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An empirical study to identify and develop constructive model of e-supply chain risks based on Indian mechanical manufacturing industries

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A B S T R A C T

Management towards control of risk issues appeared as an important area in E-supply chain for researchers in the present fast growing market. Extensive research has been accomplished in this area, but still there are several risks and uncertainties. The present research aims to identify and consolidate various e-supply risk factors for developing a constructive measurement model. The study also assesses the influence of risk factors over e-supply chain operation in Indian mechanical industries. Thus, after a thorough research and detailed discussion, 38 Risks factors are identified through literature to prepare the questionnaire. A questionnaire based survey is carried out for collecting the primary data from 148 experts of mechanical manufacturing industries located in the national capital region of India. The research methodology is combined with descriptive statistics and factor analysis. SPSS 21 software tools is used for investigating the reliability and Amos Graphics 21 software is used for the fitment validation of the theoretical construct. The results suggest that all risk issues create significant negative influence e-supply chain process. The results also show negative effects of risks over e-supply chain performance. The current research outcome develops a stochastic model based on the e-supply chain risk factors used for reducing risks in e-supply chain operation.

1. Introduction

Supply chain may become more vulnerable due to the implementation of new market trends such as programs of supplier rationalization, just in time delivery (JIT) and extensive non-core activities especially when these activities are combined with the distribution, centralization and globalization. So it becomes necessary to manage the effect of risk over performance. Risk management in E-supplier selection is emerged as an essential issue for researchers in e-supply chain. Researchers are more focused towards improving the performance by mitigating the risks in E-supply chain. Risk management plays a significant part in taking management decision and control (Giannakis et al., 2004). Competitive environment, technological transformation and the continuous exploration for gaining competitive ben-

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efit are the key issues for implementing risk management approaches (Brindley, 2004). New technologies, especially internet enhance the capabilities of consumers for searching and arranging the relevant information for relating one to another before purchase (Ranaweera et al., 2008). From the previous studies it has been proven that risks, create significant negative effects on the operations of affected firms (Craighead et al., 2007). These risks may be arising from internal (e.g. Coordination procedures and defective planning), or external factors (e.g. Economic growth) in the supply chain (e.g. related to the e-Supplier quality) (Oehmen, 2009).

Previous literature clearly defines limited research conducted over the supply chain risk issues and there are limited studies available on E- supply chain Risk factors based on the Indian manufacturing sector. India is a developing economy and world second largest rapidly growing consumer market. It has a large manufacturing sector, which is still expanding with consumer's demands. E-supply chain advances the system, reduces the complexity and enhances the manufacturing capacity. So for the smooth and uninterrupted running of e-supply chain, it is necessary to work on its risk variables. Hence, this research findings fill the gap up to some extent by identifying the risk variables for the effective operation of e-supply chain. Any manufacturing sector mainly is based on mechanical manufacturing. So, the aim of present research is to explore and identify the risk issues and their impact over the performance of a company based on Indian mechanical industries.

This study is organized as follows. Section 2 covers the distributed literature related to Risk management, Supply chain & e-supply chain risk, their classification and conceptualization of the proposed supply chain risk construct. In Section 3, we explain about research methodology such as data collection, questionnaire formation and section 4 covers the results analysis of this empirical study. In this section we investigate the result received from EFA and CFA methodology. The discussion, limitation and direction for future work are given in section 5. Finally, section 6 explains the final conclusion of the paper with a summary and research implication.

2. Literature Review

The theory of "risk" these days has become a topic of research in many corporate environments, science and engineering contexts (Chopra & Sodhi, 2004). Risk is defined as being vulnerable and the description of risk as per English dictionary is as follows: "A situation involving exposure to danger". Risk can arise from an identified or unidentified source. Risk also defined as "the likelihood of an uncommon event to happen, and the negative effects this event will have on the organization" (Khan & Burnes, 2007). Supply chain risk is defined as the rate of effects and vulnerability with respect to the potential outcome. The risks related to E-supply chain is also refer as "the uncertainty of the occurrence of an event that could affect one link within the supply chain and that could influence the achievement of the company's business objectives" (Tang, 2006). E-supply chain risk also termed as "the potential variation of consequence affecting the decrease of value added at any activity cell in a chain, where the outcome is explained through the quantity and quality of goods in any location and time in a supply chain flow" (Bogataj & Bogtaj, 2007).

