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The Effect of Risk Management on Supply Chain Management (Case Study: Saipa Company)

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Abstract

The present study aimed to determine the effect of risk management on supply chain management(case study: SaipaCompany). This study was applied in terms of purpose and descriptive-correlational in terms of data collection method. The tools used in this study include the 29-item questionnaire. The statistical population of this study included 110 managers of SaipaCompany in Tehran. In this study, 86 samples were required using the Morgan Table.In general, 100 questionnaires were distributed and 89 questionnaires were completely returned to the researcher. In order to determine the sample size, the Morgan Table was used. Thus, 100 questionnaires were distributed and a number of 89 complete questionnaires were entered the analysis after eliminating the unfilled and unreadable questionnaires. The software used for descriptive statistics included SPSS and PLS for confirmatory factor analysis using the structural equations technique (SEM). The research findings indicated that all research hypotheses, except behavioral uncertainty, other factors such as risk reduction, environmental uncertainty, risk management process, and risk monitoring affect the performance of supply chain.

Keywords:

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Introduction

Todays, considering the current opportunities and threats in the industry and business areas and evaluating the power of industries and companies facing uncertainties and risks are of great significance. In addition, the management of supply chain risks is highly important.Risk management is the process of identifying risk factors, evaluating them, and planning for the reduction of adverse effects of risks. Risk evaluation is one of the important steps of risk management due to the abundant risks and necessity of optimal spending of sources in supply chain. Ignoring the risk evaluation and even implementing this process incompletely may cause irrevocable damages to different parts of the chain.

Thus, organizations have to spend sources for demand forecasting, supply, and internal uncertainties of organization due to the increased uncertainty in supply chain and the occurrence of factors such as political issues, demand fluctuations, technology changes, financial instabilities, natural disasters, etc. to reduce vulnerability and increase the tolerance of supply chain. Considering these uncertainties and risk factors raised the issue of risk management in the supply chain (Vani, 2009).

It should be noted that risk management requires the identification, evaluation, and ranking of different risks. Risk evaluation is one of the principles of risk management and aims to measure the risks based on different criteria such as the effect and probability of occurrence. As the results of this step are more accurate, the process of risk management is performed with higher degree of confidence. Risk ranking is the key part of this process because the superiority of each risk versus other risks is determined by ranking. Thus, the decision-maker can plan the allocation of current sources for coping with any risk (Project Management Institute, 2004).

Modern procedures in the strategy of organizations, the increased complexity of projects, and globalization created new challenges for project-based organizations. Uncertainty is one of the most important features hidden in these challenges. In other words, if there is no uncertainty, no change will occur.Projects, as one of the most significant business processes, are subject to severe uncertainty due to their sources (Wiengarten, 2015).

Developed uncertainty management is considered as risk management and its main advantages include the balanced attitude to opportunities and threats, considering uncertainty as the rootof opportunities and threats, broader attitude to project by increasing its environmental and temporal dimensions, process-oriented attitude in comparison to product approach, creating an appropriate framework for the strategic attitude to project, knowledge management , and value management in project management processes. In other words, risk management sees a farther horizon in future and searches the uncertain future to identify the potential opportunities and risks (Pagell, 2014).

Managers should identify the categories of risks, stimuli, and conditions before using the effective methods for reducing supply chain risks. Understanding and identifying a variety of supply chain risks help the managers of different industries to adopt effective risk reduction approaches for their organizations (Ahmed et al, 2012).It should be noted that supply chain risks can be resulted from different sources such as political events, product availability, distance from source, demand fluctuations, change in technology, change in workforce market, financial instability, and displacement of management.In addition, some business tendencies such as the increase of outsourcing in product research and

development activities to suppliers, the tendency of companies to reduce the number of suppliers, globalization of supply chains, reduction of middle storage, inventory, and procurement time (the expected time for delivering the ordered product). Complicated and integrated processes among the companies, increased demand for timely delivery in shorter time windows, shorter procurement time, and shorter lifecycle of products will increase vulnerability and risk to supply chain (Choi, K.Narasimhan, 2012).

