the workforce at the work site as the government announced the law of social distance at public and workplace, thus forcing the contracting firms to reduce the number of laborers at the project's sites.

The strict regulations of lockdown have further tightened the situation for construction supplies as there were curfew timings for traffic movements, too, in certain regions of the UAE. However, those firms with strong information technology infrastructure can manage their planning and sourcing through digital platforms; for effective risk modeling, the firms must access and process critical supply chain data (Chernysheva et al., 2019). But every organization does not always possess enough IT infrastructure to instantly shift their operations on digital grounds upon arrival of any uncertainty. It requires sufficient investments in Information technology databases, processes, communication tools, and hardware. Managing supply chain operations on digital grounds requires suppliers and Construction Companies to be well-equipped with the necessary technology. Due to this reason, larger firms and their suppliers are most likely to achieve higher degree of digital collaboration than small firms.

Strategic Contingency Theory

The concept of contingency theory was first developed in 1960's during the open system theory of organizations. The assumptions of contingency theory are based on the idea that uncertainties in the external environment of an organization are the variables that are out of organizational control and can neither be predicted accurately (O'Connor & Martin, 1989). The literature widely uses contingency theory for organizations under the influence of external uncertainties and disruptions because it rejects the classical management approach (Lawrence & Lorsch, 1967). Instead, it argues that there is no "best approach" in handling organizations; rather, several contingent factors influence how a particular firm manages its operations and functions.

The situation of uncertainty arises due to the inability of an individual to predict future outcomes in a business environment accurately. This inaccurate prediction is caused by insufficient information or the inability to distinguish between pertinent and inapt data (Milliken, 1987). Based on this notion, the extent of uncertainty an organization faces depends on decision-makers perceptions during their environmental scanning and interpretation of the observations (Downey & Slocum, 1975). Early research explored how to condense uncertainty and improve firm performance by achieving fit between the external business environment and the organization's structure; this is later labeled as the structural approach to contingency theory (Burns & Stalker, 1994; Lawrence & Lorsch, 1967).

Nevertheless, strategists are confined to accepting organization structure as one expedient to knob external environment information and declare the strategy-making process as another effective tool (Miller & Friesen, 1983). Researchers argued that strategy formulation depends on environmental uncertainty, leading to matching organizational resources with external opportunities and threats (Venkatraman, 1989). Strategic contingency theory suggests that organizations can achieve fit by aligning with their operational industry, and this alignment depends on organizations' strategies (Miles & Snow, 1994). The change in the direction of organizations' strategies is backed by variations in contingencies external to firms connected with the national and international environment and in-house contingencies of input resources, current strategies of firms, and operational capabilities (Zajac et al., 2000).

To contribute to contingency theory, we first need to identify essential contingency variables whose contexts are different, then make groups of different contexts. Ultimately, the most operative organizational response to these groups is dogged (Sousa & Voss, 2008). The four broad contingency variables include a firm's culture, size, strategic orientation, and other variables internal to organizations (Ketokivi & Schroeder, 2004). To quandary the latitude of research and answer research questions, we selected firm size and strategic context as our contingency variables. This paper aims to explicitly provide findings on the role of a firm's size and its strategic orientation in achieving strategic fit with the external environment disrupted by Covid-19.

The concept of strategic contingency theory does not imply a general strategic fit for all organizations operating within the uncertainties caused by Covid 19; instead, this strategic fit is unique for each organization and is a crucial proposition of strategic contingency theory (Zajac et al., 2000). Organizational performance decreases when this strategic fit with one contingency variable does not fit with the second contingency variable. This kind of misfit in strategies may often be caused by a lack of resources, reluctance to change, or even obliviousness to the requisite for change (Henderson & Clark, 1990).

Organizations with sufficient resources can deploy these resources to cope with strategic change. However, it is vital to use these resources in the form of slack liberally (Cheng & Kesner, 1997). These slack resources can be tangible and intangible (George, 2005). It is possible to calculate the output of investments and input costs in the case of tangible resources as they are measurable. These tangible resources include fixed assets, unused capacity in the manufacturing plant, vehicles, and machinery that is more than the required resource to run planned business activities (Khan, Shahbaz, & Jam, 2019; Modi & Mishra, 2011). Decisions on deploying these tangible slacks are made strategically based on costs and long-term requirements. At the same time, the operational level decides the deployment of these assets for short and medium time frames (Allaoui et al., 2019). On the other hand, it is challenging to deploy intangible resources as they are unquantifiable and specific to affiliations (Figueira-de-Lemos & Hadjikhani, 2014). Searching and sharing knowledge and relationship management are some intangible resources studied to avoid risks caused by supply chain disruptions (Karunaratne, & Karunadasa, 2021; Surroca & Waddock, 2010).