2.1 Risk Management

The Risk management process generally is carried out for minimizing risks in E-supply chain. The Supply disruption risk states as the manager's opinion of the total potential loss produced from interruption of the supply from suppliers to buyers (Ellis et al., 2010). Demand management, Product Management, Information management and supply management classify four basic methods for reducing the influence of supply chain risks (Tang, 2006). Managing risk is a developing and uninterrupted practice which runs throughout the organization for policy implementation. All organization's activities surrounded by the risk factors in the past, present and future should be addressed methodically by the risk management process (Khan & Burnes, 2007).The risk management process generally initiates after assessing two conditions: first, probability of occurring of any specific event and second, the consequences should face after occurring the event (Cox & Townsend, 1998).

2.2 Supply chain and E-supply chain Risks

The theory related to risk and risk management has been covered in many regions such as economics, finance and strategy (Manuj & Mentzer, 2008). Risk is also termed as the possibility of difference in the potential results in both subjective and objective ways (Spekman & Davis, 2004). A bad risk management can lead to low product quality, inaccurate forecasting, poor relationships with other members, downfall in share price and turnover, loss of reputation and clashes amongst the organization's participants (Cousins et al., 2004). It became necessary for the companies to implement supply chain risk management approaches to eliminate or minimize their effects (Manuj & Mentzer, 2008). Many categories of risks related to the supply chain have been studied by researchers from the literature survey. These risks are further categorized into sub categories such as delays, forecast, disruptions, procurement, systems, intellectual property, inventory, and capacity (Chopra & Sodhi, 2004). Supply chain risk is divided into two categories: first, internal involving issues like information delays, regulations, capacity variations and organizational factors and second, external which involves issues like the actions of competitors, market prices, supplier quality, manufacturing yield, political issues and manufacturing costs, (Cucchiella & Gastaldi, 2006). The use of web in supply chain improves opportunities and speed of change, network complexity and consequently risk increases. Use of E-business has brought a major technological reform in purchasing, which can provide organizational profits such as savings in inventory reduction, transaction costs, and communication networks maintained between buyers and suppliers (Deeter-Schmelz et al., 2001). The perceived risk level associates with the customer for taking purchasing choice is higher in online shopping than in traditional or offline shopping (Samadi & Yaghoob-Nejadi, 2009). Incompatible application, integration and security issue related to the unpredictable atmosphere support the technological risks.

2.3 Classification of Supply chain Risk

Supply risk is related to organization and commercial environment falls into various categories (Bogataj & Bogtaj, 2007). Level of risk can also be considered based on its source for organizing risk (Norrman & Jansson, 2004; Peck, 2005). Risk sources comprises of environmental, organizational or factors related to supply chain might not be predicted, but the influence on the resultant factors of supply chain (Juttner et al., 2003). Risk related to E-supply chain is classified into two levels (Kleindorfer & Saad, 2005). First, risks generate due to the lack of synchronization among demand and supply, the second one includes those risks generated due to the interruptions into normal activities. Risk can be categorized into three groups: 1) Internal to the Supply network, but external to the company: a) Supply; b) Demand; 2) Internal to the company: a) Process; b) Regulation; 3) External to the network: i) Environmental (Christopher & Peck, 2004). There are seven different risk sources comprises of environmental features, organizational policy, industry features, supply chain members, supply chain configuration, judgment making unit and problem specific factors (Ritchie, 2007). Cucchiella and Gastaldi (2006) classified risk on source of uncertainty: a) available capacity, b) manufacturing yield, c) supplier quality, d) competitor moves, e) political environment, f) internal organization, g) information delays, h) stochastic cost, i) price fluctuations and customs regulations. It is assured to develop a robust supply network structure secure against variation and interruption, but it is uncertain to be protected from disaster. Supply chain risks are classified into two groups, i.e. operational risks and disruption risks (Tang, 2006). Similarly, Wagner classifies supply chain risk sources into five groups: supply type, demand type, lawful/bureaucratic, regulatory, infrastructure and catastrophic (Wagner & Bode, 2006). Risks are also classified according to events leading to deviation and disruption, risk-disaster (Gaonkar & Viswanadham, 2007). Internet based new market and commercial opportunities, enhance the change of pace and complexity in supply networks, and subsequent risk increases. Using e-business technology has brought a major technological revolution in purchasing, which provides organizations with various kinds of benefits like inventory reduction, savings in transaction charges, and the formation of communication links among purchasers and sellers (Deeter-Schmelz et al., 2001). The risks related to e-business are the result of weak business practices that are created from applying poor criteria which enhance the problems related to technology implementation

