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Abstract: As competition becomes more intense, it is becoming increasingly important for a firm to build an efficient supply chain for its survival and prosperity. One way to build an efficient supply chain is to integrate the supply chain activities by the member firms of different levels on the supply chain by developing cooperative relationships between firms.

Many factors are involved in developing cooperative relationships between firms, and their effects need to be studied. This paper investigates what factors are critical to build a cooperative buyer-supplier relationship in auto parts manufacturing industry.

Data was collected from two groups of firms in Korean auto parts manufacturing industry, 1st-tier parts suppliers and 2nd-tier parts suppliers. Our study reveals that there are significant differences in the way of collaboration depending on the level of the relationships.

Keywords: SCM & E-logistics; Auto industry; Multi-echelon supply chain.

I. Introduction

Nowadays supply chain management is a very popular word for industry practitioners as well as academics. As competition becomes more intense, it is becoming increasingly important for a firm to build an efficient supply chain for its survival and prosperity. One way to build an efficient supply chain is to integrate the supply chain activities by the member firms of different levels on the supply chain by developing cooperative relationships between firms, which means extending supply chain integration into further down the levels of the industry structure.

For no other industry is this true than automobile manufacturing industry of which the structure is very complex with multiple levels of firms from auto manufacturers and parts suppliers to the suppliers of suppliers, etc. Many factors are involved in developing a cooperative buyer-supplier relationship between firms in auto manufacturing industry, and their effects need to be studied. Also, researches often overlook the relationships beyond auto manufacturers and the 1st-tier part suppliers.

This paper attempts to investigate the buyer-supplier relationships in the auto parts manufacturing industry by trying to find out what factors are critical to build a cooperative buyer-supplier relationship, and whether there are any differences in the degree of collaboration between different levels of relationships, i.e., auto manufacturers and 1st-tier parts suppliers, and 1st-tier suppliers and 2nd-tier suppliers.

For this research, we are using the data collected from Korean auto parts manufacturers. Korean auto manufacturing industry is very sizable with a 5.8% of the world total production in 2002 (Korea Auto Industries Cooperation Association, 2003), and its exports to the world market is also increasing every year. The majority of Korean auto parts manufacturers is small to medium sized enterprises (SMEs), and thus are lagging behind in implementing supply chain management in their firms due to a lack of resource in financial, human, and technology area. Also, many of them are very dependent on the buyer firms in supply chain integration issues. Our research would provide useful insights into the current situation of the industry and also future directions for working toward mutually beneficial relationships among firms.

II. Literature Review

Many previous studies investigated the relationships between buyer firms and supplier firms, and found that both groups of firms will benefit more from the cooperative relationships than the competitive relationships. Table 1 contains some of the previous research that investigated various types of the buyer-supplier relationship and its impact on the firms.

In the 1980's, Japanese auto makers made an impressive progress in the US market with high quality cars, and it was considered that the high quality could be achieved by the cooperative relationships between Japanese auto makers and their suppliers. Nishiguchi and Brookfield (1997) examined and compared US and Japanese auto industry, and their findings attributed the Japanese auto makers' success to the cooperative buyer-supplier relationships. Maloni and Benton (1997) suggest that it is essential for a firm's survival to have cooperative relationships with their suppliers. Other studies also examined various types of buyer-supplier relationship and its impact on the firms' performance and the efficiency of their supply chain.

III. Research Methodology

III. 1 Hypotheses

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The variables representing each factor of the model and the related previous studies are described in Table 2. Dependent variable is the degree of cooperation between firms which are auto manufacturers, 1st-tier parts suppliers, and 2nd-tier parts suppliers. Independent variables include information system related variables, firm's commitment to the relationships, JIT (Just-in-Time) environment, and bargaining power.

Table 1. Summary of previous studies.

Researcher	Content
Nishiguchi and Brookfield (1997)	Compared US and Japanese auto industry. Japanese auto industry has more cooperative buyer-supplier relationships.
Maloni and Benton (1997)	Emphasized the importance of the buyer-supplier cooperation.
Harwick (1997)	Cooperation with the supply chain partners for improving the supply chain efficiency.
Cooper (1993)	Reasons that firms form a supply chain (inventory reduction, improving service, etc.)
Lamming (1993)	Suggest a lean supply chain model in auto industry to understand the buyer and supplier relationship.
Han (1993); Fisher et al. (1994);Imne and Morris (1993)	The importance of buyer-supplier relationship for a firm's competitive advantage.
Shapiro (1985);Spekman (1988);Landeros and Monczka (1989);Burt (1989); Bensaou and Venkatraman (1995); Helper (1991); Helper and Sako (1995)	Investigate the various types of buyer-supplier relationship: competitive vs. cooperative; open market negotiation vs. vertical integration; integrated vs. structural
Smith et al. (1995);	Trust and cooperation between firms.
Landeros (1993);	Define the cooperative relationships

Figure 1 contains the research model showing the relationships between the tiers of firms in the supply chain, and hypotheses are constructed as below for each of the relationships indicated as H1 through H3.

H1: Collaboration between firms is positively related to the independent variables selected (information system, commitment, JIT environment, bargaining power).

