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Influence Of Covid-19 On The Global Supply Chain: Learned Lessons And Mistakes Never Forgotten

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ABSTRACT

Aim: The outbreak of the Covid-19 pandemic has increased uncertainties and disruption in a supply chain. Therefore, the aim of the researcher is to explore the influence of pandemic on the supply chain. However, to address this aim three main challenges were determined (disruption on the supply side, logistics and storage, and demand side) based on the literature review, to analyse its influence on global supply chain and how the mitigation strategies control disruption on these challenges.

Method: To conduct this research, the primary quantitative research method was used, and survey questionnaires were distributed among employees and managers of the supply chain industry. After data collection, Descriptive statistics, regression analysis, and moderation analysis were used through using SPSS software.

Findings: Findings revealed that covid-19 has increased the disruption on the demand side, storage, logistic side, and supply side which negatively and significantly influences the global supply chain. Further, findings have also revealed that moderating effect of mitigation strategies has reduced the disruption in supply, storage, and logistic side which ultimately positively influences the global supply chain. Whereas, moderating effect of mitigation strategies has remained unsuccessful on the demand side.

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Future Implications: It is essential for policymakers and authorities to learn from mistakes, and also focused on demand-side strategies to overall reduce the negative influence of Covid-19 on the global supply chain in the coming future.

Keywords: *Covid-19, Supply chain, Disruption, Barriers, Challenges, Strategies, Demand & Supply, Logistic and Storage*

INTRODUCTION

Emergance of Covid-19 has been one of the major global issues. Initially, it emerged from Wuhan city in China, and it rapidly spread all over the world (Donthu & Gustafsson, 2020, Ivanov & Dolgui, 2020; Verma & Gustafsson, 2020). Although, it has attracted much attention among practitioners, scholars, and researchers in different areas and disciplines (Ivanov & Dolgui, 2020; Ivanov, 2020) as, it has influenced every aspect of the business environment, especially the supply chain. Likely, Ivanov & Dolgui (2020) in their study indicated that Covid-19 has increased the restrictions on production, manufacturing, and supply chain due to shut down exposed by authorities and states everywhere. The author further evaluated that majority of the sectors have witnessed a decline in demand, whereas other sectors (i.e. sanitizers, masks, pharmaceuticals, and healthcare) have witnessed a sudden increase in demand.

Similarly, Covid-19 has also increased uncertainties and disruption in supply chains (Ivanov, 2020). As there is an example of Fortne 1000 companies, the majority (i.e.94%) companies have faced disruption in the supply chain due to the restrictions imposed in pandemic (Fortune, 2020). Moreover, Singh et al. (2021) in their study indicated that the outbreak of Covid-91 has an influence on supply chains different areas including; demand side, supply side, and storage side. The author further evaluated that MNCs have also experienced a supply shock due to restrictions imposed on exports. Similarly, the majority of the companies have also faced demand shock due to uncertain demand, while some companies have faced a shortage of labour, raw materials, and delays in deliveries.

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However, there is little amount of research on the supply chain in the context of the Covid-19 pandemic (Ivanov & Dolgui, 2020; Ivanov, 2020; Singh et al., 2021). A very limited amount of research has been conducted on a micro level, while those studies that exist have only focused on theoretical attempts to evaluate the Covid-19 pandemic. Thus, in the context of supply chain supply, challenges faced by the supply chain amid COVID-19, and mitigation strategies for these challenges are largely missing. Therefore, the aim of this research is to explore the challenges that influence on global supply chain due to Covid-19 to bridge this gap. The following research questions have been designed to address this aim:

- What are the main challenges that arises due to COVID-19?
- How these challenges influences on the global Supply chain?
- How mitigation strategies addressed these supply chain challenges, and what lesson can be learned from these strategies in future?

LITERATURE REVIEW

Contemporary supply networks are characterised by their emphasis on creating and maintaining a value chains. These value chains are dependent upon efficacy of sources of raw materials and intermediate products to ensure delivery of high-end products (Gereffi, 2014). However, ability to forecast the supply fluctuations constitute the heart of this efficacy (Fama et al., 2016). The Covid-19 pandemic thwarted this ability through multiple economic and systemic shocks permeating throughout the global supply chains. The supply side was initially the most affected by COVID-19. The global economy goes from point "a" to point "b," with decreased output, higher prices, or "stagflation," as a result of manufacturing closures in China and other countries (Nikolopoulos et al.,2021). In particular, if the supply curve, which is also a cost curve, is price-insensitive in the short term due to the inability to find alternative sources of components and materials, a demand-side response to the contraction (such as Central Banks lowering interest rates to increase demand) will only slightly affect output and employment. Regarding the supply-side disruption, literature

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has noted that Covid-19 has made labour and raw resources scarcer as a result of limitations put in place by governments and states. This has a negative impact on Covid-19 (Sodhi et al., 2021; Raj et al., 2022). Findings from analysis of Ando et al. (2022) supported this, showing that interruption on the supply side has a negative and considerable impact on Covid-19. Similar findings from other research have shown that COVID-19 has exacerbated delays, vehicle shortages, export restrictions, and last-mile delivery issues that have a detrimental impact on the global supply chain (Hippold, 2020; Raj et al., 2022).

