Applying the Resource Dependence Theory to Enhance Supply Chain Management of Small and Medium Scale Enterprises (SMEs) in the Context of Covid-19

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ABSTRACT

The Covid-19 pandemic had deeply affected supply chain management across industries, necessitating firms to redefine their strategies to reduce the risk and imbalance caused by the disruption. The study highlights how external risk factors have influenced the internal and organizational factors of the small and medium enterprises (SMEs) in dealing with their supply chain disruptions. We applied the resource dependence theory to illustrate this aspect and also to understand the factors that impact supply chain management. The study applied the interpretive structural modelling (ISM) methodology and Cross Impact Matrix Multiplication Applied to Classification (MICMAC) methodology to understand the inter-dependence relationship between these factors of risk in supply chain management during Covid-19. Our study was specific to the ongoing COVID 19 pandemic as the external factor disrupting supply chains and impacting a firm's internal and organizational factors in dealing with the impact. Our results showed that external factors deeply influence the internal factors governing supply chain management, which in turn, impact firm performance.

Keywords: supply chain management, resource dependency theory, covid-19, small and medium enterprises, decision making

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INTRODUCTION

Supply chain management (SCM) is an activity that can give an organization the much-needed competitive edge in the market (Ivanov, 2020). Enterprises, therefore, give much thought to designing and implementing best supply chain management practices to reduce costs, improve efficiencies and achieve competitive advantage. However, the best laid plans go awry due to the vagrancies of nature or unforeseen circumstances, as illustrated in the case of the ongoing COVID 19 pandemic (Ivanov, 2020).

The literature categorizes supply chain risks into two types namely, disruption risks and operational risks (Dolgui & Sokolov, 2018). Disruption risks refer to the risks that emanate from the external environment and disrupt supply chain management. Operational risks, on the other hand, are those associated with demand fluctuations or lead-time changes in supply chain management (Hosseini et al., 2019; Hald et al., 2019). Recent times has witnessed disruptions due to pandemic, which have had high ripple effects of uncertainty on SCM (Ivanov, 2020). Recent studies have also demonstrated the various impacts of a pandemic situation on the supply chain and how competitive organizations redefine their SCM strategies to maintain the flow of products and services to manufacturers and customers (Natarajarathinam et al., 2009; Scott & Rutner, 2019; Ivanov, 2020).

The current COVID 19 pandemic has caused severe disruptions to business operations, with 94% of the top 100 ranked firms reporting negative business growth (Belhadi et al., 2021; Kulkarni et al., 2021). The biggest causality of the pandemic has been supply chain management (Araz et. al., 2020) largely attributable to the stringent national lockdowns called worldwide to contain the virus. The disruption has caused an imbalance between demand and supply in the industry (Dolgui & Sokolov, 2018; Reusken et al., 2020) providing fodder for more research in the area.

To tackle these problems, SMEs have formed partnerships with local suppliers and logistics companies, used digital technologies for inventory management, and focused on developing high-demand products. The Indian government has launched initiatives to promote self-reliance and boost domestic production. Nevertheless, more support in the form of financial assistance, credit guarantees, and policy reforms is needed to help SMEs

bounce back and revive the country's economy (Sube et al.,2021; Kumar, Sharma & Pandey, 2021; Dohale, Verma, Gunasekaran, & Ambilkar, 2023).

The existing literature has emphasized on the need for the following in the context of supply chain management (a) robotics (Nair & Vidal, 2011; Simchi-Levi et. al., 2018) (b) Improved infrastructure (Spiegler et al., 2012; Hosseini et al., 2019). (c) logistics and vendor management (Ho et al., 2015; Wieland & Wallenburg, 2012) and (d) technology adoption (Kern et al., 2012; Kirilmaz & Erol, 2016). The studies are not just restricted to large enterprises but include small and medium enterprises (SMEs).

The resource dependence theory is a befitting theory to understand the impact of the pandemic on supply chain management, as this theory studies the impact of external resources on the organizations (Pfeffer, 1987). COVID 19 pandemic has impacted the supply chain management of the organizations. Hence, a study through the lens of resource dependence theory would provide an insight on the impact of resources on supply chain management, especially in the face of disruptions, as caused by the current COVID 19 pandemic.

This theory states that a firm's ability to sustain itself in the business environment depends on its ability to obtain critical resources from the external environment and thereby reduce the uncertainty of its business functions (Pfeffer & Salancik, 2003). The theory emphasizes on the use of external sources and means to reduce risk stating that firms should identify resources from external sources and transact them for their internal processes (Pfeffer, 1987). In line with this argument, this study applied the resource dependency theory to analyse the crucial factors that firms should adopt to streamline their supply chain management practices in the face of the disruptions caused by Covid-19.

In India, small and medium scale enterprises contribute 30.27% of revenue to the economy (Singh et al., 2020). About 95% of the enterprises in the manufacturing sector are small and medium-scale enterprises (Singh et al., 2020). This study, therefore, selected SMEs to investigate the SCM factors that influenced their supply chains during the Covid-19 pandemic in India, based on the three domains of the resource dependence theory, namely, internal factors, external factors and organizational factors. It also adopted

the interpretive structural modelling (ISM) methodology and Cross-Impact Matrix Multiplication Applied to Classification (MICMAC) methodology to understand the inter-dependence relationship between these factors.

LITERATURE REVIEW

Extensive studies have been conducted in the area of supply chain management in the context of small and medium enterprises. The literature review is divided into two sub-sections: supply chain management in SMEs and, supply chain management in the times of the Covid-19 pandemic.

