

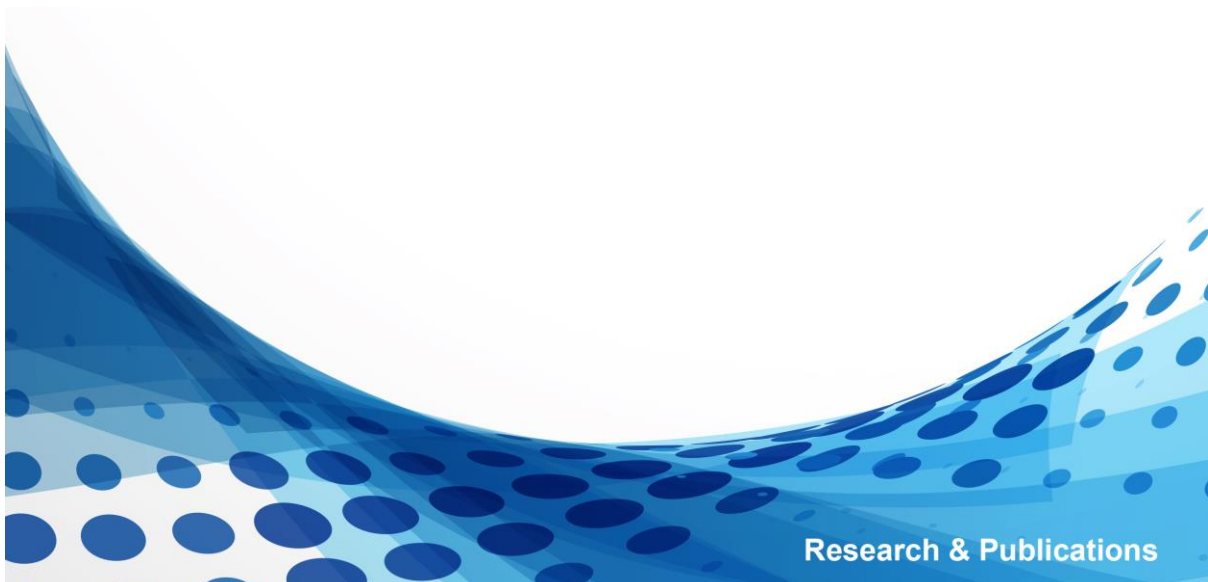


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Impact of COVID-19 disruptions on the Supply Chain: Insights from India

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Research & Publications

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Impact of COVID-19 disruptions on the Supply Chain: Insights from India

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Introduction:

The COVID-19 outbreak was declared as a Public Health Emergency of International Concern on 30th January 2020 and was declared as Pandemic on 11th March 2020 by World Health Organisation (WHO) (*WHO Director-General's Opening Remarks, 2020*). With this declaration, the struggle to keep a balance between life and livelihood started. The COVID-19 pandemic forced many countries to take extreme measures such as lockdowns to contain the spread of the disease. It is estimated that around 2.6 billion people were under some kind of lockdown during the initial phase of spread of COVID-19 pandemic (*Lockdown Is the World's Biggest Psychological Experiment, 2020*). In India, one of the most stringent lockdown among all the countries was imposed on 24th March, 2020 for 21 days (*Coronavirus in India, 2020*).

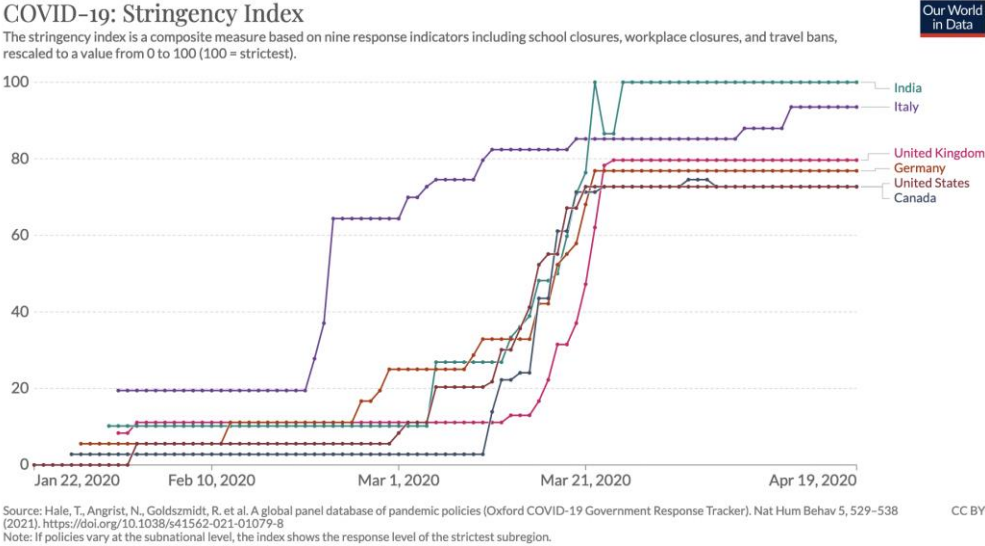


Fig 1: COVID-19 Stringency Index (Source: (Hale et al., 2021))

The closing of borders, restrictions imposed on trade and other containment measures resulted in the disruption of the supply chains (*Impact of COVID-19 on People's Livelihoods, Their Health and Our Food Systems, 2020*). From sourcing of raw materials to subdued demand added to the woes of the firms who were forced to recalibrate their strategy to counter the uncertain circumstances.

The firms faced many challenges such as lack of demand (*Kasliwal, 2020*), labour shortages (*Nag, 2020*). This hit the manufacturing and services industries both alike. The manufacturing activities contracted sharply in the month of April, 2020 when lockdown was imposed (*Suneja, 2020*). The IHS Markit index for manufacturing can be seen declining sharply in April, 2020 as compared to March, 2020. This also led to cost cutting in the production which further resulted in loss of jobs. As per CMIE data, the

unemployment rate in April, 2020 stood at 23.52 percent which was a sharp increase from 8.74 percent from March, 2020.

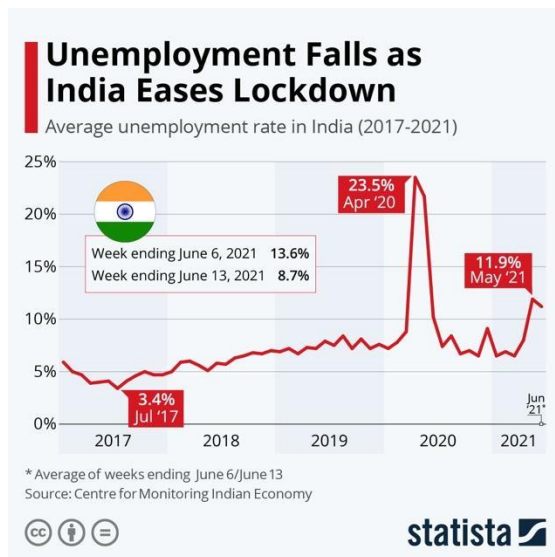
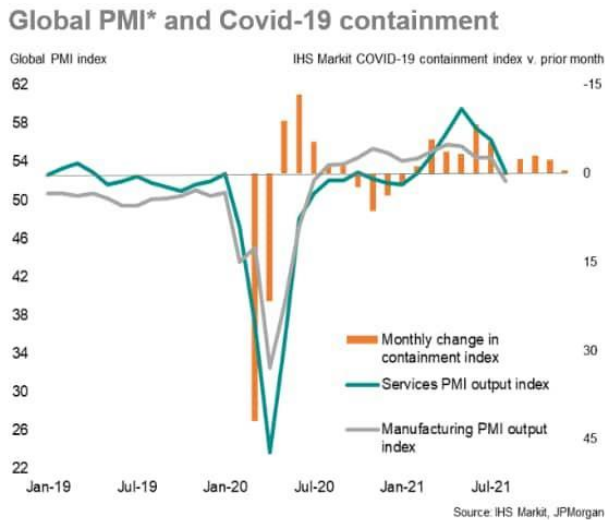


Fig 2: Global PMI

Source: (Purchasing Managers' Index® (PMI®) | IHS Markit, n.d.)

Fig 3: Fall in unemployment

Source: (Infographic, n.d.) (Unemployment, n.d.)

The pandemic laid emphasis on the need to upgrade the elements of traditional supply chain models. The centrality of China as a manufacturing hub of the world can be gauged from the fact that out of 500 firms of Fortune Global 500, 200 firms had presence in Wuhan (*Managing Supply Chain Risk and Disruption*, n.d.). The firms employed different strategies to mitigate the effects of COVID-19 pandemic induced disruptions. According to survey conducted by McKinsey, 93% of the senior supply chain leaders showed their willingness to make supply chains more agile and resilient. Some of these initiative were increasing the inventory of the critical products and diversified the supply for the raw materials. Going forward, some of the senior executives planned some degree of regionalisation (*How COVID-19 Is Reshaping Supply Chains* / McKinsey, n.d.). In US, most of the firms surveyed by EY showed their willingness to increase investments in AI

and automation while retaining employees. The executives conveyed that improving the efficiency and re-skilling the workers would be a priority in the near future for their organization. Also, a major finding of the survey was that most of the organizations put ESG goals in focus even though the pandemic had hit profits (*How COVID-19 Impacted Supply Chains and What Comes Next*, n.d.).

The impact of pandemic on different sectors of the economy and functions have also captured the interests of academicians. The following section highlights the academic research done to assess the impact of COVID-19 pandemic in the global as well as Indian context.

Literature Review:

Supply Chains play very important role in driving the economy of the country. COVID-19 pandemic and subsequent lockdowns have disrupted the supply chains of various firms. It has been estimated that the total cost of supply chain disruption due to COVID-19 and geopolitical tensions is around \$4 Trillion for US and European firms (*Total Cost of Supply Chain Disruption*, n.d.). This cost highlights the need to study the impact of COVID-19 on the supply chain function of companies and also explore the efforts made by the firms to mitigate the same.

Literature review of the studies focusing on impact of COVID-19 in global context

Various studies have been carried out to assess the impact of COVID-19 pandemic on different value chains. (Shen & Sun, 2021) evaluated the impact of COVID-19 pandemic on the resilience of the supply chains and presented the tough scenario that retail supply chains in China faced during the pandemic. They presented the response of JD.com, an online retailer, during the pandemic. (Guan et al., 2020) evaluated the impact on supply chains due to lockdowns imposed to curb the spread of COVID-19 pandemic. They used global trade evaluating framework for the analysis. The discussion around the food supply chain and policy recommendations have also been explored (Aday & Aday, 2020).