H0a: Disruption on the supply side due to covid-19 has no significant influence on the global supply chain.

H1a: Disruption on the supply side due to covid-19 has a significant influence on the global supply chain.

While logistics comprise the dynamic part of supply chain, storage constitutes the essential static aspect. With increasing length and complexity of the global supply chains, it has become imperative for manufacturers to have storage facilities across a wide range for geographical locations to ensure that their materials remain in deliverable conditions (Cohen and Roussel, 2013). However, distortions in the supply lines had direct impact on storage facilities. For instance, lowered consumption of fuel exerted substantial pressure on fuel refineries for arranging storage of excess quantities refined, since those quantities were refined on forecasts prior to the Covid-19. Logistics companies help connect businesses to markets by providing a variety of services like multimodal transportation, freight forwarding, warehousing, and inventory management.They are essential to the global industrial industry, which is complex and dispersed.Companies that handle the movement, storage, and transfer of goods are directly affected by the Covid-19 pandemic (Michail et al.,2020).Companies rely on logistics companies as an essential component of value chains to get their goods to customers, both domestically and internationally, as they facilitate trade and commerce.As a result, the pandemic's disruptions to the supply chain may have an impact on the sector's competitiveness, economic expansion, and job creation (Mohammed et al., 2021).

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H0b: Disruption on the storage and logistic side due to covid-19 has no significant influence on the global supply chain.
H1b: Disruption on the storage and logistic side due to covid-19 has a significant influence on the global supply chain.

Demand side disruptions are majorly a consequence of macroeconomic fluctuations within a state. These fluctuations are caused by changes in local consumption patterns either due to external factors or government policies which focus on reducing inflationary impact of consumption (Hobbs, 2020). However, in contrast to government's policies which manufacturers could anticipate for, disruptions due to Covid-19 had multifaceted impact on manufacturing business. For instance, in terms of energy demand (which indirectly shows the level of consumption in a society), statistics from July 2020 compared to the same month in 2019, the peak decrease rates of power usage (weather corrected) during the lockdown period were more over 10% in Italy, France, Spain, Germany, UK, India, andChina (IEA, 2020). According to estimates, the weekly energy consumption would decrease by around 9% under light limitations, around 17% under a partial lockdown, and 24% with a complete lockdown. Hippold (2020), Birkie and Trucco (2020), and others concurred when they claimed that Covid-19 exacerbated demand uncertainty and resulted in a scarcity of commodities. Additionally, when discussing how disruptions in the supply chain affect demand, storage, logistics, and supply sides globally, the term "moderating impact" of mitigation techniques has also been used for supply chain difficulties.