Supply Chain Management and Small and Medium Enterprises (SMEs)

Supply chain management is developed on the framework of logistics and seeks to achieve linkage with other entities in the organization, i.e. suppliers, customers and the organization (Christopher & Ryals, 2014).

The main focus of the supply chain management is management of relationships among the different entities among the supply chain management in order to achieve a more profitable outcome for all parities in the chain (Christopher & Ryals, 2014). The supply chain network includes purchasing, contract design, and storage; and the relationship side includes customer relationship and communication among the members of supply chain management teams (Paolo Brandimarte & Giulio Zotteri, 2007). Small and medium enterprises (SME) in India operate in a highly challenging and competitive market (Kumar et al., 2014; Kulkarni et al., 2020). Therefore, it is very important for these firms to effectively manage their supply chain to remain relevant in the market (Kumar et al., 2014; Kulkarni et al., 2020).

Studies elaborate on some of the characteristics that define Indian small and medium enterprises (SME) (Singh & Kumar, 2020; Kumar et al., 2014; Goncalves et al., 2021; Kulkarni et al., 2020) with special focus on the intense pressure they face from global competition and technology revolutions. SMEs in India are in the evolution stage with regards to the latest smart technologies related to Industry 4.0. Then again, they are more confined to the domestic market and have little presence in the international

market (Sener et al., 2019). The following challenges are unique to their supply chain management: fluctuation in the price of the raw material, which influences the production and cost of manufacturing (Wiengarten et al., 2016); lack of financial support to upgrade supply chain and manufacturing technologies (Sener et al., 2019); and the impact poor demand forecasting, logistics management, and poor communication among the suppliers, manufacturing units, and other members of the supply chain management (Punniya Moorthy et al., 2013).

Existing studies on SCM in the context of SMEs delve more on relationship management as a means to reduce risk (Tokarz et al, 2021). These studies suggest that SMEs can reduce their risk by (1) strengthening their bonds with their suppliers to win their loyalty (2) implementing suppliers' improvement programs (3) ensuring better inventory management (4) building strategic alliances with vendors and (5) implementing effective forecasting techniques (Goncalves et al., 2021).

However, these measures are more applicable to the pre-COVID 19 scenario; the post scenario requires a re-analysis to glean insights and, recommend measures to deal with supply chain disruptions. Accordingly, this study aimed to add to the existing literature enriching it with new insights derived from the evolving situation.

Supply Chain Management and Covid 19

Supply chain management is a well-established research subject in the area of operational management with much focus on economic, environmental, and human resources (Hallinger, 2020). Uncertain business environments attributable to disasters such as recession, floods, climate change have affected businesses and their supply chains in the past (Song, 2018) however, the currentCovid-19 crisis is of an unprecedented magnitude, affecting life and activity worldwide (Sarkis, 2021) and requiring enterprises to redefine how they conduct their business activities. Supply chains have been under immense pressure to supply essential medicines and other products for essential day to day consumption (Chowdhury et al., 2020). The Covid -19 pandemic has completely disrupted the supply chains, creating a mismatch between demand and supply (Guan et al., 2020).

To mitigate these challenges, SMEs have turned to digital technologies such as cloud-based inventory management systems and formed partnerships with local suppliers and logistics companies. However, SMEs in India also faced reduced demand for non-essential items, forcing them to adapt their production processes to meet changing demand patterns. The literature suggests that SMEs in India can overcome these challenges by adopting agile and flexible supply chain strategies, leveraging digital technologies, and developing products and services that are in high demand during the pandemic, such as medical equipment and hygiene products. The Indian government has also launched several initiatives to support SMEs, including financial assistance and credit guarantees, to help them access credit and manage their cash flow. Overall, the literature emphasizes the importance of managing the supply chain effectively during the pandemic, as SMEs play a crucial role in the Indian economy (Sube et al., 2021; Kumar, Sharma & Pandey, 2021; Dohale, Verma, Gunasekaran, & Ambilkar, 2023)

While the full economic impact of the pandemic has yet to be gauged, it has come to light that the SME supply chain has been greatly affected by the shortage of labour and transport caused due to the various periods of lockdowns called at the national and state levels. At the other end, consumer confidence has significantly declined leading to a drop-in demand for products (Juergensen et al*.,* 2020).

SMEs from all sectors have experienced the effect of Covid-19 on production and their supply chain management, resulting in reduced capacity utilization and financial constraints. Reduced or complete halt in production during the various lockdowns have also impacted supply chain management (Shih, 2020).

Further, it is believed that product demand may increase in the short-run, requiring SMEs to increase their production and once again redefine their SCM strategies in tune with the evolving situation (Chowdhury et al., 2020). In other words, the SMEs have to be constantly observant of the circumstances as they evolve and redefine their SCM practices accordingly (Van Hoek, 2020).

It is clear from the above discussion that supply chain has been severely affected by Covid-19, mandating SMEs to constantly redefine their supply

chain practices in tune with the ground situation in order to reduce risk and fulfil demand. Second, their financial resources have been adversely impacted, severely affecting their ability to match production with demand. In sum, the pandemic has greatly increased SCM risks for SMEs putting pressure on their margins.

THEORETICAL FRAMEWORK: THEORY AND FACTORS RELATED TO SUPPLY CHAIN MANAGEMENT AND COVID-19

The unprecedented Covid-19 pandemic has put businesses in turmoil affecting supply chains worldwide. While factors impacting supply chain management have been extensively studied, this study puts under the lens the impact of the pandemic on supply chains of SMEs in India to unearth new insights using the resource dependence theory.

