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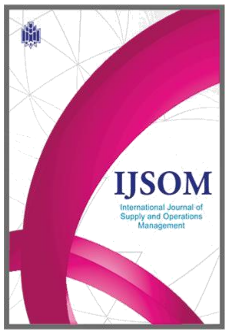

Development of a Structural Model of Risk Issues Involved in E-Supply Chain Adoption in Indian Mechanical Industries

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Abstract

Managing risk in e-supply chain has become an essential field for researchers in this fast-growing market. Many researchers have contributed to this context for managing risks, but it remains uncertain. This study recommends a structural model to analyze the impact of various e-supply chain risk issues over demand risk. This model mainly covers seven categories of risk issues such as demand, organizational, infrastructure, etc. for this study which are related to mechanical manufacturing industries of Delhi region. Therefore, after a detailed study and expert's opinion, 38 Risks factors were included in this study to formulate the survey form or questionnaire. A questionnaire-based survey was conducted for gathering responses from 148 specialists belonging to mechanical manufacturing sector situated in Delhi region. This methodology consists of measurement and mathematical modeling. The technique is based on exploratory and confirmatory factor analysis using SPSS and AMOS software tool. Software tools like SPSS17 used for descriptive statistics and Amos Graphics 21 used for structural equation modeling. Risk related factors and sub-factors have been identified, assigned weight and prioritized in accordance with their importance using expert opinion through well-designed questionnaires. On the other hand, an empirical study was conducted for transforming a conceptual model into structural equation modeling. Structural identification and comparison of various risks related to the e-supply chain. Result finding proposes various e-supply risk issues which create significant positive (0.49) effect over demand risk. Result finding also suggests that sub-factors like Forecast Error and sudden cancellation of order are highly affected by e-supply risks.

Keywords: Supply chain management, Risk management, e-supply chain, factor analysis, Structural equation modeling, and Indian mechanical manufacturing sector.

1. Introduction

The implementation of new market moves such as on-time delivery, wide-ranging non-core activities, and conducting program related to rationalization of suppliers weaken the supply network and particularly when these events are joined with the globalization, centralization, and distribution (Kumar, et al. 2019). So it turns out to be important to assess risk outcome over its performance. Nowadays, risks control framework is taking care of in various decision making process such as in the selection process of e-supplier for supply chain by the investigators in the study of supply network. Investigators are showing dedication towards minimizing the risks by improving e-supply performance. Managing risks perform an important role in taking managerial decision and control (Giannakis, et al. 2004). The main issues of implementing risk managing approaches are technological transformation, Competitive environment and the continuous exploration for gaining competitive benefit (Brindley, 2004). Internet and other new technologies make the consumer more efficient for searching and gathering significant information prior to purchase (Ranaweera, et al. 2008). Earlier

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research proved that negative influences generate over the firm's operations due to risk (Craighead et al., 2007). These threats can be created from the external source (e.g. Economic growth), or an internal source (e.g. Coordination procedures and defective planning) in the supply chain (e.g. related to the quality of e-Supplier) (Oehmen, 2009). Avelar et al., (2014) find out the effects of various risk issues over the performance in his case study. He mainly considered the effect of suppliers, demand and processes over the customer service and flexibility. Similarly, Bavarsad et al., (2014) also performed a case study in which, the effects of various categories of risks such as government regulation, delivery, operations, market, information system, human resources, demand risk and macroeconomics risks are considered and find out their effect upon supply chain performance in terms of finance, flexibility, responsiveness and relationship. After literature study, researchers found no study available on effects of risks over the product demand. Literature review also defines that there is still a scope of study available on risk factors mainly in Indian content.

Now India has become a progressive market and as a consumer market is growing at a rapid rate. It has now become a business hub, which is further growing with consumer's expectations. For maintaining the pace with the customers demand, it is necessary to update its infrastructure facilities and simultaneously work upon its risk control framework for enhancing the performance outcome. There are limited articles available having understanding on E-SCM issues in Indian perspective. In India, E-SCM practices are in the early stage of adoption. The Indian based industries believe that the Implementation of E-SCM would be very expensive, but it is the matter of knowledge on the concept and the management involvement. The misconception on the concept and the implementation methods may slowly disappear by this study. Recent studies have reported that organizations are often unable to identify the risks involved with E-SCM and to understand their implications for management practice. For this reason, the implementation of E-SCM often does not result in noticeable benefits. This framework of risk control reduces the complexity, advanced the system and enhances the production of e-supply chain (Kumar, et al. 2019). So, for the continuous running of an e-supply chain, it is essential to take care of its risk issues. Hence, this study is done to find a step forward to minimize the gap up to some level by analyzing the effects of various risks issues on the product demand. The major expansion of any manufacturing hub mainly depends upon Mechanical manufacturing. So, the purpose of this current research is to recognize and categorize the main risk issues and analyze their effect on demand by developing a structural model based on Indian mechanical manufacturing.

This research study is prearranged as section 2 contains literature or background study related to e-supply chain risk issues, classification, and conceptualization of the projected structural model of e-supply chain risk. Section 3 explains about methodologies used for this research including the process of questionnaire formation and data collection. Results testing and discussion part are covered in section 4. This section scrutinizes and analyzes the results received from the hypothesis and structural model. The limitation and direction of future study on the basis of results are covered in section 5. Section 6, covers the conclusion part with research implication and summary of this paper.

2. The literature review

In this current scenario, the concept of "risk" has become an important area of study in science, engineering, and corporate atmosphere (Chopra & Sodhi, 2004). Risk shows vulnerability and as per the definition, it can be expressed as "A condition involving exposure to danger". The chances of Risk can be created through any source; known or unknown. The risk is also explained as "the possibility of an unusual incident to happen, and this incident will affect negatively over the system" (Khan & Burnes, 2007).

E-Supply risk also describes as the potential outcome with respect to effect and vulnerability. The e-supply risk is also termed as "the event occurrence uncertainty which could influence the process of achieving company business objectives" (Tang, 2006). Risk associated with e-supply chain also referred as "the possible discrepancy of outcome influencing the drop of value added in any supply chain activity, where the consequence is described through the quality and quantity of merchandises in the supply chain on a particular time and at a particular location" (Bogataj & Bogtaj, 2007).

2.1. Management of Risk

The process of managing e-supply risk is carried out by minimizing its effects. Risk related to disruption of supply is also termed as the supervisor's perception of loss of total potential generated due to disruption in the supply from suppliers to buyers (Ellis et al., 2010). E-supply risk influence can be reduced by four basic approaches such as management of Product, Demand, Information, and supply (Tang, 2006). Risk management is a continuous and constant developing exercise which is carried out during the course of the organization for policy execution. All activities of the organization should be addressed systematically by the risk management process during the ancient, current, and future (Khan & Burnes, 2007). The management process of risk initiates after analyzing two conditions: first, the event probability of occurrence and second, the consequences of the incident happen (Cox & Townsend, 1998).

2.2. Risk related to E-supply chain

The philosophy of risk and its management covered in various domains of finance, strategy, and economics (Manuj & Mentzer, 2008). Risk can be defined as the likelihood of variance from the objective and subjective source in the outcome (Spekman & Davis, 2004). Improper management of risk is prone to imprecise forecasting, lower quality product, poor relationships among members, loss of reputation, share price downfall and turnover, and conflict within the organizational members (Cousins et al., 2004). So, it becomes essential for the Firms to enforce methodologies related to risk management to exclude and reduce their aftereffects (Manuj & Mentzer, 2008).