The occurrence of the factors leading to uncertainty in supply chain reduces the tolerance of the chain and increase of its vulnerability. The risk management of supply chain is necessary for identifying and coping with these uncertainties. The factors such as political issues, demand fluctuations, technology changes, financial instabilities, and natural disasters increase uncertainty and the occurrence of risk in supply chain. The management of such risks is necessary for reducing the vulnerability of supply chain. The risk management of supply chain has recently attracted many attentions and many articles have been published in this regard. Other industries are of great importance because the above-mentioned factors on supply chain, risk, and its management methods have a long history (Pagell, 2014).Supply risk management is another area which has been considered in the risk management of supply chain. Unexpected changes in the amount of requirements and combination of required items, changes in production and technology, increased price, product unavailability, and quality problems of products were introduced as the sources of supply risk.Many studies were conducted on supply risk management and some methods were introduced for considering supply risk as one of the most significant factors of supply chain.The results indicated that supply risk can be managed through the approaches and strategies for reducing supply risk while selecting the management supplier (Handley, 2012).

Thus, determining the optimal number of suppliers is another issue studied in the supply chain. The low number of suppliers causes risk in supply failure while the high number of suppliers increases the fixed costs. Thus, determining the optimal number of suppliers can help a model to determine the optimal number of suppliers by considering the failure risk and reducing the supply failure risk (Schoenherr, 2012).

In case of not considering the risk issue in organizations, it should be noted that the failure in supply chain risk management can have adverse effects on organizations.Supply chain risks include whatever which may decompose the flowing stream of the required items. In recent years, supply chain management has been regarded both in academic centers and industry because in most industries, the cost of new materials and product components include a major part of the product final price (Pagell, 2014).

In such conditions, the procurement sector can play a key role in the efficiency and effectiveness of organization and have a direct effect on the reduction of costs, profitability, and flexibility of a company.Obviously, decision-making on supplier selection plays a considerable role in the logistic production and management of companies and most experienced companies believe that supplier selection is the most important activity of an organization (Pagell, 2014). Risk management planning is the first step of risk management repetitive processes, i.e. planning, identifying, evaluating (qualitative and quantitative), monitoring and answering plans, controlling, and risk reviewing which are of great significance in organizations.An accurate and clear planning at the beginning of risk management increases the possibility of success in other processes of risk management. It should be noted that risk management planning should be conducted during the early stages of project planning because it is highly effective in the successful implementation of other processes (Pagell, 2014).

Esmaili (2015) in an article entitled "Pathology of supply chain performance in Saipacompany" presented some optimal suggestions and studied supply chain. This study aimed to investigate the effect of automobile supply chain components in performance and prioritization (ranking) of the variables affecting automobile supply chain to determine the most effective components which affect the performance of automobile supply chain and present some solutions to use automobile supply chain components. This study was applied in terms of nature. The research findings indicated that by improving the components of Saipa supply chain components, its performance will be improved.

Mohaghar (2017) in a study entitled "evaluating and selecting suppliers in supply chain using fuzzy multi-criteria decision making technique" studied risk in supply chain. The main objective of this study was to identify and prioritize the factors affecting the supplier selection by fuzzy TOPSIS method (The proposed criteria included quality-delivery time, purchase cost, technological ability, and financial ability). The sample of this study included 236 purchase experts in the field of material supply and facilities. Due to the increase of competition in service and manufacturing fields, most companies attempt to present their products in a lower price and more appropriate quality.For this purpose, finding an appropriate strategy for top supplier selection is a critical tool in this chain. This study used a multi-criteria decision making technique for evaluating and selecting the best supplier among the current suppliers using the fuzzy TOPSIS method. Accordingly, the verbal terms were received by purchase experts and each criterion was weighted.Then, the options were ranked and the best option that was the best supplier was selected.

ZandHesami (2012) in a study entitled "Risk management" studied supply chain management and concluded that suppliers should produce the parts and materials with the best quality and least cost. The necessity of this significant issue is to identify and rank the risks affecting the supply chain. This study explained the concept of uncertainty in supply chain, identified the risks of supply chain, and determined their severity to express risk management in supply chain as one of the main tasks of managers. Based on the proposed model, the most important risks of supply chain were identified and accordingly, a questionnaire was designed in which the severity of the effect of risks to each other was measured, finally, the results were analyzed by DEMATEL method and accordingly, the effect of the most important risks of supply chain were determined in order of priority including environment, financial resources, strategy, information technology, communications, equipment, and technology.

