한국산학기술학회논문지
Vol. 10, No. 9, pp. 2290-2299, 2009

Importance Analysis of SCM Adoption Factors

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SCM 도입 요인 중요도 분석

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Abstract This study aims to analyze the importances of various SCM adoption factors suggested in precedent researches with AHP. SCM adoption factors were categorized by four types: organization factor, transaction factor, relation factor, and information factor. Each factor has sub-factors. Organization factor has five sub-factors: adoption strategy, support of CEO, maturity of information technology, development of assessment system, and innovation leadership. Transaction factor has three sub-factors: transaction period, delivery/quality, and shared goal. Relation factor has five sub-factors: trust, collaboration, inter-dependence, conflict, and immersion. Information factor has three sub-factors: information quality, information share, and information exchange. There are sixteen sub-factors altogether. Analyzing the importances of SCM adoption factors with AHP, the importance of organization factor(.387) ranked the highest. Relation factor(.291), information factor(.167), and transaction factor(.155) followed. Putting the analysis results of primary hierarchy factors and secondary hierarchy factors together, support of CEO(.169) ranked the highest and trust(.124), adoption strateg (.089), share goal(.081), information exchange(.069), collaboration(.064), and information share (.057) followed.

요 약 본 연구에서는 선행 연구를 통해 제시된 공급사슬관리 시스템의 다양한 도입 요인에 대해서 그 중요도를 분석하기 위하여 AHP 기법을 이용하여 연구하였다. 지금까지 연구된 공급사슬관리 시스템의 도입 요인에 대해서 국내외 문헌을 통하여 SCM의 도입 요인을 조직 특성, 거래 특성, 관계 특성, 정보 특성 등 4개의 특성으로 범주화하였으며, 각 특성에 대한 세부 도입 요인으로 조직 특성 요인은 도입 전략, CEO 지원, 정보 기술 성숙도, 평가측정 시스템 개발, 혁신 선도자 등 5개 요인, 거래 특성 요인은 거래 기간, 납기/품질, 목표 공유 등 3개 요인, 관계 특성 요인은 신뢰, 협력, 갈등, 상호 의존성, 몰입 등 5개 요인, 정보 특성 요인은 정보의 질, 정보 공유, 정보 교환 등 3개 요인을 설정해서 총 16개의 세부 도입 요인으로 분석하였다. AHP 기법을 이용하여 SCM 도입 요인의 중요도를 분석한 결과 SCM 도입 요인에 관한 1차 계층 요인 중에서는 조직 특성(0.387)의 중요도가 가장 높게 분석되었으며, 관계 특성(0.291), 정보 특성(0.167), 거래 특성(0.155) 순으로 분석되었다. 1차 계층 요인의 중요도와 2차 계층 요인의 중요도를 동시에 고려해서 분석한 결과에서는 가장 중요한 도입 요인이 CEO 지원(.169)이었고, 그 다음으로 신뢰(.124), 도입 전략(.089), 목표 공유(.081), 정보 교환(.069), 협력(.064), 정보 공유(.057) 요인 순으로 분석되었다.

Key Words : Supply Management Chain, SCM Adoption, SCM Adoption Factors.

1. Introduction

Lately enterprise inclines to recognize the supply chain management (SCM) as the essential management strategy to reinforce and maintain competitiveness and, thus, many are actually building SCM. adoption of SCM is much vital as the building of SCM should be linked with corporation internal process as well as relevant other

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Received April 30, 2009 Revised (1st July 6, 2009, 2nd July 14, 2009) Accepted September 16, 2009

enterprises. This study aims to research the importance of each adoption factor looking through precedent studies.

In order to meet the purpose, SCM adoption factors suggested by many other researchers will be categorized by organization factor, transaction factor, relation factor, information factor, environmental factor, and other factors. The analysis of the importances of categorized sub-factors will follow to elicit the order of priority.

Actual research with survey was done to meet the purpose of this study. The survey was conducted among SCM specialists and users working in Seoul area to collect the data for practice analysis. The collected data were analyzed with analytic hierarchy process developed by Saaty. This study is comprised of five chapters. The first chapter covers the purpose and methodology of the study. Theoretical background of SCM are described in the second chapter while precedent studies on SCM adoption factors are covered in the third chapter. The fourth chapter suggests study model and practical analysis is dealt in the fifth chapter. Finally the sixth chapter presents the result of the study and analyzes its meaning.