Resource Dependence Theory

The existing literature has studied how disaster-like situations have impacted supply chain management and how enterprises have efficiently countered them to maintain their bottom lines and as also retain customer loyalty (Wang et al., 2016; Kaur et al., 2019; Song, 2018). However, the unprecedented scope and reach of the ongoing COVID 19 pandemic makes it different from other such disasters, prompting a need to decipher how it has impacted supply chains in small and medium enterprises. The resource dependence theory states that firms depend on an external resource to seek inputs and act to reduce this dependence.

The resource dependence theory the theory posits that firms depend on external actors for access to vital inputs such as materials, labour, and cash (Pfeffer & Salancik, 1978). Dependence creates uncertainty because the smooth flow of resources from outside actors (e.g., suppliers) can be obstructed due to their personal circumstances, whims or failure. Firms respond by pursuing strategies and structures that reduce, minimize or even eliminate their dependence on external entities. As such, the resource dependence theory is a natural fit with supply chain research (e.g., Jean & Sinkovics, 2012; Ruel et al., 2020).

Based on the discussions above, it becomes clear that of all these theories, the resource dependence theory is best suited for the problem at hand that is, identifying the internal and external risk factors that can deeply impact the SCM of SMEs, with specific reference to the Covid-19 pandemic.

Factors related to the resource dependence theory and supply chain management

Industrial trends such as outsourcing, supply base reduction, just-in-time, shorter product life cycles and changing technology is supply chain have increased organizations exposure to supply chain risks (Trkman et al., 2016). These risks have major consequences for the organizations including financial and operational problems (Rajesh et al., 2015). The role of supply chain management is critical to understand the risk in the supply chain by assessing using data and expert judgment (Cohen & Kunreuther, 2007). This means that risk assessment can be formal or informal and quantitative or qualitative (Zsidisin et al., 2005).

Gaudenzi and Borghesi (2006) argued risk assessment is inherently subjective as each analyst has his/her own concept of what constitutes a risk and of the nature of upstream/downstream relationships. Tsai et al. (2008) concluded that combining objective data and subjective perception might result in a more robust construction of risks, which in turn would improve the effectiveness of risk prediction and assessment.

In assessing risk, the following factors should be considered Internal Factors, External factors, and Organizational factors (Fan & Stevenson, 2018). The internal factors risk are those risks which influence the supply chain due to organizational factors, these internal factors are supplier selection, process flexibility, supply chain process coordination, technology, work ethics and working environment (Paul et al., 2020; Jahre, 2017; Kumar and Singh, 2017; Dubey et al., 2020; Modak et al., 2020; Narimissa et al., 2020).

External factors of risk are those factors which influence the supply chain due to external factors of business, these factors are supplier flexibility, price and cost fluctuations, market performance and business continuity (Bhat & Sharma 2020; Um & Han,2021; Reimann et al., 2021; Narimissa et al., 2020).

Organizational factors are those which are related to overall factors associated with organization such as influence of supply and demand uncertainty and response of the organization to changing business environment (Um & Han, 2021; Dubey et al., 2020).

The study applied the resource dependence theory to understand the risk factors affecting supply chain of SMEs during the COVID 19 pandemic. The resource dependence theory which posits that firms depend on external actors for access to vital inputs such as materials, labour, and cash (Pfeffer & Salancik, 1978). The details of these factors are presented in Table 1.

Table 1: Factors Related to SCM and SMEs

	Factors	Description	Source
Internal Factors	Supplier Selection	Supplier selection process considering sustainable performance to meet environmental, economic, and social objectives	Paul et al., 2020
	Process Flexibility	Ability to identify and monitor possible disruptions in the supply chain and take appropriate action to reduce the impact of the disruption	Jahre, 2017
	Process Coordination	Additional coordination required to cater to information asymmetry, and possible disagreements between supply chain partners	Kumar and Singh, 2017
	Technology	IT setup required to ensure seamless information dissemination between supply chain partners	Dubey et al., 2020
	Work Ethics	Fair pricing, adherence to commitments	Modak et al., 2020
	Working Environment	Working conditions at the workplace of supply chain partners	Narimissa et al., 2020
External Factors	Supplier Flexibility	The ability of the supplier to cater to demand changes	Bhat and Sharma 2020
	Price and Cost Fluctuations	Accommodation of price fluctuations due to market conditions and cost fluctuations to ensure that quality and delivery are maintained	Um and Han,2021
	Market Performance	Ensuring existing processes can cater to disruptions and sustaining market share	Reimann et al., 2021
	Business Continuity	The ability of the supply chain partners to ensure business continuity during unforeseen disruptions	Narimissa et al., 2020
Organizational Factors	Supply and Demand Uncertainty	Uncertainty due to inaccurate demand forecasting, unanticipated demands, and improper capacity utilization (overutilization or underutilization)	Um and Han,2021
	Response Capability	Ability to provide an appropriate response to demand changes reasonably and quickly	Dubey et al., 2020

METHODOLOGY

The current study used the Interpretive Structural Modelling (ISM) technique to study the interrelationships between the identified critical success factors (CSF); and the Matrice impacts Crosses Multiplication methodology to analyse their driving and dependence power. The ISM-MICMAC methodology is quite popular and has found application in various studies related to Industry 4.0 technologies (Kamble et al., 2021; Kulkarni et al., 2021), adoption of m-commerce by SMEs (Rana et al., 2019), digital government services (Behnke et al., 2020), and information systems projects (Hughes et al., 2019) to name a few. The ISM-MACMAC methodology is discussed in detail in this section.