Material and methods

The research model was studied the following title based on the study:

Table 1. Following title based on the study

Petra Hoffmann	Author
Uncertainty, supply risk management and their impact on performance	Title
Journal ofPurchasing&SupplyManagement	Journal

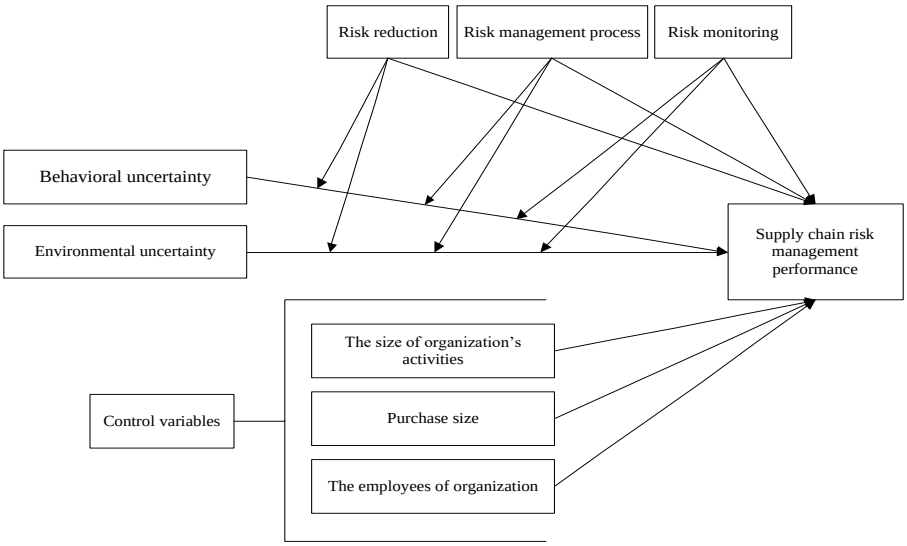

Figure 1. The research conceptual model (Hoffmann, 2013)

Research method

Since the present study aimed to describe the studied conditions and phenomena to recognize the current conditions and help the decision-making process, this study can be considered as descriptive studies based on data collection method.Since the desired data were collected through sampling from the population, they were collected to study the characteristics of the studied population.This study was survey and conducted by cross sectional technique.The present study was applied in terms of purpose which resulted in some applied results in the field of research subject. The results obtained from the studied population can be used for identifying the factors' affecting the risk present study was considered in this regard. The statistical population of this study included 110 managers of Saipa Company in Tehran. In this study, 86samples were required using the Morgan Table.Due to the lower size of sample, PLS software was used for structural equations. In this study, convenience non-probability sampling method was used. The questionnaire of this study was standard including 29 questions. In this study, the content validity was used for determining the questionnaire validity. Content validity was the structural feature of measurement tool that was considered simultaneously with developing the test. It is obtained from the following formula:

$$CVR=\frac{(ne-\frac{N}{2})}{\frac{N}{2}}$$

CRV represents the content validity ratio

Ne: represents the number of evaluators considering the desired item necessary or useful.

Ne represents the total number of evaluators (Khaki, 2014)

The content validity of this questionnaire was approved by studying the books and articles related to research, preparing the items of required data and applying the corrective opinions.Then, the questionnaires were distributed among 10 experts and elites and the content validity was calculated based on the total opinions of 10 evaluators.