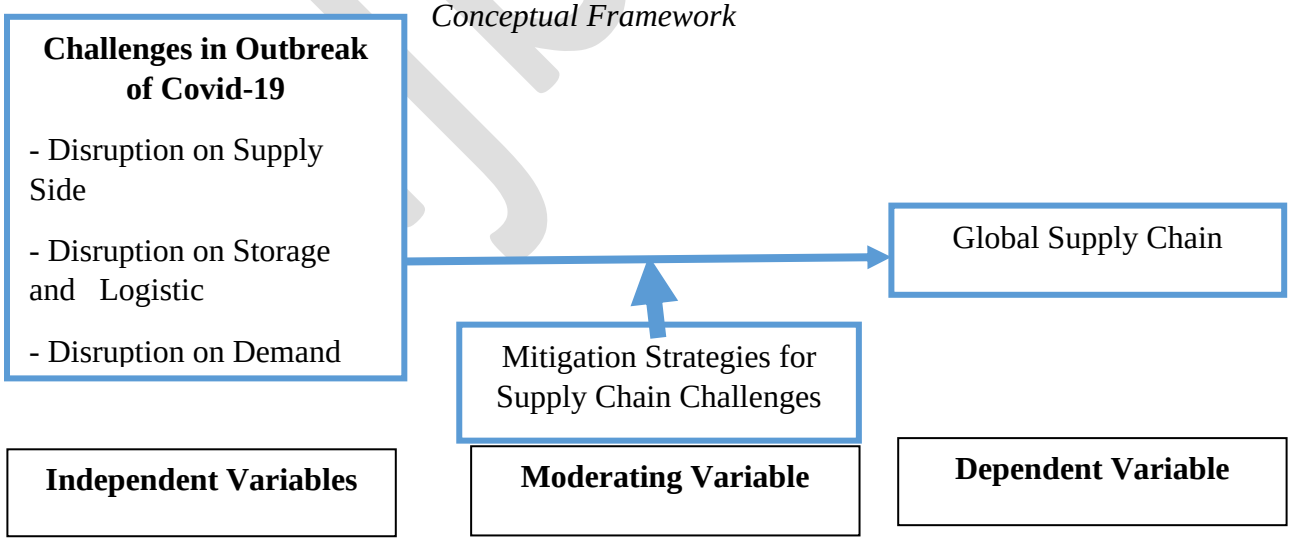
Baker et al. (2020) examined data of transaction for the U.S. and discovered that expenditure jumped significantly in March, at the onset of the epidemic, especially in retail, credit card spending, and food goods. Then, in April, there was a significant drop in expenditure overall. According to Cox et al. (2020), rather than being the consequence of labour market disruptions, U.S. expenditure drops in the early period of recession were mostly brought on by the pandemic's direct effects. Consumer expenditure in the U.K. remained rather steady in the initial phases Covid-19, but it drastically decreased later on (Chronopoulos et al., 2020).

H0c: Disruption on the demand side due to covid-19 has no significant influence on the global supply chain.
H1c: Disruption on the demand side due to covid-19 has a significant influence on the global supply chain.

Companies and governments have formulated various strategies to enhance resilience of their supply chains against Covid-19. Meanwhile, Gereffi (2016) asserted that a major limitation for global supply chains is their lowering efficiency and over extended complexity, which disables organisations from rapidly upgrading them. Results from earlier research have also shown that handling risks from Covid-19 and reorganising resources, companies' skills, technology innovation, and other factors may considerably assist businesses take advantage of opportunities and maintain their position in a changing business environment (Belhadia et al., 2020).

H0d: The effect of disruption in demand, storage and logistic, and supply side on global supply chain is not moderated by mitigation strategies for supply chain challenges.
H1d: The effect of disruption in demand, storage and logistic, and supply side on global supply chain is moderated by mitigation strategies for supply chain challenges.

Conceptual Framework



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METHODOLOGY

In research philosophy, there are two main types of philosophies namely positivism and interpretivism (Saunders et al., 2015). In this specified research, a researcher has relied on the philosophy of positivism, as the current research is based on objective information. Thus, the justification for using the philosophy of positivism is it assists the researcher in ensuring reliability by eliminating biased information.

Concerning research design, there were two main options for a researcher to carry out this research including quantitative research design and quantitative research design (Edmonds & Kennedy, 2016). However, the intent of the researcher is to analyse the influence of Covid-19 on the global supply chain; therefore, quantitative research has been deployed. The justification for using the quantitative method is as it researcher uses statistical and mathematical tools for analysis while ensuring the validity of data and findings.

In the research approach, there are two main types of approaches that are widely used to carry out a study (i.e., deductive and inductive approaches) (Azungah, 2018). Based on the nature and topic of the current research, the deductive approach is the most suitable approach. Hence, it assists the researcher in testing the hypothesis that was developed, based on the aim and objectives of this research.

For data collection, the primary quantitative research method has been used. Information was collected from 200 participants (employees and manager in supply chain industry) using a close-ended questionnaire, based on the Likert scale. Hence, it enabled the researcher to collect up-to-date information relevant to the research topic while eliminating errors and inherent biases. For data sampling, convenience sampling was used, as per the accessibility and convenience of the researcher. After data collection, descriptive, regression analysis, and moderation analysis were used through using SPSS software to ascertain the statistical relationship between variables.