Interpretive Structural Modelling (ISM)

The ISM methodology was first proposed by Warfield (1974) to study the interrelationships between various socioeconomic factors. Academicians and practitioners have often used it to study the interrelationships among factors and glean insights. The ISM methodology, as outlined by Warfield (1973), is as under:

1. *Identify criteria*: The CSFs are identified based on their relevance to the problem under consideration and can have a direct or indirect influence on it. They are identified from existing literature or through exploratory studies, and then validated by a team of experts.

2. *Establish contextual relation between the CSF*: The team of experts, who validate the CSF, also identify the contextual relationships among them. The relationships could be comparative, neutral, influencing, or temporal (Pfohl et al., 2011).

3. *Construct structural self-interaction matrix (SSIM)*: This is the most critical step of the entire ISM methodology. A pair wise comparison is done to construct the SSIM. The experts define the pair wise relationships between the CSF, which are then represented as V, O, X and A.

4. *Develop the initial reachability matrix*: The values V, O, X and A are replaced by binary values 0 and 1 to convert the SSIM to the initial reachability matrix.

5. *Develop the final reachability matrix*: The initial reachability matrix must be checked for transitivity. The transitivity rule states that if a variable X affects another variable Y and if Y affects another variable Z, then X affects Z. The outcome of resolving transitivity is the final reachability matrix.

6. *Create the digraph*: The final reachability matrix helps in identifying different levels for grouping the results into four critical success factors, which are then used to draw a directed graph or digraph. The development of digraph involves a step-wise elimination of transitive relationships by examining their interpretation. However, the ones that are critical to the problem under study are retained.

7. *Create the ISM diagram*: The ISM diagram is created from the digraph by replacing the variable nodes with statements. The diagram is then checked for conceptual inconsistencies.

MICMAC Analysis

The MICMAC analysis is based on multiplication properties of matrices (Sharma & Gupta, 1995). The primary objective of a MICMAC analysis is to analyse the driving and dependence power of the CSFs. Based on the above analysis, the CSFs are categorised into autonomous, dependent, linkage or relay, and independent CSF. These categories are detailed as under:

1. *Autonomous CSF*: These CSFs have weak dependence and driving power, and zero influence on the total system.

2. *Dependent CSF*: These have weak driving power compared to the other CSFs and are influenced by the independent CSFs.

3. *Linkage CSF*: Also known as the relay CSF, these CSFs have both strong driving and dependence power. They are usually unstable and

hence any action taken on any one them can have significant impact on the other CSF.

4. *Independent CSF*: These have strong driving power but weak dependence power. These CSFs are high priority and should be suitably handed.

Application of the Proposed Methodology

This section outlines the research process executed along with details on data collection and analysis made using the ISM-MICMAC methodology. Figure 1 outlines the proposed methodology.

Data collection: To apply the ISM methodology, it was necessary to understand the CSFs related to the study. For the purpose of the study, initially experts in the domain of supply chain in SMEs were identified and risk factors in supply chain due to Covid-19 were discussed with these experts. The experts suggested including experts from SMEs, owners of SMEs, consultants in supply chain and academicians in the domain of supply chain. The expert team size of 12 members met the group size requisite for conducting exploratory studies, as outlined by (Kamble et al., 2018). The details on the background of experts who attended brainstorming sessions are as shown in Table 2. The study adopted the brainstorming method due to the fact that it is one of the most effective methods for creative problem solving, resolve biases among participants and reach consensus (Rawlinson, 1981). The details with regards to demography of experts are presented in Table 2.

Table 2: Demography of expert for Brainstorming Session

Business Sectors	N	Percentage
Foundry Sector	4	33.33%
Pharmaceutical	2	16.67%
Auto Components	4	33.33%
Textiles	2	16.67%
Total	12	100.00%
Designation of the Experts	N	Percentage
Supply Chain Manager	3	25.00%
Founders of SME	3	25.00%
Supply Chain Consultant	4	33.33%

Academicians	2	16.67%
Total	12	100.00%
Experience of the Experts	N	Percentage
11-15 Years	3	25.00%
15-20 Years	5	41.67%
20-25 Years	2	16.67%
25 Years and above	2	16.67%
Total	**12**	**100.00%**

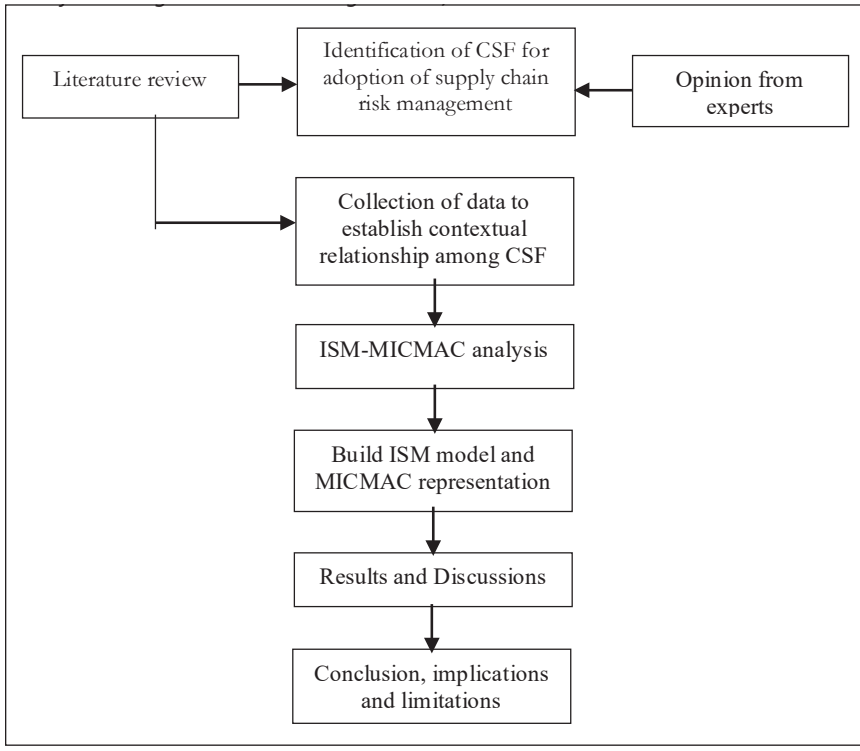

Figure 1: Research Methodology framework

ISM analysis

Developing the SSIM: The team of experts also defined the contextual relationships between the selected pairs of the twelve CSFs Based on which the SSIM was constructed. As outlined in Section 4.1 (c), four symbols V,O,X and A were used to identify the contextual relationships, as under:

V: CSF_i will facilitate attainment of CSF_j
A: CSF_j will facilitate attainment of CSF_i
O: CSF_i and CSF_j do not demonstrate any relation
X: CSF_i and CSF_j help in attainment of each other

The SSIM matrix is developed based on expert opinion. Based on their responses, CSF 5 i.e., "Process flexibility" leads to CSF 11 i.e., "Working environment" and is, therefore, represented by the symbol 'V'. Similarly, CSF 3 i.e., "Response capability" aids CSF 1 i.e., "Supply and demand uncertainty" and is, therefore, represented by the symbol 'A'. Also, CSF 7 i.e., "IT Setup" and CSF 10 i.e., "Business continuity" help each other and so are represented by the symbol 'X'. Further, CSF 2 i.e., "Supplier selection" and CSF 9 i.e., "Market share performance" do not demonstrate any relationship, which is symbolized by 'O'. This process is followed to denote symbols for mutual relationships of all the CSFs and the final SSIM is generated, as shown in Table 3.

Table 3: Structural self-interaction matrix (SSIM)

	C12	C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1
C1	O	O	O	O	O	A	O	O	O	A	O	1
C2	O	O	O	O	O	A	O	O	O	O	1	
C3	O	X	X	O	O	X	O	A	O	1		
C4	A	A	A	A	O	X	A	X	1			
C5	A	V	V	A	O	V	X	1				
C6	A	X	X	O	O	O	1					
C7	O	X	X	O	O	1						
C8	O	V	V	O	1							
C9	A	X	X	1								
C10	O	X	1									
C11	A	1										
C12	1											

Developing the initial reachability matrix: Once the SSIM was developed, the next step was to develop the initial reachability matrix by replacing the symbols V, A, O and X with '0' and '1'. This replacement was done based on the following rules:

1. If the SSIM (i,j) entry is represented by V, then the (i,j) value in the initial reachability matrix is entered as "1" and the corresponding (j,i) value is entered as "0".
2. If the SSIM (i,j) entry is represented by A, then the (i,j) value in the initial reachability matrix is entered as "0" and the corresponding (j,i) value is entered as "1".
3. If the SSIM (i,j) entry is represented by O, then both the (i,j) and their corresponding (j,i) values in the initial reachability matrix are entered as "0".
4. If the SSIM (i,j) entry is represented by X, then both the (i,j) and their corresponding (j,i) values in the initial reachability matrix are entered as "1".

Accordingly, the initial reachability matrix was developed and is shown in Table 4. Developing the final reachability matrix: The initial reachability matrix was next checked for transitivity. The transitivity check was done, as detailed in the research methodology section 4.1(e). The outcome of the transitivity check was the final reachability matrix, as represented in Table 5. The final reachability matrix was used for level partitioning of the CSF to create the ISM hierarchical structure. The matrix was also used to calculate the driving and dependence power. This would be useful during the MICMAC analysis.

Table 4: Initial Reachability Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
C1	1	0	0	0	0	0	0	0	0	0	0	0
C2	0	1	0	0	0	0	0	0	0	0	0	0
C3	1	0	1	0	0	0	1	0	0	1	1	0
C4	0	0	0	1	1	0	1	0	0	0	0	0
C5	0	0	1	1	1	1	1	0	0	1	1	0
C6	0	0	0	1	1	1	0	0	0	1	1	0
C7	1	1	1	1	0	0	1	0	0	1	1	0
C8	0	0	0	0	0	0	0	1	0	1	1	0
C9	0	0	0	1	1	0	0	0	1	1	1	0
C10	0	0	1	1	0	1	1	0	1	1	1	0
C11	0	0	1	1	0	1	1	0	1	1	1	0
C12	0	0	0	1	1	1	0	0	1	0	1	1

Table 5: Final Reachability Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
C1	1	0	0	0	0	0	0	0	0	0	0	0
C2	0	1	0	0	0	0	0	0	0	0	0	0
C3	1	1*	1	1*	0	1*	1	0	1*	1	1	0
C4	1*	1*	1*	1	1	1*	1	0	0	1*	1*	0
C5	1*	1*	1	1	1	1	1	0	1*	1	1	0
C6	0	0	1*	1	1	1	1*	0	1*	1	1	0
C7	1	1	1	1	1*	1*	1	0	1*	1	1	0
C8	0	0	1*	1*	0	1*	1*	1	1*	1	1	0
C9	0	0	1*	1	1	1*	1*	0	1	1	1	0
C10	1*	1*	1	1	1*	1	1	0	1	1	1	0
C11	1*	1*	1	1	1*	1	1	0	1	1	1	0
C12	0	0	1*	1	1	1	1*	0	1	1*	1	1

Level partitioning: Based on the guidelines given by Warfield (1974), the reachability set and the antecedent set were identified for each CSF. The reachability set for each CSF contained the CSF itself, along with the other CSFs. The antecedent set for each CSF contained that CSF itself along with other CSFs that help in achieving it. In the next step, the intersections of both the reachability set and the antecedent set for each CSF are obtained. The CSFs for which both the reachability and the antecedent sets were identical, enjoyed the top position and are therefore, allotted to the 1st level in the ISM model (Kannan & Haq, 2007). Table 6 outlines level 1 after the first iteration. The table shows that CSF "supply and demand uncertainty", "supplier selection" and "process coordination" are identified as the top CSFs and are allotted to level 1.