Table 2. Minimum acceptable CVR based on the number of evaluators

number of evaluators	valueCVR	number of evaluators	valueCVR	number of evaluators	valueCVR
5	0/99	11	0/59	25	0/37
6	0/99	12	0/56	30	0/33
7	0/99	13	0/54	35	0/31
8	0/75	14	0/51	40	0/29
9	0/78	15	0/49		
10	0/62	20	0/42		

Table 3. The results related to obtained content validity for the questions

Number of question	CVR	Number of question	CVR	Number of question	CVR	Number of question	CVR
1	0/67	12	0/72	23	0/67	34	0/76
2	0/72	13	0/67	24	0/67	35	0/68
3	0/71	14	0/75	25	0/75	36	0/68
4	0/64	15	0/77	26	0/77	37	0/73
5	0/87	16	0/64	27	0/64	38	0/80
6	0/65	17	0/67	28	0/74	39	0/79
7	0/73	18	0/78	29	0/66	40	0/75
8	0/67	19	0/67	30	0/67	41	0/74
9	0/70	20	0/79	31	0/75	42	0/69
10	0/77	21	0/76	32	0/77	43	0/63
11	0/78	22	0/71	33	0/64	44	0/76
						45	0/79

It should be noted that the indicators in previous studies related to the subject were used for designing the questionnaire. Based on the standard indicators, the content validity of the questionnaire was confirmed using Cronbach's Alpha. First, 30 questionnaires were distributed as default among the statistical sample and their Cronbach's alpha was calculated using SPSS22 software.

Table 4. Cronbach's alpha coefficient table for each dimension of the questionnaire

variables	Number of questions	Cronbach's alpha coefficient
Supply risk management performance	4	0/762
Risk management process	5	0/830
Risk monitoring	6	0/817
Risk reduction factors	8	0/890
Environmental uncertainty	3	0/717
Behavioral uncertainty	3	0/789
Total Cronbach of the questionnaire	29	0/950

Results

In order to run the statistical methods and calculate the appropriate test statistics and logical inference about the research hypotheses, the most important measure was selecting an appropriatestatistical method for the study. For this purpose, understanding the data distribution is of great priority. Thus, the Kolmogorov-Smirnov testwas used in this study to investigate the normality of research data. This test dealt with data normality based on the following hypotheses:
H0: Data have normal distribution.
H1: Data do not have normal distribution.
The Table of the Kolmogorov-Smirnov test indicated that if the significance level for all variables is bigger than the test level (0/05),

the data distribution will be normal. The result of this test is shown in Table 5.

Table 5. The results of the Kolmogorov-Smirnov test

variables	Kolmogorov statistics	Significance level	Test result
Supply risk management performance	1/446	0/031	Non-normal
Risk management process	1/827	0/003	Non-normal
Risk monitoring	1/400	0/040	Non-normal
Risk reduction factors	0/948	0/330	normal
Environmental uncertainty	1/598	0/012	Non-normal
Behavioral uncertainty	1/461	0/028	Non-normal

As the above table indicated, the significance level for reducing the risk factor 90/330) was more than 0/05 indicating the confirmed null hypothesis and normality of data distribution. However, the significance level was less than 00/05 for other variables of supply risk management (0/031), risk management process (0/003), risk monitoring (0/04), environmental uncertainty (0/012), and behavioral uncertainty (0/028) indicating the rejected null hypothesis and confirmed the non-normality of data distribution.

In order to calculate the correlation between research variables, the Spearman correlation test was used due to the non-normal distribution of most variables. Correlation coefficient indicates the severity of the relationship and type of relationship (direct or reverse). This coefficient is between -1 and 1 and equals zero in case of no relationship between the two variables. This test examined the relationship between these two variables based on the following hypotheses:

H0: There is no significant correlation between the two variables.

$H_0: \rho = 0$

H1: There is a significant correlation between the two variables.

$H_1: \rho \neq 0$

Judgment about the presence or absence of the relationship was conducted based on the obtained significance level/If the test significance is less than 0/05, H0 will be rejected indicating a significant relationship between the two variables.

Table 6. The table for the judgment method of correlation coefficient numerical value

Judgment t method	value
Direct- weak correlation	0 -0/25
Direct-relatively strong correlation	0/25 -0/50
Direct-strong correlation	0/50 -0/75
Direct-very strong correlation	0/75 -1
No correlation	0
Reverse- weak correlation	-0/25 -0
Reverse -relatively strong correlation	-0/50 - -0/25
Reverse-strong correlation	-0/75 - -0/50
Reverse-very strong correlation	-1 - -0/75

The results of the correlation test are given in the following table.