2. Theoretical Background

2.1 Definition and Concept of SCM

Precedent studies have inclined to define SCM in terms of business integration, business field and management process.

GSCF (Global Supply Chain Forum) defines that, considering its integrative character, SCM is integrative management strategy of business process extending over the flow of information, product and service from initial supplier to final consumer to create added value. APICS (American Production and Inventory Control Society) seeing SCM in terms of process considers it as single unit including all the essential functions in organizations internally/externally and defines that SCM is the activity of optimizing total process by managing the flow of information, product and money related to product. Thomas and Griffin[1] explains that SCM is supply chain covering from raw materials to customers and, thus, it is the strategy increasing efficiency of supply chain by general control of the flow of product, information and cash among each process.

2.2 Expect Effect of SCM Adoption

Cooper and Ellram[2] suggests that the purpose of SCM adoption is to reduce the stock, to increase customer service, and to secure the competitive superiority over channels. D. H. Han[3] explains that it is to synchronize consumer demand and product supply process, to activate the sales through the maximization of customer satisfaction, to maximize the total value of supply chain, and to maximize profitability through optimization of supply chain.

Meanwhile the expect effects of SCM adoption are quick flow of goods within supply chain, reduction of stock cost in supply chain with reduced stock, increase of investment earnings, and reduction of transaction cost. In relation to the above-mentioned, La Londe[4] suggests that the number of transaction is likely to be reduced with shared information system, comparing with conventional system. Further, electronic transaction system can reduce the transaction cost considerably and it helps the members within supply chain to realize significant cost reduction. J. B. Moon[5] organizes the effects: less disagreements and walls among the members in supply chain, creation of synergy among the members in terms of function/process, quick reaction to market changes, less production cost, reduced capital investment for excess production facilities, reduced product development cycle and cost, higher profitability and competitiveness.

3. Precedent Studies on SCM Adoption

3.1 Studies on SCM Adoption Factors

S. R. Choi[6] studied the four factors for successful SCM adoption: environment, relation, organization, and information. He set sub-factor under environment factor as the uncertainty of supply environment. Sub-factors under relation factor were interdependence, trust, and relation immersion. Sub-factors under organization factor were the level of information technology and the will of CEO. Sub-factor under information factor was the quality of information.

Stank[7] suggested that adoption strategy was very important for successful SCM system adoption and

approached from the view. He presented development of adoption strategy, collecting information, partnership, elimination of fear for supply network management, change of organization, and development of assessment system as the factors for successful SCM adoption.

P. S. Kim[8] suggested the there were three characteristic factors precedent to SCM application: relation, organization, and transaction. Concrete sub-factors under relation factor were trust, immersion and dependance. Sub-factors under organization factor were support of CEO and similarity of organization culture. Sub-factors under transaction factor were shared goal, transaction period, information quality, and change speed of technology.

Monczka et. al.[9] suggested that, in the position of purchaser, precedent factors of strategic joint were trust, adjustment, interdependence, information quality, disagreement resolving method and formal aoption process. Mentzer et. al.[10] noted that precedent factors of information sharing and collaboration were trust, dependence, immersion, support of CEO, similarity of organization culture, and shared goal of transaction. Also, Moberg[11] suggested that immersion and information quality were vital factors in relation to strategic information exchange between enterprises.

3.2 Studies on SCM Adoption Sub-factors

3.2.1 Organization Factor

1) Support of CEO

The successful starting of SCM depends largely on the will of CEO, how he or she takes it seriously and approach from strategic level. Premkumar and Ramamurthy[12] suggested that support of CEO and innovation leader in organization affect greatly on the adoption and spread of administration method and new technology such as information system. Higginson and Alam[13] also explained that support and eagerness of CEO were vital factors for adopting new administration method and SCM adoption was highly likely to be successful if CEO encouraged staff or promoted its adoption positively.

2) Maturity of Information Technology

Information technology is holistic concept explaining technologies used for the flow of all information from information collection and keeping for information process and storage.