(Meyer et al., 2021) applied text mining approach to gain insights on impact of coronavirus on supply chains. They applied this text mining approach using R to the general newspapers and newspapers specific to supply chains and logistics. (van Hoek & Dobrzykowski, 2021) stated that the reshoring might be one of the tools to reduce dependence on global suppliers and build resilience in supply chains. It further explored whether the pandemic was pushing companies to reshoring of their supply

chains. (Bayoumi et al., 2021) assessed the impact of COVID-19 pandemic on the logistics sector activities in Egypt. It employed interview methodology and evaluated published reports to present their results. (Nagurney, 2021) provided a supply chain game theory network framework that take into account labour constraints due to disruptions caused by COVID-19 pandemic.

(Acioli et al., 2021) investigated the Industry 4.0 innovations effect on sustainable supply chains processes. It also analyzed the impact of Industry 4.0 technologies as an enabler for sustainable supply chain during COVID-19 pandemic. It carried out a bibliographic review of the literature published in this regard. (Parast & Subramanian, 2021) evaluated the relationship between supply chain disruption risk drivers to supply chain and firm performance. It employed a cross-sectional survey and collected data to determine the relationship. Another paper (Zhang et al., 2021) studied the impact of COVID-19 pandemic on shellfish supply chain in early 2020. It conducted farm and market level survey to collect the data. It further delved deeper to assess the ability of farmers and sellers of shellfish to cope up with the pandemic. (Inoue & Todo, 2020) discussed the economic impact of a possible lockdown of Tokyo City to curb the COVID-19 spread. It evaluated the impact of supply chain disruption of non-essential goods in Tokyo and their impact on other regions. The authors have used agent-based model to simulate the scenario. (Chenarides et al., 2021) discussed key measures of input and output market performance. These indicators helped to measure the stability of the fruit and vegetable market in Canada. This study was carried out after one year of start of the pandemic. (Panwar et al., 2022) discussed the changes that can occur in global value chains. It argues that automation and digitalization will play a major role in driving these changes.

Literature review of the studies focusing on impact of COVID-19 in Indian context

The COVID-19 pandemic induced lockdown in India was one of the stringiest. Also, given the huge population of the country, the COVID-19 pandemic induced disruptions impacted a large section of humanity. Therefore, the research in Indian context becomes significant. (Lowe et al., 2021) assessed the impact of COVID-19 pandemic on food supply chain. They evaluated the supply disruption's correlation with the COVID-19 incidence. The relationship was examined in both initial phase and the recovery phase. Another paper (Mahajan & Tomar, 2021) also evaluated the disruption in food supply chain. It looked at the effect of disruptions on product stockout and prices considering a case of online grocery retailer. (J. Sharma et al., 2021) studied the issues and perspective associated with agricultural practices, food industries and societal concerns related to food supply chain during COVID-19 induced disruptions.

(A. Sharma, Gupta, et al., 2020) discussed challenges and solutions to health supply chains in India considering the onslaught of COVID-19 pandemic. It enumerates various challenges such as supply of PPEs, API for drug manufacturing and availability of ventilators. It detailed out the financial risk management framework and supply chain risk management framework with respect to on-going pandemic. (Khanna, 2020) evaluated the impact of COVID-19 pandemic on migrant population. It discussed the economic repercussion of the lockdown and unemployment on the migrant population. (Narasimha et al., 2021) examined the impact of COVID-19 pandemic on maritime supply chain in India. It evaluated the performance parameters of major ports in India in both pre-pandemic and during pandemic. An expert survey was also the part of the study which indicated that there was lack of preparedness with respect to COVID-19 and formulation of future strategies by maritime organizations. (Kumar et al., 2021) assessed the impact of COVID-19 induced disruptions on farming in India. The study focused on Indian state of Uttar Pradesh and it combined the qualitative and quantitative research to analyze the factors that disrupted the farming sector post lockdown. (A. Sharma, Adhikary, et al., 2020) intended to provide strategic insights into major problems faced by the firms due to COVID-19 disruptions and the actions these firms are planning to take. It utilized twitter data from NASDAQ 100 firms to formulate the major themes related to issues faced by the firms. (Chaudhary et al., 2020) focused on evaluating the impact of COVID-19 pandemic on sectors such as aviation, MSMEs, tourism, retail, capital markets and oil. It further assessed the impact on GDP growth rate and migrated labours. (Khurana et al., 2021) highlighted the important factors that can aid the firms to overcome the COVID-19 disruptions. The paper used Analytical Hierarchy Process (AHP) technique to identify the important factors that aided the firms to enhance their supply chain resilience.

Research Gaps and Objective of the Study

Research Gap

Various studies have been carried out to assess the impact of COVID-19 pandemic on different aspects of the supply chain and related areas in India. Some of these studies focused on the food supply chain (Lowe et al., 2021), disruptions in food supply chain (Mahajan & Tomar, 2021) and from societal perspective (J. Sharma et al., 2021). The focus of these studies was on food supply chains.

Another study (A. Sharma, Gupta, et al., 2020) focused on healthcare supply chains whereas (Khanna, 2020) evaluated the impact on migrant population. (Narasimha et al., 2021) in their paper evaluated the impact of COVID-19 on transportation and maritime supply chains. (Kumar et al., 2021) assessed the impact of lockdown on agriculture sector in an Indian state of Uttar Pradesh. As far as impact on firms are concerned, (A. Sharma, Adhikary, et al., 2020) examined the impact and future course

of action taken by these firms. (Chaudhary et al., 2020) assessed the impact of COVID-19 on different sectors of the Indian economy. (Khurana et al., 2021) highlighted the factors that can aid the firms to improve their resilience of supply chains.

Thus, there are limited literature available on impact of COVID-19 disruptions in India. The research articles have focused on one of the sectors (e.g., food, maritime, health etc.) and didn't represent the impact on value chains of different sectors. In present scenario, where the according to Economic Survey 2021-22, the GDP of India is projected to grow at 8.0-8.5% in 2022-23 (*Key highlights of Economic Survey 2021-22, 2022*), it becomes necessary for the firms to build resiliency in their supply chains to sustain the growth rate. The academic community has carried out the research work related to the supply chain resiliency, however, the challenges faced by the industry due to COVID-19 pandemic and their response to that can provide more research opportunity to academicians.

Objective of Study

The objective of the paper is to examine the disruptions caused by COVID-19 pandemic in value chains of different sectors. It further aims to bridge the gap between the approach taken by the industry practitioners to mitigate the challenges faced by the COVID-19 pandemic and research work carried out by the academicians. The study examines the challenges faced by the industry and suggest opportunity areas where research can support efforts in industry to improve supply chain resilience.

Scope of the Study

The study examines the challenges faced by the firms during the period of March, 2020 to May, 2021. It captures the impact and mitigation effort by the firms during this period. The long-term impact can be studied as a future scope of work.

Research Methodology

The interview is a vital data collection method which requires verbal communication between the interviewer and the subject. It is mostly used in survey, exploratory and descriptive research works (Fox, 2006).

The structured interview methodology was adopted to capture the responses from the industry practitioners. The interviews were conducted through telephones and through e-mails due to restrictions due to COVID-19. The responses were also recorded through the virtual roundtable with the supply chain executives.

The interview transcripts were studied to identify the major focus areas under a specific theme/question. The interview transcripts were analysed by classifying the

industries under heads such as manufacturing sector, service sector and infrastructure sector. Then for a particular sector, column wise common focus areas were identified for a particular theme. The focus areas suggest towards the academic area of interest.

Data from different sectors

The interviews were conducted to assess the impact of COVID-19 on the value chain of different sectors. The insights from the interview have been represented in the table below.

Table 1: Interview data of few business sectors regarding issues faced in supply chain management during COVID-19

Industry/Organisation	What are the supply chain issues with the business context during the covid pandemic?	What steps did you take to manage the supply chain challenges?	Resiliency Plan in the long run
Chemicals	<ul style="list-style-type: none"> ● Supply side disruption (Suppliers were unable to fulfil the demand of the businesses) ● Stock out scenario (For e.g.- The firm interviewed had zero stock for close to 45 days) 	<ul style="list-style-type: none"> ● Approval from Govt India to treat the firm's product as essential goods. ● Scouted for alternate suppliers within India. The business sector also helped some suppliers to get enrolled as essential goods supplier which resulted in an increased cost. ● Approached customers to pay as a surcharge to cover the variance. Informed that the surcharge will be dynamic due to the ongoing scenario 	<ul style="list-style-type: none"> ● During the lockdown, the chemical company found great difficulty in supplying goods to their customer due to a lack of raw material from all over the world. The government intervened after that to declare the products as essential goods. As a result, the companies enrolled some suppliers as essential goods supplier. This new list of suppliers solved the problem of shortage of goods in the SR. In the LR, additional discounts were given to retaining customers.
Real estate	<ul style="list-style-type: none"> ● Raw material shortage due to the closure of markets and labour migration 	<ul style="list-style-type: none"> ● Created flexibility for a project where the primary raw material like concrete was manufactured on-site ● For Labour - Labour camps set up within the construction site with provisions of basic needs (food/water/shelter in place) to avoid any need to step out of the site ● Raw materials remained in short supply (steel / Bagged Cement etc.) ● Focused on priority plants and stopped non-priority plants - to make the most of the available raw material 	<ul style="list-style-type: none"> ● There was a substantial raw material shortage due to the closure of markets and labour migration. ● In the short run, Labour camps set up within the construction site with basic needs (food/water/shelter in place), avoiding any need to step out of the site. ● In the long run, the offices located in China were closed, and the company re-deployed resources in Indian offices.

			<ul style="list-style-type: none"> ● Focused more on Make in India initiatives to make the country self-sufficient.
Banking	<ul style="list-style-type: none"> ● Non-availability of WFH infrastructure for up to 50% of operations staff. Some of the WFH infrastructure issues were - <ul style="list-style-type: none"> ○ VPN / remote enabled laptops not available ○ Shortage of laptops from the open market ○ Delays in obtaining broadband services in some areas due to spike in demand ○ Wi-Fi Dongles were not practical due to network issues 	<ul style="list-style-type: none"> ● Work from home was not an acceptable work practice. However, it was allowed immediately after Pan India Lockdown in March 2020. Some of the WFH enablers were – <ul style="list-style-type: none"> ○ Allowed office enabled laptops and desktops to some employees ○ Distributed UPS and additional dongle equipment (Jio / Airtel) ○ Provisions to reimburse the cost of broadband set up ○ Adhoc provisions for buying a laptop from the open market and receiving a reimbursement 	<ul style="list-style-type: none"> ● Banking companies behaved in a very unique way to handle the COVID Crisis. The backend banking operations for most banks are carried mainly in India, and the unavailability of the workforce (working in offices) has hit all global banks. ● Banks, because of data security and GDPR norms, don't allow WFH. However, in the short run, Firstly, WFH was allowed immediately, followed by office enabled laptops and desktops to some employees. Broadband set-up was provided to employees. ● In the LR horizon, banking will be retaining WFH to a % of employees and Data security and GDPR norms implementation has to be strengthened.
Software	<ul style="list-style-type: none"> ● Changes due to covid: <ul style="list-style-type: none"> ○ Demand: The technology business saw a boom due to the covid situation. Even though they could not travel to win new customers, they could earn a good number of customers remotely. They saw more in-flow than usual. ○ Supply: WFH resulted in ineffective execution of software deliveries rather than working from the office. Suddenly there was a rise in attrition throughout the industry, significant rises in salary packages for engineers as now they can apply throughout the country. Even people are applying for positions in different countries. 	<ul style="list-style-type: none"> ● Innovative hiring practices were followed <ul style="list-style-type: none"> ○ Increased packages to tier-1 city level ○ Partnerships for the joint execution ○ Saying no to customer Pooling up engineers across the skillset ○ The firm interviewed had tripled their hiring team 	<ul style="list-style-type: none"> ● The company adopted innovative hiring methods, like Increased packages to tier-1 city level, Partnerships for joint execution, saying no to customer, Pooling up engineers across the skillset. ● The company decided to restrict new engineers hiring as the business situation was unstable during the Covid situation. ● Salary revisions were frozen. ● WFH initiative was an effective execution of software deliveries rather than working from the office.