Several classifications of supply chain risks have been covered by investigators from the literature. These issues are further distributed among sub-factors, for example, intellectual property, systems, procurement, disruptions, inventory, delays, forecast, and capacity (Chopra & Sodhi, 2004). Risk are of two types in supply chain: Internal and external, internal covers issues like information delays, regulations, organizational factors, and capacity variations and external covers includes factors such as manufacturing yield, market prices, competitors moves, supplier quality, political concerns, and manufacturing expenses (Cucchiella & Gastaldi, 2006).

Internet usage in the supply chain improves the development prospects and change of pace but also simultaneously increases the network complication and risk occurrence. E-business usage has carried a key technical change in purchasing also enhance the business profits such as transaction costs, savings in inventory reduction and communication link among consumers and sellers (Deeter-Schmelz et al., 2001). Customer's perceived risk for making purchase decision is better in web based spending instead of conventional spending (Samadi & Yaghoob-Nejadi, 2009). Technological risks supported by various issues such as Incompatible application, integration, and unpredictable atmosphere related security issue.

2.3. Classification of Supply chain Risk

Supply risk is connected with the commercial environment and organization segregated into different groups (Bogataj & Bogtaj, 2007). For the proper organization of risk, criticalness of risk can be measured depending on its root cause (Norrman & Jansson, 2004; Peck, 2005). Root causes related to risk involves organizational, environmental creates an impact on the resulting issues in the supply chain (Juttner et al., 2003). These e-supply risks split into two categories (Kleindorfer & Saad, 2005). Firstly, chances of risks arise because of mismanaging in between supply and demand the second category cover those issues which arise from the disruptions in the regular working cycle. There is an increased wakefulness and concern about implementing the environment friendly aspect in various facets by various stakeholders of the manufacturing firms (Nazam et al., 2015).

Supply risk also be divided into three categories: 1) Belongs to supply system but not belonging to the firm, 2) Belong to firm internally and 3) internally not belong to the system (Christopher & Peck, 2004). Broadly seven distinct types of risks causes are available which involves supply chain members, supply chain configuration, organizational policy, industry features, environmental features, problem-related issues, and decision-making unit (Ritchie, 2007). Risk issues can be categorized on uncertainty basis: a) competitor moves, b) information delays, c) quality of supplier, d) available capacity, e) political atmosphere, f) internal organization, g) manufacturing yield, h) stochastic cost, i) customs regulations and change in rate (Cucchiella & Gastaldi, 2006). It can be specified that information sharing, market orientation, supply chain orientation and strategic resources play a significant part in the association of environmental uncertainty and supplier innovation with supply chain agility (Rasi et al., 2019).The development of a structure which is secure against disruption and variation is possible but it becomes difficult to secure it from disaster. Tang (2006) categorized supply chain risks in two sets, i.e. disruption and operational risks. Similarly, Wagner & Bode suggested five different types of causes related to supply chain risk: demand, regulatory, infrastructure supply, disastrous and bureaucratic/lawful. (Wagner & Bode, 2006). Categorization of risk is also possible according to the incident leading to risk-disaster, variation, and interruption (Gaonkar & Viswanadham, 2007). Moneymaking prospective and new e-market increases the progress rate along with the complexity in the network of the supply chain but also consequently enhance the level of risk. E-business technology usage has introduced a key source of technical improvement in purchasing and offers to the organizations with various profits like transaction charges saving, inventory reduction and the network formation between sellers and purchasers (Deeter-Schmelz, et al. 2001).

E-business risks are the outcomes of vulnerable business activities that are originated through implementing irrelevant factors which increase the difficulties in the implementation of technology (Vaidyanathan & Devaraj, 2003). Therefore, different measures belong to the e-supply chain risk used in this paper. Various e-supply chain issues which were extracted by the investigators from the literature are available in Table 1.

Table 1. Various Factors (Issues) related to e-Supply Chain Risk

Issues	Sub-Factors	References
Information & Policy Risk (IP)	(f1) Information Security (f2) The extent of acceptable information (f3) Intellectual property risk (f4)Information Sharing Privacy (f5) Strategic uncertainty	(Rasi et al., 2019), Song et al. (2016), Gross-Claypool et al. (2015), Sofyalıoglu & Kartal (2012), Belghis et al.(2014), Ravasizadeh et al. (2011),), Cucchiella & Gastaldi (2006), Tang (2006), Faisal et al. (2007), Tapiero (2007), Murtaza et al. (2004), Choy et al. (2007), Rao et al. (2005), Wu et al. (2006), Wagner & Bode (2006), Gaudenzi & Borghesi (2006), Sheffi & Rice (2005), Peck (2005), Sodhi (2005), Giunipero & Eltantawy (2004), Christopher & Peck (2004), Norrman & jansson (2004), Hallikas et al. (2002), Zsidisin (2003), Dyer (2000), Simons (1999), Johnson (2001).
Environmental Risk (ER)	(f6) Macroeconomic risk (f7) Social (f8) External and uncontrollable risk (f9) Political Stability (f10) Government Regulation (f11) Natural disasters	(Rasi et al., 2019), Sreedevi & Saranga (2017), Song et al. (2016), Giannakos & Papadopoulos (2016), Gross-Claypool et al. (2015), Matotek et al. (2015), Avelar et al. (2014), Belghis et al. (2014), Ouabouch & Amri (2013), Thun & Hoenig (2011), Ravasizadeh et al. (2011), Ziegenbein & Nienhaus (2004), Rao & Goldsby (2009).
Operation & Supply Risk (OS)	(f12) Supplier opportunism (f13) Transit time (f14) Risk affecting supplier (f15)Asset & Tool Ownership (f16) Inventory ownership (f17) Product quality and safety	Sreedevi & Saranga (2017), Song et al. (2016), Gross-Claypool et al (2015), Matotek et al. (2015), Avelar et al. (2014), Belghis et al. (2014), Ouabouch & Amri (2013), Sofyalıoglu & Kartal (2012), Thun & Hoenig (2011), Ravasizadeh et al. (2011), Blome & Schoenherr (2011), Jiang et al. (2009), Manuj & Mentzer (2008), Zsidisin et al. (2004), Chopra & Sodhi (2004), Giunipero & Eltantawy (2004), Zsidisin (2003), Johnson (2001), Hallikas et al. (2002), Dyer (2000).
Relation & dependence degree of inter-organization Risk (RDDIO)	(f18) Lack of honesty in the relationship (f19) Commitment capability (f20) Commercial Exploitation (f21) Interrelationship risk (f22) Competitiveness	Gross-Claypool et al. (2015), Avelar et al. (2014), Belghis et al. (2014), Ouabouch & Amri (2013), Rao & Goldsby (2009), Ravasizadeh et al. (2011), Jiang et al. (2009), Spekman & Davis (2004).
Infrastructure Risk (IR)	(f23) Economic (f24) Technological Risk (f25) Implementation risk (f26) Appropriate e-market (f27) Transaction Delay (f28) Credit	Song et al. (2016), Venkatesh et al.(2015), Gross-Claypool et al. (2015), Avelar et al. (2014), Belghis et al. (2014), Ouabouch & Amri (2013), Thun & Hoenig (2011), Ravasizadeh et al. (2011), Blome & Schoenherr (2011), (2007), Jiang et al. (2009).
Demand Risk (DR)	(f29) New product acceptance risk (f30) Drastic change in fashion (f31) Competitor moves (f32) Demand variability (f33) Forecast error (f34) Sudden cancelation of order (f35) Short product life	Gross-Claypool et al. (2015), Matotek et al. (2015), Avelar et al. (2014), Belghis et al. (2014), Sofyalıoglu & Kartal (2012), Ouabouch & Amri (2013), Thun & Hoenig (2011), Ravasizadeh et al. (2011), Blome & Schoenherr (2011) (2011), Manuj & Mentzer (2008), Ellis et al. (2010), Ziegenbein & Nienhaus (2004), Peck (2005), Johnson (2001), Simons (1999), Svensson G (2002).
Organizational Risk (OR)	(f36) Operating risk (f37) Currency risk (f38) Culture risk (f39) Reputation risk (f40) Lack of expertise (f41) Legal issues (f42) Leadership	Thun & Hoenig (2011), Ravasizadeh et al. (2011), Blome & Schoenherr (2011), Cucchiella & Gastaldi (2006), Rao & Goldsby (2009), Wagner & Bode (2006), Gaudenzi & Borghesi (2006), Wu et al. (2006), Tang (2006), Sheffi & Rice (2005), Rao et al. (2005), Peck (2005), Sodhi (2005), Christopher & Peck (2004), Norrman & jansson (2004), Spekman & Davis (2004), Chopra & Sodhi (2004),), Murtaza et al. (2004), Zsidisin et al. (2004), Svensson G (2002), Zsidisin (2003), Simons (1999).

