A Study on the effects of suppliers’ organization capability and collaboration process on supply chain quality: An empirical approach based on the experiences of small and medium enterprises in Korea

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Abstract
The purpose of this study is to verify the effects of suppliers’ organization capability and collaboration process on supply chain performance in the context of supply chain quality management. This study developed structural equation model using the data from Supply Chain Collaboration Index investigated by Korean Standards Association.

Keywords: Supply Chain Management, Quality Management

Introduction
The nature of competition in the new century has been between companies but rather between supply chains. The most efficient, flexible, and agile supply chain wins the race. Streaming cross-company processes is the next great frontier for reduction costs, enhancing quality, and speeding operations. (Michael Hammer, 2001; Fawcett etc., 2006; Kuei etc., 2001) It has already been 10
years since the importance of supply chain management was widely spread around the world. In Korea, solutions for collaboration between manufacturers and suppliers was discussed in many ways because the win-win strategy between ‘chaebol’ and sub-companies became an issue of society.

According to enthusiastic effort of manufacturers, suppliers did not have enough ability to participate supply chain management. Suppliers generally have low knowledge of the importance of supply chain management compare to major companies. Also, suppliers have lack of human resources and does not have enough facility to manage supply chain. Based on the research of 120 firms in Korea from Korean Management Association, the firms with supply chain management team are 21%, firms know about supply chain management but the roll is only for logistics department are 37%. Therefore, there was not enough empirical researches whether suppliers has gained a real positive effect from supply chain management in Korea.

Quality management appeared in 1980s. The concept of quality management faced challenge about expansion of the concept to as the increase of the importance of supply chain management (Sousa and Voss, 2002). The activity to combine quality management and supply chain is under the supports of Ministry of Knowledge Economy in Korea. Korean Standard Association developed Supply Chain Quality Management(SCQM) model and Quality Collaboration Index for Supply Chain Management(QCI-SCM) since 2006. (Tae Kyou Kim etc., 2008) However, the research and analysis was mainly focused on large companies, and the research did not work well with the achievement from the perspective of suppliers.

Therefore, this research aims to provide meaningful implications for supplies which participates in supply chain quality management based on the analysis of structure equation model and to prove whether supply chain quality management actually improve firm performance in what aspects.. From theoretical perspective, this would figure out what kind of exact relationships exist among supply chain quality management, organization capability, and collaboration process. Finally, it would help build middle and small size firms establish strategic guidelines.

Theoretical Background
Assadei and Barbara (2009) performed interesting research about comparing with and contrasting
of TQM and SCM. TQM started from the perspective of quality management, by the way, SCM started from the perspective of logistics. Therefore, the main purpose of TQM is to get rid of the defective items, and the main purpose of SCM is to secure the delivery. However, development of two concepts had common purpose of satisfying customers. Therefore, TQM achieved partnership of the inside firm, and SCM achieved partnership of the outside firm. They insisted that two concepts are not different in terms of their goal, and the combination of TQM and SCM should become a new research area.

**Organization capability**

The research about organization capability mainly processed by leaderships, operation formation and training. Firstly, previous researches strongly confirmed that the leadership of CEO was a key element on supplier’s quality assurance (Kaynak and Hartley, 2008). In other words, effective leaderships emphasized quality and delivery time rather than price, and induced suppliers to check the quality of raw materials. They also emphasized on information sharing between companies and this would improve quality management. Cua et al. (2001) investigated the relationships between the implementation of TQM, JIT, TPM and the firm performance. It was found out that in order to secure quality the participation of employees are very important. To implement JIT correctly, employees should have abilities to perform in many tasks and the active participation was necessary. Also, in order to execute TPM, the dedication of all employees from board members to daily workers is required for the maintenances. Kaynak (2003) proved that training has directly related with quality management. Training made employees recognize more actively in quality issues. According to Lai and Cheng (2005), the understanding of the meaning of quality was necessary for the success of quality management and customer-centered service.

**Collaboration Process**

The research of the relationship between manufacturer and supplier has been made for a long time. Masson (1986) found out that collaboration improved delivery and quality in the electronic industry in Scotland. It was also found that this brought inventory reduction and stabilization of production scheduling. Followed by Cusumano and Takeishi (1991), the defect rate reduced when
supplier participated early in the development process. Nevins and Whitney (1989) also found out that if all the suppliers participated, the development time reduced and the result performed better in design process.