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RESULTS

Descriptive Statistics

In the current research, descriptive statistics has been used as a first step to summarise the key variables involved in the current research. Likely, Mishra et al. (2019) in their study indicated that descriptive statistics is one of the most essential statistical measures to analyse and understand the characteristics of the variables. However, it has been analyse based on the Likert scale from 0 strongly agree to 4 strongly disagree, as shown in the table below:

Table 1 – Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Disruption on Supply Side	200	0.00	3.33	1.31	0.76
Disruption on Storage and Logistic Side	200	0.00	3.00	1.59	0.68
Disruption on Demand side	200	0.00	3.00	1.42	0.68
Mitigation Strategies for Challenges	200	0.00	3.00	1.12	1.03
Global Supply Chain	200	0.00	4.00	1.48	0.99
Valid N (listwise)	200				

Concerning disruption on the supply side, it is noteworthy that value of mean is identified as 1.31, and the value of standard deviation is 0.76 which suggested that the average number of respondents have been agreed, and this mean value is expected to move to strongly agree. Additionally, with disruption on the storage and logistic side, average participants have also responded neutral responses, as the mean value is estimated to be 1.59. However, it has been expected to is expected to move to strongly agree. Moreover, the mean value of disruption on the demand side has been identified as 1.42, and the value of standard deviation is 0.68. It demonstrated that an average number of participants are inclined towards agree and expected to deviate toward strongly agree. Further, while referring to the mitigation strategies for challenges, it can be observed that mean is identified as 1.12, and the value of standard deviation value is 1.03 which suggested that the average number of participants has responded agree, and expected to remain on agree. Lastly, the

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global supply chain's mean value is recorded as 1.48, and the standard deviation value is 0.99 which implies that average participants have agreed, and are expected to deviate toward strongly agree

Regression Analysis

The following equation has been estimated for regression analysis:

$$GSC = \beta_0 + \beta_1(DSS) + \beta_2(DSL) + \beta_3(DDS) + \varepsilon$$

Table 2 - Regression Analysis

a. Dependent Variable: Global Supply Chain					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	-0.212	0.146		-1.446	0.150
Disruption on supply Side	-0.968***	0.060	0.741	-16.222	0.000
Disruption on storage and logistic side	-0.130**	0.065	0.089	-1.990	0.048
Disruption on Demand side	-0.152**	0.065	0.104	-2.333	0.021
Sig	0.000				
R	0.792				
R-Square	0.682				
Significant Level at 1% ***, 5% **, 10% *					

The above table of regression analysis refers to the influence of explanatory variables on the explained variable. However, referring to the above table, the coefficient value of disruption on the supply side is estimated to be -0.968, and the sig value is 0.000 < 0.01. Thus, it suggested that

disruption on the supply side has a significant and negative influence on the global supply chain. Similarly, disruption on the storage and logistic side has also a negative influence on the global supply chain, as the coefficient value is found to be negative, and it is significant at 5%. Lastly, disruption on the demand side has also a significant and negative influence on the global supply chain, as the coefficient value is identified as -0.152, and the sig value is 0.048 < 0.05. Hence, findings revealed that all variables (i.e. disruption on the supply side, demand side, and storage and logistic side have a negative influence on the global supply chain.

Further, the above table also indicates the variance and fitness of the model. Again referring to the above table, it can be seen that R-square is compted to be 0.682 which suggested that 68.2% variance in overall model is due to changes in the explanatory variables. Moreover, the sig value is also found to be significant at 0.05 (i.e. 0.000). Thus, the above-estimated model is significant and appropriate for analysis.

Moderation Analysis

The following equation has been estimated for moderation analysis:

$$GSC = \beta_0 + \beta_1(DSS)(MS) + \beta_2(DSL)(MS) + \beta_3(DDS)(MS) + \varepsilon$$

Table 3 - Moderation Analysis

a. Dependent Variable: Global Supply Chain

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.291	0.082	-	15.707	0.000
Disruption on Supply Side(Strategies)	0.429***	0.048	0.821	8.978	0.000
Disruption on Storage and Logistic Side (strategies)	0.168***	0.050	-0.336	-3.331	0.001
Disruption on Demand side (Strategies)	-0.093*	0.054	-0.161	-1.712	0.088

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Sig	0.000
R	0.556
R-Square	0.309
Significant Level at 1% ***, 5% **, 10% *	

Moderation analysis has also been used to ascertain the moderating influence of mitigation strategies on explanatory variables and dependent variables. From the above table, it can be seen that disruption on the supply side moderating with mitigation strategies positively and significantly influence on the global supply chain, as the coefficient value is estimated to be 0.429, and the sig value is 0.000 < 0.01. Similarly, disruption on the storage and logistic side moderating with mitigation strategies positively and significantly influence on the global supply chain, as the coefficient value is found to be positive, and it is significant at a 1% level. On contrary, disruption on the demand side moderating with mitigation strategies negatively and significantly influence on the global supply chain, as the coefficient value is identified as -0.093, and the sig value is 0.08 < 0.1.

Further, the above table also indicates the fitness and changes of overall model. It is imperative to noted that R-square is computed to be 0.309 which depicted that 30.9% variance in the model due to variance in the explanatory variables. Moreover, the sig value is also found to be significant at 0.05 (i.e. 0.000). Thus, the above-estimated model is also significant and appropriate for analysis.