<p>Building Material</p>	<p>As the construction industry was already facing issues in payments due to financial crisis in the market, during lockdown in March 2020, industry got big hit due to the following reasons:</p> <ul style="list-style-type: none"> ○ As construction is labor-intensive, labour availability becomes a significant issue at all sites. So, labour went back to their native places. ○ Fixed cost of all plants PAN India becomes another primary indicator of significant lockdown losses. Land lease rent for majority of plants. ○ Transit Mixer availability and cost become an issue as construction we also have hired TM from vendors. TM vendors started asking for fixed payments as they also have to give salary to drivers. ○ Pump is run by a gang of labours and operator; hence pump availability and labour issue in the gang start arising. ○ Cost of Labour on contract becomes another cost which is going to hit in lockdown period. ○ Raw material: Availability of raw material like Cement, aggregate and sand becomes a big challenge for the industry. For example, aggregate mines were closed due to government restriction. Also, selected vendors increase their prices for raw material. ○ IT vendors who are providing technology for different systems start asking for payments. 	<p>Significant steps were taken to manage the supply chain, and logistic challenges. Some of them were:</p> <ul style="list-style-type: none"> ● Logistics: <ul style="list-style-type: none"> ○ Force primary letters were issued to all vendors ○ Variable cost model for further operations is designed in which fixed cost component is zero down. All charges were given to the vendor on a per km basis model. It proved to be a significant game-changer strategy ○ Resistance from the vendor is handled after discussion with other industry and convinced all vendors on the same line. <ul style="list-style-type: none"> d. Pump where gangs are not available is shared with its pump gangs. Also, hire pumps are replaced by Own pumps. ○ Towing van and plant vehicle is also reduced to the extent and shared between plants at multiple plant locations. ● Long Term Tie-Ups: long-term tie-ups with vendors for raw material availability and assured them they would benefit on condition of a regular supply. ● Arrangement from different locations: Due to increased cases in Mumbai, raw material was arranged from nearby location and mines. ● Mix optimizations – The Quality control department did innovation in the mix to save the cost of mix preparation. Different type of mix was studied for their cement consumption and trend analysis. ● Labour contract: Contract was revised after negotiation with the vendor to lower contract rates in current pandemic times. ● Land lease rates: All landowners were negotiated for land lease rent and to reduce it by 20% in covid situations. 	<ul style="list-style-type: none"> ● In the building material companies, the availability of labour became a major issue at all sites. Most labours migrated back to their native places. Fixed cost, and Land lease rent, suffered significant losses in lockdown for the majority of plants. ● Transit Mixer availability and cost becomes an issue as in construction. No labour was available to run the pumps. So, in the short run, hired pumps were replaced by self-owned pumps to cover up the variable cost of production. ● The number of Towing van and plant vehicle were also reduced to the extent and shared between plants at multiple plant locations. ● In the long run, the company tied up with the vendors for an undisrupted supply of raw material and assured them that they would benefit.
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<p>Food and beverage</p>	<ul style="list-style-type: none"> ● Key Supply Chain Challenges Faced by the company ● Inventory – Anticipating the regular demand and growth, inventory at various stages were in the system as below <ul style="list-style-type: none"> ○ Finished Goods: 25+ days ○ Semi-Finished Goods: 7 days ○ Raw Material & Packing Material: 55+ days ○ Raw Material and Packing Material in transit – Local 8 – 10 days ● Unpredictable Demand – Demand remained volatile and unpredictable for all businesses and product lines. B2C demand suddenly was more than double, while the Foodservice/QSR requirements tanked. Within B2B, the need for ingredients for packaged foods segment/RTE/RTC like Chips, noodles, frozen food, etc., skyrocketed post the 1st month. There was a significant change in the product mix within the increased demand. One example is the snacks & Noodles manufacturers shifted their focus to bigger pack sizes & higher profitability products. ● Shortage of Raw Material and Packing Material – The Unpredictable demand and change of forecasts put the Purchase & PPIC function (production planning and inventory control) under tremendous stress. The entire industry had come to a standstill, which disrupted the material availability when needed the most. 	<p>Initiatives were identified, and actions were taken to mitigate the impact and overturn the situation during the year. Some of the key initiatives are listed below</p> <ul style="list-style-type: none"> ● Demand Forecasting <ul style="list-style-type: none"> ○ Produced Finished Goods: Scenarios were run to analyze the impact on the offtake of Finished Goods in consensus with the customers. ○ Orders in System: Customers were called upon to check for changes, postponement/ cancellation of unproduced order. ○ Revised Forecasts: for Top SKUs, weekly forecasting was implemented. ● Raw Material and Packing Material <ul style="list-style-type: none"> ○ All purchase orders were put on hold immediately after lockdown to avoid inventory build-up. ○ Suppliers were contacted to understand the disruptions at their end and the possible impact on the lead time of the material. ○ Forecasts to Vendors have modified the projections as per point no one and the lead time changes. ○ Alternate vendor development: For critical raw material, where the lead times had changed or disruptions were expected, it was accelerated. ○ Inventories were also built up for critical raw material where disruption of the supply chain or increased prices were expected. 	<ul style="list-style-type: none"> ● The food and beverages companies faced a sudden, unpredictable upsurge in demand for specific food items, such as snacks, biscuits, chips, noodles, frozen food etc. The companies didn't have sufficient stocks of raw materials to meet the immediate demand. ● Due to Lack of Labour, Shortage of Raw Material and Packing Material and transportation glitch, the companies could not supply products to the consumers on time. ● In the SR, certain goods shelf life was increased to meet the present supply glitch of goods. ● In the LR, Communication channels were strengthened, and the frequency of reviews established with all stakeholders (customers, suppliers, management, etc.) to accelerate decisions, updates, and corrections in the overall strategy.
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<p>Automobile</p>	<ul style="list-style-type: none"> ● INDUSTRY SCENARIO Before Covid, three-wheeler Automobile Industry was already going through slow downtrends because of low demand in FY 19-20, and after COVID-19 industry was severely disturbed due to severe disruption in the supply chain & erratic demand graph. The primary cause which impacted the supply chain & Business were: <ul style="list-style-type: none"> ○ Parts availability from the vendor- Since most vendors have their manufacturing unit in MH state, which was severely impacted with covid 19, either vendor closed down their unit due to lock down or partly operated with limited workforce capacity. They also got impacted because of the non-availability of raw material. This entire thing forced them to produce less than 40% of their capacity. ○ Transportation- This is another area where lead time increased drastically from vendor end to company for raw materials and from company to distribution for finished goods because logistic provider facing lots of issue due to state guidelines for lockdown. ○ Vehicle Sales drastically down- Firstly, vehicle sales were down by almost 70% for two primary reasons, 1.) Public transport was closed due to Covid-Hence passenger transport business poorly affected because of social distancing, resulting in significantly fewer people travelling through auto. 2) School/Colleges closed- which also limited commuters travelling through auto. Hence overall 3W industry down by 60 to 70% in respect to demand because of covid. This lower demand in sales affects vendor PO, making it 	<ul style="list-style-type: none"> ● Business Opportunity- It has been observed that in the automobile industry whenever vehicle sales are down, spare parts sales boom up because of re-fabrications of old vehicles. This means buyer is more interested in buying an old vehicle and then spent some money to re fabricate vehicle by changing old parts with genuine new parts, so that vehicle performance gets improved. So, knowing above fact, the firms were hopeful that post lockdown, they will get good orders to boost spare sales. ● Based on the discussion with all stakeholders (Distributors, Key retailers, few mechanics), they identified some bullet points and a good road map designed to flow along with the covid era. Below points were on top of their "Game changer" strategy- Motivation- <ul style="list-style-type: none"> ○ During the lockdown, the biggest challenge was to motivate the distributors as they were sitting on inventories & the market outstanding were also blocked at the retailer end. The firm used to organize weekly zoom meeting with them to discuss business plan post lockdown, our new plans for FY 20-21, took feedback from them and helped them reduce their outstanding from the market by combining communication with the retailers. ○ Demand Forecasting – Because of a significant drop in vehicle sales, plant orders was almost negligible. With this fact, it had massive pressure from management to reduce & issue limited purchase orders to vendors through our purchase team. To optimize forecast, the firms have started pre-collecting of orders from retailer end, based on their orders, distributors could place his monthly orders in advance. It used the "Early Bird" incentive scheme to set this process, which gave a 2% extra 	<ul style="list-style-type: none"> ● The automobile industry worked with local manpower capacity. They also got impacted because of the non-availability of raw material, which made them produce less than 40% of their capacity. Due to lower vehicle sales, Cost cutting was done by reducing manpower & cutting wages to control overall operations. ● The company organised weekly zoom meeting with the distributors to discuss business plan post lockdown, new plans for FY 20-21, took feedbacks from them and the company team also helped them to reduce their outstanding from market by doing combined communication with retailers. ● To optimize forecast, it had started pre-collecting of orders from retailer end, based on their orders distributors. Early Bird incentive scheme gave 2% extra incentive on placing full month target order in advance with payment.
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	<p>challenging for them to cater to low demand because of increased transportation cost.</p> <ul style="list-style-type: none"> ○ Cost Cutting- Because of the 2-month lockdown & heavy fall in demand, companies started cost-cutting by reducing the workforce & cutting wages to control overall operations. However, this also impacted the motivation level of individual employee's which ultimately affecting the efficiency level. ○ Channel Partner retention- This is another essential subject. Because of lockdown & low demand, primary network retention was adamant as they could not keep their Business in viable mode. ○ BS-4 to BS-6- As the industry was moving from BS-4 to BS-6 pollution norms, this was the most challenging time for all OEM'S, because of advance technology product which was not settled in the market also cost was increased due to meeting BS-6 norms. 	<p>incentive on placing complete monthly target order in advance with payment.</p> <p>Based on last three-year trends, it took management approval to keep three-month stock of parts whose contribution is 80% in the sale.</p> <p>Because of Covid, the lead time increased from 7 days to 20 or up to 25 days, meaning that it can serve a distributor once a month. In addition, it had to redesigned commercial incentive policy, which forced distributor to place bulk orders and get only single billing throughout the month to maximize respective incentives. The business with distributors was in cash & carry, hence with the new commercial policy it was able to collect 80% of the month's orders by maximum 10th of every month with payment. This allowed to revise the PO with vendors, and in case of increased order, it was able to get material by month-end from vendors.</p>	
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<p>Broadcaster</p>	<ul style="list-style-type: none"> ● The channel thrives of program ratings and hence aims to create varied content with multiple characters and story lines to appease the taste of Indian diversity. So, the content team continued to engage with the audience through polls, research, customer insights team to find what is working in the show, which character is gaining popularity or which theme is not going down very well with audience. Hence creating content is an ongoing process and with continued tweaking to get ratings ● In covid times in April, 2020 when the country was in lockdown mode the content was not getting created at all. The top channel with others in tow in the same genre crashed in ratings (grps cumulative tv program ratings fell down from 200 grps to 60 grps) The irony was that the people were at home(eyeballs) waiting to watch content but there was nothing to be telecasted. The effect of ratings fall was multi-fold ● The rates per 10sec crashed massively leading to revenue collapsing from 100 crs per month to 20 crores. ● The channel reach (no of people who watch the channel) took a hit as people moved from appointment view of shows (which didn't exist anymore) to movies genre where they go at least watch a movie even if it was a repeat telecast. ● Advertisers got jittery and didn't want to part with the deary advertisement budget on the genre wherein the eyeballs were depleting. This was a unique situation which had never hit this industry wherein the customers were available in plenty even more than before, but the commodity was not produced to deliver to the customer. 	<ul style="list-style-type: none"> ● Steps taken <ul style="list-style-type: none"> ○ When new content/product was unavailable the broadcasters recycled the old to new. What they realized that the country was going through huge mental and emotional pain people were scared. Broadcasters bought the rights to the age-old mythological programs like Ramanand Sagar's Ramayan, BR Chopra's Mahabharata and repacked them with more graphics and effects and telecasted it throughout the day with multiple repeats. ○ To add to that it also had few of their own banked shows made in past like Krishna/Sai Baba/Ganesh which were previously telecasted at some point and were now repackaged and telecasted. 	
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<p>Hospitality</p>	<ul style="list-style-type: none"> ● For a hospitality company, operating hotels, the guest rooms and restaurants need to be operating at all times to meet guest expectations. While rooms were not an issue, restaurants and kitchens had their share of issues with regards supply chain. <ul style="list-style-type: none"> ○ Raw material required by the kitchens to cater to the restaurant menus became an issue during the pandemic. Availability was an issue with restrictions in place, imports on hold whereby specific requirements were not being fulfilled, logistics for moving raw material was also a big issue due to non-availability of easy transport. ○ While above was an issue, there was another issue of forecasting demand as hotel occupancies had gone down drastically and some had shut for a certain period of time. All this hampered the supply chain to a large extent. ● However, when the restrictions were partially lifted and hotels were allowed to operate, the company offered to provide accommodation to the medical fraternity / frontline healthcare workers in some of the hotels and this allowed the hotels to forecast a demand for raw materials. Also, by then some of the resort properties had started receiving guests which again helped in forecasting a reasonably accurate demand. ● Transportation costs were up by more than 200% during the initial phase of the pandemic. This coupled with the fact that raw material was also being sold at a much higher price due to less supply and higher demand meant the company was paying a much higher price for raw material. ● The imports were impacted in a major way as containers were not available to ship material, 	<ul style="list-style-type: none"> ● The supply chain with contracted vendors for regular supplies works very well in the hotels, however with the pandemic and issues with supplies, alternate vendors had to be looked at and a new supply chain had to be created. This meant increased costs on account of new vendors and logistics. ● Usually, the material would be supplied from within the city or state the hotel is operational in, unless there is a specific demand / requirement. However, during the pandemic material has had to be sourced pan India basis availability. However, after the initial phase of lockdown, things were streamlined and pre-pandemic supply chains were restored to a large extent. 	<ul style="list-style-type: none"> ● Raw material required by the kitchens to cater to the restaurant menus became an issue during the pandemic. Availability was an issue with restrictions in place, imports on hold whereby specific requirements were not being fulfilled, logistics for moving raw material was also a big issue due to non-availability of easy transport. ● While above was an issue, there was another issue of forecasting demand as hotel occupancies had gone down drastically and some had shut for a certain period of time. All this hampered the supply chain to a large extent. However, when the restrictions were partially lifted and hotels were allowed to operate, the company offered to provide accommodation to the medical fraternity / frontline healthcare workers in some of the hotels and this then allowed the hotels to forecast a demand for raw materials. Also, by then some of the resort properties had started receiving guests which again helped in forecasting a reasonably accurate demand. ● Transportation costs were up by more than 200% during the initial phase of the pandemic and this coupled with the fact that raw material also being sold at a much higher price due to less supply and higher demand. In the SR, the supply chain with contracted vendors for regular supplies works very well in the hotels, however with the pandemic and issues with supplies, alternate vendors had to be looked at and a new supply chain had to be created.
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	<p>material on ports were not getting cleared, post clearance material was not being shipped due to transport issues. This meant the hotels had to depend on stocks available with local vendors and pay a premium to buy these.</p>		
<p>Financial Service</p>	<ul style="list-style-type: none"> ● A large portion of the deliveries is related to software, consultancy services and solutions, as well as support, and these were not very dependent on physical presence. However, 100% remote working did cause issues initially notably related to – <ul style="list-style-type: none"> ○ People <ul style="list-style-type: none"> a. Delivery of our services from Global teams remotely b. Employee availability, Key talent and domain experts c. Sales negotiations & Customer Interactions ○ Global Infrastructure <ul style="list-style-type: none"> a. VPN Capacity & Remote Access b. Virtual meeting capacity c. Cyber security 	<ul style="list-style-type: none"> ● The primary objective is to ensure the delivery of our services by securing employee availability globally. The following actions were taken – <ul style="list-style-type: none"> ○ Urged our employees to work from home when possible, according to local authorities' guidance and in close dialogues with customers. ○ Increased service availability to correspond to the increased demand in e.g., remote access and virtual meeting capacity. ○ The firm's distributed service delivery model combines the local and global competences in the best way according to customer specific agreements, which is an advantage in this kind of extraordinary situation. ○ For customer interactions the employees were encouraged to 	<ul style="list-style-type: none"> ● In the Fin sector 100% remote working did cause issues initially notably related to <ul style="list-style-type: none"> ○ People <ul style="list-style-type: none"> a. Delivery of services from Global teams remotely b. Employee availability, Key talent and domain experts c. Sales negotiations & Customer Interactions ○ Global Infrastructure <ul style="list-style-type: none"> a. VPN Capacity & Remote Access b. Virtual meeting capacity c. Cyber security ○ ICT <ul style="list-style-type: none"> a. Logistics, Laptops, Monitors, Headsets b. ICT Service (breakdowns, leaving employees and new joiners) c. Broadband connectivity