After selecting the external environment as one of the contingency variables, it is important to consider size

of the firm as the financial and resource independency of the firm relates to the magnitude of the organization's business and operational boundaries. Similarly, the tendency of the firm to manage resource slacks and then use them later during uncertain times depends on its size because large firms have more capacity to hold financial and physical resources than smaller firms (George, 2005). Furthermore, it is known that the strategy formulation process of the firms is backed by the internal contingencies of resources and business competencies (Zajac et al., 2000), and these internal elements vary with the firm's size. Organizations with the difference in size and scope of business activities may react differently to the same external disruptions therefore the size of the firm is significant to study when firms are trying to manage uncertainties of Covid 19 disruptions.

Organizational Strategies to Cope with Supply Chain Uncertainty

Supply chain risk and uncertainty: Literature treats supply chain uncertainty management as reducing the negative impacts of supply chain disruptions by creating an excess inventory or rebuilding supply chains (de Sa et al., 2019). There are multiple approaches found in the literature to manage supply chain uncertainty, like as integrating supply chain and organizational processes (Flynn et al., 2016), managing intangible resources like human resource capabilities, or searching for new opportunities to do business (Hendry et al., 2019). The concepts of risks and uncertainty often get overlapped as both foci on the deployment of resources to minimize the deleterious consequences of supply chain disruptions (Ho et al., 2015). However, risk and uncertainty are two separate concepts. The availability of probabilities about certain events is a risk, while too ambiguous information about specific events that cannot be summarized in probabilities leads to uncertainty. Risks and uncertainty are not substitutes for each other somewhat. Risk results from uncertain events (March & Shapira, 1987). The perceptions of uncertainties in the external business environment cause supply chain risks.

Passive risk management strategy: Supply chains are subject to uncertain situations due to unpredictable events at the micro or macro level of the external business environment. These uncertain situations can adversely affect the whole or part of supply chains, thus leading to operational and strategic irregularities (Ho et al., 2015). An organization's intention to ultimately wait for the event to occur and then react after the situation; manifests as passive uncertainty management. Due to less beneficial outcomes, passive risk management strategy receives very little appreciation from the literature (Grotsch et al., 2013).

Reactive risk management strategy: Literature receives ambiguous responses from researchers on the nature of reactive strategy to mitigate risks. One view takes reactive strategy as a course of action before an event to minimize its adverse effects (Thun et al., 2011; Grotsch et al., 2013; Chopra & Sodhi, 2004). On the other hand, some researchers argue that a reactive strategy fosters organizations to react quickly after the disrupting event and explore ways to recover to past desired conditions (Ali et al., 2017). The timing of the reactive response strategy is not the only conflict among scholars; there is also a dispute on the nature of retaliation. Acquiring excess inventory is one device to allay adverse situations (Kwak et al., 2018), while shifting inventory and production facility to an entirely new location is regarded as a reactive response to avoid disruptions (Tang & Tomlin, 2008) altogether. However, authors stress that organizations embed flexibilities in their inventory and production capacities to react quickly against uncertain disruption (Craighead et al., 2007; Stevenson & Spring, 2007; Juttner et al., 2003).

Generally, a reactive strategy is about reducing disruption events' severity by deploying fixed and variable assets. The point of disagreement is the timings of the company's actions against disruption. The decision-making level within the organization at which the decision to manage uncertainty caused by disruption needs to be made. To clarify the concept, we propose the following definition of reactive risk management strategy: Decisions to allocate fixed and variable assets to mitigate the adverse effects of uncertain situations caused by disruption.

Proactive risk management strategy: Strategies that intend to reduce or diminish the probability of risks caused by any disruption, either by investment in fixed assets or by temporarily changing the architecture of supply chains, are referred to as proactive risk management strategies. Proactive risk management strategies may embrace the creation of new contracts and facilities (Elluru et al., 2019), sourcing from multiple suppliers (Craighead et al., 2007), and sharing risk with supply chain partners. The proactive strategy seeks to prepare for uncertain events by developing organizational risk management systems (Grotsch et al., 2013) or taking financial support in insurance or hedging (Blome & Schoenherr, 2011).

