

Impact of Supply Chain Uncertainties on Supply Chain Performance in Manufacturing Companies: Moderating Role of Organisational Centralization

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Abstract- This research paper assesses the role of supply chain uncertainties on the supply chain performance in the manufacturing companies while considering the role of organisational centralisation. This paper has made use of quantitative data where survey questionnaire was used to collect data from 355 employees and managers working in the manufacturing sector. Structural Equation Modelling (SEM) has been used as the main data analysis instrument. The results of this paper suggests that supply chain uncertainties cannot be considered as an individual factors during the decision making because the organisation structure play an integral role in explaining the relationship of uncertainties with supply chain performance. The model has suggested that customer demand uncertainty has a significant impact over the supply chain performance due to the sig value obtained from the SEM. However, the remaining factors that is: manufacturing uncertainties, customer delivery uncertainty, and supplier performance uncertainty does not have a significant impact on the supply chain performance of manufacturing companies.

Keywords; Manufacturing Companies, Organisational Centralization, Supply Chain Performance

1. Introduction

Supply chain uncertainty has gained increased significance in the manufacturing sector. There have been various studies conducted in this domain to assess the impact of supply chain uncertainty on its performance within the organisations operating in the manufacturing sector. According to the study conducted by [1], based on the uncertain nature, it has been highly difficult to forecast or expect these uncertainties associated with supply chain management as there had not been any formal solutions of dealing with these uncertainties before-hand. Based on the study conducted by [26], the increasing influence of risks and uncertainties in supply chain performance and management has become popular over the past few years. Firms operating in the manufacturing sector in the contemporary world are seeking different tactics to counteract the impacts of the increased levels of the global competition, demanding customers and employees, shrinking life cycle of products and also the decreasing

acceptable response times of attaining success in the market place in terms of becoming the market leader [1].

Based on the study conducted by [34], various huge stakes are involved in supply chain management of the manufacturing sector in terms of making decisions and developing supply chain strategies to make supply chain processes effective and efficient. The study conducted by [6] shows various theoretical aspects of uncertainties associated with supply chain management. It shows that these uncertainties lead towards huge risks that could result in failure of making supply chain management effective in manufacturing organisations. Managers often take supply chain related decisions under various uncertain conditions where these uncertainties arise from various sources. According to the study conducted by [7], endogenous uncertainty exists in these firms operating in the manufacturing sector that could be mitigated in an effective manner by the quick managerial responses. However, there are some exogenous uncertainties that are derived from outside the organisation that are most likely to impact the external environment of the organisation leading to decline in performance of supply chain. In the light of the study conducted by [29], uncertainty inherent in the supply chain management usually has an exogenous factor for any given participant because the functioning of the whole supply chain processes do not only depend on that participant but also on others being the influential aspects of the supply chain process and its effective management.

The study conducted by [24] identifies a significant relationship between the supply chain uncertainties and the supply chain performance that could be understood in terms of the negative impact of higher uncertainties on supply chain management performance. The effectiveness of the performance of supply chain process in the manufacturing sector is highly dependent on their supply chain functions [13]. Exogenous uncertainties primarily are not in the managerial control as arise through the influence of the factors existing in the macro environment. According to the study conducted by [17], the portion of uncertainty associated with the supply chain performance

could be mitigated or reduced over a certain period of time is known as the risk uncertainty. The study conducted by [36] states that in supply chain operations, lead time uncertainty is the primary management issue that leads towards the increasing costs of inventories and unstable level of services that directly impact the performance of the supply chain in a negative manner. The new business approach has led various manufacturing firms to look into different risks and uncertainty mitigating strategies that could enhance the performance of their supply chain functions and could make these processes effective.