	<ul style="list-style-type: none"> ○ ICT <ul style="list-style-type: none"> a. Logistics, Laptops, Monitors, Headsets b. ICT Service (breakdowns, leaving employees and new joiners) c. Broadband connectivity 	<p>utilize virtual meetings (with camera's on) until further notice – to limit the risk for themselves as well as for our customers. The dialogue with customers is essential in this situation.</p> <ul style="list-style-type: none"> ○ Asked customers to contact in matters related to security as there is increased risk for cyber frauds. ○ Enhanced VPN login security of VPN to two-factor authentication. ● At the Unit level, the firm took the following steps – <ul style="list-style-type: none"> ○ Conducted review meeting on periodic basis & status update on Pandemic Situation. ○ Business impact analysis and risk assessment related to remote connectivity, restricted travels and uncontrolled leaves due to pandemic situation done. ○ BCP plan for employees and project updated with Primary, Secondary and Tertiary owners. <ul style="list-style-type: none"> a. Key employees and their primary delegates identified. b. Active cross training to secondary and tertiary persons & up to date documentation c. Identify resources across delivery locations with similar skills in worst case scenario. d. Managers ensuring backup plans and ROTA plans for critical functions. iv. While the teams were working out of remote places, there were power issues, therefore the team coordinated when someone was facing issues by covering for them. The affected members upgraded their mobile internet capabilities. The team also did early morning or late-night deliveries to circumvent risks of power failures in their areas in consultation with project managers to keep customer commitments. d. HR Team 	<ul style="list-style-type: none"> ● As a short run measure, the financial sector urged their employees to work from home when possible, according to local authorities' guidance and in close dialogues with customers. They increased service availability to correspond to the increased demand in e.g., remote access and virtual meeting capacity. For customer interactions they encouraged their employees to utilize virtual meetings (with camera's on) until further notice – to limit the risk for themselves as well as for the customers. The customers were also asked to contact the company related to security matter as there was increased risk for cyber frauds. Enhanced VPN login security of VPN to two-factor authentication. ● In long run, they also conducted review meeting on periodic basis & status update on pandemic situation. Business impact analysis and risk assessment related to remote connectivity, restricted travels and uncontrolled leaves due to pandemic situation done.
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		<p>Optimization for Remote support done.</p> <ul style="list-style-type: none"> ○ Data card/Broadband connectivity for remote connectivity from home for critical resources available. <p>Process of Shipping replacement/new laptops and collecting the old laptops with Courier vendors done. Asset care guidelines published and communicated regularly.</p> <p>Discussion with Laptop vendors for bulk orders for speedy deliveries done to prioritize.</p>	
<p>Healthcare/Pharmaceutical</p>	<ul style="list-style-type: none"> ● Component shortages and obsolescence – <ul style="list-style-type: none"> ○ At the center stage were the healthcare companies themselves in this fight as all of them – they didn't possess a robust predictive supply chain management program implemented to address this sort of a disruption actively. Since demand increased, for instance, for ventilators - from about a 1,000 per month to 50,000 units projected for 2020, a multi fold increase. Many of these models have market maturity periods also. Often, it happens that either the said models are reaching the end-of-life periods and therefore their components also. To complicate matters, they had over 300 critical component shortages that was also to be managed. Second, with component constraints and urgent needs, they created new production planning models designed for scenario planning and restructuring the internal 	<ul style="list-style-type: none"> ● Partial list of Possible Solutions or, Measures taken: <ul style="list-style-type: none"> ○ From a short-term perspective, process and logistics optimizations are key. In dealing with a pandemic response, GE, despite being so tech heavy and a pioneer of LEAN, six sigma, KANBAN streamlined their processes to reduce response times to process recovery & increased incident management coordination. ○ It also deployed new technology in areas including supply chain visibility, risk management and additive manufacturing. ○ Covid 19 created many challenges from the point of maintaining distance on the shop floor and especially from the point of sharing tools, workstations and standing 6 feet apart and therefore all of it had to be sanitized considering round the clock shifts to meet the sudden spurt in demand. The teams applied more of creativity, left their pre conceptions and kept on embracing something different every time and kept on changing and improvising the shopfloors. Rapid prototypes and iterations were done and brainstormed to come up with Just in time solutions like creating new fixtures, holders to hold tools etc. to keep everything together in place to work. GE also implemented 	<ul style="list-style-type: none"> ● Due to logistical Challenges like Closure of Ports and airports causing delays in transportation and delivery of critical components in the Pharma sector. ● Manpower required to produce and transport products were either out or, reporting sick or were not showing up to work. In case of pharmaceutical sector, there was a sudden for ventilators from about a 1,000 per month to 50,000 units. ● Very effectively, they created new production planning models designed for scenario planning and restructuring the internal processes to respond rapidly to the demand. In order to respond rapidly to address these issues, organizations had to restructure internal control measures to accelerate the ability to secure components in high demand. ● For a short term perspective, firms streamlined their processes to reduce response times to process recovery & increased incident management coordination. It also deployed new technology in areas including supply chain visibility, risk management and additive manufacturing. ● For long term perspective, the teams applied more of creativity, left their pre conceptions and