(Vaidyanathan & Devaraj, 2003). Some e-supply chain risks that explore by the researchers are summarized in Table 1.

Table 1
Literature review related to Risk factors/ Sub- factors

Factor	Indicators	Sources
Information & Policy Risk	(f1) Information Security (f2) Extent of acceptable information (f3) Intellectual property risk (f4) Strategic uncertainty	Claypool et al. (2015), Belghis et al.(2014), Cigdem & Burak (2012), Ravasizadeh et al. (2011), Murtaza et al. (2004), Tapiero (2007), Choy et al. (2007), Faisal et al. (2007), Cucchiella & Gastaldi (2006), Wu et al. (2006), Wagner & Bode (2006), Tang (2006), Gaudenzi & Borghesi (2006), Rao et al. (2005), Sheffi & Rice (2005), Sodhi (2005), Peck (2005), Norrman & jansson (2004), Giunipero & Eltantawy (2004), Christopher & Peck (2004), Zsidisin (2003), Hallikas et al. (2002), Johnson (2001), Dyer (2000), Simons (1999).
Environmental Risk	(f5) Macroeconomic risk (f6) External and uncontrollable risk (f7) Political Stability (f8) Government Regulation (f9) Natural disasters	Matotek et al. (2015), Claypool et al. (2015), Belghis et al. (2014), Avelar et al. (2014), Lhoussaine et al. (2013), Ravasizadeh et al. (2011), Jorn & Daniel (2011), Rao & Goldsby (2009), Ziegenbein & Nienhaus (2004)
Operation & Supply Risk	(f10) Supplier opportunism (f11) Transit time (f12) Risk affecting supplier (f13) Inventory ownership (f14) Product quality and safety	Matotek et al. (2015), Claypool et al (2015), Belghis et al. (2014), Avelar et al. (2014), Lhoussaine et al. (2013), Cigdem & Burak (2012), Ravasizadeh et al. (2011), Jorn & Daniel (2011), Rao & Tobias (2011), Bin et al (2009), Manuj & Mentzer (2008), Giunipero & Eltantawy (2004), Chopra & Sodhi (2004), Zsidisin et al. (2004), Zsidisin (2003), Hallikas et al. (2002), Johnson (2001), Dyer (2000)
Relation & dependence degree of inter-organization Risk	(f15) Lack of honesty in relationship (f16) Commitment capability (f17) Commercial Exploitation (f18) Interrelationship risk (f19) Competitiveness	Claypool et al. (2015), Belghis et al. (2014), Avelar et al. (2014), Lhoussaine et al. (2013), Ravasizadeh et al. (2011), Bin et al (2009), Rao & Goldsby (2009), Spekman & Davis (2004).
Infrastructure Risk	(f20) Economic (f21) Technological Risk (f22) Implementation risk (f23) Appropriate e- market (f24) Credit	Claypool et al. (2015), Belghis et al. (2014), Avelar et al. (2014), Lhoussaine et al. (2013), Constantin & Tobias (2011), Ravasizadeh et al. (2011), Jorn & Daniel (2011), Bin et al (2009), Ratnasingham (2007).
Demand Risk	(f25) New product acceptance risk (f26) Drastic change in fashion (f27) Competitor moves (f28) Demand variability (f29) Forecast error (f30) Sudden cancelation of order (f31) Short product life	Matotek et al. (2015), Claypool et al. (2015), Belghis et al. (2014), Avelar et al. (2014), Lhoussaine et al. (2013), Cigdem & Burak (2012), Ravasizadeh et al. (2011), Jorn & Daniel (2011), Rao & Tobias (2011), Ellis et al. (2010), Manuj & Mentzer (2008), Peck (2005), Ziegenbein & Nienhaus (2004), Svensson G (2002), Johnson (2001), Simons (1999).
Organizational Risk	(f32) Operating risk (f33) Currency risk (f34) Culture risk (f35) Reputation risk (f36) Lack of expertise (f37) Legal issues (f38) Leadership	Ravasizadeh et al. (2011), Jorn & Daniel (2011), Rao & Tobias (2011), Rao & Goldsby (2009), Cucchiella & Gastaldi (2006), Wu et al. (2006), Wagner & Bode (2006), Tang (2006), Gaudenzi & Borghesi (2006), Rao et al. (2005), Sheffi & Rice (2005), Sodhi (2005), Peck (2005), Norrman & jansson (2004), Christopher & Peck (2004), Murtaza et al. (2004), Zsidisin et al. (2004), Spekman & Davis (2004), Chopra & Sodhi (2004), Zsidisin (2003), Svensson G (2002), Simons (1999).