2. Literature Review

There have been numerous studies conducted on the impact of uncertainties of supply chain processes on reducing the supply chain performance in different firms operating in the manufacturing sector [27]. According to the study conducted by [35], the emergence of the risks and uncertainties of supply chain management have led businesses operating in the manufacturing sector towards realizing the difference between risks and uncertainties in these areas. There, the uncertainties are related to the ineffectiveness of the decisions made related to the supply chain processes and also lack of capabilities that impacts the performance of the supply chain functions in the manufacturing sector [8]. Uncertainties are primarily associated to the inefficiency of estimating the outcomes of the supply chain management and the probability of the occurrence of these negative outcomes in terms of increasing inventory costs and the reduction in the overall output of the supply chain function. In the light of the study conducted by [33], supply chain uncertainty and risks associated to it are most often interchangeable as organisations operating in the manufacturing sector consider these aspects similar in terms of the decreasing output of their organisations.

The difference between supply chain uncertainty and the risks has been blurred to the degree that the importance of distinguishing the difference does not exist in the contemporary business practices [12]. Furthermore, various supply chain risks are associated to the uncertainty as they cannot be easily separated where the risks are only associated with the issues in the supply chain management that have a potential to lead an organisation towards negative outcomes. In accordance to the study conducted by [2], the traditional thoughts about the supply chain uncertainties and risks refer to two distinct attributes in which the first attribute is related to the inadequate capture of the expected values in terms of the events having a low probability to occur but have higher consequences. The second attribute refers to the occurrence of rare and extreme events that have the potential to cause substantial negative outcomes to the supply chain management of the firms operating in the manufacturing sector [26]. This

study does not only focus on these two extreme conditions and situations but is also focused on the daily operational risks and the high level of uncertainty in the logistics and the transport service providers used to supply the raw materials to the manufacturing units and to transport the final products to other divisions.

According to the study conducted by [10] supply chain risks and uncertainties are usually complex notions that arise in various different forms and might involve different sources of supply chain management risks and uncertainties. Consequences of these uncertainties and risks and also various risks drivers that have an influence on these supply chain processes in terms of altering these processes. Various studies that have been conducted on the similar study area identifies different uncertainties and risks that have a tendency to alter the supply chain processes in terms of leading these processes towards a negative outcome. Based on the study conducted by [26], there are two distinct categories of uncertainties included in the supply chain management processes namely demand uncertainty and supply uncertainty.

The uncertainties identified in this study show that these two types are highly significant to be understood by organisations operating in the manufacturing sector. These could lead towards an increase in the demand and decrease in supply or decrease in the demand and increase in the supply. This is the sign of ineffectiveness in the supply chain management process. The study conducted by [16] indicated that uncertainties associated with the supply chain process in the manufacturing sector were highly relevant to the manufacturing processes implemented internally, processes followed with the supply side and also the issues on the demand side that could be the demand arising from end-consumers.

Based on the study conducted by [20], global trade boosts have started shifting the short-distance supply chain within a region to long-distance supply chain between different countries. This has resulted in an increase in the lead time and has also accelerated fluctuation among the supply chain process. However, there have been various other uncertainties raised as a result of this shift that need to be highly considered by the manufacturing sector operating globally. There are some factors that could be the primary contributors of the supply chain uncertainty including the manufacturing uncertainties, customer deliveries, fluctuating demand from end consumers and lastly the supplier performance [23]. These factors have a high impact on the supply chain performance of firms operating in the manufacturing sector.

According to the study conducted by [19], uncertainty increases the risk within the supply chain process that is the outcome of the internal and external uncertainties impacting the supply chain performance. Various studies recognize the uncertainty within the supply chain process

as the primary issue in the supply chain and logistic functions of the manufacturing industry. Here, the risk mainly involves the negative performance of the supply chain and logistics performance like delays, damages and loss. According to the study conducted by [25], the concept of organisational centralization can play a moderating role in terms of minimizing the uncertainties and risks associated with the supply chain management and could help with the effective management of the supply chain functions of an organisation operating into multiple locations.

Most of the giant firms operating in the manufacturing sector operate in various countries having different supply chain management processes for their specific regions of operating. This leads towards raising various uncertainties within their supply chain processes that are impactful on these processes that could be resolved through centralizing the supply chain operations. According to the study conducted by [28], organisational centralization could offer various benefits in terms of mitigating supply chain risks that include standardisation of the common supply chain processes being followed in each location of the firm, getting economies of scale and increased visibility into spread management. It also leads towards the enabling of the firm towards rapid change management and change in the global process in terms of reducing the time and effect of the supply chain disruption that lead towards the enhancement of the supply chain performance of the firms operating in the manufacturing sector [14].