Expansion from value chain to network of supply chain changed firm’s business area and created new chances for improvements. Hammer (1990) said that firms eliminated or outsourced unnecessary processes that did not contribute to the company’s profit. Especially, except for core competence, partnerships with other firms or strategic alliance put to practical use for efficiency. Therefore, in terms of business process, the interface between firms were expanded and the importance of collaboration process has increased. Collaboration process expanded from just information sharing activity to synchronizing planning and execution, combining work flow, venturing new business, sharing resources and so on. (Angel, 2005)

**Hypothesis**

In terms of supply chain quality management, research model developed to analyze relationships among organization capability, collaboration process and firm performance. (Figure 1)

Hypothesis 1. Supplier’s organization capability has a positive impact on collaboration process between manufacturer and supplier.

Supplier’s organization capability consisted of CEO’s leaderships, organization structure, and training. Sufficient organization capability would have a strong interest in collaboration process and make effort to set up adequate processes.

Hypothesis 2. Supplier’s organization capability has a positive impact on supply chain quality management

To pursuit high level of quality management, supplier’s CEO is likely to have a strong leadership and SCQM team has been set up and has a role and responsibility on quality management. Finally, there would be a training program on SCQM inside the firm. The firm performance can be directly affected by leadership of CEO, organization structure, and training program.

Hypothesis 3. Collaboration process between manufacturer and supplier has a positive impact on supply chain quality management

Manufacturer and supplier has a relationship in every aspect of product development,
test/approval, procurement, manufacturing, delivery, and after service. If the collaboration process establishes and operates well, the proper quality can be achieved. The outcome will be great if manufacturer and supplier perform well as these tasks are progressed. Collaborated well means they have great communication, also the probability of occurring error becomes lower. As a result, product quality can be improved, and the cost will be reduced at the same time. Also, if they have well-structured collaboration process, they will try to improve efficiency and reduce the accident together. In terms of supply chain quality management, firm performance can be explained by product quality, cost, productivity, and safety.

Data
Data was gathered by Korean Standard Association, named by supply chain collaboration index. It educated supplies for 3~4 months to measure supply chain quality management. It compared the firm performance result after 1 year from the investigation. 346 suppliers participated in the survey, but only 329 were used because 17 were insufficient.

Measurement
The assessment of Supply chain quality assurance were formed by organization capability, collaborate process, firm performance. In detail, leaderships, organization, education were measured in organization capability. Leadership is measured based on the leaderships of CEO, organization collecting SCQM data, training is measured based on how the education helps to achieve the SCQM.

Collaboration process measured whether the tasks is correctly working in six different parts between manufacturer and supplier. In detail, building collaboration process is formed by development, test/approval, procurement, production, delivery and after service. In development part, it is possible to find out whether the collaboration performs well between companies. Test and approval measured whether they have structured relationships. Procurement is measured by whether the data and information is being used correctly. They also review the production and quality assurance parts or whether they correctly perform joint projects. Storage and transfer tasks are shared by inventory or deliver computer network, and find out whether the controlling
information is effectively performing, so that how the logistics management of transportation performs. Finally, service parts measured how they deal with the claims from the customers, and how they have divided the expense of the claims.

The outcome of company operation is formed by quality, price, productivity, safety. Quality measured the reduction of the rate of errors from the production or Procurement through the collaboration. The price measured the rate of the unit price per sales reduce logistics costs, inventory costs. The productivity measured the rate of improve production and delivery time. The safety is measured the rate of industrial disasters.

![Figure 1 - Research Model](image)

Supply chain collaborate quality index is measured each evaluation 5 levels, A through E. Original index had a weight for measurement items. However, in this research, every variable was standardized to unify scales.

**Results**

Characteristics of collected data are as follow. Average sales of researched companies in 2008 were 1.089 billion won, average number of employees was 49.5, and sales of the each employee were 17 million won. For sales, more than 100 million to 500 million were most, 166 (51.2%), more than 10 people less than 30 people were most as 116 (35.8%). Sales less than 100 million was 269 (83%) in overall, less than 50 people were 239 (73.8%), most of the collaborate company
were mid-size level.

The statistics of collected data are as follow. Firstly, in the organization capability, collaborate company’s supply chain quality assurance have significantly less in leaderships, training area. Test and approval tasks are relatively higher in collaboration process with one company. But collaborated level is lowest at quality management process. Lastly, in the outcome of the supply chain quality management the data are shown most in costs, productivity, quality. However, the outcome is low in safety area.