2.4 Theoretical foundation of Conceptual Model

Fig. 1 shows the theoretical model highlighted the relationships among various risk factors such as environmental, Information & policy, operation & supply and inter-organizational dependency risks with infrastructure risk in the first phase and in the next phase it represents the relation of infrastructure, organizational with demand risk.

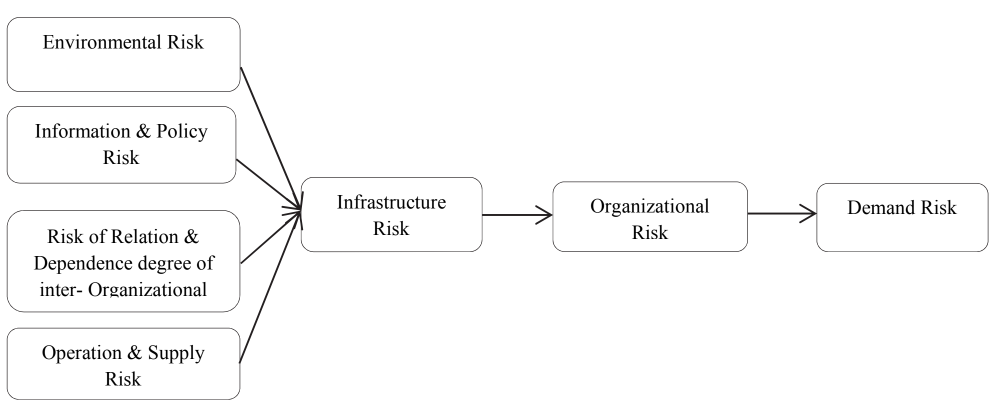

Fig. 1. Conceptual Model for Risk in E-Supply Chain

3. Research Methodology

The three-stage constant development cycle, which is located in the center of the development cycle, applies the confirmatory factor analysis (CFA) which is more appropriate for assessing unidimensionality and construct validity of the model (Ahire, et al. 1996). In the initial phase of the development cycle, the value of Cronbach alpha is generated for each construct. The second phase of the development cycle, exploratory factor analysis (EFA) is applied using principal component analysis. The normally suggested method for explaining the factors are Varimax rotation with Kaiser Normalization was used (Loehlin, 1998). In the third phase, CFA is implemented for testing the unidimensionality and construct validity. Exploratory and confirmatory factor analysis are used in this study to examine the proposed construct. Research adopted both descriptive and casual study. Descriptive research helps to explain the reliability of the collected responses and factor loading of risk factors related to e-supply chain and casual research used to confirm fitment and acceptability of measurement model and association between measured factors and latent factors.