Wait and see risk management strategy: Wait and see strategy is the intention of organizations to go for a carefully calculated decision by deploying intangible resources. This deployment of resources creates new knowledge for

decision-makers about the disruption, and thus a new course of action is developed to manage uncertainty (Clarke & Liesch, 2017). The need for implementing a wait-and-see strategy is higher for the manager working in turbulent markets, who cannot precisely predict the nature of the disruptive event (Sull, 2005). Companies that follow wait and see a strategy to manage risks used to align their resources according to the current situation. The commitment of intangible resources to reduce risks can be the creation of new relationships or redesigning and strengthening of the prevailing associations (Clarke & Liesch, 2017).

The international business literature suggests a wait-and-see strategy to tackle both pure and contingent uncertainties caused by disruptions. The term pure uncertainty is the situation where it is impossible to determine future disruption, while contingent uncertainty is the ability of an individual to learn and develop contingent strategies. When an organization is up to particular uncertainty, managers at the strategic level do not instantly proceed with tangible resource commitment as there is always a cost associated with the deployment of resources, and this transition is not reversible. Therefore, committing intangible resources to gain insights into the existing scenario is the feat per the wait-and-see strategy (Figueira-de-Lemos & Hadjikhani, 2014). Furthermore, the strategic differentiation of risk management strategies is summarized in Table 1.

Table 1: Strategical differentiation of risk management strategies

Strategy	Resource Allocation	Decision Level	Strategical Features
Passive Strategy	No resource Allocation	No decision before disruption	• No Advance actions (Grotsch, Blome, & Schleper, 2013) • Routine Business (Grotsch, Blome, and Schleper, 2013) • Taking steps after disruption to reduce negative effects (Grotsch, Blome, & Schleper, 2013)
Reactive Strategy	Measurable allocation of variable assets	Tactical and Operational	• Ensuring excess inventory (Kwak, Seo, & Mason, 2018) • Transfer of manufacturing facility (Tang & Tomlin, 2008) • Planning flexible plans of productions for quick actions (Stevenson & Spring, 2007) • Increasing transportation network capacity (Tang & Musa, 2011)
Proactive Strategy	Measurable allocation of Fixed assets	Strategic	• Identification and management of risk (Grotsch, Blome, & Schleper, 2013) • Moving facilities to risk free areas (Knemeyer, Zinn, & Eroglu, 2009) • Expanding storage and production facilities (Knemeyer, Zinn, & Eroglu, 2009) • Securing finances by Hedging (Blome & Schoenherr, 2011)
Wait and See Strategy	Allocating Intangible resources	Operational, Tactical and strategical	• Collecting knowledge (Clarke & Liesch, 2017) • Relationship building with suppliers, Government agencies and Trade associations (Figueira-de-Lemos & Hadjikhani, 2014)

The wait-and-see strategy is different from the proactive strategy as it is not directed to make arrangements before the disruption event. It is also unlike passive strategy as this does not direct organizations to sit slothfully till the disruption happens and then react as per the damage caused. Neither is it similar to reactive strategy as the commitment of tangible resources nor in the scope of wait-and-see strategy concepts. A comparison of all four strategies based on their resource commitment and time frame is presented in Table 2.

Table 2: Comparison of four risk management strategies

Risk Management Strategy	Tangible Resource Commitment	Intangible Resource Commitment	Actions Before Disruption	Actions After Disruption
Proactive Strategy	✓		✓	
Reactive Strategy	✓	✓	✓	✓
Passive Strategy	✓			✓
Wait and see Strategy		✓	✓	✓

DATA COLLECTION AND RESEARCH DESIGN

Studying Covid 19 disruptions and organizational strategies to cope with these uncertainties is a new research area requiring more observational evidence for conclusive results. As covid 19 disruptions are a scenario never witnessed before, qualitative information is gathered using the key informant technique (Marshall, 1996). The key informant technique is advised to implement in new subject areas, and members of a particular community or business are not fully aware of the phenomenon (Tremblay, 1982). In research studies, key informants are selected based on their position, which allows them to provide deeper insights into what's new going on in the situation where they exist. We selected senior and middle-level managers from the United Arab Emirates with at least seven years of Construction industry experience to thoroughly understand their relative industry along with the impacts of Covid 19 disruptions and briefly describe strategies to minimize its negative impacts.