	<p>processes to respond rapidly to the demand.</p> <ul style="list-style-type: none"> ● Internal and quality control measures – <ul style="list-style-type: none"> ○ In order to respond rapidly to address these issues, organizations had to restructure internal control measures to accelerate the ability to secure components in high demand before other products used them up. This created a need for both an emergency approvals process and a capability to use the assembly lines 24 hours of the clock, regardless of buying location. Even by late 2020, firms were still found to be working to fulfill the requested volumes by addressing the component constraints and production planning optimizations. ● Logistical Challenges - Closure of Ports and airports causing delays in transportation and delivery of critical components – Due to sudden closure of outgoing and incoming deliveries, the parts required were not able to be delivered at the shopfloors causing bottlenecks that slowed down deliveries of critical supplies. ● Man power or, workers required to produce and transport products were either out or, reporting sick or were not showing up to work. ● Over-reliance on offshore manufacturing for essential products and raw materials. 	<p>visual scheduling systems like JIT, KANBAN to check the inventory supplies considering the supply of parts etc. was a constraint and the OEMs were to be apprised beforehand due to the logistical constraints.</p> <ul style="list-style-type: none"> ○ Build redundancy in the supply chain As had been mulled over earlier, one way to increase supply chain resiliency is by adding redundancy in the supply chain, such as by carrying extra inventory of essential health care items, holding excess manufacturing capacity for producing critical items. Redundancy, however, can be counterintuitive for most supply chain professionals, as it comes at a cost, and supply chain professionals have largely focused on efficiency in the past. Sourcing managers, for example, rarely get rewarded for risk management, instead they are often rewarded based on cost-focused metrics, such as inventory reduction and supply base rationalization. Unless the reward system is modified, it would be unrealistic to expect sourcing leaders to focus on measures that would make supply chains more resilient. ○ Ford and 3M to ramp up production of ventilators and preventive equipment thus cross leveraging the assembly lines and logistic partners. Considering all these sectors were on the back seat, they cross leveraged the personnel and the idle manufacturing capabilities by a lot of internal improvisation. They were able to find part substitutions by setting up virtual clearinghouses so that the suppliers could work collaboratively, together with the customer, to find solutions. ○ Logistics One of the unique challenges of the pandemic is related to global logistics. Between lockdowns, border closures and travel 	<p>kept on embracing something different every time and kept on changing and improvising the shopfloors.</p>
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		<p>restrictions, many supply chains were in a complete standstill. The business entities pursued a combination of different changes to alleviate their logistics issues. For instance, they transferred some SKD units to different sites and balance components to parent locations and thereafter utilized local workforce to complete the finished products. The pandemic continues to drive higher rates due to capacity constraints across all regions. Greater visibility, transportation management optimizations and planning can help reduce costs while providing predictability in delivering materials and products to their desired destination.</p> <ul style="list-style-type: none"> ○ Regionalizing supply chains There is a significant discussion around this would certainly see the light of the day for our country in some form or other in consequence to the Govt of India initiatives like "Make in India" and "Atmanirbhar Bharat" though it may not happen the way it is envisaged. Component suppliers of standard components who are already established would neither like to change their established footprints nor set up shops here in India until they see real incentives and volumes. The management of companies perceive and thereby even from a balance sheet perspective, the solution is to create some level of local inventories and have buffer stocks. 	
<p>Interior Design & Build</p>	<ul style="list-style-type: none"> ● Major issue in Supply Chain in this Industry is Labour supply on site When the lock down happened in April 2020, it came as challenge. But the firm faced major impact on supply of Labour (Skill & Unskilled). The requirement of labour was around 120 and it had only 50%. 	<ul style="list-style-type: none"> ● The firm explained the client the situation and requested them that they would arrange the 100% labour on site but it wanted space for hutment and common kitchen for the same that cost of the same will be bare by the firm. 	<ul style="list-style-type: none"> ● The Interior design sector faced major impact on supply of Labour (Skill & Unskilled). It was almost reduced by 50%. ● As a short term measure the labour camps were set up, and food and basic necessities were made by the company, so that the labours could come back to work.

<p>Construction</p>	<ul style="list-style-type: none"> ● Limited raw material availability: When the Covid pandemic occurred, the firm was almost on the verge of finishing the civil structure (which it could have finished in mid Feb, 2020). But only 25% of MEP material was available at site (against expected 75%). Also, as per the govt guideline the booking amount (deposited by client) is controlled by MAHARERA only. The fund under MAHARERA is released by govt only after reaching the milestone set before starting the project. The firm needed to finish the work related to CFO NOC (Chief fire officer) on priority so that it could get the fund released from MAHARERA and ask the customer for the balance payment to maintain the cash flow. ● Customer Relationship: The customer constantly follows up for the finished product as they were not ready for further delay and ideal bank interest payment. ● The firm as a PMC have to maintain healthy relationship with client, contractor as well as customer to deliver the project within time as it was one of the prestigious and milestone projects of Mumbai. It is the first building to have 19 floor vertical automated car parking as well as imported plumbing fixture (imported from Italy), grove fixture (imported from USA and Dubai). 	<ul style="list-style-type: none"> ● The firm had taken the task as a challenge and had called for the meeting with its MRO (Mumbai region head) and Western region director along with client representative. The steps mentioned below have been discussed to meet the SCM challenge. The top management as well as client was convinced with this strategy and given green signal to proceed. <ol style="list-style-type: none"> 1. It came to know that out of 50 only 30 flats were sold. And also, out of 30 no one have deposited 100% payment till date. 2. It needed to concentrate on those 30 flats and make the schedule flat wise to finish it for handover stage. 3. The positive note was that whatever the imported material it had ordered earlier, it had to be air lifted to the site if need be. Also, there was logistics challenge for the storage of these material. So, it had decided to keep that material on the balance 20 flats which were not crucial to handover at this stage. 4. The firm had further divided the requirement weekly so that it could get the idea of material use and avoid any unforeseen bottleneck due to material shortage. It would be in position, well in advance to identify the resource if the shortage of material is going to happen and identify the other option / alternate to keep the uninterrupted execution of work. 5. The next challenge was to stop the labour running away to their hometown. The contractor labour was coming from far away to the site location. The local train services were stopped in Mumbai. So, the firm had suggested 5 different places near the vicinity of site and within 5 km radius from site. It needed to arrange the labour bus for up-down and needed to appoint camp boss for each location. The camp boss is regularly taking care of camp and regularly measures the parameters of each labour (temperature, oxygen, pulse level etc.), also need to arrange the grocery, kirana, utility etc. requirement at least for the next 3 months. 	<p>The major problem faced by the construction company was drop on sale of flats. Out of 50 only 30 flats were sold. And also, out of 30 no one have deposited 100% payment. So immediately, the company concentrated on those 30 flats and make the schedule flat wise to finish it for handover stage. The next challenge is to stop the labour running away to their hometown. The contractor labour was coming from far away to the site location. They had further divided the requirement weekly so that we can get the idea of material use and avoid any unforeseen bottleneck due to material shortage. They would be in position, well in advance to identify the resource if the shortage of material is going to happen to keep the uninterrupted execution of work. As a SR initiative labour bus was arranged, and need to and a specific manager was appointed for each location. He regularly took care of camp and regularly measured the parameters of each labour (temperature, oxygen, pulse level etc.), also need to arrange the grocery, kirana, utility etc. requirement at least for the next 3 months.</p>
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		<p>6. Also, the staff member of the company is coming from far away to the site. The firm needed a few rented accommodations in nearby (walking distance) and needed to shift all the staff to those places for smooth operation of the activities.</p> <p>7. It needed to finish the crucial utility work like STP, fire-fighting, Electrical, basement ventilation and make it operational for entire building to get the CFO NOC.</p> <p>8. The firm needed to concentrate on the finishing activities pertaining to club house, gym area and swimming pool. Because it was committed facilities under MAHARERA as well as families who will come to live will ask for the same recreational facilities.</p>	
<p>Military/Defence</p>	<ul style="list-style-type: none"> ● The issues pertaining to supply chain and defence's role in particular are highlighted in the following points: - <ul style="list-style-type: none"> (a) Transportation of 10k persons from across the country (during lockdown) back to their respective locations and duty stations in the forward deployment areas. (b) Inducted additional fresh 20k persons for deployment at the earliest to include their quarantine, acclimatization and in battle ready condition before dispatch. (c) Ensured isolation / quarantining of all these 30k persons for 14 days on arrival into Leh and thereby further despatching it for delivery to their rightful locations. (d) Ensured transportation of military tactical and administrative equipment and items, including rations, fuel, oils, clothings for subzero weather to be ferried up alongside the troops using them from airbases across the country. Labour was difficult to garner to collect in places not affected, which hampered the loading process into the aircraft. 	<ul style="list-style-type: none"> ● It became imperative to balance the virus and the task at hand. The challenge was to think out of the box and create methods and procedures which could last the uncertainty and sustain the volumes. Foresight and vision were the key to be resilient here, as all plans modified and failed almost immediately as being spelled out, redundancy was the spine in support of a successful plan. Some of the more pronounced methodology adopted are as under: - <ul style="list-style-type: none"> (a) 10k Persons Stranded across the country. Military approached the highest authorities to approve move of five special military trains daily from Hyderabad, Bangalore, West Bengal, UP and Punjab to ferry all troops to Ambala and Delhi, for further induction into Leh. The challenge was to contact each and every one to coordinate the train move and ensure the individuals reached the nearest railway station. Induction into Leh from Delhi and Chandigarh strained the existing administrative infrastructure and Adhoc infrastructure to accommodate incoming passengers. ● Additional Military and civil air crafts were allowed to land at Leh. Usually, 5 civil and up to 3 military aircraft landed, however, we were averaging 4 civil and 11 military aircrafts per day. 	<ul style="list-style-type: none"> ● Immediate challenge faced was Induction of Fresh 20k Troops. With no time for preparation and elaborate planning, foresight and vision in accommodating for the quarantining / isolation and acclimatization of these troops posed a new challenge. These troops did not have the available support structure neither administratively nor medically. Adhoc arrangements for accommodation were established alongside road where ever possible. As an immediate effect, Establishment of Communication with Air Control. Continuous coordination with Air India and IAF ensured all air operations and induction went as per planning. One central operations room was established to monitor all COVID cases and their contact tracing to include the personal health.