3. Theoretical Concept and Framework

Based on studying the impact of uncertainties on the supply chain performance and also the role of organisational centralisation in terms of the mitigation of these uncertainties, there are some theories that could reflect this study effectively. These theories include Real Options Theory and SCOR Model. Real Options Theory has been considered in terms of understanding the uncertainties within the supply chain management and SCOR model has been considered in order to make an understanding regarding the performance of supply chain management in the manufacturing sector.

3.1. Real Options Theory

Real options theory is associated with the investment of resources including human, capital and time into a certain course of action at a future point of time. According to the study conducted by [30], this theory talks about the selection of right options and making decisions related to the investments specifically when a certain future point of time is uncertain. In supply chain management, the concept of real option is a choice that is available to an organisation related to opportunities that might be availed by the company as these opportunities could make the

supply chain performance of an organisation effective and efficient. Based on the study conducted by [11], Real Options Theory has become significant in the business sector specifically the manufacturing sector as different firms operating in the manufacturing sector are more conscious regarding making investments in their supply chain management functions. This also includes analysing the uncertainties and risks that are associated with the performance of supply chain management that are needed before making further investments or making any decision regarding the supply chain division [5].

According to the study conducted by [31], supply chain management is one of the most important functions of an organisation operating in the manufacturing sector as it is directly related to the manufacturing of the products in terms of getting suppliers and the transportation of raw materials and final products. These aspects make it essential for the company operating in the manufacturing sector to look into the uncertainties that are associated with the future investments and also the ways that could make the supply chain management more efficient and effective in terms of meeting the demand and supply objectives. The study conducted by [4], Real Options Theory having a focus on the risk uncertainty within the business functions appears to be based on the managerial decisions that revolve around the creation of certain options and plans that are known as strategies and them considering it to exercising it or not exercising it in certain conditions that might appear in future.

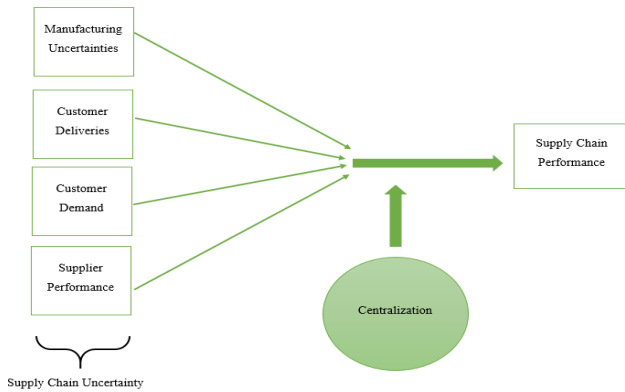
3.2. SCOR Model

SCOR Model refers to the supply chain operations reference model related to the supply chain performance as it is a management tool to improve and communicate decisions associated with supply chain management including the suppliers and customers of the organisation [22]. The development of SCOR Model is highly related to the manufacturing sector where it was developed by the more than seventy world's leading manufacturing companies. According to the study conducted by [15], this model is highly useful for the integration of the business concepts of measurement, process engineering and benchmarking into a single framework. In the manufacturing sector, since the supply chain management is highly essential for the management of demand and supply from and to the end consumers, this model can be used in order to improve the supply chain performance. SCOR Model includes five distinct functions of the supply chain management that include planning, sourcing, making, delivering and returning [21].

In the manufacturing sector, planning refers to the analysis of the demand and supply within the manufacturing capabilities. Sourcing refers to the selection of suppliers and identifying the raw material sources. The step of making refers to the manufacturing of

products after the planning and sourcing. Delivering step refers to the transportation and logistics functions in terms of transporting final products to end consumers and lastly returning refers to the management of the returned products in terms of defective products. These steps are vital for firms operating in the manufacturing sector in order to make their supply chain management effective and to enhance their supply chain performance.