The hierarchical segregation of respondents based on the level they possess within the organization is important for understanding the phenomenon under observation. Senior-level managers are involved in decision-making and strategy formulation while middle managers hold critical positions between senior managers and staff. Literature also highlights the prime responsibilities of middle manager as they are the one who implements strategies of senior managers by interacting and exercising control over administrative staff (Harding et al., 2014). Senior-level management looks for the whole organization, while middle-level managers are responsible for a particular unit or the business, thus projecting operational insights to decision-makers for effective strategy formulation (Uyterhoeven, 1972).

Interviews were conducted from April 2021 to 31st June 2021, using 16 interviews with 13 respondents. Interviews were rescheduled with three key informants to clarify some previously discussed points. Six of the experts were from Large organizations (Coded as LEX), and the remaining seven were from Small and Medium-sized enterprises (Coded as MEX). To fulfill the criteria of anonymity, we further coded responses LEX-1 or MEX-2 to discern information collected from different organizations. Table 3 outlines the sequence of information collection.

Table 3: Timing and interview sessions from organizations

Organization	April 2021	May 2021	June 2021	Total
LEX-1	1			1
LEX-2	1			1
LEX-3		1	1	2
LEX-4		1		1
LEX-5		1		1
LEX-6			1	1
MEX-1		1		1
MEX-2		1		1
MEX-3	1			1
MEX-4	1	1		2
MEX-5			1	1
MEX-6			1	1
MEX-7	1	1		2

Organizations are categorized as SMEs with employees 1 to 500 and large with 500+ employees based on the OECD (Organization of Economic Cooperation and Development) definition. The interview findings from 13 experts were triangulated to improve the validity of the construct (Yin, 2014). Table 4 describes the respondents' roles and the frequency of interview sessions.

Table 4: Respondents role and interview frequency

Organization	Category	Respondent Role	Interview Frequency	No of Employees
LEX-1	Large	Project Manager	1	590-650
LEX-2	Large	Procurement Manager	1	620-670
LEX-3	Large	Planning Manager	2	700-760
LEX-4	Large	Director Research and Development	1	550-590
LEX-5	Large	General Manager	1	750-820
LEX-6	Large	Operations Manager	1	760-810
MEX-1	SME	Director Procurement	1	130-150
MEX-2	SME	CEO	1	50-80
MEX-3	SME	Project Manager	1	200-240
MEX-4	SME	Manager Coordination	2	40-65
MEX-5	SME	CEO	1	320-350
MEX-6	SME	Director Operations	1	250-280
MEX-7	SME	CEO	2	80-110

DATA ANALYSIS

As supply chain disruptions due to Covid 19 is a new phenomenon, an interview-based exploratory study can better serve the purpose of how construction firms respond to this unforeseen event. We selected thematic analysis (Braun & Clarke, 2006) to sort interview data. This technique is used by various scholars (Leininger, 1992) for analyzing and describing results with themes from their data (Braun & Clarke, 2006). The thematic analysis also helps to handle data with a well-structured approach to generate an insightful explanation of the observed phenomenon (King, 2004). Pattern-matching techniques are used after the first level of coding of summarized data (Yin, 2014). Pattern-making is done to cluster similar codes and then attach these codes with broader-level codes of strategies defined from theoretical aspects of literature. Recoding data is done to enhance reliability, and getting agreement on close themes helped strengthen the qualitative data analysis (Armstrong et al., 1997). Table 5 reflects the codes closely related to the literature review. These codes are used to link with construction organizations' risk management strategies. In the last, findings are in a systematized way to explain the strategical orientations of organizations to manage Covid 19 disruptions' uncertainties. We engaged practitioners' responses for short-term and long-term strategies to determine how they are achieving strategic fit to manage supply chain uncertainties.