Premkumar and Ramamurthy[12] explained that technology specialty in organization means rich technological experiences. It would provide psychological stability that, as a result, it gave positive effects on accepting new information technology. Hence, positive acceptance and use of information technology in organization will decide whether or not SCM will be adopted successfully.

3.2.2 Transaction Factor

1) Shared Goal

The establishment of shared goal and vision among partners in SCM should come prior to adopt SCM. All of the members in supply chain should communicate enough and participate in establishing shared goal and vision. It is not certain member's lot[14]. Those goal and vision can be the standard for measuring individual enterprise's business result. But the goal and vision of each member can conflict with others' that it would infringe other party's goal if certain member has worked only for its goal.

2) Transaction Period

Transaction requires adjustment and adaptation process between partners. It helps to understand each other and, with long transaction, each party wouldn't even need specific contract document. Anderson and Narus suggest that the transaction is highly likely to continue as the transaction period gets longer and expectation for future business will rise as well.

3.2.3 Relation Factor

1) Interdependence

Interdependence has functioned as major variable to explain relation factor. Monczka et. al.[9] suggested that interdependence happened when certain enterprise couldn't control all the conditions to draw desirable result. They defined interdependence as the power of one partner to affect decision making or goal achievement of the other and/or the degree that one partner needed the other to achieve his own goal.

2) Trust between Supplier and Purchaser

Moorman et. al.[15] defined trust as the belief volunteering for the exchange with partner. Geyskens et. al.[16] suggested that trust was very important factor in deciding how to exchange information with partner and supposed trust was the core factor for building successful relation between supplier and purchaser.

3) Immersion

Moorman et. al.[15] defined immersion as the will to maintain valuable relation, while Anderson and Weitz defined it as the will to invest the resources necessary to build expectation that transaction would be continued. Reviewing precedent studies, immersion is represented largely as the will to sustain significant relation. Immersion then can be interpreted that enterprises need to spare no effort to keep the relation with partners if they want long-term business.

4) Partnership

Macbeth and Ferguson[17] defined partnership as being tied up through activities including share of design process, staff exchange, share of business vision, establishing committee among members in long-term, and co-project to improve business. Partnership can minimize the troubles that can worsen the relation between supplier and customers[18]. Tang et. al.[19] suggested that it was important to build dynamic and flexible partnership between purchase and supplier,

3.2.4 Information Factor

Information factor of SCM adoption has sub-factors of information quality, sharing of information, and exchange of information. Evans and Wurster[20] also suggested that information exchange was important factor for successful performance of SCM. But it is not easy task in real.

Marien[21] suggested that the success of supply chain depended on the amount of information actually exchanged among supplier, purchaser, and carrier. Exchanged/shared information should be qualified. Guinipero and Brand[22] suggested that the success of SCM depended on the level and quality of information exchanged.

3.2.5 Environment Factor

Business environment is the condition surrounding organization and can be divided into external environment and internal environment. External business environment means the outside factors affecting strategy, structure, and management of organization, while internal environment implies peculiar characteristics or atmosphere of organization. Davenport[23] suggested that the growth and development of enterprise could be achieved by coping with external environment properly and meeting various needs of consumers.

3.2.6 Planning and Control

1) Integration of Demand and Supply Plan

Tyndal et. al.[24] suggested that integration of demand and supply in SCM was important factor to control each member consisting SCM, as well as different departments within same organization, when they explained about the core factors of SCM in terms of integration of demand and supply plan.

2) Co-planning

Maximizing internal efficiency within certain organization is not enough to grant the competitiveness of SCM. Actual competitive superiority can be achieved only when it is more efficient and effective than rival SCM. Thus certain SCM becomes competitive when shared goal and plan are established and followed by responsibility and duty.

3) Stable Supply

Securing stable supply through effective demand management is very important within SCM. Quick reaction to consumers' demand, minimizing stock cost, and less out-of-stock are required. Fisher et. al.[25] suggested that stable supply should be taken into account from the stage of production planning in order to react to demand accurately. They supposed that concrete factors were stock management, production planning based on market demand, proper handling of emergencies, production planning by long-term demand forecast, trustable production system, and quality of products.