So, 42 sub-factors was extracted from the literature belong to supply network. After detail discussion with the experts of this field, 38 sub-factors were found suitable according to mechanical manufacturing supply network in indian context which include in this study is given in table 2.

Table 2. List of Risk factors/ Sub-factors included in this study

Risk Sub-Factors	Definitions
Information Security risk	Risk rises from the Software and hardware Incompatibility that exposes a system to compromise.
The extent of Acceptable information risk	Information accurateness reliability that is achieved from a business companion.
Intellectual property risk	Risk arises due to intangible property that is a result of creativity e.g. patent, copyright, trademark.
Macroeconomics risk	Financial risk associated with macroeconomics or political factors.
External and uncontrollable risk	The uncontrollable event happened out of the company
Political risk	Risk arises from fluctuations in political stability
Government action risk	Loss or risk arises from government regulation
Natural disaster risk	Risk of loss arises due to nature
Supplier Opportunism risk	It related to the lack of trustworthiness in transactions in such activities as misrepresenting statistics with the intention to deceive and failing to complete the commitment
Transit time risk	It related to the average time or variability of time spent in transfer including port clearance and transportation time
Risk affecting supplier	Risk arises from the supplier side
Lack of honesty in the relationship	Risk arises if a commercial companion intentionally not to behave as per the commitment
Commitment and capabilities risk	Risk arises due to the agreement that business partner have because of company plan but not capable of doing work accordingly
Commercial Exploitation	Product demand exploited by the market
Strategic uncertainty risk	It affects business strategy implementation
Interrelationship risk	Risk arises if the business agreements are increased among the firm and its business companion; the risk caused by process reduction also will be increased interrelationship
Competitiveness risk	It influences a company competency to distinguish its articles/product from its opponents
Operating risk	It affects the manufacturing and supply capacity of goods due to breakdown
Currency risk	It arises due to the change in the exchange rate.
Culture risk	The work tradition follows in an organization
Reputation risk	The general estimation that a market has for a firm
Lack of expertise	It affects due to the skill level limitations
Legal Issues	Risk related to legal policies
Leadership risk	Risk arises due to the activity of leading
Credit risk	It affects the money available for investment in business
A drastic change in fashion risk	Risk arises due to a change in trend or advancement
New product acceptance risk	It refers to flexibility according to change or advancement
Demand variability risk	Risk arises due to fluctuations in demand
Competitor's moves	Risk arises due to the competitor's business strategy
Forecast Errors	Risk arises due to wrong assumptions in demand
The sudden cancellation of orders	The risk arises due to order cancelation suddenly from the commercial partner
Short product life	It relates to product life
Economic	It related to a firm economy
Technological Risk	It refers to the results of security issues, integration issues, and incompatible application related to the unstable web system
Implementation	Risk related to implementing new technology and policies
Appropriate e-market	An inter-organizational network that permits buyer and seller to interchange information about product, processes, and goods
Product quality and safety	Risk related to product quality and safety
Inventory ownership	The possibility such as price change will cause the value of an inventory to decrease

2.4. Hypotheses Model

Figure 1, shows the proposed hypotheses model which emphasizing the relations or dependency of infrastructure risk on environmental risk, operation & supply risk, Information & policy risk, and risk of relation dependence degree of inter-organizational in the first stage. In the second stage it shows the relation and dependency of organizational risk on infrastructure risk. And finally in the last stage, it shows the dependency of demand risk on organizational risk.

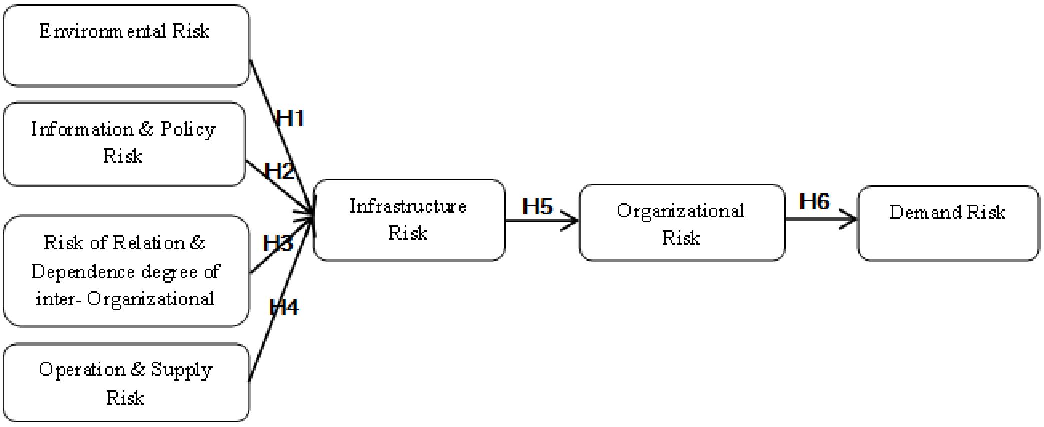

Figure 1. Hypotheses of proposed model of Risk in E-Supply Chain

Structural equation model (SEM) presented by Joreskog in 1970 includes a measurement model and structural equation model. Primarily, it identifies the dependency of latent variables or hypothetical construct over observed indicators/variables. It also defines the measurement attributes of observed variables. A structural equation model describes casual effects among latent variables and assigns the explained and unexplained variances (Kaiser, 1974). The proposed model as shown in figure (1) focuses on analyzing the effect of risk over demand.