Table 5: Thematic coding of strategies

Strategy	Codes	Themes	Evidence from Literature	Discussion
Proactive – α	$\alpha 1$	New Suppliers	Includes new contracts or multi souring to reduce risk (Craighead et al., 2007)	Implementing flexibility in Supplier selection Criteria, decreasing dependence on single or few sources of supplies.
	$\alpha 2$	Financial hedging	Financial hedging to reduce anticipated risks (Blome & Schoenherr, 2011)	Policies to insure organization's interests damaged by global pandemic are still under development.
	$\alpha 3$	Fixed assets commitment	Measureable investment in fixed assets (Elluru et al., 2019)	Considerable investments in assets with the aim of providing support during any incoming wave of Covid 19.
	$\alpha 4$	Other	Apply, where above contexts are not applicable	Sharing risks with suppliers by amendments in contractual arguments.
Reactive – β	$\beta 1$	Inventory stocks	Keeping inventory as safe stocks (Knemeyer et al., 2009)	Maintaining more construction stocks as per future Project's requirements.
	$\beta 2$	Shifting Production facility	Moving to new manufacturing locations (Tang & Tomlin, 2008)	Prioritizing tenders of projects in the geographical regions that are least affected by global pandemic.
	$\beta 3$	Resource commitment	Commitment of variable assets (Blome & Schoenherr, 2011)	Ensuring availability of construction machinery in anticipated conditions of lockdown.
	$\beta 4$	Strengthen Transport	Increasing transport capacity to connect with new locations (Juttner et al., 2003)	Setting new routing with Logistics and transport organizations for seamless inventory delivery.
	$\beta 5$	Other	Apply, where above contexts are not applicable	Optimizing stocks of items that are critical for operations and revenue.
Passive – γ	$\gamma 1$	No advance action	No action before the event (Grotsch et al., 2013)	No proactive strategies due to uncertain Requirements of Construction Supply chains that vary with project to project.
	$\gamma 2$	Action after event	After event taking steps to reduce disruption effects (Grotsch et al., 2013)	Rescheduling and operationalizing task activities as per the change in Client's demands and Project's requirements.
	$\gamma 3$	Normality	No actions and doing business as usual (Grotsch et al., 2013)	Managing supply chains in an attempt of continuing business on Normal basis similar to pre pandemic level.

Cont.....

Strategy	Codes	Themes	Evidence from Literature	Discussion
	$\gamma 4$	Other	Apply, where above contexts are not applicable	Temporarily pausing the business operations till situation get stable.
Wait and See – Δ	$\Delta 1$	Information sourcing	Getting information from suppliers about the disruption effects (Clarke & Liesch, 2017)	Correspondence with business consultants and market allies.
	$\Delta 2$	Industrial relations	Getting information from industry association about disruption effects (Figueira-de-Lemos & Hadjikhani, 2014)	Getting guidance from governmental sources about the policies to settle disruption effects.
	$\Delta 3$	Intangible resource allocation	Making investment in intangible resources (Figueira-de-Lemos & Hadjikhani, 2014)	Investments in stocks and intangible assets that act as finance support during the time of price inflation due to pandemic.
	$\Delta 4$	Other	Apply, where above contexts are not applicable	Collecting information from suppliers about their risk mitigation strategies and generating risk aversive plans for their own firms.

FINDINGS

The construction industry comprises customers with diversified and customized needs for projects. We found various strategies that construction companies will follow to attain strategic fit.

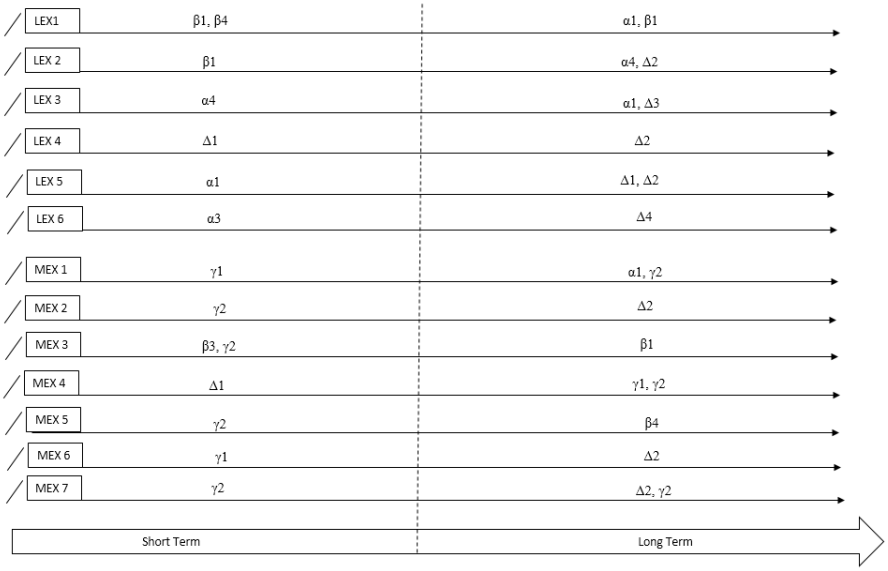

Figure 1: Coding results for strategies opt by organizations in short term and long term

Figure 1 provides a snapshot of construction firms' strategies for the short term and their plans for long-term horizons. The word short term depicts the time phase till one year since the world started recovering from Covid

19 restrictions. Still, businesses will take time to get on their routine business before the pandemic. Moreover, long-term duration strategies will imply more than one year of plans. Figure 1 summarizes the response of interviewed firms, and Table 6 summarizes the coding results and strategies used by Contracting firms in the Short and Long-term.