4. Research Model



5. Research Method and Approach

For this comprehensive study, a primarily quantitative data was carried out by the research, since the research relates to the impact of supply chain uncertainties on its performance by the manufacturing companies. The collection of relevant data was based upon few tests that were applied with the help of employing the most effective software for the study. An ample data was collected by the researcher by brining as many as 200 employers, employees and logistic persons of different organisations who are engaged in supply chain operations on a regular basis. Along with it, the targeted population brought into this study belonged to a one particular region within which several supply chain operations are taken place by the organisation. Besides, the questionnaire designed by the researcher were distributed among the respondents through which they had to provide their subjective opinions upon different facts asked through the questionnaire. The questionnaire entailed five different options ranging from strongly agree to strongly disagree, and the respondents are allowed to freely opt for one option in an impartial manner. It might show the extent of their consent with the closed ended statement provided in the form of facts [32].

In addition to this, structural equation modelling was utilised which is a general technique used with a diverse set of numerical models and statistical methods. This technique was used by the researcher as it required to assess the relations between measured variables coupled with dependent variable. Through this technique, multiple regression analysis was applied along with multiple factor analyses with a view to attaining the impact of relevant

factors upon the dependent variable. Further, a discriminant validity test along with convergent validity was applied with the help of statistical tool namely ‘Smart PLS’. These tests were thoroughly conducted to analyse the construct between two variables. While the discriminant validity test is used to gauge variables construct that are not related to one another, convergent validity test examines whether the two variables have the same association or not [3].

Perhaps the most significant part of the research method and approach is the test of factor loadings that is used for assessing the variability or alterations between variables that the researcher observed to evaluate their impact upon the dependent variable [18]. With a view to further reinforcing the overall methodology of this study, the research also took the path analysis into account, which is generally used to discern the directed dependencies between or among different sets of variables. In particular for this study, the research used it to find and analyse the relationship between the variables with the help of multiple regression analysis of the overall accumulated data. The analysis of findings was necessary to extract out relevant hypothesis of the study, which was followed by coherent conclusion and pragmatic recommendations to prevent challenges of supply chain uncertainties that adversely impact the organisation’s performance.

6. Analysis of Results

6.1. Confirmatory Factor Analysis

In order to determine fitness of the model, confirmatory factor analysis is carried out. To study the fitness of each variable included in the model, the benchmark value of 0.6 is considered as per the study of [37]. Table 1 below shows the each value for the constructs in the model are considered to be statistically fit as their values are more than 0.6. Thus, the model includes predictors that are statistically significant.

	Factor Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
		0.752	1.353	0.808	0.591
CDE L1	0.818				
CDE L2	0.626				
CDE L3	0.839				
		0.679	0.719	0.809	0.589
CDE	0.890				

M1					
CDE M2	0.890				
CDE M3	0.768				
		0.807	0.814	0.887	0.725
CEN1	0.941				
CEN2	0.626				
CEN3	0.703				
		0.755	0.829	0.860	0.676
MU1	0.825				
MU2	0.934				
MU3	0.688				
		0.640	0.643	0.805	0.581
SCP1	0.764				
SCP2	0.870				
SCP3	0.904				
SCP4	0.863				
		0.873	0.889	0.913	0.726
SP1	0.739				
SP2	0.829				
SP3	0.714				

The most widely used metrics for the purpose of assessing the fitness of constructs are Cronbach's alpha and composite reliability. The model under consideration has used both these metrics to evaluate the fitness of the model. In the above table, other than reliability of the variables and sub-variables, the AVE or Average Variance Extracted for each one of them is also shown. This metric indicates the variance that can be explained by the predictors where residual variance is considered to be zero. One of the widely accepted benchmark for AVE is 0.5, this means that in order for variables to be deemed as significant their AVE should be higher than 0.5 [9]. The above table indicates that for all the variables and sub-variables the values of AVE is greater than 0.5 which further shows that the variables are suitable statistically for further meeting the aim of the research.