Literature review clearly indicated that firm facing issues like limited infrastructure, bad environment, poor organization setup, week information network, and policy may interrupt its operations. A firm facing these issue further affected by its product demand. So it is expected that variables like infrastructure, organization, environment, inter-dependency, supply, operation and policy may be the key factors of enhancing demand. The hypothesis proposed for the conceptual model described below

H1: An environment risk significantly enhances the infrastructure risk.
H2: An information and policy risk has a significant positive impact on Infrastructure risk.
H3: A good relation & dependence degree of inter-organization risk positively related to infrastructure risk.
H4: An operation and supply risk has a significant positive impact on infrastructure risk.
H5. An infrastructure risk significantly enhances the Organization risk.
H6: An organizational risk creates significant positive affect over demand risk.

3. Research Technique

A consistent improvement cycle in three phases situated in the middle of the improvement process used the confirmatory factor analysis (CFA) for measuring construct validity and unidimensionality (Ahire, et al. 1996). In the first stage of the improvement process, Researchers calculated the Cronbach alpha values for all models. In the second stage, EFA (exploratory factor analysis) is applied using principal component analysis. Varimax rotation with Kaiser Normalization method is adopted for factor analysis (Loehlin, 1998). CFA applied in the last stage for the analysis of the validity of construct and unidimensionality. This study uses both factor analysis techniques: confirmatory and exploratory for testing the model. Both casual and descriptive study used in this research. The casual study applied for testing the acceptability and checking the fitment of the structural model and interrelationship among the measured factors with latent factors and descriptive study used for checking the reliability and factor loading of risk factors of the sample.

3.1. Questionnaire Development

For addressing the risk issues related to Indian mechanical manufacturing supply network, a preliminary discussion was carried out with the academician, industry professional & risk management specialists. Several stages followed for the development of questionnaire. In starting, discussion was carried out with the colleagues and academician on a paper based version of the questionnaire. After some changes, the survey form was forwarded to senior's manager, deputy managers from reputed mechanical manufacturing companies and also discussed with the directors of some Japanese based Indian company along the supply chain. On the basis of their valuable comments and feedback the final questionnaire was refined and developed related to risk factors for e-SCM. On the basis of information collected from the available literature, a preliminary questionnaire-based survey was performed in industries. The final questionnaire was outlined based on the statistics collected from the preliminary questionnaire survey, industries professionals and academician. Researchers also created the questionnaire on Google form which is linked with Google drive and forward this link to industry experts through the mail for achieving a higher response rate. Several meetings have been arranged with the industrial professionals related to questionnaire survey in Delhi-NCR (National capital region). The structured questions were framed on the seven-point Likert-scale shows the relative amount of attribute (Best and Kahn, 1986) and it is easy for the respondent to understand.

This questionnaire delivers the meaning of all the questions as per the literature for easy identifying a suitable reply. The questionnaire is arranged into three sections: the first section comprises of a cover letter which explains the motive of research and declaration of confidentiality. In the second section, general details were collected related to the sampled population such as dealing individual name, Company name, and related particulars. The last segment contains risk issues belong to the supply network. In this study, Researchers incorporated 38 risk issues based on Likert Scale of 7-point such as Important, somehow important, very important, not important, etc. Multiple choice questions on a weight basis were included in the survey if possible because of the large scale survey technique (Sekaran & Bougie, 2010).

The judgment analysis process is carried out for validating the content of survey form. For finalizing the design, structure and content, the final survey form sent to 5 professionals of different organizations such as Toyoda Gosai, Sankai Giken, Suprajit, and Hitachi Metals. After receiving the expert's feedback and recommendations, Researchers rearranged the survey form and then again forward it to specialists for their final recommendation.

The responses received from the Likert scale were converted into fuzzy scale. A conventional scale drawback can be overcome by using a fuzzy scale. Design of the final questionnaire was based on this methodology. The respondents from various backgrounds were chosen as the questionnaire sample population which intricate directly or indirectly in managing the issues related to risk in Indian mechanical manufacturing context.

3.2. Sample population and Organizations

In the sample population, it include managers and engineers who belong to the organizations using web based supply network in Delhi capital region, namely Krishna Maruti, Sankai Giken, Toyoda Gosai, Chap India and Suprajit Pvt. Ltd etc. Most of the firms in this study were from mechanical components manufacturing sector. Total of 300 survey forms were forwarded to the Professionals of different firms. Out of 300 survey forms only 148 were correctly filled forms were received with a response rate of 0.49. Kline (2005) Proposed 200 minimum sample sizes appropriate for conducting structural equation modeling. But for the preliminary study, this sample size is sufficient. In general, Sample size should be four times higher in ratio to the no. of questions and our study satisfies the requirements. The aggregate sample contained 68 Engineers (46%), 66 managers (45%), 8 Executives (5%), and 6 others (4%). Demographic details of respondents are available in Table 3.

The sample should be self-explanatory with demographic detail of the organizations and the sample population. From Table-3, it seems that the contribution of engineers and managers are almost similar. Engineer's involvement in providing responses is around 45.94%, which is worthy. A major number of the respondents were engaged at the middle level and often participated in the risk managing practice on a regular basis. The contribution by the top level and upper management personals are satisfactory, which are responsible to make judgments.

Table 3. Respondent Table

Profile	Total	(%)	Profile	Total	(%)
Administrators	8	5.41	**Engineers**	68	45.94
Senior Vice President	1		Engineer (Senior)	13	
Executive (Senior)	2		Engineer (Assistant)	20	
Executive (Section)	2		Engineer	18	
Executive	3		Engineer (Junior)	17	
Managers	66	44.60	**Others**	6	4.05
Asst. General	2		Team Head	3	
Manager(AGM)	4		Expert	1	
Manager (Senior)	20		Other	2	
Manager (Deputy)	20				
Manager	20				
Manager (Assistant)					

3.3. Data Reliability and validation

Each research associated with some benefits and restrictions. A single technique is insufficient to resolve all research issues (Sekaran & Bougie, 2010). The research techniques suitability is analyzed by the purpose and limitation of research. The offline and online approach was used for collecting feedback from the respondents. The received response rate was suitable and also fulfilling the condition of minimum sample size. All evaluation was finalized on the statistical hypothesis base that this sample (N=148) was taken out from a uniformly distributed respondents. As per the judicious hypothesis, it is recommended that a sample size of 25 or 30 for all conditions is sufficient (Howell 2002).

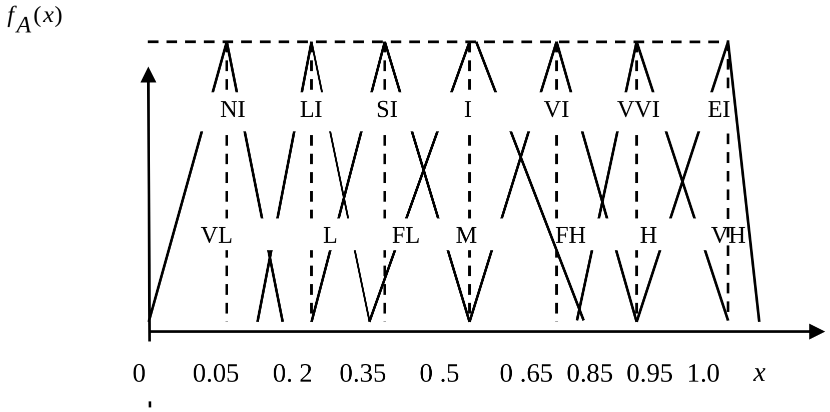

Figure 2. Membership Functions and Linguistic Terms

The value of Cronbach alpha test is executed for testing the reliability of the accumulated responses. Collected feedback first converted from Likert scale into fuzzy scale on 7-points scale. In this work, Triangular Fuzzy Numbers (TFN) is used as membership functions. The ratings and the weights can be evaluated by linguistic terms and can be expressed via TFN as shown in Table 4; while the membership functions of these linguistic terms are shown in Figure 2.