Table 6: Coding results and strategies opt by firms in short term and tong term

Firm	Short Term	Long Term
LEX-1	Reactive β1: Developing strategies to stock critical stocks Reactive β4: Redesigning logistics network to ensure resource availability	Proactive α1: Looking for new supplier within national boundaries Reactive β1: Efficient use of stocks
LEX-2	Reactive β1: Prioritizing stocks for important projects thus more focus on stock accumulation	Proactive α4: Waiting to settle down the world before we make any significant long term strategy and then react in the perfect way Wait and See Δ2: Awaiting response from industrial sources about long term strategies
LEX-3	Proactive α4: Setting new standards for products from different suppliers	Proactive 1: Starting new sourcing especially for important resources Wait and See Δ3: Seeking more security from Insurance agencies
LEX-4	Wait and See Δ1: Generating more information from our Third party contractors about ground realities	Wait and See Δ2: Depending on National and International Governmental policies that will guide firm's strategy formulation
LEX-5	Proactive α1: New sourcing of essential items necessary for operations	Wait and See Δ1: Assigning increased correspondence with our partner firms Wait and See Δ2: Finding out ways how Governmental institutions can be of support by subsidy or discounts on production materials
LEX-6	Proactive α3: Prioritizing projects with more suitable payment options and immediate returns	Wait and See Δ4: Depending on industrial entities and witnessing their strategies for long term
MEX-1	Passive – γ1: Can't risk our limited resources by getting advance actions before normality	Proactive α1: Resourcing from more than one suppliers from locations near to production site Passive γ2: First need to completely identify Covid 19 effects on business operations than act accordingly
MEX-2	Passive – γ2: Trying to look for increase in Project's returns after increase in Cost of production after pandemic	Wait and See Δ2: Will look for actions taken by firms in the same business environment
MEX-3	Reactive β3: Ensuring availability of Critical stocks Passive γ2: Will wait for some more time regarding decisions of heavy investments	Reactive β1: Arranging warehouse for stock management
MEX-4	Wait and See Δ1: In coordination with Regional disaster management authority about future policies	Passive γ1: Limited availability of financial resources restricts taking huge moves in uncertain situations Passive γ2: Decision making is halted till the clarity of new scenarios

Cont.....

Firm	Short Term	Long Term
MEX-5	Passive $\gamma 2$: Will take action based on Client's requirements after pandemic	Reactive $\beta 4$: Reshaping supplier network and operational objectives
MEX-6	Passive $\gamma 1$: Uncertain about upcoming recovery of businesses will not take drastic steps	Wait and See $\Delta 2$: Depending on business associations guidelines for long term strategies
MEX-7	Passive $\gamma 2$: Contracts renewal after incorporating pandemic effects on prices and availability	Wait and See $\Delta 2$: Getting information of Tier 1 and Tier 2 suppliers of trading partners Passive $\gamma 2$: Immediately no significant change of business model, will try to look for change in external environment first

Covid-19 Disruption Management Strategies of Large Organizations

Political changes and new rules and regulations disturb supply chains. Still, organizations can expect negative impacts from these uncertain events, and sometimes there is a grace period for organizations to settle their business as per new protocols. Industrial trade organizations and media usually create awareness about the upcoming shifts in laws that could change the usual way of doing business. However, natural hazards and pandemics are uncertainties whose magnitude of impact and time cannot be calculated. The planning manager LEX 3 at one large enterprise explained this scenario as follows:

> *We were not in a state to understand how the pandemic of Covid 19 will affect our lives once it has started in Wuhan-China. At the start, we thought that maybe it would be limited to certain parts of the world only. Nevertheless, how the global world turned into a state of "no movement" was not expected. Since we grew up, we only studied such uncertain events as pandemics and world wars in history books. We believe that now the world has progressed so much in medicines and technology that no such event could restrict the fast pace of life – (Planning manager LEX3).*

Disruptions caused by Covid 19 are in various forms, including restrictions on the movement of workers, closure of production facilities, changes in consumer demands, and hindrances in the cargo delivery process, thus tapping a financial pressure on the global supply chain (Aday & Seckin Aday, 2020). The project manager at LEX 1 established the ground based on which strategic orientation of construction firms will formulate:

> *We work on sites with a specified space allocated for keeping our inventory, which typically involves bricks, blocks, and aggregate. Keeping the worst-case scenario of strict lockdown and shortage of material, we are now asked to keep at least four weeks of building material as safety stocks – (Project Manager LEX 1).*

However, the limitation of storage space is always a deterrent. The procurement manager supports this portent in the following way:

> *Buying inventory and keeping it at safety stock is a strategy to keep functioning in the short term. For the long term, we must devise ways to handle this disruption to stop recurring current uncertainties. In construction, we cannot rely on safety stocks always. The relationship with suppliers helps to be safe in a time of crisis. We are looking to sign contracts with suppliers who can source, produce, and store building materials during critical disruptions (Procurement Manager LEX 2).*

LEX 4 and LEX 5 exhibited indications of arraying proactive strategies for the short and long term, respectively. LEX 5 is strategically oriented to seek the solution of new suppliers in the short term, and then industry norms and practices will guide to decide for future direction.

> *We were sourcing from two significant suppliers of building materials in the past. Now we have shifted our dependency from a few large suppliers to multiple - relatively small suppliers. This step is taken to prevent a colossal shortage of building materials in case of any uncertainty like Covid 19. We realize this step is not as cost-effective as the previous one, but if it smoothly ensures a continuous supply of materials, our overall balance sheet will not affect by an enormous level. The reduction in penalties for time delay and operational efficiencies is our company's focus these days (General Manager – LEX 5).*

LEX 6 is also inclined to develop strategies of resource commitment. Hence, organizations are looking for complete information about Covid 19 pandemic settlement in the form of the reduced number of affected cases, calling off travel restrictions, and functioning production facilities with total human resource capacity.

Covid-19 Disruption Management Strategies of Small and Medium Organizations

In our study, medium-sized organizations tend to use passive or wait-and-see strategies for the long term. Director procurement at MEX 1 describes the phenomenon of COVID-19 disruption in the following way:

> *We asked our suppliers about their planning to cope with the challenges of Covid 19. We are not so much confident about their responses. Moving to new suppliers is not cost-effective as we rely on credit terms during negotiations with new suppliers. It is an essential factor (Director Procurement – MEX 1).*

The stance, as mentioned earlier, support the fact that large organizations have more capital in finance, infrastructure, and human resource to act proactively before the event. In comparison, organizations operating on a minimal expense capacity cannot opt for resource commitments for a longer time. Most small and medium enterprises, including MEX 5, MEX 2, MEX 6, and MEX 7, opted for a passive strategical orientation, i.e., no action before the event. Still, no claims of completely handling the spread of Covid 19 are received. Vaccination drives are going faster, yet as per United Nations Regional Information Centre for Western Europe, the average vaccination rate in Europe is 24%, and 50% of elders and 40% of health workers are still not vaccinated against Covid 19 (Nations, 2021).

At the same time, on a long time horizon, contracting firms are looking for the same strategy of first knowing the industrial trend and then developing strategies for future business. Manager coordination at MEX 4 explained the problem of conglomerates with new suppliers.

> *During the construction phase, usually items of steel and other small equipment we outsource from international suppliers. Due to Covid 19 travel restrictions, we faced a shortage of these materials. The other option could be to rely on local materials. It is a hard decision to take as there are client concerns for perceived low quality and high price (Manager Coordination – MEX 4).*

CONCLUSION

As shown in Table 6, our results suggest that organizations with more support from financial resources tend to opt for Reactive Risk Management Strategy more often in the short term compared to long-term horizons. But the criterion of selecting a risk management strategy varies with the contingency variable of size. However, selecting new suppliers closer to the project's site and are from the regions not heavily affected by Covid 19 restrictions and lockdown appears to be the most appropriate solution for managing Covid 19 disruptions. Firms including LEX-1, LEX-3, and LEX-5 are considering searching for a new supplier for short term and long term to tackle current difficulties. But the same is not equally feasible for small and medium enterprises due to the limitations of contractual agreements, pricing, and payment terms, settled with old suppliers.

The dynamic nature of the construction industry makes it more vulnerable to accepting new changes in strategies and policies. The reason behind this nonflexibility is that the product of the construction industry is not always consistent in terms of size, cost, design, time duration, and location. Each project is unique with its specifications for clients and concerned organizations. Therefore, firms like LEX-2, LEX-3, LEX-5, LEX-5, LEX-6 and MEX-2, MEX-4, MEX-6, and MEX-7 chose to go for the Wait and See Risk Management strategy because of which they get a chance to look for the industrial trends, pricing fluctuations, and governmental policies. Firms with less risky

cultures tend to consider this as one of the most secure strategies to deal with Covid 19 disruptions as it saves what they already have and then reacts appropriately to suit the organizational aim and mission.