	<p>(e) Overcame non-availability of civil administration and civil support for day-to-day requirements for sustenance.</p> <p>(f) Mitigated shortage of medical resources like doctors, medical staff, PPE, ventilators etc.</p> <p>The supply chain in the scenario mentioned above was already largely affected by cold weather, terrain restrictions, bad weather peculiarities, and poor transportation. An additional requirement to defend fronts at Galwan aggravated the straining supply chain to its maximum limit, which was already infected by the lockdown. With experience and foresight, all steps and necessary actions were put into place to achieve success tactically and strategically.</p>	<p>With these volumes military could overcome the requirement of pulling in our troops into Leh in the desired time frame.</p> <p>(b) Induction of Fresh 20k Troops. This had never been done before nor ever planned prior to this, so the existing depleted supply chain system suddenly had the additional load of these 20k also. There was also a need felt to segregate these 20k from the previous 10k for better administration accountability.</p> <ul style="list-style-type: none"> ○ Vision. With no time for preparation and elaborate planning, foresight and vision in accommodating for the quarantining / isolation and acclimatization of these troops posed a new challenge. These troops did not have the available support structure neither administratively nor medically. Adhoc arrangements for accommodation were established alongside road where ever possible. ○ Establishment of Communication with Air Control. Continuous coordination with Air India and IAF ensured all air operations and induction went as per planning. ○ Administration. Sustenance of 20k person landing up at Leh with no Civil support nor existing available accommodation created the instability as predicted. Therefore, creation of fresh facilities to cater for administration were set up insitu by the organisation itself. <p>(c) Mitigation of Spread of Virus. Alongside new challenges, a mundane but never before task of handling the pandemic was also on the shoulders. The following were the broad measure instituted: -</p> <ul style="list-style-type: none"> ○ Camps. Establishment of 30 COVID camps over 400km territory was inescapable for quarantining and isolation of troops per government protocols. The infrastructure, administration and the staff to run the camp were sub allotted to the local military units around the camps and its operations 	
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		<p>decentralized. Central control was next to impossible.</p> <ul style="list-style-type: none"> ○ COVID Monitoring Room. One central operations room was established to monitor all 	
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Source: Author's analysis of data

Discussion and Analysis

Based on the above data captured through the interview of the various professionals in different sectors of the Indian economy, one can clearly see different supply chain challenges faced by the firms. The different sectors of the economy that have been analysed can be divided into three categories namely Manufacturing sector, Infrastructure sector and Services sector. The Manufacturing sector has different industries such as Chemical industry, Food and Beverage industry, Automobile industry and Pharmaceutical industry. The Infrastructure sector has various industries such as Real Estate, Building Materials and Construction. Similarly, the data collected interviews from services sector industries such as Banking, Software, Broadcaster, Hospitality and Financial Services.

Manufacturing sector:

The major issues faced by the manufacturing firms due to COVID-19 pandemic was the impact on their supply chain. Major issues faced by the firms by almost all the industries in this sector was the supply disruption. This manifested in the form of uncertainty among the buyers about the raw materials, shortages of raw materials and packaging materials,

availability of parts from the vendor (service level impacted), many of the components became obsolete which had lower shelf life particularly in pharmaceutical sector. The other challenge was that in anticipation of demand, inventories were piled up at various stages of the supply chain. This phenomenon was more prominent in the food and beverage sector which witnessed surge in demand due to uncertainty of the lockdown scenario. The unpredictability of the demand affected almost all the industries in the sector but the most prominent were food and beverage, automobile and pharmaceutical. In automobile industry, the vehicle sales decreased drastically due to lockdown and uncertainty about the future. In pharma industry, the demand skyrocketed for few products and the supply chain predictive model failed to take account of that. The case in point is the demand for the ventilators that grew exponentially during the second wave of COVID-19. The production planning designs have to be altered to take into the account the surge in demand. The other major issue faced by the manufacturing firms is related to the shortage labour force due to lockdown and social distancing norms. In pharma industry, the quality control measures had to be restructured to accelerate the approval process.

The manufacturing firms responded with various measures to address the challenges posed by the COVID-19 pandemic. The firms tried to get approval for some of their product to be in essential goods category so that their smooth movement can be insured. Some of the suppliers were helped by these firms to get enrolled as an essential goods supplier. Another intervention on the supply side was to develop the alternate vendor to build the resilience in the supply chain. The firms also made effort to understand the effect of COVID-19 pandemic on the supplier lead time and made efforts to minimize the impact. To build redundancy in the system, sourcing managers should be rewarded for making supply chain more resilient. Also, taking the opportunity to manufacture ventilators, firms like Ford and 3M cross leveraged their personnel and idle manufacturing capacity. On demand side, different scenarios were run to analyze the impact on finished goods in collaboration with customers. Postponement and cancellation of not produced orders were executed. Short horizon forecast was implemented (weekly) to maintain the forecast accuracy. In automobile industry, firms started pre-collecting the order from retailer's end. Based on this input, the distributors placed their order. To incentivize the early placement of orders, 2% extra incentive was given. Some of the firms also approached the problem with the lens of lean manufacturing practices. GE optimized the processes using lean tools to reduce the response time. Also, firms deployed new technologies to increase their supply chain visibility. To build resiliency in the system, redundancy had to be built in the system by adding extra manufacturing capacity or by carrying extra inventory. The logistical challenge for pharma sector can be dealt with optimization and having greater visibility. One of the long-term measures which the manufacturing firms were discussing was of the regionalization of the supply chains. But the firms are of the opinion that it would take time to bring a significant change in this direction.

Most of the manufacturing firms have devised the long-term resiliency plan for their supply chains. Some of the chemical manufacturing firms opted for additional discounts for retaining customers. Automobile manufacturing firms went for cost cutting in short run to curb their manufacturing costs and also, established a communication channel for the distributors through zoom calls which helped them to reduce their outstanding from the market. A few manufacturing firms opted for more creative and flexible way of working due to changing norms at workplace because of COVID-19 pandemic.

Infrastructure sector:

The infrastructure sector comprised of mainly different industries such as Real estate, Building materials, Interior design and Construction. The firms in this sector faced major issues due to COVID-19 pandemic. One of the major issues was of raw material shortages due to closure of markets. The availability of raw materials like cement and sand were in short supply due to closure of mines due to Government restrictions. Due to shortages of raw materials, many firms faced the stoppage of the projects and the funds got stuck with the regulatory authority due to non-completion of the project. The second major issue faced by the firms was shortage of labour supply. As infrastructure is a labour-intensive industry, the shortage of the labour impacted the industry severely. Most of the workers who work in construction sites are migrant workers. These workers went back to their native places following the lockdown. For example, one of the firms in interior design and building industry cited that labour force during lockdown decreased by 50%. The cost incurred by the firms in hiring the contractual workers also increased. The third issue that the availability of the construction equipments such as Transit mixtures and pumps. The vendors for these equipments started charging more to mitigate their losses due to the fixed cost incurred by them.

The firms undertook various measures to curb the impact of COVID-19 pandemic on their value chain. To lessen the effect of raw materials shortages, the firms created flexibility in the projects where the on-site manufacturing of the cement occurred. Rationalization of the demand was done to prioritize some plants over the others. Long term tie-ups were made with the suppliers for raw materials availability. Other sources of raw materials were explored and a tradeoff between transportation costs and raw material costs were made. The quality control department took innovative steps to change the mix preparation to save costs. To mitigate the ill effects of labour shortages, labour camps were setup with basic facilities to avoid the migration of the workers. The labour contracts were revised to lower the contract rates during the pandemic. To lower the fixed costs further, land lease rates were also renegotiated. To control the logistics costs, variable cost model was adopted by the infrastructure firms. To address the shortages of the equipments, most of the equipments were shared between the plants and new equipments were purchased on

sharing basis. The flat whose payments were yet to be deposited were given priority over others and were to be finished at the earliest. The imported raw materials were airlifted to address the shortages.

The firms formulated some long-term strategy for building the resilience in the system. Relocation of offices were done and the staffs were relocated to other locations. The strategic decisions were now more focused towards “Make in India” initiative. To build resilience in the system and address the shortages of the raw materials, companies tied up with the vendors for long term.

Services sector:

The services sector contributes a major portion of country’s gross domestic product. The impact of COVID-19 pandemic on the services sector was severe. The services sector industries such as Banking, Hospitality, Software, Broadcaster, Financial services and Military. One of the major issues faced by the Banking, Software and Financial services industry was of Work from Home (WFH). There was no precedence for the WFH mode of working on continuous basis. The lack of infrastructure such as high-speed internet, shortages of laptops and lack of VPN enabled devices were of major concern. WFH also resulted in ineffective execution of the tasks during initial period of the lockdown. Also, the interaction with global teams during WFH was a challenge due to lack of sufficient bandwidth with the internet and also cybersecurity challenges. The other issue that service sector particularly software industry faced was that of high attrition rate of the software engineers due to WFH norms. These WFH norms provided them flexibility to work from anywhere and hence options were not limited by the geographical constraints. Another service sector industry that was impacted uniquely was Broadcasting. For the industry, creating content while keeping the tab on the mood of the audience is the key. However, due to sudden lockdown and social distancing norms, it became difficult to generate new content. The unique challenge was that the demand for content increased as most of the people stayed at home but the industry was not able to cater the surge in the demand. Due to this the revenue plummeted from ~100 Cr. To ~20 Cr. Hospitality industry faced the challenge particularly for their restaurant business. Raw material shortage for the kitchens was one of the major issues. Logistics for moving a raw material due to restrictions on moving goods was a concern area. The transportation costs and raw materials costs also shot up. The imported materials availability also got impacted in a major way. The imported materials could not be shipped due to restrictions and transport issues. Thus, the hotels had to buy the raw materials from the local vendors who then charged premium for these raw materials. The demand forecasting could not be done accurately due to uncertainty prevailing. This also resulted in inventory being either piled up or shortages scenario. Military also got impacted due to COVID-19 disruptions and international geopolitical situation. Transportation of military personnel across the country during

lockdown and then back to their respective forward deployment areas posed a major logistical challenge. Fresh induction of military personnel imposed a major challenge as they had to be quarantined and acclimatized before being deployed to certain areas. The resources had to be arranged for the forces and due to labour constraints the pace of the work got affected.