DISCUSSION

The main intent of the researcher was to ascertain the influence of Covid-19 on the global supply chain. To address this aim four main hypotheses were developed to decipher the relationship between dependent, independent, and moderating variables.

Concerning, disruption on the supply side, literature has pointed out that Covid-19 has increased the scarcity of raw materials, and labours due to restrictions imposed by authorities and states, and as a result, it negatively influences Covid-19 (Sodhi et al., 2021; Raj et al., 2022). This was also substantiated by findings in the current research, as disruption on the supply side has a negative

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and significant influence on Covid-19. Thus, alternative hypothesis H1a is found to be true, and null hypothesis H0a has been rejected.

Additionally, the current research has also examined the influence of disruption in storage and logistics on the global supply chain. However, findings in the research revealed that disruption on the storage and logistic side has a negative and significant influence on Covid-19. Similarly, findings in the previous studies have also revealed that covid-19 has increased the delays, unavailability of vehicles, restriction on exports, and last-mile delivery challenges which negatively influence on global supply chain (Hippold, 2020; Raj et al., 2022). Thus, hypothesis H1b is also found to be true and correct.

Moreover, Covid-19 has also increased the disruption on the demand side. Likely, Hippold (2020); Birkie and Trucco (2020) in their study suggested that Covid-19 increased uncertainties in the demand, and causes a shortage of goods. Similarly, findings in the current research are also in-line with the previous studies which indicated that disruption on the demand side has a negative influence on the global supply chain. Hence, H0c was rejected, and H1c is found to be correct.

Further while referring to the effect of disruption on demand, storage and logistics, and supply side on the global supply chain moderating effect of mitigation strategies has also been used for supply chain challenges. Findings in the current research show that mitigation strategies (i.e. technological adoption, remapping capacity, production, human planning, and initiative strategies) have a significant influence on the relationship between disruption on the supply side, demand side, and logistics side and mitigation strategies. Similarly, findings in the previous studies, have also revealed that reconfiguring resources, firms' capabilities, technological advancement, and managing threats of Covid-19 can significantly help in seizing potential opportunities and sustaining their position in a dynamic business environment. (Verma and Gustafsson, 2020; Belhadia et al., 2020). Thus, hypothesis H1d is also found to be true and correct.

However, the following hypotheses have been accepted or rejected, based on the findings in the current research outcomes.

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Table 4 - Hypothesis Summary

	Hypothesis Statement	Accept	Reject
H0a	Disruption on the supply side due to covid-19 has no significant influence on the global supply chain.		✓
H1a	Disruption on the supply side due to covid-19 has a significant influence on the global supply chain.	✓	
H0b	Disruption on the storage and logistic side due to covid-19 has no significant influence on the global supply chain.		✓
H1b	Disruption on the storage and logistic side due to covid-19 has a significant influence on the global supply chain.	✓	
H0c	Disruption on the demand side due to covid-19 has no significant influence on the global supply chain.		✓
H1c	Disruption on the demand side due to covid-19 has a significant influence on the global supply chain.	✓	
H0d	The effect of disruption in demand, storage and logistic, and supply side on global supply chain is not moderated by mitigation strategies for supply chain challenges.		✓
H1d	The effect of disruption in demand, storage and logistic, and supply side on global supply chain is moderated by mitigation strategies for supply chain challenges.	✓	

CONCLUSION AND FUTURE IMPLICATION

The main intent of the researcher was to determine the influence of Covid-19 on the global supply chain. However, the primary quantitative research method was deployed, and a survey questionnaire was distributed among 200 employees and managers in the supply chain industry, based on a 5-point Likert scale. For data analysis descriptive, regression, and moderation analysis were used to explore the statistical influence and relationship among the variables. However,

findings revealed that disruption on the supply side, storage and logistic, and supply side negatively and significantly influence on the global supply chain.

Further, mitigation strategies were also considered, as a moderating variable in the current research to analyse its influence on the global supply chain. Hence, findings demonstrated that mitigation strategies (i.e. technological adoption, remapping capacity, production, human planning, and initiative strategies) have successfully helped in mitigating disruption on the supply, storage, and logistic side, and overall positively influenced the global supply chain. Whereas, these strategies have remained unsuccessful to reduce disruption on the demand side. Therefore, it is essential for policymakers and authorities to learn from findings, and also focus on demand-side strategies to overall reduce the disruption on the demand side. More so, findings in the current research would also help in bridging the gap between previous studies and literature relevant to the covid-19 and its influence on the supply chain.

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