4) Establishing Integrated Solution

Integrated solution is essential factor to manage supply

chain. Integrated solution aims to optimize the whole supply chain with sharing information in supply chain by collecting, processing, and storing information. External link, as well as internal functioning of each enterprise is important for integrated system managing supply chain that investment of much capital and time is required.

3.3 Summary of Precedent Studies

Since the precedent studies researched SCM adoption in various aspects, the results were various as well. Summarizing the results of the studies, SCM adoption factors can be categorized as organization factor, transaction factor, relation factor, information factor, environmental factor, and planning and control.

[Table 1] The Results of Precedent Studies on Organization Factor

Researcher	Adoption Strategy	Support of CEO	Maturity of Information Technology	Information System Building Capacity	Development of Assessment System	Innovation leadership
Derocher and Kilpatrick	○			○	○	
Higginson and Alam		○	○			○
Mentzer et. al		○				
Willamson and Rao		○	○			○
Rao Tummala, et. al.					○	
Prekumar and Ramamurthy		○	○			○
H. W. Jang					○	
Stank and Daugherty	○				○	
Grover			○		○	

As shown in table 1, in precedent studies on organization factor, adoption strategy, support of CEO, maturity of information technology, development of assessment system, and innovation leadership were studied by two or more researchers.

[Table 2] The Results of Precedent Studies on Transaction Factor

Researcher	Transaction Period	Delivery/ Quality	Shared Goal
Ellram (1995)		○	○
Rhonda et. al. (2000)		○	
Niederkofler (1991)	○		○
P. S. Kim (2004)	○		○
Mentzer et. al. (2001)			○

As shown in table 2, in precedent studies on transaction factor, transaction period, delivery/quality and shared goal were studied by two or more researchers.

[Table 3] The Results of Precedent Studies on Relation Factor

Researcher	Trust	Collaboration	Inter-dependence	Conflict	Immersion
Pfeffer and Salancik			○		
Moberg					○
Dwyer and Forman	○				○
Anderson and Narus	○	○			○
Moorman et. al.	○		○		○
Peterson			○		○
Mentzer et. al.	○		○		○
Niederkofler	○	○			
Ganesan			○		
C. B. Kim		○			
S. R. Choi	○		○		○
P. S. Kim	○		○		○
Monczka et. al.	○		○	○	

As shown in table 3, in precedent studies on relation factor, trust, collaboration, inter-dependence, conflict and immersion were studied by two or more researchers.

[Table 4] The Results of Precedent Studies on Information Factor

Researcher	Information Quality	Information Share	Information Exchange
Closs et. al.	○		
Gustine et. al.	○		
Peterson	○		
DeLone and McLean	○		
McGowan	○		
Rhonda et. al.		○	
Ellram		○	
Moberg	○		
P. S. Kim	○		
Monczka et. al.			○
S. R. Choi	○		
C. B. Kim			○

As shown in table 4, in precedent studies on information factor, information quality, information share and information exchange were studied by two or more researchers.

[Table 5] The Results of Precedent Studies on Environment Factor

Researcher	Environmental Uncertainty	Environmental Dynamism	Envronmental Fusibility	Environmental Complexity	Environmental Tolerance
Starbuck	○				○
Clemons and Row	○				
Pfeffer and Salancik	○				
Peterson	○				
Bensaou and Venkatraman		○	○	○	

As shown in table 5, in precedent studies on environment factor, environmental uncertainty, environmental dynamism, environmental fusibility, environmental complexity, and environmental tolerance were studied by researchers.

[Table 6] The Results of Precedent Studies on Planning and Control Factor

Researcher	Stable Supply	Integration of Demand and Supply Plan	Co-planning	Integrated Solution
Fisher et. al.	○			
Tyndal et. al.		○		
Christopher			○	
Lee and Tang				○

As shown in table 6, in precedent studies on planning and control factors, stable supply, integration of demand and supply plan, co-planning, and integrated solution were studied by researchers.

4. Design of Study Model

Each SCM adoption factor summarized in previous chapter will be resolved into hierarchy structure to analyze them with AHP(Analytic Hierarchy Process). Mainly treated factors in precedent studies will be considered in the hierarchy structure in this study in order to avoid complexity of research model.