Calculating the correlation between the research variables and dependent variable

Table 7. Variables

variables	Supply risk management performance
Risk management process	0/684**
Risk monitoring	0/673**
Risk reduction factors	0/673**
Environmental uncertainty	0/697**
Behavioral uncertainty	0/624**
**: Correlation is significant at 99% level (p<0/01)	

Based on the above table, the correlation between all variables was positive and significant at 99% confidence level. It should be noted that the correlation between environmental uncertainty and supply risk management performance was estimated 0/697 (direct and strong) more than other relationships and correlation between behavioral uncertainty and supply risk management performance was estimated 0/624 (direct and strong) less than the other relationships.

In order to test the conceptual model, SEM was used by PLS software.the advantage of SEM to regression is that it can estimate all relationships in the model at once. The reasons for using PLS software were the low number of sample (=89), predictability of the model, and non-normal data distribution (Azar et al, 2013).The criteria for evaluating the validity of the research model (measurement, structural, and general model) PLS method for evaluating the validity of structural equations models covers three parts:

1. The part related to measurement models
2. Structural part
3. The general part of the model (management and structural)

The researchers used the software related to PLS method such as smart PLS.

The coding of variables in the general figure of the model is as follows:

Table 8. The table for the coding of variables

Code	variables
Supply risk per/	Supply risk management performance
Risk management	Risk management process
Control to risk	Risk monitoring
Risk reduction	Risk reduction factors
Environment unsure	Environmental uncertainty
B/ doubt	Behavioral uncertainty

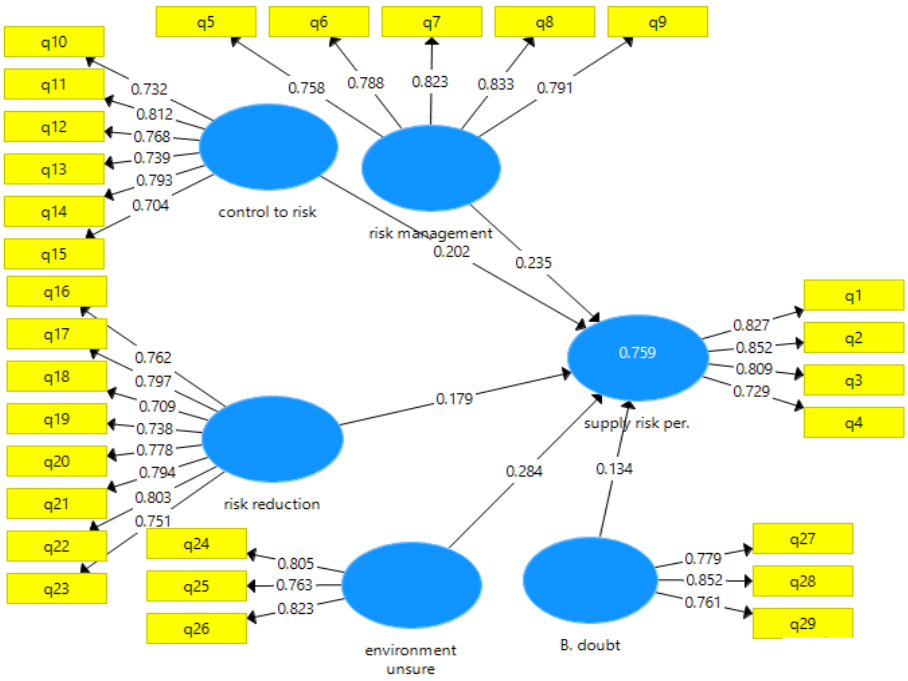

Figure 2. The figure for the primary structural equations model with factor load coefficients

As the primary model indicated, the factor load of all observed variables was optimal and more than 0/4.such coefficients are mentioned in the following table:

Table 9. The standard coefficients of PLS outer model (primary model)

variables	Supply risk management performance	Risk management process	Risk monitoring	Risk reduction factors	Environmental uncertainty	Behavioral uncertainty
q1	0/827					
q2	0/852					
q3	0/809					
q4	0/729					
q5		0/758				
q6		0/788				
q7		0/823				
q8		0/833				
q9		0/791				
q10			0/732			
q11			0/812			
q12			0/768			
q13			0/739			
q14			0/793			
q15			0/704			
q16				0/762		
q17				0/797		
q18				0/709		
q19				0/738		
q20				0/778		
q21				0/794		
q22				0/803		
q23				0/751		
q24					0/805	

q25					0/763	
q26					0/823	
q27						0/779
q28						0/852
q29						0/761

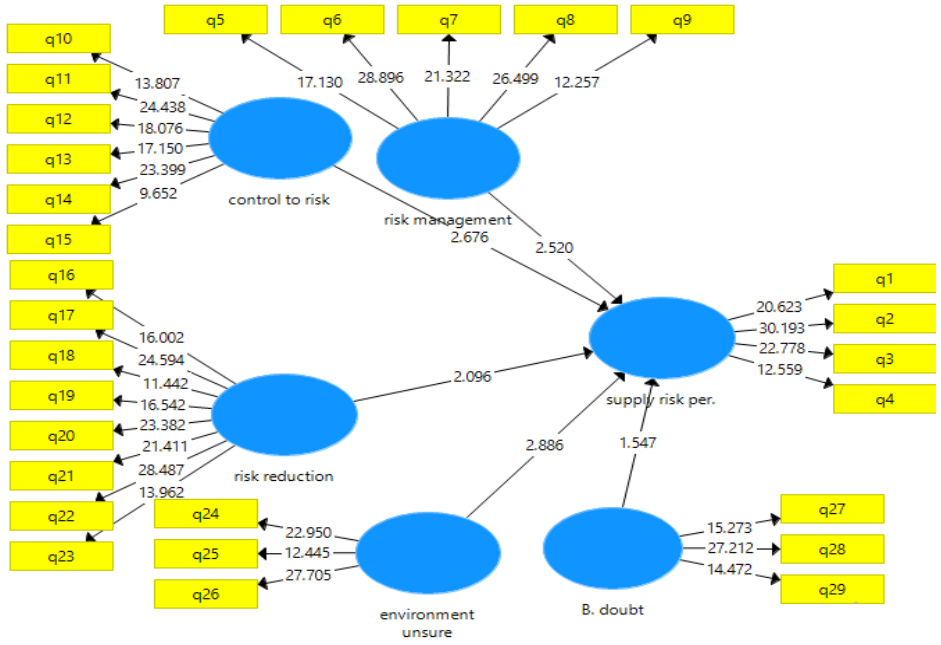

Figure 3. The primary structural model of the study with significant coefficients

Table 10. The table for bootstrapping value of PLS (primary model)

variables	Supply risk management performance	Risk management process	Risk monitoring	Risk reduction factors	Environmental uncertainty	Behavioral uncertainty
q1	20/623					
q2	30/193					
q3	22/778					
q4	12/559					
q5		17/130				
q6		28/896				
q7		21/322				
q8		26/499				
q9		12/257				
q10			13/807			
q11			24/438			
q12			18/076			
q13			17/150			
q14			23/399			
q15			9/652			
q16				16/002		
q17				24/594		
q18				11/442		
q19				16/542		
q20				23/382		
q21				21/411		
q22				28/487		
q23				13/962		

q24					22/950	
q25					12/445	
q26					27/705	
q27						15/273
q28						27/212
q29						14/472

Based on the results of the measurement model included in the above table, the bootstrapping value (T statistics) in all items was bigger than the critical value 10/96 indicating that the correlation between observed variables and latent variables is significant. Thus, it can be concluded that each main variable was evaluated correctly.
The evaluation criteria of the general part fitting in the executive model

Table 11. The table for path coefficients and comparing them in the studied sample

Path	(n=89) The studied sample		
	path coefficient	Standard deviation	statisticst
risk management process- supply management performance	0/235	0/093	2/520
risk monitoring- supply management performance	0/202	0/076	2/676
Risk reduction factors- supply management performance	0/179	0/086	2/096
Environmental uncertainty- supply management performance	0/284	0/098	2/886
Behavioral uncertainty- supply management performance	0/134	0/087	1/547

As the above figure indicated, the effect of risk management process on performance (0/235), risk monitoring on performance (0/202), risk reduction factors on performance (0/235), environmental uncertainty on performance (0/284), and behavioral uncertainty on performance (0/134). Among the hypotheses, the effect of behavioral uncertainty on performance was rejected due to the significance value 1/547 (less than 1/96) at 5% error level. The relationships are explained below. Thus, this relationship was eliminated from the model and re-implemented like the following figure.