Table 4. Triangular Fuzzy Numbers for Linguistic Terms

Rating of Risk Factors			Importance Weight of Each Criterion	
Linguistic Term	**Membership Function**		**Linguistic Term**	**Membership Function**
Extremely Important (EI)	(.85, .95, 1.0)		Vey High (VH)	(.85, .95, 1.0)
Very-very Important (VVI)	(.7, .8, .9)		High (H)	(.7, .8, .9)
Very Important (VI)	(.5, .65, .8)		Fairly High (FH)	(.5, .65, .8)
Important(I)	(.3, .5, .7)		Medium (M)	(.3, .5, .7)
Somhow Important (SI)	(.2, .35, .5)		Fairly Low (FL)	(.2, .35, .5)
Less Important (LI)	(.1, .2, .3)		Low (L)	(.1, .2, .3)
Not Important (NI)	(0, .05, .15)		Very Low (VL)	(0, .05, .15)

Here, Mean Maximum Membership method is applied to convert Fuzzy Triangular numbers into Crisp Score. This method is also called Middle of Maxima (Z =$\frac{b+c}{2}$).

In the next phase, descriptive analysis and exploratory factor analysis (EFA) were performed for data converging and data reduction by using SPSS software tool. The achieved overall value of Cronbach's alpha was found 0.81 which is above 0.6 defined the sample reliability.

Table 5. Reliability Statistics

S. No.	Group No.	No. of Respondents				Cronbach Alpha
		Valid	Excluded	Total	%age	
1	IP	148	0	148	100	0.881
2	ER	148	0	148	100	0.913
3	OS	148	0	148	100	0.823
4	RDDIO	148	0	148	100	0.803
5	IR	148	0	148	100	0.778
6	DR	148	0	148	100	0.832
7	OR	148	0	148	100	0.668

As per the result is given in table 5, the values of Cronbach's alpha varying from 0.668 to 0.913 were extracted for each risk factors group. These coefficients values fit under the acceptable limit. The Value of Cronbach's alpha found above 0.6 generally proved acceptability (Tasir and Salleh 2003) for performing a pilot study. The results of these tests represent the consistency and uniformities in the opinion of the respondent. The information collected through the respondent's feedback is examined using software (SPSS-V21) through inferential and descriptive statistics to test the bonding between dependent and independent variables and to measure and analyze the variances in opinion between two issues.

The test of ANOVA (Analysis of variance) implemented for detecting the variance in an expert's opinion. The results of ANOVA tests were found above $P > 0.05$ represent uniformity in expert's opinion towards allocating the level of importance to any factor/indicator. In the next step, the values of the local and global weight were also calculated based on the importance of all risk issues for assigning the rank. Statistical tests generally implemented on aggregated expert's perception basis rather than any individual perception. The weight of experts generally considered equal in terms of their qualification, experience, and competency, but minor variation observed in credibility and importance. The global priority weights of each main factor are assessed based on the average local weights of these factors/ sub-factors. The ranking list along with their weight for all major categories is shown in Table 6.

Table 6. Composite Priority Weight for Strategic Measures of Risk Factors

Groups	Group %weight	Rankings of Groups
Organizational Risk (OR)	0.230899447	**1**
Infrastructure Risk (IR)	0.143575449	**3**
Operation & Supply Risk (OS)	0.167020482	**2**
Demand Risk (DR)	0.113012777	**6**
Relation dependence degree of Organization (RDDIO)	0.116745977	**5**
Information and policy Risk (IP)	0.136701328	**4**
Environmental Risk (ER)	0.09204454	**7**

3.4. Exploratory Factor Analysis (EFA)

For examining the structure detection feasibility of the data, KMO and Bartlett's test were performed. The KMO measure value was 0.78 and the results of Bartlett's Test of Sphericity defines data appropriateness. In the parameter's estimation, the method used was Varimax rotation with Kaiser Normalization and for extracting the components the method used was principal component analysis. The key judgment rubrics (factor loading ≥ 0.5, eigenvalues ≥ 1, & simple structure) were used for issues detection (Hair, et al. 2008). The eigenvalue ≥ 1 suggest the no. of groups required for loading all factors which are self-explained. Varimax rotation method was implemented for improved understanding, (Kaiser, 1974). The EFA (exploratory factor analysis) result outcomes are available in the table 8. Finally seven factors were extracted having eigenvalue greater than one and they represented 62.33% variation collectively in the total contribution.

On the basis of EFA test results, four sub-factors were deleted out of total 38 sub-factors. Two sub-factors were rejected based on the commonality which is below 0.5 and the other two rejected on the basis of loading complexity or common loading. The values of commonality for all extracted variables were above 0.5. The results of the rotated component table 8 shows the factor loading of the final 34 sub-factors distributed in seven separate groups without having any common loading issue. It suppresses the coefficient in the rotated component matrix with a value below 0.4. The results of Factor loading varying from 0.644 to 0.858 were showing significant level. Finally projected research conceptual model was examined based on structural equation modeling by AMOS Graphics 21 Software.

4. Results

4.1. Research Conceptual Model Evaluation

The effect of latent factors on observed factors generally observed by applying CFA (Confirmatory factor analysis). In CFA, first check or test the measurement model before testing the final structural model (Hulland et al., 1996). Confirmatory factor analysis is also performed for examining the discriminant validity, construct validity, and unidimensionality. A statistical test for checking the significance is insufficient to categorize a correct model from the sample data. Goodness-of-fit factors were used for different types in this study for observing the measurement and structural model (Byrne, 2001).

CFA is also calculated by two measures. Primarily, Standard factor loading shows a solid association among criteria and sub-criteria (Power, 2005, Yeh, 2005, Gallagher et al., 2008,). Sometimes factor loading results found more than 0.50

then it is presumed satisfactory (Churchill, 1979). Another, Covariance of correlation between two factors can influence the estimate value, or correlation among two factors or influence both that can be calculated by Critical Ratio (CR) (Schmacker & Lomax, 1996). The acceptable limit of CR for all issues should be higher than 1.96 and the value of standardized regression weight should be above 0.60 (Tarofder et al., 2013). Table 7 demonstrates the model fitness index.

Table 7. Confirmatory Factor fitness index

Name	Acceptable Limit	Source
CFI,	CFI ≥ 0.9	(Yeh, 2005), (Power, 2005), (Lopez, 2010)
x^2 (p, df,)	P greater than 0.05	(Norzaidi, 2008)
NFI	0.8 > value > 0.9	(Power, 2005), (Yeh, 2005), (Lopez, 2010),
RMR	value less than 0.10	(Norzaidi, 2008), (Lopez, 2010),
Covariance (CR)	value greater than 1.96	(Gallagher, 2008) , (Lopez, 2010),
RMSEA	value less than 0.10	(Norzaidi, 2008), (Lopez, 2010),

Confirmatory factor analysis is performed for all 7 factors with 34 sub-factors. As shown from the results, no offensive estimate left with t-value (critical ratio) below 1.96; proved estimates were significant. The results of standardized regression weights were also found greater than or equal to 0.60, shows the significance of indicators in the model. The values of all indicators were logical and positive. Results outcome of squared multiple correlations (R^2) were higher from 0.30. The results of all individual models construct placed in table 8. The values of Chi-square, Eigenvalue, Cronbach alpha, X^2/df and p-value for each construct also available in table 8. Mostly results follow the satisfactory level in expressing a good fit as seen from table 7.