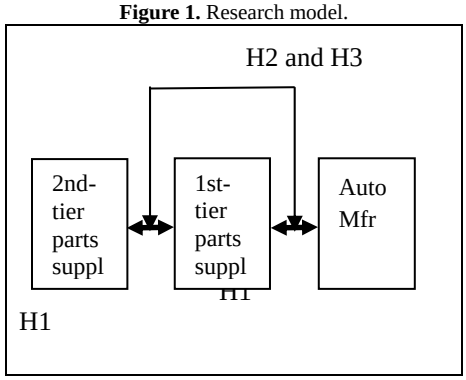
H2: The intensity of collaboration is different between the 1st-level relationship (auto manufacturer and1st-tier parts suppliers) and the 2nd-level relationship (1st-tier and 2nd-tier parts suppliers).

H3: Important factors affecting collaboration are different between the 1st-level and the 2nd-level relationships.

Table 2. Description of the variables.

Variable	Name	Content
Independent	Information system	Informatization level Information exchange Information sharing
	Commitment	Technical cooperation Length of relationship
	JIT environment	JIT environment
	Bargaining power	Bargaining power on transaction condition
Dependent	Collaboration	Degree of cooperation

Figure 1. Research model.



III. 2 Data Collection

Data for this study was collected from auto parts manufacturers through survey in 2003-2004. The survey questionnaire consists of 35 questions. The survey was conducted by company visits and e-mails inviting managers to participate in the survey through the active server page on the web site. The respondents are the staff of the sales department in each company, and thus familiar with the relationships between their own company and their buyer company. A total of 69 companies participated in the survey, and 67 of them were used for this study after two were discarded due to incomplete responses. They were divided into two groups depending on their relationship with the

automobile manufacturers. 35 companies were the 1st-tier parts suppliers, and 32 companies were the 2nd-tier parts suppliers.

The survey questions are answered by 5-point Likert-type scale except those requiring single item answers. We used descriptive statistics, factor analysis, t-test, and regression to analyze the data. The summary of the results are presented in the tables.

IV. Analyses and Results

Tables 3 through 5 show the results of the tests to find out the relationship among the variables and to determine the acceptance of the hypotheses presented in the above.

IV. I Test of Hypothesis 1

We used simple and multiple regression analyses to find out what variables affect the inter-firm collaboration level and the results are presented in Table 3. In simple regressions, each independent variable was individually tested, and in a multiple regression analysis all the independent variables were tested with the dependent variable. Except the JIT environment, the effect of all the other variables turns out to be significant. Therefore, information sharing, commitment and bargaining power are all important for developing and improving inter-firm collaboration. However, a simple delivery of parts on time, i.e. JIT implementation alone, may not be enough to enhance the inter-firm collaboration.

Table 3. Test of Hypothesis 1 (simple regression).

Variables	b	t	p-value
Information sharing	0.491	4.541	0.000
Commitment	0.686	7.610	0.000
JIT environment	0.097	0.784	0.436
Bargaining power	0.502	4.674	0.000

IV. 2 Test of Hypothesis 2

We used t-test to determine whether there is difference in the degree of inter-firm collaboration between the 1st-level relationship (auto manufacturer and1st-tier parts suppliers) and the 2nd-level relationship (1st-tier and 2nd-tier parts suppliers). Table 4 shows the results. The difference turned out to be significant at $\alpha = 0.05$. Thus, firms tend to have different degree of inter-firm collaboration depending on which level a firm belongs to in a multi-echelon supply chain. The suppliers in the first level seems to have a closer relationship with auto manufacturers than the relationship between the first level suppliers and the second level suppliers. A possible reason for this may be that the firms' infrastructure such as information system is more compatible in the 1st-level relationships than the 2nd-level.

Table 4. Test of Hypothesis 2 (t-test).

group	N	mean	s.d.
1st-level relationship	35	2.83	0.776
2nd-level relationship	32	2.38	0.875
t = 2.248, df = 65, p-value = 0.028			

IV. 3 Test of Hypothesis 3

We conducted simple regressions separately for the 1st-level and 2nd-level relationships and compared the results with each other. As shown in Table 5, the important variables affecting the inter-firm collaboration are not different between the two levels. For both cases, information sharing, commitment, and bargaining power turned out to be important to develop inter-firm collaboration.

Table 5. Test of Hypothesis 3 (simple regression).

Variables	1st-level	2nd-level
Information sharing	Significant (0.081)	Significant (0.002)
Information sharing	Significant (0.081)	Significant (0.002)
Commitment	Significant (0.000)	Significant (0.003)
JIT environment	Not (0.322)	Not (0.659)
Bargaining power	Significant (0.021)	Significant (0.001)

V. Conclusion

We have found several factors important for inter-firm collaboration. Specifically, important factors include information sharing, commitment, and bargaining power. JIT environment was not found to be essential for developing inter-firm collaboration. This results confirms the findings by Helper(1991) that JIT implementation was not necessarily an indication of a cooperative relationship. Secondly, the level of collaboration increased as the relationships were closer to the auto manufacturer. That is, the 1st-level relationship has a higher degree of inter-firm collaboration than the 2nd-level relationship. Lastly, there were no difference in the factors affecting inter-firm collaboration between the two levels. In both levels of relationships, the three factors of information sharing, commitment, and bargaining power had a significant impact on the inter-firm collaboration.

Summing up the results, firms need to develop a proper communication system for information sharing, and a trustworthy relationship through commitment such as a long-term contract, and allow suppliers with a certain degree of bargaining power for determining delivery, price, payment method, etc.

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