3.1 Research Sample and Organizations

The research sample group comprised of engineers and managers from the firms using E-supply chain in Indian context, such as Sankai Giken, Krishna Maruti, Suprajit Pvt. Ltd., Toyoda Gosai, and Chap India, etc. Most of the firms in this research sample are related to manufacturing automobile components. 300 questionnaires are forwarded to the Experts (Engineers and managers) of these companies. 148 correct and filled responses have been received back with a response rate of 0.49. Kline, (2005) suggested for conducting structural equation modeling 200 responses is more appropriate. But for the pilot study, this research sample size is appropriate. The 4 times the sample size with respect to the no. of questions is appropriate for the study. The research study fulfills the condition. The final sample consisted of 7 Executives (5%), 67 managers (45%), 69 Engineers (47%), and 5 others (3%). Respondent's demographic profiles are presented in Table 2.

Table 2
Respondent Table

Title	Count	Percent (%)	Title	Count	Percent (%)
Executives	7	4.73	Engineers	69	46.62
Sr. Vice President	1		Senior Engineer	14	
Senior Executive	3		Asst. Engineer	22	
Section Executive	1		Engineers	18	
Executive	2		Junior Engineer	15	
Managers	67	45.27	Others	5	3.38
AGM	1		Team Leaders	3	
Senior Manager	4		Analyst	2	
Deputy Manager	21		Other	1	
Manager	22				
Assistant Manager	19				

3.2 Questionnaire Design

This research questionnaire provides definitions of all the questions as per the literature for easy identifying appropriate data for giving the correct answer. Questionnaire was prepared into three segments: first part consists of a covering letter for describing the purpose of the study and statement of confidentiality. The second part covers the demographic detail, e.g. company name, contact person name and their details. Third section covers the E-supply chain Risk factor. We have included 38 risk indicators/factors of 7-point Likert Scale (like Extreme important, very important. Not important etc.). Close ended questions based on grading procedure were used for the questionnaire, wherever possible owing to the larger scale survey approach (Sekaran & Bougie, 2010). Questionnaire content's validity was accomplished through judgment analysis. We have forwarded prepared questionnaire to 5 experts from different firms such as Sankai Giken, Toyoda Gosai and Hitachi metals, Suprajit for validating the content, design and structure of the questionnaire. On the basis of their feedback and suggestions received, we have updated the questionnaire and again forwarded to experts for their final approval.

4. Result Analysis

4.1 Data Reliability and validation

Every survey has advantages and limitations. Not all research situations can be resolved by one single method (Sekaran & Bougie, 2010). Research objectives and limitations define the best suitability of survey methods. In this survey, responses were received through online and offline mode. The response sample size satisfies the minimum sample requirement. Initially, we converted factors collected responses from Likert scale in 7- point fuzzy scale. The SPSS software tool has been used for conducting descriptive and exploratory factor analysis. The value 0.81 of Cronbach's alpha measure, above 0.60 confirmed the reliability of the research sample. Analysis of variance (ANOVA) conducted for analyzing the significance difference among experts' perceptions. The ANOVA test results were significant, $P > 0.05$ for all variables, and defines there is no difference in the perception of experts towards assigning the level of importance of any factor/indicator. We also calculated the value of mean, standard deviation, local and global weight for assigning the rank of all the risk questions based on their importance. These entire statistical tests performed on aggregated expert's opinion, not on any individual opinion. All experts were considered equal weighted in terms of their competency, qualification and experience, but negligible difference observed in terms of importance and credibility.

4.2 Exploratory factor analysis (EFA)

To check data feasibility for structure detection, KMO and Bartlett's test have been conducted. The value 0.78 of KMO measure, which is above 0.6 and Bartlett's Test of Sphericity results significant define the suitability of data for structure detection.