The tests for other indices were conducted after measurement model approval for analyzing the model. The CMIN/df ratio represented acceptability. The value of RMSEA (Root means square error of approximation) which is known by the badness of fit indicator shows perfect fit. This fitment variable or indices is mentioned as one of the main fit indices of the construct. The results of other variables like p-value and NFI (Normal fit index) results found average. The Value of p ≥0.05 represents the chi-square value statistically (good fit) significant. The Value of Chi-square changed by the no. of responses and CFA technique cannot be limited by the chi-square test only when other factors reflect decent fitment. The critical ratio for all the estimates was found above acceptable limit i.e. higher than 1.96 and in the range of range in from 4.5 to 12.530 as given in table 8. The received outcomes were appropriate for model fitment as given in table 8.

Table 8. Result outcome of factor analysis

Criteria(Eigen Value, Cronbach Alpha,)	Factor Loading (Principal component analysis)	Measurement Model		
		Standard Co-Efficient	R^2	t-Value
OR (Organizational Risk) (X^2=25.343, X^2/df=1.80,P=0.030, CFI=0.974, RMSEA=0.073, NFI=0.945,) Eigen Value=7.118, α=0.881,				
OR1	0.686	0.681	0.464	8.441
OR2	0.820	0.793	0.62	9.44
OR3	0.737	0.725	0.526	9.086
OR4	0.643	0.633	0.401	7.758
OR5	0.802	0.790	0.624	10.056
OR6	0.712	0.688	0.474	8.547
OR7	0.746	0.715	0.512	8.940
IR (Infrastructure Risk) (X^2=7.153, X^2/df=1.430, P=0.208, CFI=0.994, RMSEA=0.053, NFI=0.984,) Eigen Value=3.950, α=0.913,				
IR1	0.821	0.791	0.627	12.115
IR2	0.812	0.824	0.655	12.113
IR3	0.857	0.856	0.734	11.914
IR4	0.81	0.821	0.674	11.592
IR5	0.851	0.835	0.698	12.530
OS (Operation and Supply Risk) (X^2=4.352, X^2/df=0.92, P=0.49, CFI=0.992, RMSEA=0.01, NFI=0.982,) Eigen Value=3.269, α=0.822,				
OS1	0.671	0.57	0.336	7.047
OS2	0.813	0.805	0.648	10.13
OS3	0.835	0.862	0.740	9.071

Table 8. Continued

Criteria(Eigen Value, Cronbach Alpha,)	Factor Loading (Principal component analysis)	Measurement Model		
		Standard Co-Efficient	R^2	t-Value
OS4	0.645	0.603	0.364	7.387
OS5	0.722	0.602	0.363	7.366
DR (Demand Risk) (X^2=6.220, X^2/df=1.240, P=0.285, CFI=0.993, RMSEA=0.040, NFI=0.970,) Eigen Value=2.169, α=0.802,				
DR1	0.702	0.604	0.365	8.215
DR2	0.69	0.661	0.440	6.820
DR3	0.752	0.75	0.576	6.920
DR4	0.732	0.762	0.581	7.277
DR5	0.682	0.573	0.328	7.578
RDDIO (Relation & dependence degree of inter-organizational Risk) (X^2=3.240, X^2/df=0.647, P=0.662, CFI=0.994, RMSEA=0.023, NFI=0.981,) Eigen Value=1.890, α=0.779,				
RDDIO1	0.775	0.671	0.451	6.319
RDDIO2	0.67	0.642	0.412	6.131
RDDIO3	0.64	0.595	0.354	5.80
RDDIO4	0.670	0.629	0.397	6.050
RDDIO5	0.734	0.690	0.474	6.420
IP (Information & Policy Risk) (X^2=4.109, X^2/df=2.055, P=0.127, CFI=0.989, RMSEA=0.079, NFI=0.979,) Eigen Value=1.619, α=0.829,				
IP1	0.699	0.73	0.547	7.770
IP2	0.814	0.849	0.722	8.381
IP3	0.775	0.682	0.466	7.256
IP4	0.716	0.696	0.485	8.1
ER (Environmental Risk) (X^2=5.319, X^2/df=2.24, P=0.234, CFI=0.979, RMSEA=0.02, NFI=0.966,) α=0.670, Eigen Value=1.354,				
ER1	0.742	0.651	0.424	4.8
ER2	0.725	0.63	0.410	4.4
ER3	0.710	0.622	0.390	4.514

4.2. Testing of Hypothesis

Hypothesis testing is a statistical method to observe the probability of sample data, to know whether the hypothesis is true or false. Hypothesis testing is the specific method to test the population sample data and predicted outcomes will improve results. The Objective of the hypothesis testing is to understand the similarity/dissimilarity of issues related to risk belongs to the e-supply chain in Indian mechanical manufacturing sector. Researchers use the survey response of 148 respondents presented earlier.

The study of this conceptual model was detected using bootstrapping to estimate standard errors, Parameters, and t-value (critical ratio) (Hwang, 2004). In Table 10, hypothesis results are given. This conceptual model study clarified the significant variance of organizational risk over demand (R^2=0.24). The data fitment with the survey data is well explained by the fitness indices. The results of the conceptual model for Goodness of fit were under acceptable fit as shown in table 9. The value of X^2/Df was below 3, RMSEA below 0.05. The value of CFI, RMSEA, and remaining indicators were found beyond the preferred limit, showing strong favor to the model. Finally, results outcome conclude that the structure is adequate for being assessed.

Table 9. Results of Hypothesized Model

CMIN/df	p	CFI	RMSEA	Df	IFI	NFI	PCLOSE
1.363	0.000	0.910	0.049	515	0.912	0.735	0.500

For assessing the validity of the parameter path coefficients or estimates, this study examined the followings:

a) Estimates should be statistically significant?
b) Factors should be significant to the latent variables?
c) Logical direction should be there (+ or -) (Belghis et al. 2014, Kumar et al. 2020).

The value of CR (critical ratio) must be greater than 1.96 to mark parameter estimate significant. The values of Standardized Regression Weights estimates also should be higher than or equal to 0.20 to make the factors/indicators significant. Hypothesized theory of the model decides the directions of estimates are logical/ not logical. The value of the critical ratio for all the estimates varies in between 4.434 to 11.580 as shown in Table 10.

All Standardized Regression Weights estimates are more than 0.20 except one which is also close to 0.20. Therefore, all criteria are essential to the latent variables. The values and direction of all the estimates were also found positive. Finally, the results outcome of squared multiple correlations (R^2) for analyzing the variance in proportion should be above 0.30. From Table 10, it can easily justify that variable DR4 individually can explain 61% of demand risk variance. So, DR4 (Demand variability) criteria are the top indicator of demand risk. Furthermore, Transit time (OS2) criteria can explain 64% variances of operation and supply risk. So, Transit time represents the best predictor of operation and supply risk. Remaining factors are not considered so good because of justifying a little variance of operation and supply. The relationship among various risk issues has been hypothesized in this research conceptual model as given in figure 3.