Once the 1st level was identified, the allotted CSFs were eliminated. The same steps were carried out for the second iteration to identify the CSFs that form the next level. These iterations were carried till each CSF was allotted to a specific level. Table 7 displays the 5 levels that were thus created.

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Table 6: Level Partition at iteration 1

Components	Reachability Set	Antecedent set	Intersection set	Level
1	1	1,3,4,5,7,10,11	1	I
2	2	2,3,4,5,7,10,11	2	I
3	1,2,3,4,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,6,7,9,10,11	
4	1,2,3,4,5,6,7,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,10,11	
5	1,2,3,4,5,6,7,9,10,11	4,5,6,7,9,10,11,12	4,5,6,7,9,10,11	
6	3,4,5,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,9,10,11	I
7	1,2,3,4,5,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,9,10,11	
8	3,4,6,7,8,9,10,11	8	8	
9	3,4,5,6,7,9,10,11	3,5,6,7,8,9,10,11,12	3,5,6,7,9,10,11	
10	1,2,3,4,5,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,9,10,11	
11	1,2,3,4,5,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,9,10,11	
12	3,4,5,6,7,9,10,11,12	12	12	

Table 7: The complete partition

Components	Reachability Set	Antecedent set	Intersection set	Level
1	1	1,3,4,5,7,10,11	1	I
2	2	2,3,4,5,7,10,11	2	I
6	3,4,5,6,7,9,10,11	3,4,5,6,7,8,9,10,11,12	3,4,5,6,7,9,10,11	I
3	3,4,7,9,10,11	3,4,5,7,8,9,10,11,12	3,4,7,9,10,11	II
4	3,4,5,7,10,11	3,4,5,7,8,9,10,11,12	3,4,5,7,10,11	II
7	3,4,5,7,9,10,11	3,4,5,7,8,9,10,11,12	3,4,5,7,9,10,11	II
10	3,4,5,7,9,10,11	3,4,5,7,8,9,10,11,12	3,4,5,7,9,10,11	II
11	3,4,5,7,9,10,11	3,4,5,7,8,9,10,11,12	3,4,5,7,9,10,11	II
5	5	5,9,12	5	III
8	8	8	8	III
9	9	9,12	9	IV
12	12	12	12	V

The ISM model: Using the level partitions represented in Table 6, a hierarchical model was generated, as shown in Figure 2. This model represented the interdependency between CSFs and CSF_i by an arrow pointing from CSF_i to CSF_j. The output generated was called the digraph, which finally takes the shape of the ISM model for the identified CSFs. The model accounted for the transitivity rule, as detailed earlier.

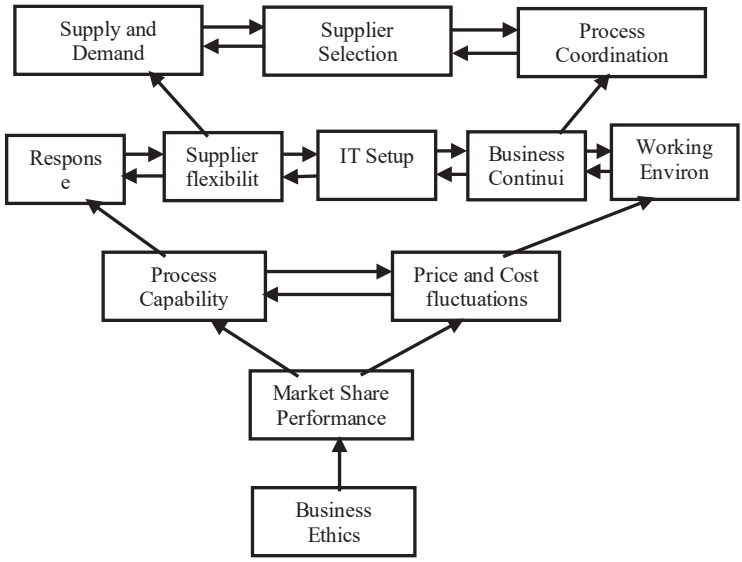

Figure 2: ISM Model for the Identified CSF

For the ISM model, it can be seen that CSF "Business ethics" was positioned at the bottom due to its high driving power and low dependence power. Also, the CSFs "Supply and demand uncertainty", "Supplier selection" and "Process Coordination" had high dependence and found themselves at the top of the ISM structure. The final ISM model is shown in Figure 2.

MICMAC analysis

As outlined earlier, the MICMAC analysis used the driving power and dependence power of each CSF and categorised them as autonomous, dependent, linkage and independent CSF. The final reachability matrix (Table 4) was used to analyse the driving and dependence power for each CSF. The outcome of this analysis is presented in Table 8. Figure 3 represents the power diagram generated based on the MICMAC analysis.