Table 3
KMO and Bartlett's Test Results

Kaiser-Meyer-Olkin Measure (KMO) of sampling Adequacy	0.781
Approx. Chi- Square	2428.804
Barlett's Test of Sphericity (DF)	561
Significant	.000

Table 5 describes the Principal component analysis for extraction and Varimax rotation with Kaiser Normalization method to estimate parameters. The three well- known decision rubrics (factor loading ≥ 0.5, eigenvalues ≥ 1 and structure, simplicity) were applied for identifications of the variables/factors (Hair et al., 2008). The eigenvalue less than 1 suggested variable was not self-explained and can be discarded. Varimax rotation was applied for better interpretation (Kaiser, 1974). The exploratory factor analysis results are reported in Table 5. Scree plot graph Suggested 7-factors was extracted having eigenvalue ≥ 1 and together they represented 62.33% variation in the total variables. 4-observed variables were excluded out of 38. 2-variables excluded due to commonality measure less than 0.5 and other 2-variables excluded due to loading complexity or common loading. All extracted variable's value was ≥ 0.5. The rotated component Table 5 shows the factor loading of 34 variables under 7-groups. It also reflects the loading of variable under each group and no common loading is observed. In the rotated component matrix we suppress the coefficient having a value less than 0.4. Factor loading results ranging from 0.644 to 0.858 were found satisfactory.

4.3 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) has been implemented for measuring the effect of latent variable over observed variable. CFA first assesses individual influence on measurement items, then tests the structural model (Hulland et al., 1996). This CFA also tested the Unidimesionality, construct validity and discriminant validity. No single statistical significance test classifies a correct model from the sample data. Different types of goodness-of-fit variables used in this research to examine both the measurement model and the final model. (Byrne, 2001). CFA can also be measured by two criteria. First, standardized factor loading reflects a strong relationship among factors and indicators (Gallagher et al., 2008; Power, 2005; Yeh, 2005,). Sometimes factor loading results found higher than 0.50 are assumed satisfactory (Churchill, 1979). Second, covariance of correlation among two indicators can impact on the amount of the estimate, or correlation between two variables/indicators can affect both (Schmacker & Lomax, 1996) that are measured by Critical Ratio (CR). The recommended value of CR measure for the factor loading or variance should be above 1.96. The standardized regression weight should be greater than 0.60 (Arun Kumar Tarofder et al., 2013). Table 4 illustrates the indicators of a good model fitment.

Table 4
Confirmatory Analysis Model Overall Fit

Name	Acceptable Limit	Source
χ^2 (df, p)	p>0.05	(Norzaidi, 2008)
CFI,	Value close to 0.9 or above	(Power, 2005), (Yeh, 2005) (Lopez, 2010)
RMR	RMR<0.10	(Lopez, 2010), (Norzaidi, 2008)
NFI	Value >0.8 close to 0.9	(Power, 2005), (Lopez, 2010), (Yeh, 2005)
RMSEA	RMSEA <0.10	(Lopez, 2010), (Norzaidi, 2008)
Covariance (CR)	CR>1.96	(Gallagher, 2008), (Lopez, 2010)

This study, conducted CFA for each 7 factors and 34 variables. As per the results, no disagreeable estimate exists, having a critical ratio (t-value) less than 1.96, verifies the estimates were significant. Results suggested that all standardized regression weights higher than 0.60 or close to it, shows the importance of factors/indicators in the model. The values for all factors were found positive and logical. The value of squared multiple correlation (R^2) found greater than 0.30. The detailed list of EFA and CFA result related to individual construct available in Table 5. The value of Cronbach alpha, Eigenvalue, Chi- square, p-value and χ^2/df for each construct are also given in Table 5. As seen from the table, most of the results come under acceptability limit representing average fit. After confirming the measurement model, other indices were tested to analyze fitment of the model. The value of CMIN/df ratio came under acceptable limit. Root mean square error of approximation (RMSEA) is also identified as the badness of fit index falls in the range of acceptability. This index is recommended as one of the key fit indices of construct. The other indicators such as Normal fit index (NFI) and p-value results shown were not perfect fit but very close to it. Indicator, p $\geq$0.05, explains chi-square value is statically significant (good fit). The Chi-square value affected by the sample size and CFA is a large sample technique cannot be common by the chi-square test when other indicators show good fit. The value of the Critical Ratio (CR) should be above 1.96, to make the estimates significant. The critical ratio for all the estimates range from 5.79 to 12.529 as shown in the table. The overall results received were quite satisfactory as shown in the table 5.