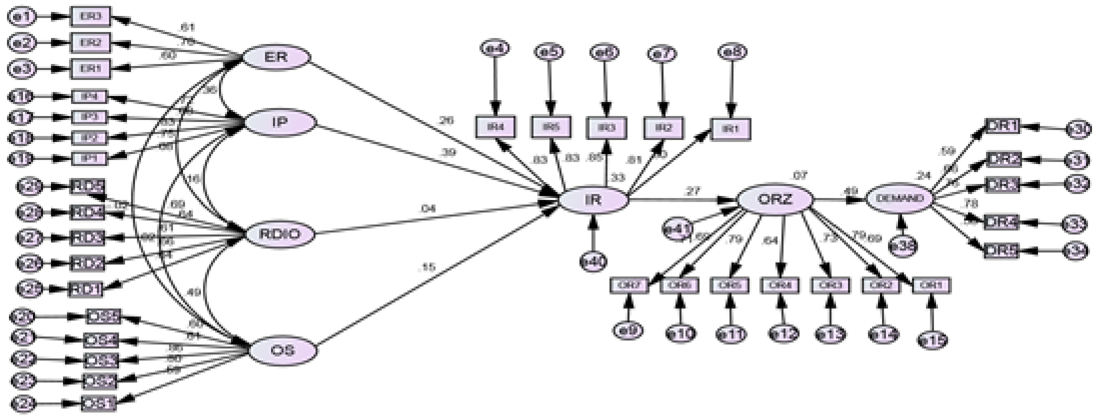

Figure 3. SEM for measuring the relationship among various Risk Factors in e-supply chain

Table 10. Results of Hypothesized Model

	Estimates	S.E.	C.R. (t-value)	P	Standardized Regression Weights (estimates)	Squared Multiple Correlations (R^2)	
ER1 <--- ER	.967	.197	4.901	***	.595	RD5	.474
ER2 <--- ER	1.150	.259	4.434	***	.697	RD4	.409
ER3 <--- ER	1.000				.614	RD3	.368
IR1 <--- IR	1.000				.798	RD2	.433
IR2 <--- IR	1.044	.097	10.759	***	.806	RD1	.405
IR3 <--- IR	1.065	.092	11.580	***	.854	DR5	.319
IR5 <--- IR	.924	.083	11.142	***	.832	DR4	.614
IR4 <--- IR	.928	.083	11.161	***	.826	DR3	.570
OR1<--- ORZ	1.000				.689	DR2	.434
OR2 <--- ORZ	1.086	.126	8.582	***	.787	DR1	.348
OR3 <--- ORZ	1.000	.126	7.947	***	.732	OS5	.358
OR4 <--- ORZ	.843	.119	7.090	***	.640	OS4	.375
OR5 <--- ORZ	1.044	.124	8.409	***	.789	OS3	.741
OR6 <--- ORZ	.928	.125	7.450	***	.688	OS2	.640
OR7 <--- ORZ	.991	.129	7.710	***	.710	OS1	.345
IP1 <--- IP	1.000				.750	IP4	.521
IP2 <--- IP	1.187	.127	9.341	***	.828	IP3	.457
IP3 <--- IP	1.014	.136	7.458	***	.676	IP2	.686
IP4 <--- IP	1.016	.128	7.917	***	.722	IP1	.562
OS1 <--- OS	1.000				.587	OR7	.504
OS2 <--- OS	1.400	.204	6.862	***	.800	OR6	.473
OS3 <--- OS	1.516	.209	7.242	***	.861	OR5	.623

Table 10. Continued

	Estimates	S.E.	C.R. (t-value)	P	Standardized Regression Weights (estimates)	Squared Multiple Correlations (R^2)	
OS4 <--- OS	1.062	.181	5.861	***	.612	OR4	.409
OS5 <--- OS	1.048	.180	5.815	***	.599	OR3	.536
DR1 <--- DEMAND	1.000				.590	OR2	.620
DR2 <--- DEMAND	1.112	.181	6.154	***	.659	OR1	.475
DR3 <--- DEMAND	1.282	.199	6.456	***	.755	IR4	.683
DR4 <--- DEMAND	1.269	.197	6.449	***	.783	IR5	.692
DR5 <--- DEMAND	.926	.170	5.432	***	.565	IR3	.729
RD1 <--- RDIO	1.000				.637	IR2	.649
RD2 <--- RDIO	.953	.157	6.069	***	.658	IR1	.636
RD3 <--- RDIO	.866	.152	5.681	***	.606	ER3	.377
RD4 <--- RDIO	.977	.166	5.893	***	.639	ER2	.486
RD5 <--- RDIO	1.073	.165	6.505	***	.688	ER1	.355

The testing of hypotheses was based on path coefficient with a significant outcome. All hypotheses were supporting the model except H3 and H4. Favoring H1, Environmental risk had a positive impact on infrastructure risk (β=0.26, p < 0.00). Similar outcomes shows that information and policy risk has sufficient positive influence on the infrastructure risk (β=0.39, p< 0.00) and also test results supported the hypothesis. Now discussing the H3, good relation and interdependence risk also has a positive impact over infrastructure risk but the significant value (p > 0.00) found inadequate for considering effective for supporting the test. So hypothesis (H3) is considered as rejected. Likewise, H4, operation & supply risk also creates a positive impact over the infrastructure risk but the significant value of (p > 0.00) found insufficient for supporting the hypothesis, H4 also rejected. Supporting to H5, infrastructure risk creates sufficient positive impact over organizational risk (β=0.27, p < 0.00) considered as accepted. Similarly H6, organizational risk also create positive influence with very high standardized regression weights over the demand risk and the value of path coefficient and significant value (β=0.40, p < 0.00) accepted the hypothesis. A summary of hypothesis testing has shown in Table: 11.

Table 11. Summary of Hypothesis

No.	Hypothesis	Results
H1	*An environment risk significantly enhances the infrastructure risk*	Accepted
H2	*An information and policy risk has a significant positive impact on Infrastructure risk*	Accepted
H3	*A good relation & dependence degree of inter-organization risk positively related to infrastructure risk*	Rejected
H4	*An operation and supply risk has a significant positive impact on infrastructure risk*	Rejected
H5	*An infrastructure risk significantly enhances the Organization risk*	Accepted
H6	*Organizational risks create significant positive effect over the demand risk*	Accepted

5. Final Discussion and Limitation

The development in the utilization of internet in the manufacturing sector and an increase in production demand has been a major cause of introducing the e-supply chain (Kumar, et al. 2019a).This study recognizes those risk issues which imperil the e-supply chain process in the Indian mechanical manufacturing sector. The primary target of this investigation is to identify and approve risk related structural model of the e-supply chain. On the basis of an exhaustive study of literature in various directions, the final conceptual model was achieved. A step by steps exploration procedure was implemented for achieving a consistent, valid, & unidimensional constructs (Chen & Paulraj, 2004).