4.1 Design of Hierarchy Model

As examined in the former pages, many researchers have suggested SCM adoption factors. Adoption factors needed to be categorized prior to the analysis of the importance of various factors with AHP, but it was not easy job due to the diversity. However, based on the precedent studies, I tried to design the hierarchy model by categorizing similar factors as much as possible to meet the purpose of this study.

4.1.1 Design of Primary Hierarchy Model

S. R. Choi[6] suggested the categorized factors: environment, relation, organization and information. P. S. Kim[8] also presented the categorized factors: relation, organization, and transaction. However, Derocher and Kilpatrick[26], Stank and Daugherty[7], and Y. W. Park[27] suggested the adoption factors individually.

Organization factor, transaction factor, relation factor, and information factor were set as primary hierarchy factors in this study as given in table 7.

[Table 7] Primary Hierarchy Model

	Primary Hierarchy factors
SCM Adoption Factors	Organization factor
	Transaction factor
	Relation factor
	Information factor

4.1.2 Design of Secondary Hierarchy Model

Secondary hierarchy model, based on primary hierarchy model, was designed by classifying and rearranging the sub-factors given in precedent studies. Under the categorized adoption factors in primary hierarchy model, sub-factors suggested by two or more researchers as shown in from table 1 to table 6 were set as secondary hierachy factors. Secondary hierarchy model is given in table 8.

[Table 8] Secondary Hierarchy Model

	Primary Hierarchy Factors	Secondary Hierarchy Factors
SCM Adoption Factors	Organization Factor	Adoption Strategy
		Support of CEO
		Maturity of Information Technology
		Development of Assessment System
		Innovation leadership
	Transaction Factor	Transaction Period
		Delivery/Quality
		Shared Goal
	Relation Factor	Trust
		Collaboration
		Inter-dependence
		Conflict
		Immersion
	Information Factor	Information Quality
		Information Share
		Information Exchange

4.2 Design of Survey and Process

Questionnaire was comprised of the questions to evaluate primary hierarchy model and the questions to evaluate secondary hierarchy model. The questions to evaluate primary hierarchy model were designed to compare the importance of each four categories: organization factor, transaction factor, relation factor, and information factor. And the questions to evaluate secondary hierarchy model were designed to compare the importance of sub-factors under four categories in primary hierarchy model. Basic scale for paired comparison suggested by Saaty[28] was applied. Rating was on a scale of 9.

5. Practical Analysis

5.1 Data Collection and Analysis

Targets of this survey were carefully selected to study the structured hierarchy models practically. SCM specialists working at enterprises, universities, and institutes were selected and, consequently, total of 43 questionnaires were analyzed. Expert Choice 11 was applied to analyze the importance of hierarchy models suggested as study model. Survey was re-conducted among the respondent with consistency rate of over 0.2 and consequently overall consistency rate became under 0.1. Thus, the result secured credibility.

5.1.1 Importance Analysis of Primary Hierarchy Model Factors

Organization factor, transaction factor, relation factor, and information factor were set as primary hierarchy factors(model) to analyze the importance of SCM adoption factors.

Organization factor(0.387) ranked the highest among primary hierarchy factors. Relation(0.291), information(0.167), and transaction(0.155) followed. CR (0.00978) is under 0.1, which means this result is reliable.

5.1.2 Importance Analysis of Secondary Hierarchy Model with Sub-factors

1) Analysis of Sub-factors under Organization Factor

Adoption strategy, support of CEO, maturity of information technology, development of assessment system, and innovation leadership were set as secondary hierarchy factors to analyze the importance of secondary factors under organization factor.

Support of CEO(0.436) ranked the highest among the sub-factors under organization factor. Adoption strategy(0.229), maturity of information technology(0.141), innovation leadership(0.098) and development of assess- ment system(0.096) followed. CR(0.00978) is under 0.1, which means this result is reliable.

2) Analysis of Sub-factors under Transaction Factor

Transaction period, delivery/quality, and shared goal were set as secondary hierarchy factors to analyze the importance of secondary factors under transaction factor.

Shared goal(0.523) ranked the highest among the sub-factors under transaction factor.

Transaction period(0.246) followed and delivery/quality (0.231) was the last. This result shows practically that the more the members in supply chain share goals, positive results occur from SCM adoption. CR(0.00007) is under 0.1, which means this result is reliable.