6.1. Discriminant Validity

The metric of discriminant validity explains the conceptual accuracy of the variables. In other words, discriminant validity explains the magnitude with which a variable or sub-variable differs from other. The following table 2 indicates the values of discriminant validity for the sub-variables and variables that are included in the model of this research:

Heterotrait-Monotrait Ratio (HTMT)	Centralisation	Customer Delivery	Customer Demand	Manufacturing Uncertainties	Supplier Performance
Centralisation					
Customer Delivery	0.448				
Customer Demand	0.476	0.834			
Manufacturing Uncertainties	0.336	0.870	0.603		
Supplier Performance	0.445	0.744	0.670	0.817	
Supply Chain Performance	0.344	0.462	0.683	0.395	0.411

Discriminant Validity is assessed through the value of Heterotrait-Monotrait Ratio (HTMT) which needs to be 0.90 at maximum. Thus, if the value of HTMT is greater than 0.90 it means that the variables are not conceptually accurate. However, from the above table, it can be deemed that all the variables and sub-variable are conceptually accurate since the values of HTMT are lower than 0.90.

6.2. Basic Model

The basic model of this research includes supply chain uncertainty as the main independent variable which is further characterized into different sub-variables that are: manufacturing uncertainties, customer deliveries, customer demand, and supplier performance. The dependent variable under this model is supply chain performance and the moderator chosen for this study is centralization. The following table shows some of the important values that interpret the relationship and impact of predicting variables on the criterion variable.

	R Square	R Square Adjusted
Supply Chain Performance	0.377	0.361

The above table includes two important values that are the value of R square and adjusted R-square. Both the values generally explain the amount of change that the sub-independent variable are able to explain caused in the dependent variable. The latter value is adjusted for any

discrepancies in the model. It is evident from the table above that collectively all the supply chain uncertainties are able to predict 37.7% of variations that are caused in the performance of supply chain. On the other hand, it is evident from the value of R-square that after the adjustment of the discrepancies in the model, supply chain uncertainties are able to explain 36.1% of variations that are caused in the performance of supply chain operations. The following table explains the values of coefficient of each node of relationship in model under consideration:

	Original Sample (O)	T Statistics (O/ST DEV)	P Values
CEN*CDEL -> Supply Chain Performance	-0.126	1.264	0.207
CEN*CDEM -> Supply Chain Performance	0.102	1.364	0.173
CEN*MU -> Supply Chain Performance	0.184	2.392	0.017
CEN*SP -> Supply Chain Performance	-0.064	1.052	0.293
Centralisation -> Supply Chain Performance	0.169	3.033	0.003
Customer Delivery -> Supply Chain Performance	0.005	0.064	0.949
Customer Demand -> Supply Chain Performance	0.470	6.855	0.000
Manufacturing Uncertainties -> Supply Chain Performance	0.065	0.907	0.365
Supplier Performance -> Supply Chain Performance	-0.024	0.355	0.723

Since this research has included a moderating variable thus, the above table has included the sig value for the impact of predicting variable on dependent variable considering the role of moderating variable. It is suggested from the p value (0.207) that centralisation does not

moderate the impact of customer delivery uncertainty on supply chain performance. The above table also indicates that centralisation does not moderate the impact of customer demand uncertainties on the supply chain performance as the p-value is 0.173. However, the model under consideration suggests that centralisation significantly moderates the impact of manufacturing uncertainties on the supply chain performance of manufacturing companies considering the p-value of 0.017. For the last predicting variable that is supplier performance, centralisation does not moderate its impact on supply chain performance considering the sig value of 0.293. It is suggested from the p value (0.003) that centralisation has an impact on supply chain performance that is statistically significant.

Considering the direct effects of predicting sub-variables on the criterion variable, it is evident from the above table that supply chain performance of manufacturing firms is not significantly impacted by the customer delivery performance as the sig value is 0.949 at 95% of significance level. The above table shows that supply chain performance of manufacturing firms is significantly impacted by the customer demand as the sig value is 0.000 at 95% of significance level. Moreover, supply chain performance of manufacturing firms is not significantly impacted by manufacturing uncertainties as the sig value is 0.365 at 95% of significance level which is not acceptable. Lastly, supplier performance uncertainty also do not impact the supply chain performance given the sig value of 0.723 which surpasses the benchmark assigned.