The service industries tried to tackle the challenges posed by the disruption of COVID-19 through various interventions. The firms adopted WFH policies and provided an enabling environment to employees. Laptops and broadband connections were provided to the employees. Some of the firms particularly in the software industry opted innovative hiring practices by increasing the packages for recruitment at tier-1 city level. Also, the firms that were interviewed had tripled their hiring teams. The financial services industry also framed the WFH policies and they urged the employees to increase their service availability to cater to the increased demands. Employees were encouraged to engage the customers on virtual meetings. Addressing the cyber security concerns, the financial services firms adopted the two-factor authentication for VPN. These financial firms kept a tab on evolving situation of the pandemic through review meetings and business impact analysis. Coordination between the teams was encouraged so that in case of absenteeism, the work doesn't get affected. Military also struck a right balance between the spread of the virus and completion of the tasks at hand. The approval for the movement of troops through trains were taken from highest level to smoothen the flow. Adhoc arrangements were made for the newly recruited troops wherever possible. Establishment of control system was done in coordination with Air India and IAF. To curb the spread of COVID-19, 30 COVID camps were established over 400kms territory with local military unit taking care of the operations. A central monitoring room was established to monitor these camps. Another service sector industry that took innovative measures to mitigate the ill effects of the COVID-19 pandemic. Old shows were re-telecasted for the viewers banking on their nostalgic value. The Hospitality sector took various steps to curb the impact of their supply chain disruption. Similar to some of the manufacturing firms, hotels looked for alternate vendors to build resilience in their supply chains. However, this also increased costs of the supply chains.

The service sector firms also devised a long-term strategy to build effective resilience into their value chains. In Banking and software services, WFH has been retained as a policy for some % of the employees. Data security norms has been strengthened and GDPR norms have been taken into account. In financial services sector too, WFH norms were implemented for the short-term and infrastructure were made available for the same. Military services implemented some Adhoc measures to support the newly recruited 20k troops. Due to paucity of time, short-term measures were implemented such as administrative measures and medical facilities. Central operations room was established to monitor COVID-19 cases and contact tracing. The Hospitality industry suffered from disruption of the supply chain and resultant high prices. To mitigate these in long-run,

alternate vendors were looked for and new suppliers were added to build resilience into the system.

Table 2: The risk management measures taken by organizations to manage the supply chain challenges due to COVID-19 pandemic are discussed as follows

S No.	Risk management measures	Explanation
1	<i>Capacity Enhancements</i>	Increasing work hours but reducing people on the shop floor.
2	<i>Promoting Teleworking</i>	Promote teleworking by increasing access to proper hardware and software to minimise Covid-19 spread at the workplace.
3	<i>Shift work</i>	Shift work has been introduced to avoid large concentrations of workers in the facility centres and warehouses.
4	<i>Restrict non-essential travel and promote flexible working arrangements</i>	All travel plans were postponed, including business travels and job assignments. Necessary information was shared by the office administrations/management about travel restrictions, recommendations issued by the Govt of India, the latest information on areas where COVID-19 was spreading and health risks for travellers.
5	<i>Planning and Communication through Virtual Meetings</i>	In-person meetings were avoided. Preference was given to phone calls, emails and virtual meetings for communication purpose.
6	<i>No-contact delivery</i>	Delivery workers, truck drivers and other transportation workers were assisted in minimising the direct contact with customers and ensuring personal hygiene practices such as handwashing and hand sanitisers. In addition, the provision of PPE kits was considered, where the workers were in direct contact with the clients.
7	<i>Developing a crisis command centre</i>	It will systematically organise and coordinate the supply chain system during the pandemic. This will strengthen communication channels and establish relations with all stakeholders (customers, suppliers, management, etc.)
8	<i>Digitalisation</i>	Invested in technology and infrastructure to support remote work and virtual collaboration capabilities. The business sectors were also focusing more on leveraging artificial intelligence and the adoption of Cloud Services for a better understanding of customer's changing demands.
9	<i>Alignment of IT systems/Evolving Work from Home (WFH)</i>	<ul style="list-style-type: none"> i. Provision of Asset (Software, Infrastructure and Remote working). ii. Enhanced Remote support and troubleshooting. iii. Bandwidth optimisation for Remote support done. iv. Data card/Broadband connectivity for remote connectivity from home for critical resources available. v. Process of Shipping replacement/new laptops and collecting the old laptops with Courier vendors done. vi. Asset care guidelines published and communicated regularly. vii. Discussion with Laptop vendors for bulk orders for speedy deliveries done to prioritise. viii. Forecasting of new Laptops requirements made a regular monthly activity.

		<p>ix. Smart use of VPN advocated employees.</p> <p>x. Acceleration on the adoption of Cloud Services.</p>
10	<i>Vendor management/Understand and activate alternate sources of supply</i>	<p>During the pandemic and issues with supplies, alternate vendors had to be looked at, and a new supply chain had to be created. This meant increased costs on account of new vendors and logistics. Procurement of new vendors according to new needs of customers/clients; finding out what kind of vendor services would be more critical in the pandemic situation. Therefore, new strategies were built to support these vendors in this challenging situation. Key business partners (especially in the supply chain) were mapped to product lines, and their status is checked daily with a prediction for the following days.</p>
11	<i>Understand the demand impact</i>	<p>Much focus was laid on the new demand line of the customers. They demanded more food with better shelf lives, as they wanted to store more food due to panic in the lockdown. So understanding the impact of demand specific to Business was essential.</p>
12	<i>Communication with key customers</i>	<p>Given the probability of shortages, inventory management, timely communication with key clients, and alternative supply arrangements were explored. As a result, the business sectors came up with ways to cut costs and prevent consumer attrition during this challenging period. The team also did early morning or late-night deliveries to circumvent risks of power failures in their areas in consultation with project managers to keep customer commitments. For customer interactions, employees were encouraged to utilise virtual meetings to limit the risk for themselves and the customers.</p>
13	<i>Inventory allocation strategy</i>	<p>Strategies like "first come, first serve" and "fair share" were used during the lockdown to fulfil the customers' needs, especially in the food and beverages business sector.</p>
14	<i>Regulatory requirements</i>	<p>The contractual labourers were coming from far away to the site location. The local train services were stopped in various places. The firms arranged the labour bus for transport and appointed a camp boss for each location. The camp boss took care of the camp and regularly measures the parameters of each labour (temperature, oxygen, pulse level, etc.) and also arranged the grocery, kirana, utility, etc., requirement. Also, the staff members of the company were commuting from far away to the site. Therefore, there was a need for a few rented accommodations in nearby (walking distance) and needed to shift all the staff to those places. Labour camps were set up within the construction site with provisions of basic needs (food/water/shelter in place), avoiding any need to step out of the site.</p>

15	<i>Community partnerships</i>	The availability of towing vans and plant vehicles were also reduced and were shared between plants at multiple plant locations. The raw material had been arranged from nearby location and mines.
16	<i>Reviewing, Testing and Update</i>	Regular emails were sent on health awareness and government-issued circulars. When any family members get infected, the HR and Facility team were informed. Review meetings were conducted on periodic basis for status update on pandemic situation.
17	<i>Cyber Security</i>	Customers were asked to contact the office administration related to security matter as there is an increased risk for cyber frauds. Enhanced VPN login security of VPN to two-factor authentication were adopted.
18	<i>COVID-19 symptoms and prevention</i>	Organisations educated their staff and their key suppliers about the symptoms of the virus and followed the protocols of the government of social distancing and wearing of masks.

Source: Author's analysis of data

The following figure gives details about major issues in different sectors and different focus areas where the organizations focused to mitigate the disruption caused by COVID-19 pandemic.

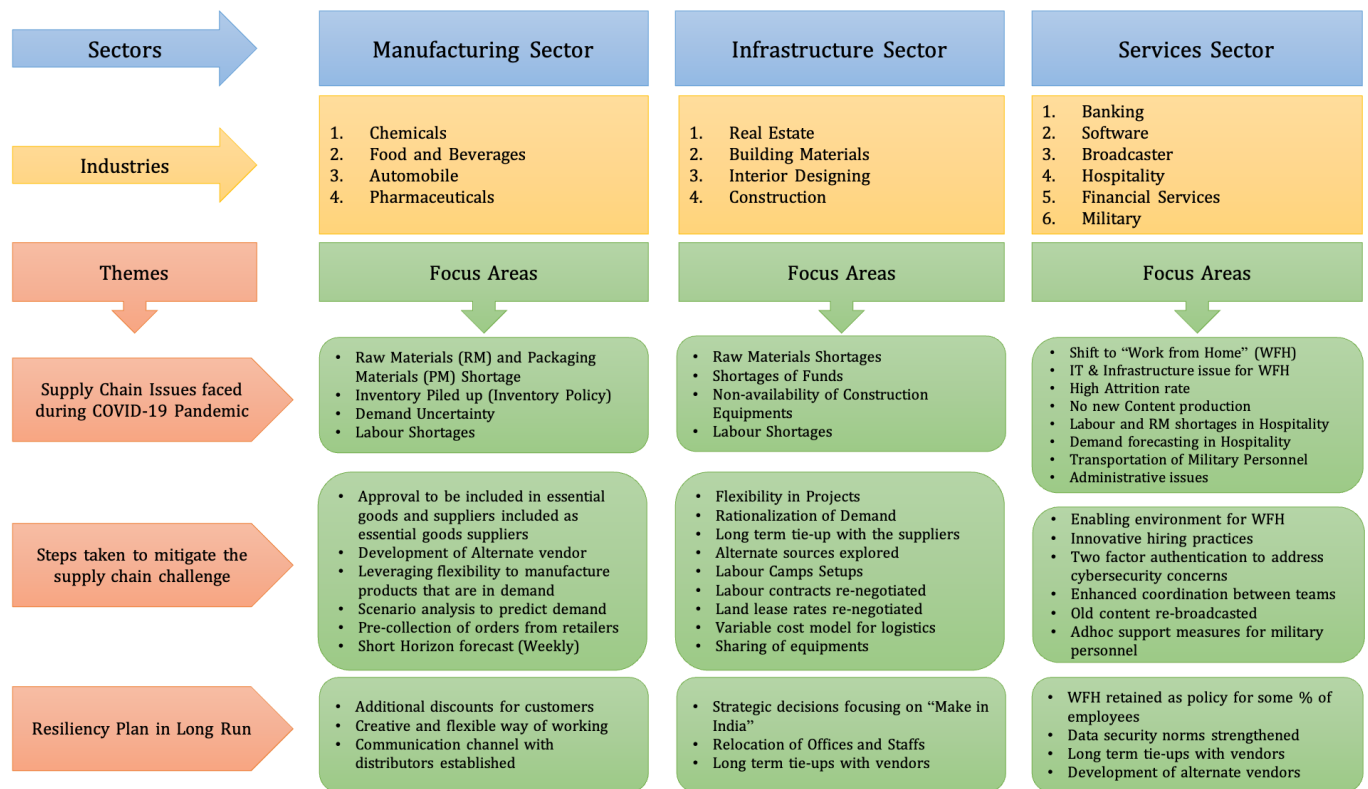


Fig 4: Focus areas in different sectors under different themes (Source: Author's analysis of data)

The major issues faced by the firms in different sectors were identified from the interview data collected. The interview data further gave insights about the steps taken by the firms in the short-term to mitigate the immediate challenge faced due to disruption in the supply chain. Long-term plan to build resiliency in the system was also a key insight which the data provided. However, systematic academic research into these focus areas can shed light on these issues and can generate more novel ideas to build a resilient supply chain for the future. Academic researchers can focus on these areas and can find useful insights through analyzing different variables in the case of a disruption. Researchers from different business disciplines such as Operations Management, Finance and Organizational Behaviour can collaborate to study the issues and provide a useful case by case solution by analyzing different scenarios. The following figures suggests some of the academic research areas that have been derived from the focus areas discussed in this paper under different themes.