3) Analysis of Sub-factors under Relation Factor

Trust, collaboration, inter-dependence, conflict, and immersion were set as secondary hierarchy factors to analyze the importance of secondary factors under relation factor.

Trust(0.427) ranked the highest among the sub-factors under relation factor. Collaboration (0.220), interdependence(0.166), immersion (0.105) and conflict(0.082) followed. CR(0.02) is under 0.1, which means this result is reliable.

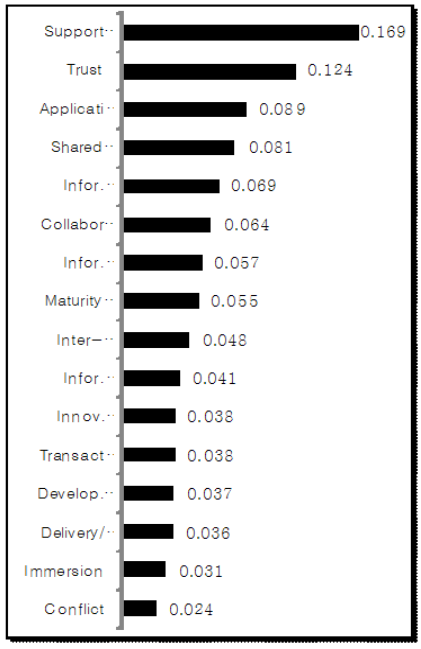
4) Analysis of Sub-factors under Information Factor

Information quality, information share, and information exchange were set as secondary hierarchy factors to analyze the importance of secondary factors under information factor.

Information exchange(0.415) ranked the highest among the sub-factors under information factor. Information share(0.339) and information quality(0.246) followed. This result shows that the importance of each suggested factor do not differ significantly that the information exchanged among the members in supply chain, the quality of such information, and its share should be all considered positively to maximize the effect of SCM adoption. That is to say, all three sub-factors are important. CR(0.02) is under 0.1, which means this result is reliable.

5) Summary of Analysis

Putting the analysis results of various factors together, primary hierarchy factors and secondary hierarchy factors were considered simultaneously. First, the importance of organization factor(.387) ranked the highest. Relation(.291), information(.167), and transaction(.155) followed. Organization factor is 38.7% and relation factor is 29.1% respectively and their sum reaches 67.8%. They are significantly more important than information factor(16.7%) and transaction factor(15.5%). Second, support of CEO(.169) under organization factor ranked the highest and trust(.124) under relation factor, adoption strategy(.089) under organization factor, shared goal(.081) under transaction factor, information exchange(.069) under information factor, collaboration(.064) under relation factor, and information share(.057) under information factor followed. Third, support of CEO(.169), trust(.124), shared goal (.081) and information exchange(.069), which were the most important when analyzing secondary hierarchy factors, also ranked high in overall importance analysis. Meanwhile, immersion and conflict under relation factor were analyzed to be the least important.



[Fig. 1] Importance of Sub-factors in Relation to Each SCM Adoption Factor

6. Conclusion

Importances of SCM adoption factors have been analyzed with AHP in this study. The result are:

First, the importance of organization factor (.387) ranked the highest. Organization factor is 38.7% and relation factor is 29.1% respectively and their sum reaches 67.8%.

Second, putting the analysis results 16 sub-factors together, support of CEO (.169) under organization factor ranked the highest.

Third, immersion and conflict under relation factor are analyzed to be the least important. The result shows the prior factors for enterprises' successful adoption and use of SCM. SCM should be adopted at the level of all participants in supply chain, not of individual enterprise. And it gives prominences to organization factor and relation factor in this study. Above all the rest, support of CEO, trust, and adoption strategy can be suggested as vital factors for SCM adoption. Meanwhile this study acquires significances by drawing various SCM adoption factors through researching precedent studies, generating importance of each factor with AHP, and suggesting priority of sub-factors. Precedent studies have approached more from adoption factors and achievement, but this study explains about the relation among categorized four factors (organization, transaction, relation, and information) and also the relation among sub-factors of each factor through statistical method.

Hence, considering that supply chain management system is not limited to the matter of individual enterprise and it is consolidated with sharing of the members in supply chain, this study can be used by enterprises that intend to apply SCM in practice, as strategic guideline.

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