7. Results of Hypothesis

S. No	Hypothesis Statement	Sig Value	Result
H1	Centralisation significantly moderates the impact of manufacturing uncertainties on supply chain performance	0.017	Accepted
H2	Centralisation significantly moderates the impact of customer delivery uncertainty on supply chain performance	0.207	Rejected
H3	Centralisation significantly moderates the	0.173	Rejected

	impact of customer demand uncertainties on supply chain performance		
H4	Centralisation significantly moderates the impact of supplier performance uncertainties on supply chain performance	0.293	Rejected
H5	There is a significant impact of centralisation on supply chain performance	0.003	Accepted
H6	There is a significant impact of manufacturing uncertainties on supply chain performance	0.365	Rejected
H7	There is a significant impact of customer delivery uncertainty on supply chain performance	0.949	Rejected
H8	There is a significant impact of customer demand uncertainty on supply chain performance	0.000	Accepted
H9	There is a significant impact of supplier performance uncertainty on supply chain performance	0.723	Rejected

The above table has provided a summarised view of all the results based on the model that has been taken into consideration for the purpose of testing out the aim and objectives of the study. The first hypothesis is accepted which shows that centralisation significantly moderates the impact of manufacturing uncertainties on supply chain performance. However, for all the other predicting variables, the moderating variable that is centralisation does not moderate their impact on supply chain performance which is apparent from their p-values. The above table also indicates that there is a statistically significant relationship of centralisation with the supply chain performance of manufacturing companies. The current model also suggests that customer demand

uncertainty has a significant impact over the supply chain performance due to the sig value obtained from the SEM. However, the remaining factors that are: manufacturing uncertainties, customer delivery uncertainty, and supplier performance uncertainty does not have a significant impact on the supply chain performance of manufacturing companies.

8. Recommendations

In the above section, the detailed interpretation of the model is given which shows that there is a significant influence of uncertainties on the supply chain performance, while centralization plays a significant moderating role among the predicting and criterion variables. Firstly, it is recommended to the management of the manufacturing organisations that supply chain uncertainties cannot simply be counted as a singular variable that can predict the effectiveness of the decision making. The supply chain department of the company should consider all the different types of uncertainties and know that there is no one strategy that can counter or handle the uncertainties. Each uncertainty is different and thus it requires different approach or level of supply chain integration. The supply chain managers need to design their supply chain strategy in such a manner that it aligns with the different kinds of uncertainty they are facing. Also, the results of this research has suggested that each different type of uncertainty can function independently within the organisation. In this regard, it is advised to the management of the company to focus on handling one uncertainty as per the needs and requirement without having to worry about the spill over effect.

9. Conclusion

It can be concluded from the primary findings that are obtained from this research that the uncertainties and challenges in the supply chain management of manufacturing companies have varying magnitude of problems in the overall operations and performance of supply chain. It has been deduced from the secondary findings as well as the primary results of this research that with effective planning and implementation of proactive strategic approach, such uncertainties can be changed into opportunities. This research has taken into consideration the moderating role of centralization which is significant as the organisational structure tends to control the operations as well as overall performance of each department including the supply chain process. The theoretical contributions made by previous researches have suggested that centralization has an inverse effect on the customer integration however it does not have an effect on the internal supplier integration. Moreover, it can also be concluded from the findings of this research that in the case of centralized organisation, individuals look up to the management for the provision of information and

guidance hence there is less focus on customer integration as source of information. The findings of this research can provide useful implications in the practice. Firstly, it is important to note that supply chain uncertainties cannot be considered as an individual factors during the decision making because the organisation structure play an integral role in explaining the relationship of uncertainties with supply chain performance.

10. Research Limitations

Throughout conducting this specific study, there have been some limitations that restricted this study towards some particular aspects. This study is based on the supply chain performance within the manufacturing sector. However, supply chain functions are vital in other sectors also where it plays a significant role that could have been considered in this study to get detailed findings. Moreover, various other business functions in a firm could have also been considered other than supply chain in this particular study. Furthermore, there has been a shortage of time in order to conduct the study more effectively and carry out more detailed findings. This study only focuses on implementing the quantitative research design where the study could have also implemented qualitative design as well in terms of knowing the reasons behind the high or low performance of the supply chain management within the organisations operating in the manufacturing sector.

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