Manufacturing sector:

The focus areas were identified from the qualitative data captured from interviewing the executives from the manufacturing firms. The figure below indicates towards the corresponding area of academic research that can be pursued in future academic researches.

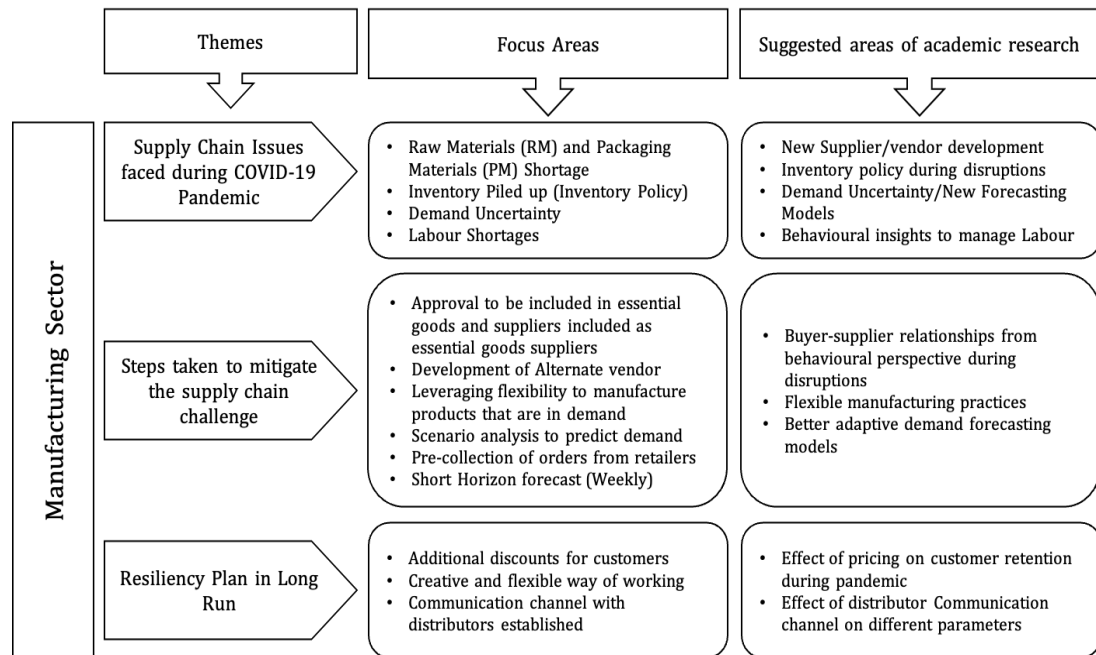


Fig 5: Suggested areas of academic research in Manufacturing sector (Source: Author's analysis of data)

Infrastructure sector:

Similarly, the focus areas were identified for infrastructure sector based on the interview data from the executives of infrastructure firms. The following figure suggests the corresponding academic research areas that can be investigated further which will help building resiliency in the value chain of these firms.

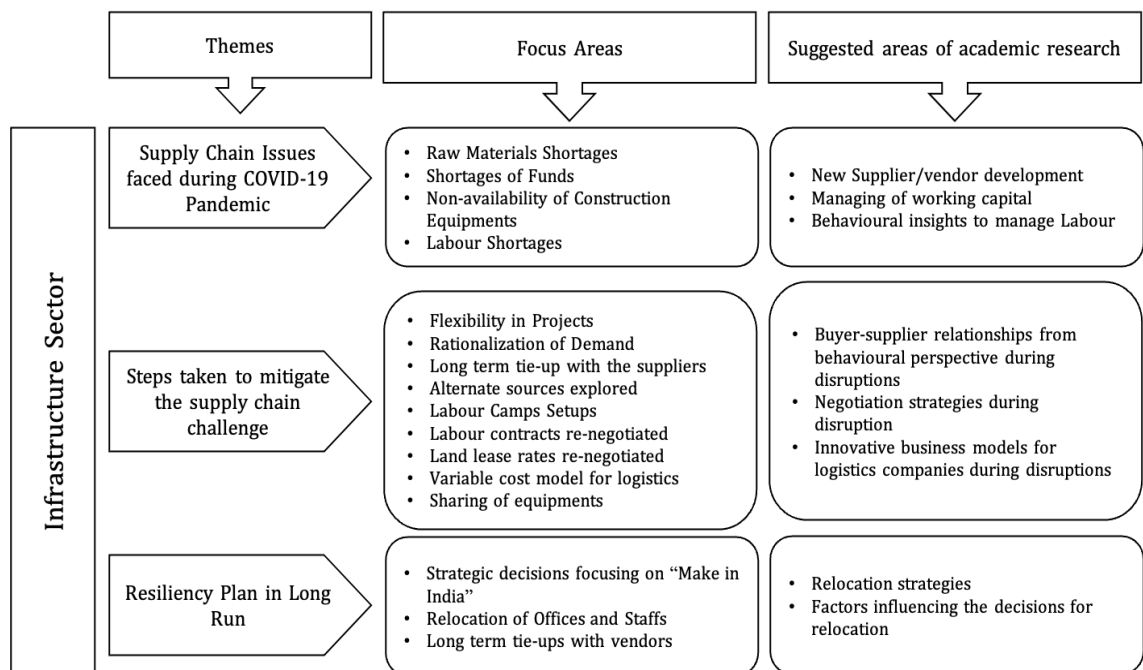


Fig 6: Suggested areas of academic research in Infrastructure sector (Source: Author's analysis of data)

Service sector:

The services sector was also impacted due to COVID-19 pandemic. The qualitative data in the form of interview captures the focus areas under the themes. The following figure depicts the suggested areas of academic research corresponding to the focus areas identified from the data.

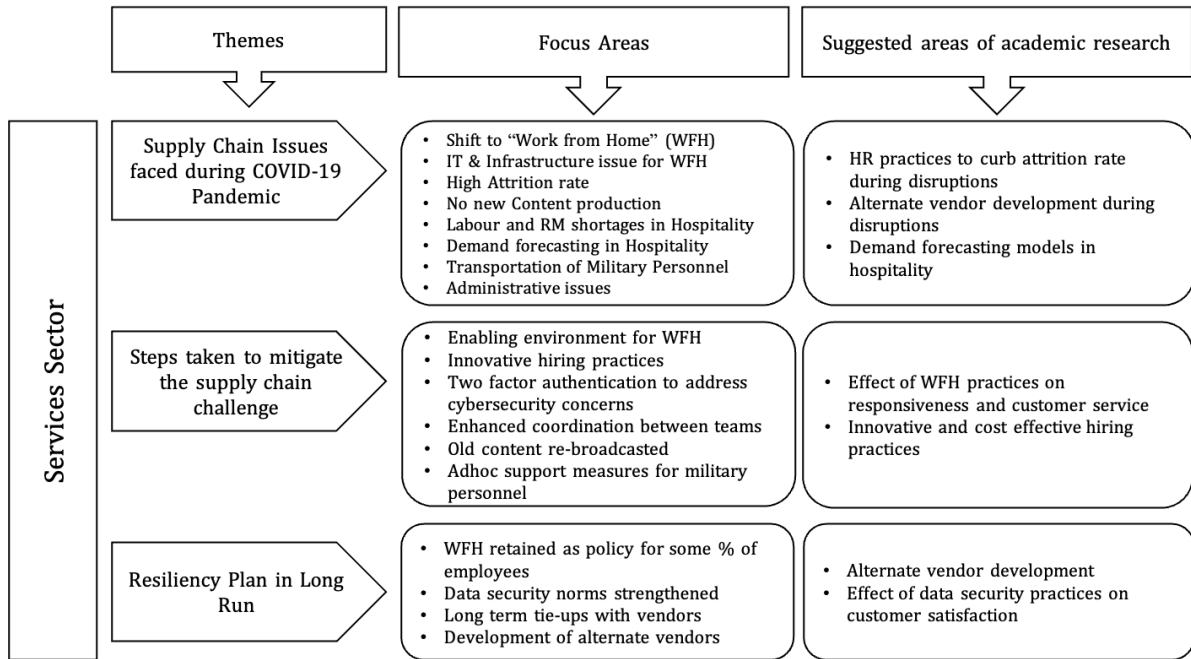


Fig 6: Suggested areas of academic research in services sector (Source: Author's analysis of data)

Conclusion

The qualitative data collected through various telephonic interviews, emails and virtual roundtable meetings with supply chain executives in different firms across sectors helped to gain useful insights. The severity of impact of COVID-19 pandemic on different value chains were evaluated using structured interview methods. The questions were designed to gain insights into the effect of COVID-19 pandemic induced disruptions, the immediate response of the firms to mitigate the challenge and the long-term plan to build resilience into the supply chains. The response to these questions were captured and analyzed to assess the major focus areas under each question/theme. These focus areas acted as a gap to be filled by the academic research. In manufacturing sector, academic research can focus on areas such as inventory policies during disruptions, different behavioural dimensions in buyer-supplier relationships during disruption of supply chains, effective HR practices during uncertain times to manage labour and improvement in forecast accuracy amidst disruption using ML algorithms. Similarly, in infrastructure sector, academic research could focus on the new vendor

development practices during disruptions, innovative business models for logistics companies, managing working capital, innovative negotiation strategies during pandemic using interdisciplinary theories and global facility location models amidst disruption of global supply chains. In services sector, the focus areas are somewhat different from the manufacturing and infrastructure sector. The academic researchers could look into the areas such as effective HR practices to curb the attrition rate in uncertainty, effect of Work from Home (WFH) practices on customer service levels, responsiveness etc., regionalization of supply chains for hospitality sector and effect of implementation of data security practices on cost, customer satisfaction etc.

The academic areas of researches mentioned in this paper are based on the qualitative data collected and hence are indicative. More research areas can be explored further since the pandemic is still ongoing. The long-term impact of this disruption can also be researched after the pandemic. The academic research will help supply chains to become more resilient in long-term and will also provide theoretical base to prepare firms for any similar scenarios in future.

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