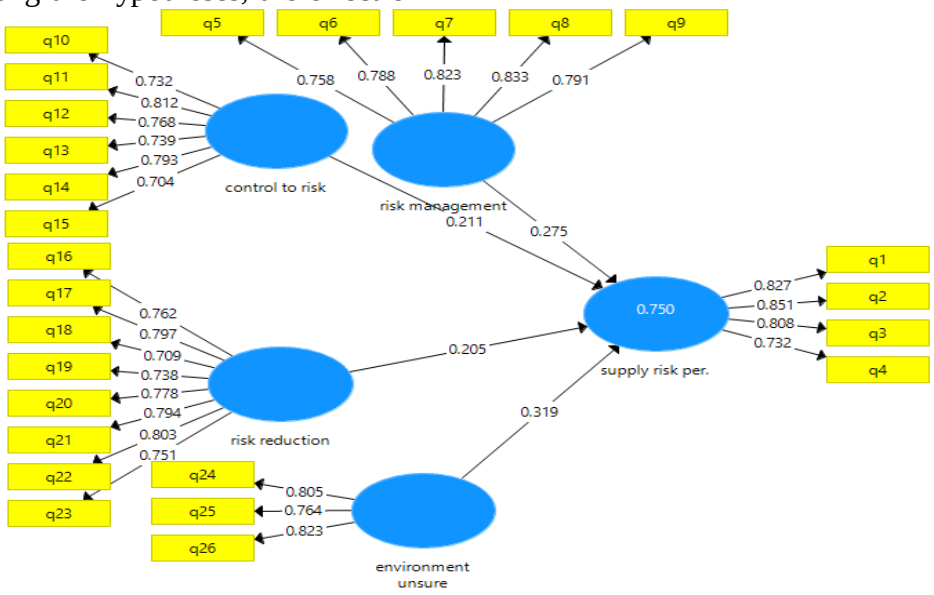

Figure 4. The research final model with standard coefficients

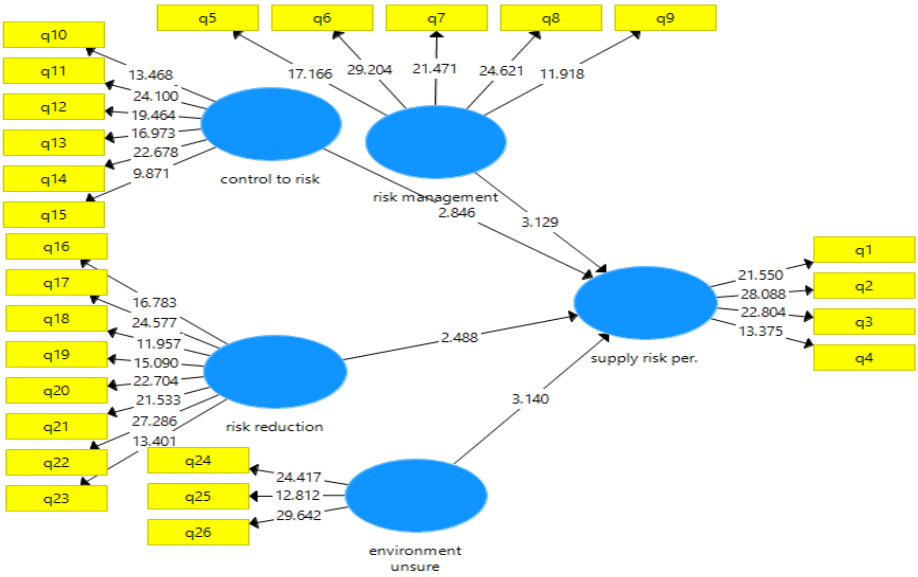

Figure 5. The research final model with significance values

Table 12. The table for the path coefficients and comparingthem in the studied sample

path	(n=89) The studied sample		
	path coefficient	Standard deviation	T statistics
Risk management process- supply management performance	0/275	0/088	3/129
Risk monitoring - supply management performance	0/211	0/074	2/846
Risk reduction factors - supply management performance	0/205	0/82	2/488
Environmental uncertainty- supply management performance	0/319	0/101	3/140