This process is usually organizationally centered whenever organizations try to achieve strategic fit with a peripheral business environment (Zajac et al., 2000). There are some insights shed by contingency factors of firm size and strategic environment about the strategical orientations of organizations to tackle Covid 19 disruptions. We examined Covid 19 as a strategic context that keeps changing over time. Multiple corona waves spread around the globe from the time of Covid 19 origin, along with the discovery of vaccines and massive vaccination drives. This constantly changing environment compels organizations to be more precarious while deciding on their strategic actions. In our research study, the contingency variables of the firm's size and ability to maintain safety stocks affect the organizational commands of the individual entity to achieve strategic fit under a specific Covid 19 context.

MEX 1 and MEX 6 make decisions on strategy formulation based on worst-case scenario conventions. Director operations at MEX 6 explained that

"Covid 19 is not a phenomenon that will eliminate instantly; instead, its time taking slow recovery process. The world has to develop ways to live with Covid 19. There is a need for evaluation of business practices. Covid 19 is now a hurdle we will face daily".

This primes to the perception that:

P1: Inclusion of worst-case scenario assumptions in the strategy formulation phase reduces the perceived supply chain uncertainty to an acceptable extent

We analyze the outcomes with the notion that risk is not a substitute for uncertainty but rather a consequence of an uncertain situation (March & Shapira, 1987). Our findings suggest that the firm's size determines the strategy of the firm to manage risks caused by Covid 19 disruptions. During the pandemic, contracting firms tend to take a passive strategy. However, for longer terms, Medium-sized enterprises consider a wait-and-see strategy as the appropriate course of action, while Large organizations move towards reactive strategies. This decision choice is the number of resources and financial stability of organizations that can be taken at risk to mitigate uncertainties. Firms with less tolerance for the anticipated loss of resources during risk management tend to be safer when deciding their strategies. The capacity to be more reactive while managing disruptions depends on the number of resources a firm can stake for possible returns. This conception primes us to propose that:

P2: The strategy to manage pandemic Covid 19 disruptions varies with the size and resources of firms.

P3: Disruption risks need to decline to tolerable levels before a firm invests in diminishing the supply chain risks.

These perceptions draw the following empirical model of strategies for supply chain uncertainty caused by the Covid-19 pandemic (Fig 2)

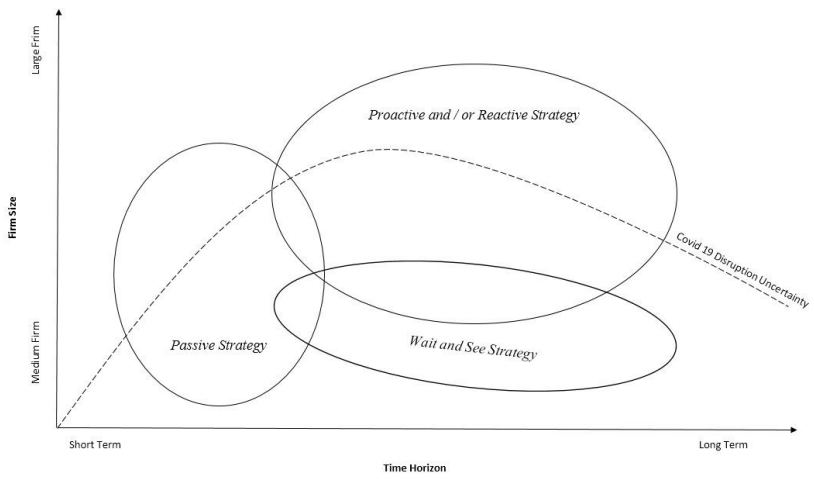

Figure 2: Strategical model for firms managing supply chain risks raised by Covid 19

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The implications and execution of risk management strategies may vary from one industry to another due to changing operations structure and Product outcomes. This study explored the strategies used by Construction Industry in response to the uncertainties caused by Covid 19. However, this research could duplicate in other industries as well to validate the findings. Moreover, the uncertainties arising due to other geo political reasons such as war, natural disasters or financial crisis could be the main theme of research for future studies. The elements of investigation that includes the size of the firm as focal element of organizational differentiation could be replicated with Firm Structure, scope of business and market dynamics. Any future exploration from the perspective of different theoretical lens could also add valuable insights to the body of knowledge.

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