Table 8: MICMAC Analysis

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	Driving Power
C1	1	0	0	0	0	0	0	0	0	0	0	0	1
C2	0	1	0	0	0	0	0	0	0	0	0	0	1
C3	1	1	1	1	0	1	1	0	1	1	1	0	9
C4	1	1	1	1	1	1	1	0	0	1	1	0	9
C5	1	1	1	1	1	1	1	0	1	1	1	0	10
C6	0	0	1	1	1	1	1	0	1	1	1	0	8
C7	1	1	1	1	1	1	1	0	1	1	1	0	10
C8	0	0	1	1	0	1	1	1	1	1	1	0	8
C9	0	0	1	1	1	1	1	0	1	1	1	0	8
C10	1	1	1	1	1	1	1	0	1	1	1	0	10
C11	1	1	1	1	1	1	1	0	1	1	1	0	10
C12	0	0	1	1	1	1	1	0	1	1	1	1	9
Dependence	7	7	10	10	8	10	10	1	9	10	10	1	

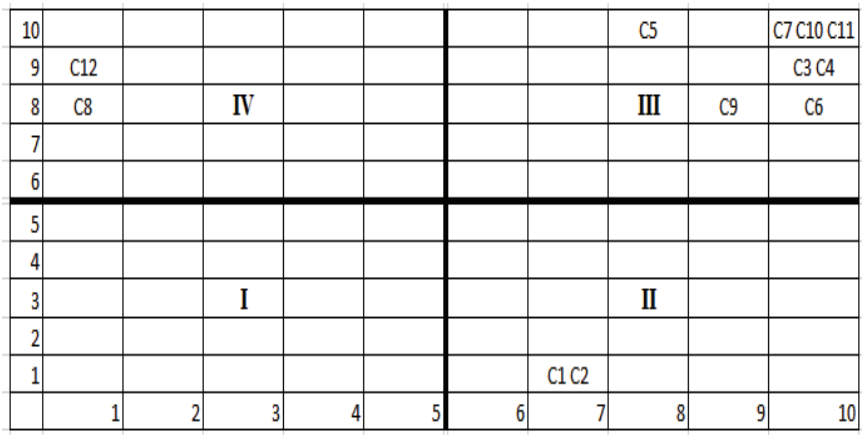

Figure 3: MICMAC Analysis Representation

Sector I: This sector represents the Autonomous CSF. Figure 3 indicated that there were no CSFs in this sector, signifying that all the identified CSF had either significant influence or hinder the adoption of supply chain risk management processes.

Sector II: This sector indicated the dependent CSFs that had considerably weak driving power and are significantly influenced by independent CSFs. Figure 3 shows that CSF1 i.e., “Supply and demand

uncertainty" and CSF 2 i.e., "Supplier selection" had high dependence but weak driving power. These CSFs must be specially monitored and handled appropriately.

Sector III: This sector represented the Linkage CSFs that had both strong driving power and dependence power. Figure 3 shows that the CSF3i.e. "Response capability", CSF4 i.e., "Supplier flexibility", CSF5 i.e., "Process flexibility", CSF6 i.e., "Process coordination", CSF7 i.e., "IT setup", CSF9 i.e., "Market share performance", CSF10 i.e., "Business continuity" and CSF11 i.e., "Working environment" have strong driving as well as dependence power. These CSFs would affect other CSFs and also had a closed-loop impact on them. Any action taken on these CFS i.e., internal, external and organizational should be carefully planned.

Sector IV: All the independent CSF are indicated in this sector. These independent CSF have weak dependence power but were strong drivers. Figure 3 indicates that CSF 8 i.e., "Price and cost fluctuations" and CSF12 i.e., "Business ethics" are strong drivers. This was also evident from the ISM model in which CSF12 i.e., "Business ethics" is placed at the bottom due to its high driving power and weak dependence power. Practitioners should focus on this CSF on high priority.

DISCUSSION

The empirical results highlighted the need to adopt supply chain risk management processes during Covid -19. Munir et al., (2020) argue for the need to understand the challenges organizations face in effectively managing their supply chains. A review of the literature showed that information is scant on the consequences of Covid-19 on supply chain management and how organizations should deal with the uncertain scenario.

Supply chain management has in the past witnessed challenges from unforeseen disasters such as floods, war, drought, and recession (Sahin and Robinson, 2002). But the present situation is influenced by a more serious pandemic and has a long-term influence on the supply chain management of the organizations (Craighead et al., 2020). Under these circumstances, we argue that the resource dependence theory is more relevant for understanding the risks in supply chain management and Covid -19.

Previous studies (Teixeira et al., 2020; Kamble et al., 2018; Wieland, 2021) have found that any period of crisis presents an opportunity for managers to re-evaluate and redefine their SCM best practices in tune with the evolving situations. From the perspective of academic studies, there is a need to create a research agenda for supply chain management research on pandemics by considering its key tenants. Therefore, to provide more insights from the perspective of industry and academics, we integrate the resource dependence theory and supply chain management to explain the risks of Covid-19 on supply chain management. We have further outlined our main findings as: Firstly, the risk in supply chain is related to external factors of SCM, which influence an SME's performance in the market. The two main categories of risk associated with supply chain are disruption risk and operational risks (Dolgui & Sokolov, 2018). Recent times have witnessed disruptions due to pandemic, which have had high ripple effects of uncertainty on SCM (Ivanov, 2020). Secondly, organizational factors related to supply chain management, i.e., supply and demand uncertainty are dependent on the internal factor, supplier selection. Thirdly, there is a relationship between the organizational and the internal factors such as process flexibility, process coordination, technology, and work environment. Fourthly, the ethics in supply chain management have a direct impact on the price fixation in the open market and the cost of supplies from the suppliers in the supply chain management.