5. Discussion and Limitation

This research has identified various risk factors which imperil firms doing activities in the Indian mechanical manufacturing sector. The main aim of present research was to recognize and confirm key constructs essential in e-supply chain risk factor study. Based on detailed assessment of literature across diverse discipline, the construct were identified. A multi-stage research process has been adopted for attaining a group of valid, consistent & unidimensional constructs (Injazz & Antony, 2004). In the refinement practice, four variables/indicators were deleted for enhancing the validity and reliability of this theoretical model. Each of the two variables/indicators was deleted from the main construct of environmental and demand risk were not affecting its theoretical domain significantly. The construct of environmental risk was categorized in terms of political stability and government regulation contributed by the environment risk to enhance the supply chain risk issues. The indicators related to political stability and government regulation were removed from the environmental construct. Therefore, as per the present conditions, this construct cannot be used for analyzing the influence of environmental risk in e-supply chain. Even though environmental risk construct still is used as a key domain in analyzing the influence of risk factor in e-supply chain. Demand risk is also used as a key theoretical domain for representing the risk issue in e-supply chain. Two factors related to demand risk were also deleted from the final construct. Two factors were deleted on the basis of commonalities value found less than 0.5 and other two factors were deleted due to loading complexity. So the final construct includes only those indicators which were found significant empirically.

Table 5

EFA & CFA results of all Risk related variables

Indicators (Cronebach Alpha, Eigen Value)	Principal Component Factor Loading	Measurement Model		
		Standard Co- Efficient	R^2	t- Value
Organizational Risk (χ^2=25.344, P=0.031, χ^2/df=1.81,CFI=0.975, NFI=0.946, RMSEA=0.074) α=0.881, Eigen Value=7.118				
OR1	0.689	0.682	0.465	8.442
OR2	0.821	0.794	0.63	9.45
OR3	0.738	0.726	0.527	9.087
OR4	0.644	0.634	0.402	7.759
OR5	0.803	0.791	0.625	10.057
OR6	0.713	0.689	0.475	8.548
OR7	0.747	0.716	0.513	8.941
Infrastructure Risk (X^2=7.154, P=0.209, X^2/df=1.431,CFI=0.995, NFI=0.985, RMSEA=0.054) α=0.914, Eigen Value=3.951				
IR1	0.822	0.792	0.628	11.516
IR2	0.813	0.81	0.656	11.912
IR3	0.858	0.857	0.735	12.315
IR4	0.82	0.822	0.675	12.193
IR5	0.852	0.836	0.699	12.529
Operation and Supply Risk (X^2=4.353, P=0.50, X^2/df=0.91,CFI=0.993, NFI=0.983, RMSEA=0.02) α=0.823, Eigen Value=3.270				
OS1	0.672	0.58	0.337	7.048
OS2	0.814	0.806	0.649	10.14
OS3	0.836	0.861	0.741	9.072
OS4	0.646	0.604	0.365	7.388
OS5	0.723	0.603	0.364	7.367
Demand Risk (X^2=6.221, P=0.286, X^2/df=1.242,CFI=0.994, NFI=0.971, RMSEA=0.041) α=0.803, Eigen Value=2.171				
DR1	0.701	0.605	0.366	6.616
DR2	0.7	0.662	0.439	7.21
DR3	0.753	0.76	0.577	7.921
DR4	0.733	0.763	0.582	8.08
DR5	0.683	0.574	0.329	6.279
Relation & dependence degree of inter-organizational Risk (X^2=3.239, P=0.663, X^2/df=0.648,CFI=0.995, NFI=0.982, RMSEA=0.024) α=0.778, Eigen Value=1.889				
RDDIO1	0.776	0.672	0.452	6.321
RDDIO2	0.68	0.643	0.413	6.132
RDDIO3	0.65	0.596	0.355	5.79
RDDIO4	0.698	0.631	0.398	6.049
RDDIO5	0.735	0.688	0.473	6.418
Information & Policy Risk (X^2=4.112, P=0.128, X^2/df=2.056,CFI=0.990, NFI=0.981, RMSEA=0.080) α=0.832, Eigen Value=1.620				
IP1	0.701	0.74	0.548	7.769
IP2	0.815	0.851	0.723	8.382
IP3	0.776	0.683	0.467	7.257
IP4	0.717	0.697	0.486	7.9
Environmental Risk (X^2=5.321, P=0.235, X^2/df=2.26,CFI=0.981, NFI=0.967, RMSEA=0.03) α=0.669, Eigen Value=1.355				
ER1	0.743	0.652	0.425	4.9
ER2	0.726	0.64	0.409	4.5
ER3	0.709	0.623	0.388	4.515