Q2 (CV red): This criterion determines the predictability of the model about an endogenous construct and is between 0 and 1. As the value is closer to 1, it will be better. In fact, this indicator shows how well the independent variables of an assumed dependent variable could predict it. If Q2=0/02, the predictability will be weak, if Q2=0/15, the predictability will be average, and if Q2= 0/35, the predictability will be strong. The following table reports the explained variance and Q and E2 coefficients for the criterion variable of the studied sample.

Table 13. The table for the explained variance R2 and Q2 coefficients of groups

(n=39) The studied sample		Criterion variable
Q2	(R2) Explained variance	
0/444	0/738	Supply risk management performance

Based on Table 22-4, four factors of risk management process, risk monitoring, risk reduction factors, and environmental uncertainty explained 73/8% of supply risk management performance.This value of variance explained by predictor variables indicated the considerable predictability of certain variable by predictor variables. Q2 indicator for criterion variable (supply risk management performance) was positive and 0/444 indicating that predictor variables can significantly predict the criterion variable and the predictability of the model was average on the endogenous constructs of the study.

Discussion and Conclusion

Based on the research findings and the obtained results, the suggestions are indicated as follows:

The first hypothesis indicated that environmental uncertainty affects the performance of supply chain. According to this hypothesis, organizationsare suggested to get informed about the current procedures by studying the market and industry and predict the future motions of market by studying the environmental behaviors and evolutions in the past. For this purpose, the researchers suggest to respond the changes analytically in a reactive way by forming the task forces of market research. In addition, it is suggested to study the measures of competitors' measures or integration and coalition with them and act in such a way to not be caught by their measures.Finally, it is suggested to form the task forces and Scopusfor evaluating the customer behavior and improving their performance according to the changed demands.

The second hypothesis considered risk management effective in supply management performance. Thus, the organizations are suggested to regard risk management in a process way, follow evolutions, and adopt appropriate strategies because this process and its management are effective in improving the organization's performance. In addition, organizations are suggested to study the risks due to small suppliers and organize them by an appropriate strategy in such a way to be safe from their collusion problems and make sure of product suppliers by them. Finally, organizations are suggested to always study and analyze the environmental changes and the best method to conduct this is using the information obtained fromretailersand capillary manufacturers.

According to the third hypothesis, the risk reduction factors affect the supply chain performance management. Thus, organizations are suggested to make outsourcing decisions and tenders for service purchase and implementation to reduce the risk in the performance of organization.In addition, the managers are suggested to adopt appropriate strategies by studying the risk from its origin in reducing the non-systematic risks. However, they can perform it by signing detailed contracts and predicting the unexpected conditions. In addition, organizations are suggested to always have negotiating teams with other major suppliers to be safe from collusion due to the bargaining power of each team and solve this problem by developing the number of suppliers. Furthermore, it is suggested that organizations perform strategic participations with other competitors to reduce the power of suppliers and increase the purchase trust by creating competitive prices among the suppliers. Finally, organizations should expand their trust-making contracts with their competitors and suppliers for these activities of organizations.

According to the last hypothesis, risk monitoring affects supply chain performance. Thus, since the cash purchase of other buyers may become the tendency of suppliers to other organizations, it is better to reduce this risk by strategic alliance or by long-term purchase contracts. Furthermore, increasing the share of market may cause the sensitivity of other competitors and supplies to ask for share. Thus, such a risk can be overcome by developing the evaluation of other buyers. Finally, it is suggested that organizations can prevent crisis in purchase and supply of new materials by supplying the new materials because the conditions of market especially in Iran are affected by the internal and foreign political behaviors, exchange rate, bank interest, and other factors which may not encounter this sensitivity in other parts of the world.

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