Contrary to our expectations, the present study found that supply chain management in SMEs during this pandemic created an imbalance between their demand and supply of components and products (Guan et al., 2020). We interpret from our study that the imbalance in SCM at SMEs can largely be attributed to their dependence on external factors which are beyond their control. Factors such as supplier flexibility and business continuity have a direct impact on the internal factors of SCM, such as process coordination, process flexibility, and working environment. The factors identified in the study are significantly different from the earlier research findings on SCM which are more focused up on cost and supplier selection (Kumar et al., 2014; Singh et al., 2012; Kaur & Singh, 2016; Song, 2018).

Similarly, the resource dependence theory brings forth two perspectives from the context of covid-19 and SCM. Firstly, from the perspective of external factors, there is fluctuation in the price of the components needed for

the manufacturing process (Mohammed et al., 2020), which then influences the internal and organizational factors. Secondly, from the perspective of organizational factors, an SME's response capability shows weaker independence, hence, the situation of Covid-19 has had the maximum impact on the SCM of SMEs. Therefore, these uncontrollable external factors pose a challenge for the SMEs.

The above discussion shows that SMEs in India follow the traditional methods of supply chain management, and are thus, deeply impacted by any change in the external environment. The COVID 19 pandemic has been one of the greatest disrupters of modern history and so its impact on the SCM of SMEs has been extremely significant.

IMPLICATIONS FROM THE STUDY

Theoretical Contributions

At the theoretical level, the resource dependence theory has extensively been applied in the study of supply chain management in the context of SMEs (see., Rehman et al., 2020; Walker et al., 2021; Craighead et al., 2020). However, these studies were conducted before the Covid-19 period, thus, providing the necessary motivation to use it to study the impact of the pandemic on the SCM of SMEs. Our study makes two contributions to the literature. First, it is one of the few research studies to collaborate the resource dependence theory and risk in SCM in SMEs during the Covid-19 period.

Previous studies have incorporated the resource dependence theory to study how (a) strategic relationships in logistics services help manufacturing firms to enhance the performance of their SCM (McMaster et al., 2020) (b) technology uncertainty influences resource dependence amongst the buyers' suppliers, and manufacturing (Xiao et al., 2020). (c) firms should plan before investing in green supply chain management practices for sustainable development positively impacts (Jawaad & Zafar, 2019). (d) external factors influence the internal factors of the supply chain management of SMEs (Kanyoma, Agbola & Oloruntoba, 2018). (e) SMEs can improve their supply chains through resource efficiency (Negi et al., 2021).

Second, the present study highlights the role of resource dependency theory to improve supply chain management in SMEs during the pandemic situation and business. The present study argues that internal resources such as process flexibility, process coordination, technology, work ethics and working environment (Alora & Barua, 2021; Mishra, Dutta & Kakoti, 2020) can help to correct the imbalance in demand and supply caused by external factors and prevent disruption of their supply chain.

Our study can be seen as the first attempt of its kind to identify the SCM practices for SMEs to follow in the face of the ongoing COVID 19 pandemic.

Managerial Implications

Our study provides insights that would be of great use to the supply chain managers in SMEs. Firstly, our findings provide insights for managers to understand how factors such as process flexibility, process coordination, and response capability can help to limit the supply chain disruptions caused by unnatural circumstances, in this case, the pandemic (An understanding of these factors would support intelligent decision-making in improving SC performance. Managers can also use the insights to plan and reduce their dependence for manufacturing

Secondly, findings show that the factor, high level of dependence on the supply and demand uncertainty my influence supplier selection. Thirdly, the pandemic situation has influenced business activities across the globe, including SCM. Going forward, strategic planning with regards to key components and products could help to reduce the risk and performance in supply chain management.

Fourthly, organizations have long-term association with supply chain partners. It is in the interest of the SMEs need to have long-term association with supply chain partners for efficient supply chain management during turbulent times.

LIMITATIONS OF THE STUDY AND FUTURE RESEARCH FOR THE STUDY

This study was triggered by the exponential rise in the interest in SCM in the context of SMEs in the Covid-19 pandemic situation. Despite the interest of both practitioners and academics, there is still a lack of theory-based research on the subject. To build on existing literature, the study seeks to identify and detail the role of these risk variables; SCM managers in SMEs can use the insights to their advantage. However, the study has its share of limitations. Firstly, it is based on the response of SME owners, consultants and other experts on SCM. The study is general in nature; further studies can be sector or domain-specific Secondly, the present study has only considered Indian SMEs. However, the pandemic is a worldwide phenomenon and so research based on other countries, both developed and developing, would add to the insights. Thirdly, our study provides empirical support for findings; however, additional research using case studies would further add to the literature.

CONCLUSION

In order to broaden the understanding of supply chain risk management process adoption in small and medium enterprises during Covid-19, this study seeks to investigate SCM risk management practices in SMEs, and also evaluate the resources and capability that SMEs need in order to respond and manage their SCM practices in the face of the disruption caused by the pandemic.

Our findings show that while the SCM practices followed by SMEs during the normal times, they could not cope with the disruption caused by the pandemic. As a result, there was a gap in supply and demand in the sourcing of raw material or providing the finished goods to the end customers. Within this context, evaluated the SMEs' resources and capabilities and how they could be leveraged to face the disruption. Our results indicate the capability to respond to the risk level posed by the current pandemic situation or any other unnatural situations, SMEs need direction and support from professional supply chain practitioners.

We used the resource dependence theory to analyse the factors. Our results show that external risk factors influence the organization's supply chain management, and in particular, process flexibility and manufacturing coordination. To offset the risk, SMEs could consider implementing advanced forecasting methods to anticipate and eliminate risk in their supply chains.

Overall, the results show that SMEs have to manage their internal risks to effectively manage their SCM in the face of Covid-19 in order to achieve higher performance and meet customer expectations.

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