During the scrutinizing process for enhancing the reliability and validity, four factors were removed from this theoretical model. All major dimensions were found influential as a risk in e-SCM but few factors associated with the major dimensions were removed which reducing their reliability. One factor was removed from both models of demand and environment risk. The environmental risk construct was classified in relations to government regulation and political stability to increase supply chain risk issues. But, the factors of government regulation and political stability were removed from the environmental construct. Therefore, these factors no longer were used for evaluating the impact of environmental risk in the e-supply chain. But the construct of environmental risk still used as an important area of exploring the impact of risk on the e-supply chain. Likewise, Demand risk is also termed as an influential factor of e-supply chain risk. Similarly, two factors were also removed from the main model of demand risk. First two factors were removed due to commonalities value basis which was below 0.5 and rest of two factors were removed due to a common loading issue. So, the remaining 34 factors were included in the final measurement model which were found significant in this study and fit the model.

The empirical investigation of the structural model as shown in figure 6 define four out of six main factors are found influencing for enhancing the demand risk significantly with an R^2 value is 0.24. As per the results found, information and policy risk has been detected as the most influencing factor for enhancing the level of demand risk. Such finding is not unexpected, as, without proper implementation of information and policy system, the running of any e-supply chain cannot be considered. So, it is necessary for any e-supply chain to set up a proper information and policy system and implements it properly. This is because, with proper implementation of information and policy, it becomes easy to achieve the goals, objectives, and needs of any e-supply chain.

Consistent with the prior research, the environmental risk was found the second most influencing risk issues which independently affect the supply demand. It is easy to understand that a good environment directly boosts the e-supply chain for enhancing the demand. This seems to be making sense for a firm, first understand and implement a proper policy and information system and then provide the proper environment for the successful running of any e-supply chain for gaining its benefits, So that risks issues associated with e- supply chain can be greatly reduced. It is too essential to instruct the firms in this context, that a proper policy and information system with ergonomic environment avoid the system complexity and also decrease the chances of occurrence of risk issues up to great extent. The government should also do some efforts and set some standard laws for all supply chain and assess its implementation. This will greatly reduce the level of risks if firms consider and implement these issues in its supply chain.

A good relation and dependence degree of inter-organizational risks found positive for enhancing the demand risk but the significant value found inadequate to consider its role for increasing the demand risk. The reason behind makes it insignificant because of factors like lack of honesty in the relationship, commitment capabilities, competitiveness, interrelationship, and commercial exploitation. E-Supply chain system these days become so updated and transparent that it becomes difficult for a firm to hide information from anyone. So the factors like honesty in relationship and commitment capabilities were no longer become effective for affecting the e-supply chain performance. Due to this reason may be it become insignificant. An operation and supply risk also influence the demand risk positively but the significant value was found inadequate to consider it effective. Factors like transit time, risk affecting supplier, inventory ownership, product quality, and safety make it insignificant. Nowadays it becomes imperative for a firm to equip with good quality and safety features with reduced transit time. So in this competitive environment supply chain has to be equipped with these characteristics. May be these become the reason for its insignificance. So, research finding in this study offers an innovative direction of thinking for the researchers to think in this way.

Study results show that infrastructure risk positively influences organizational risk. It generally makes sense that a firm equipped with good infrastructure facility has also a better organization. So it is expected that infrastructure helps in maintaining better organization. So infrastructure risk directly enhances the organizational risk and found significant in this study. Result also shows that organizational risk also positively influence the risk of demand. It is a well-known fact that the demand is directly influenced by the organization. As seen from the results, the value of path coefficient and significant quiet high which strongly support the organizational risk have a positive influence over demand risk. Hence it is worth to summarize that a good infrastructure facility and a better-organized approach can manage the activities efficiently and effectively and play a major role for the successful running of e-supply function in relations with demand, performance, and other benefits.

As a future scope, Researchers will concentrate more on developing strong measures to minimize risk level in e- supply chain. In brief, all risk models are made up of a minimum of five factors except environmental risk and information & supply. Even then, it shows fair outcomes. In a future study, the researcher should focus on adding more sub-factors to certify improved factors representation.

The crucial job in handling the concept of the supply chain is to identify those factors which can interfere in the network of the supply chain (New, 1996). This is a broad field of research. So, it is evident that partial research is not sufficient to cover up the whole domain of e-supply risks. So the development of this structural model tries to cover the maximum possible risk issues but still, some remain uncovered. Furthermore, the growth of the measurement model is a routine course and it will be upgraded by continuous development and evaluation across different groups of people (Hensley, 1999). Hence, this study might be evaluated at a preliminary phase in the way of assessing the theoretic phase of risk factors. As a future perspective, Researchers might be focused on firming and refining the structure model. There are numerous issues were mined from the earlier studies in the preliminary phase of study but were not incorporated owing to response rate and extent of research.

As per the research, four factors were excluded due to commonalities and loading complexity during constructing the measurement model. Future research should be more focused on data refining for avoiding common loading and commonalities issues. Researchers would also be familiar with the limitations of the approach which is used for developing a measurement model. Researchers used factor analysis in this study which is a large sample method and might be changed due to the size of the sample. (Hair et al, 2008).

To overcome the restrictions in future research, Practitioners would collect the responses from a large group to certify and extend the study. This study did not consider the effects arise due to the different types of firms. This sample data related to the mechanical manufacturing companies situated in India. Might be all firms belong to the same nature of the business but still main risk causes may differ in between. Therefore, as a future research perspective for eliminating the difference in opinion, we would more concentrate our research towards the individual category of firms for data collection.

This current research influence positively into e-supply chain risk factors and contributed significantly in the literature to overcome risk issues. However, there are always found restrictions or possibility which might be used as a vision for future study.

6. Conclusion

The risk is always associated with the structural system of the supply chain on numerous platforms like in decision making, management, and the advertising of new item and facilities (Ravasizadeh et al, 2011). Any operational research may be detected in ways of two interrelated branches: substantive and validation of construct. Substantive branch demonstrate the associations between theoretical models projected through empirical analysis, and the conceptual model validation comprises of relations among the consequences achieved from theoretical model and empirical study that measures the estimation objectives (Schwab, 1980). Research on many supply chain relationship has been growing daily; even though no exact methodology exists for the growth and measurement of the conceptual model (Kumar, et al. 2019). This might be mostly due to the circumstances that strongly support the necessity of development and validation of the theoretical model and measures of SCM (Chen & Paulraj, 2004).

As more and more organization are using e-supply processes so it is essential to examine the factors mathematically which disturbing the demand of supply chain and still received little care till date. There is little data available with the study of risk issue related to e-supply chain. This research study adds significant latest risk issues on the e-supply chain by providing empirical evidence on demand risk. This study justifies strongly that demand risk is highly affected by organizational risk.

As per the theoretical perspective, this research defines how demand can be affected by different variables. This study also provides real-world knowledge regarding different factors which need attention for gaining benefits and to avoid risk in any e-supply chain. This study also provides support to the practitioner. By classifying serious risk issues of the e-supply chain, researchers can decide suitable plans for executing proper organizational and infrastructure facility to increase the demand rate. Researchers will become familiar of their most significant role in building the e-supply chain network successful. Finally, this research provides a guiding principle about the importance of different risk-related factors.

As we know, the risk is an interdisciplinary subject. This research has attained a set of theories, functional constraints with constant supports to their measurement properties (i.e. consistent, valid, and unidimensional) through improvement and investigation. We believe that practitioners will utilize this concept in their learning agendas either directly or as a basis to make a clear understanding of e-supply risks for expanding and purifying in the best practice of collective theory building and testing.

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