**Factor Analysis**

Structural equation model was used in this research and it generally has two steps of approach (Anderson and Gerbing, 1984). In other words, first stop implements check variables of theory model or evaluation model, second step decides to accept hypothesis based on the result of the models. AMOS 20 and SPSS 20 was used to normality test, factor analysis and model verification. Analysis on primary factor was implemented to find out unidimensionality convergent validity, and discriminant validity. Exploratory factor analysis was used to find out how many variables affect supply chain quality management directly or indirectly. Correlation analysis was conducted first and then maximum likelihood estimation and direct oblimin rotation were used to find out number of factors and factor loadings. Correlation analysis shows Pearson correlation between 0.43 ~ 0.74 at p<0.01. As for factor analysis, more than 4 factors had no meanings. When extracted three factor, the last was only consisted of development. It was judged that this has little meaning, therefore, organization, leaderships, training are made of one factor, and then rest of 6 factors, from development to after service are the second factor.

After extracting two factors through correlation analysis and exploratory factor analysis, reliability and validity were evaluated through confirmative factor analysis. The result shows that Cronbach’s α of organization capability and collaboration process is more than 8.5 each. It can be concluded that these factors have high reliability. Also, the construct reliabilities and the construct validities are more than 9.0. There is an enough evidence that index is consist. Construct validity is analyzed by the suggestion of Hair (2006) or average variance extracted.

The result showed that measurement index was more than 0.7 and p<0.001. This means that there
are no problem satisfying validity of concept validity and average variance extraction. Finally, if average variance expected is bigger than square, \((r^2)\) then there are sufficient validity and organization capability and collaboration process are higher than 0.9 in index variance extraction. Therefore, it can be concluded that this model shows enough validity.

**Model**

Continue to conformity factor analysis, throughout the structural equation model analysis suitable estimation. Model’s suitability is to find out how much consistency that the covariance has. This paper proposed model \(\text{chi-square} = 205.9045 \ (\text{df}=62, \ p<0.001)\), \(\text{GFI}=0.911\), \(\text{CFI}=0.935\), \(\text{TLI}=0.918\). Model fits are more than 0.9 which are the satisfactory results. \(\text{RMSEA}=0.084\), which means the model is suitable. Especially in chi-square test, the samples size becomes bigger and deviation is really small, which means ‘the model is suitable’. This paper has more than 300 data which satisfy the entire standard.

The result of structural equation proved that organization capability reinforcement, and there are statistical positive effects between company operation and the result. (Figure 2) The coefficient of determination of organization capability and collaboration process reliable below 0.001 was 0.89, between collaboration process and company operation was also coefficient of determination of 0.87. In other word, as collaborated companies increase organization capability, the collaboration process becomes useful, and as one company and collaboration process becomes more structured, the result of the company operation increased.

However, the hypothesis about organization capability has positive relationships with company operation, (-0.33, \(p>0.05\)) organization capability for supply chain does not have relationship with company operation. In other word, one can’t have expectation that supply chain will not always bring positive effect on the company operation, and this has to be with collaboration process with collaborated company.

Additionally, there are interesting information between latent variable and observation variable. Firstly, organization capability influence on leaderships, training, and organization, however, it influence leadership most. In other word, it is most important for CEO to build supply chain management and have management policy about collaborate with one company. In collaboration
process, all the processes are equally important from development tasks to service. Of course one can say that production and quality control have greatest influence in supply chain, but there are not many differences between other collaboration processes. Because of this, from the point of view of collaborate company, they should not focus on some specific tasks, rather, they should focus systemically on end-to-end process.

![Figure 2 - Results](image)

Finally for company operation and result, there are actual cost reductions when organization capability is reinforced and collaboration process is built. Also, the quality and production could have positive influence, but there were not any improvement in stability of industrial accident. In other words, from the point of view of collaborate companies, to increase stability of industrial accident, other programs should be introduced other than supply chain quality management.

**Conclusion**

The quality management needs to be expanded for the part of collaboration process. Based on the result of this research, the conclusion and implication can be explained from the point of view of the supplier about supply chain quality management.

Firstly, building collaboration process between manufacturer and supplier has positive influence on improvements of suppliers’ operations, especially there are direct effect on cost reduction.
Collaboration process has similar influence on six different kinds of activity which is from the development of products to after service.

Secondly, organization capability reinforcement for supply chain quality management does not directly connected to firm performance. It will contribute from the collaboration process to improve result.

Thirdly, improvements on the result of supply chain quality management can be seen in cost reduction, higher productivity and quality improvement. However, the improvement can be little on the reduction of industrial accidents. Therefore, other programs might be required to decrease them.

As the discussions above, how organization capability and collaboration process influence positive outcomes of companies that have supply chain quality management. Based on this research, there would be a further study in the future.

References