As a future research, we will focus towards developing more concrete measures for avoiding risk issues in e- supply chain. In summary, all the risk related constructs are made up of five or more than five indicators except information & supply and environmental risk. Still, it reflects decent results, so the future research should concentrate towards adding more indicators to ensure better dimensions representation. The most critical task in addressing the supply chain concept is in detecting variables that can be involved in the periphery of managing the supply network (New, 1996). The supply chain is an extensive research area. So, it is clear that one study cannot cover up the entire domain of e-supply chain risk. So this conceptual framework developed herein has tried to cover the maximum possible but does not cover every risk related facts. Moreover, development of measurement model is a continuous process and the model can be improved only through continuous improvement and assessments across different sample populations (Hensley, 1999). Therefore, this research work could be measured as an initial stage in the direction of the evaluation of the theoretical aspect domain of E-supply risk factors. As a future scope, we should be focused towards strengthening and purifying the constructs identified by this study. Many factors/variables were extracted from the literature survey in the initial stage of the research but were not included due to research size and rate of response. As we know, four indicator variables were removed in the early measurement model. These variables were deleted on commonalities basis and loading complexity. Future research should more concentrate towards purification of the sample data while filling the questionnaire, so such issue like loading complexity and commonalities eliminates. We would also like to highlight the limitations of the methodology used for this measurement model. As we know, we were using factor analysis and it is a large sample technique and can be affected by sample size (Hair et al., 2008). Therefore, for future studies to overcome this limitation, we encourage towards collection data from large population to further validate and extend this research. In this study, we did not consider the effects of industry difference, in our sample, we collected data from Japanese manufacturers, Indian manufacture, components difference, small and large scale industries, whether they all belong to the same nature of the companies but the key risk issues may vary. So as a scope of future work for further reducing the variance in perception, we would focus our research to stick with individual category for data collection. As a future study, we would also extend this research for further developing the Structural Equation model of e- supply risk by using the present measurement model. The present study contributed significantly in the literature and positively influences the supply chain risk issues. Nevertheless, there are some limitations or scope which can be utilized as an opportunity for future studies.

6. Conclusion

Risk is always associated with the organizational life in various domains such as taking investment decisions, supply chain management, staffing and the promotion of new product and services (Ravasizadeh et al., 2011). Any methodological study may be observed in ways of two interconnected branches: substantive and validation of construct. Substantive stream shows the relationship between theoretical model predicted through empirical analysis, and the construct validation includes relationship among the outcomes attained from empirical study and the theoretical model that measures the objective of the evaluation (Schwab, 1980). Research has been growing on various supply chain relationship day by day, still no specific comprehensive approach is available for the measurement and development of construct. This might be mainly responsible for the circumstance that a strong support is necessary to start the growth and validation of the theoretical model and measures of supply chain management (Injazz & Antony, 2004). This study has achieved a primary set of theories, functional measures with consistently supports of their measurement properties (i.e., valid, consistent and one-dimensional) through continuous phases of investigation and improvement. We expect that researchers will make use of this theory either directly in their study frameworks or as a source to develop a coherent theory of e-supply risks for refining and expanding in the best practice of cumulative theory building and testing.

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