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The Linkage of Partnership in American Automotive Industry Supply Chain Management

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Abstract

This study explores the level of partnership in automaker-supplier relations in the American auto industry with regard to component development. T-testing and linear regression were used to analyze the results of component development projects conducted jointly by automakers and suppliers. The results supported three hypotheses that suggest that three independent variables— frequency of communication, the level of engineers' knowledge, and internal coordination—are all positively correlated with component design quality. A significant linear correlation was found between two variables: component design quality and the level of engineers' knowledge.

Introduction

The purpose of this research was to investigate the linkage of partnership of supply chain management (SCM) in the automotive industry. In order to raise both profits and customer satisfaction, many firms are implementing SCM, which is a topic receiving a great deal of attention in the industry today. The increase in competitive pressure in the business environment has resulted in SCM becoming a critical component of most new competitive strategy models. Supply industry economist Russell Kay (2001) provides the following simple definition: "supply chain management lets an organization get the right goods and services to the place they're needed at the right time, in the proper quantity, and at an acceptable cost" (p. 32). SCM involves the supply chain activities of planning, executing, and coordinating material flow inside the enterprise and among integrated companies. SCM activities include the sourcing of raw materials and parts, manufacturing and assembly, warehousing, and inventory tracking. They also comprise order entry and order management, as well as distribution across all channels, and ultimately, delivery of the finished goods to the customer.

The automotive industry includes multiple players in extensive, complicated, global supply chains. According to Treleven, Watts and Hogan (2000), many companies are using SCM improvements as an element of a rapid response implementation. The relationships within the automotive supply chains tend to be fixed and clearly demarcated. Thus, enormous potential exists for shaping the relationships between these players to make them more interactive.

The industry tendency to reduce inventory levels rapidly is forcing automotive component companies to redesign and expand their SCM initiatives. Effective SCM involves building trust and relationships with long-standing suppliers, who are intimately included in the development and production of components. Improving partnerships along the supply chain seems to have significantly helped the growth of automakers. Swaminathan (2001) stated, "inventory reduction and partnership improvement are the major benefits of implementing supply chain management" (p. 5). The supply chain network is increasing its complexity on a daily basis. The integration of the supply chain is the

key to relieving the problems caused by variations and complexities in the system. Bland (2003) indicated that managers understand that SCM is providing a competitive edge for their enterprises. They also know that SCM can reduce internal supply, storage, labor, and delivery costs—savings that can then be passed on to the customer.

The supply chain of the 21st century will probably be a fully automated network and will have as much to do with technology as it will have to do with communication based on trust. Getting suppliers and automakers to trust each other and share their most sensitive information over the business world will be crucial. SCM could become a more collaborative environment, in that it could emerge from the environment of internal personnel, business partners and the trading community, into an opportunity to discover new ways of solving business problems.

Purpose of the Study

The purpose of this study was to explore the level of partnership in automaker-supplier relations in the American auto industry with regard to component development.

Statement of the Problem

The existing literature on strategic alliances, such as buyer-supplier relations, technology collaboration and virtual cooperation, has shown the significance of external integration and outsourcing. However, the problem of how to conduct external integration and outsourcing in order to maximize competitive advantage has remained unsolved.

Hypothesis

Three hypotheses were tested to examine the relationship between component design quality and three elements— frequency of communication, engineers' knowledge, and internal coordination.

- Hypothesis 1: A component development project in which an automaker and a supplier communicate more often should display a higher level of component design quality.
- Hypothesis 2: A component development project in which an automaker's engineers have a higher level of knowledge regarding the component should display a higher level of component design quality.
- Hypothesis 3: A component development project in which an automaker performs a higher level of internal coordination should display a higher level of component design quality.

Methodology

The target population of this study was auto suppliers in the U.S., where the practice of supplier involvement in component development has been widely diffused. This study provides a convenient avenue for exploring the partnership linkage in managing automaker-supplier relations in the U.S. The framework of this study examines the relationship between automakers and suppliers with regard to conducting the diverse activities of component development.

Table 1 shows the variables that were used in the study. Component design quality measures the design quality of the developed component for output performance. The frequency of communication between the automaker and the supplier measures the frequency of mutual visits between engineers, purchasing staff, and sales staff from both the automakers' and suppliers' sides. Engineers' knowledge measures the knowledge level of the component. Internal coordination measures the level of the automaker's coordination among different internal departments, such as the purchasing department and sales departments.

To emphasize the importance of partnership between automakers and the suppliers, the selection of the survey instrument was geared toward a specific area, such as quality in component development projects. As no U.S. - based survey instrument was available at the time of the study, the instruments used in a study by Takeishi (1998) and IRC (1997) in Japan were considered. The instrument used in the Takeishi (1998) study was eventually selected because of its internal reliability 0.92. An initial listing of the top original equipment manufacturer (OEM) parts suppliers in America was obtained from *Automotive News* (Sherefkin, 2003). This list contained the top 150 suppliers in North America, based on annual revenue. Ninety additional suppliers were gathered from the Internet (http://

Table1. List of Variables

Area	Construct	Variable
Component development performance	Design quality	CDQ: Component design quality
A*'s external coordination with S**	Communication	COM: Communication frequency between A and S
A*'s internal capabilities	Level of A*'s Engineers' Knowledge	EKN: Engineers' knowledge
	Level of A*'s internal Coordination	INC: Internal coordination

A*: automaker
S**: supplier

www.ai-online.com/suppliers.asp). Phone calls were placed to people within these selected industries in order to solicit their assistance in this study, and a total of 240 surveys were sent out. To increase the response rate, reminder postcards were sent to each non-responding supplier after two weeks. At the end of the survey period, 50 responses were received, resulting in a return rate of 20.8 %.

The purpose of the survey was to collect data on automakers' supplier management patterns and analyze their impact on component development performance. Each supplier was asked to choose one component development project that had recently been completed for a new vehicle. T-testing and linear regression analysis were used to analyze the component development performance conducted jointly by the automaker and the supplier and the hypotheses concerning a population correlation.

Findings

As assumed in hypothesis 1, a component development project in which an automaker and a supplier communicate more often should display a higher level of component design quality.

$$H0 : \rho qc = 0 \quad Ha : \rho qc > 0$$

where

- ρ rho is the population correlation coefficient for the paired variables,
- q is the component design quality (CDQ), and
- c is the communication frequency (COM).

As shown in Figure 1, the significance level (p = 0.030) reported in the correlation matrix is smaller than the chosen significance level of alpha 0.05, and so the null hypothesis (Slope = 0) was rejected. This shows that there is a positive relationship between CDQ and COM in the population of American auto suppliers represented by the sample. Figure 2 shows a two-dimensional scatter plot with CDQ as the dependent variable, and COM as the independent variable.

As assumed in hypothesis 2, a component development project in which an automaker's engineers have a higher level of knowledge regarding the component should display a higher level of component design quality.

$$H0 : \rho qe = 0 \quad Ha : \rho qe > 0$$

where

- ρ rho is the population correlation coefficient for the paired variables,
- q is the component design quality (CDQ), and
- e is the engineers' knowledge (EKN).

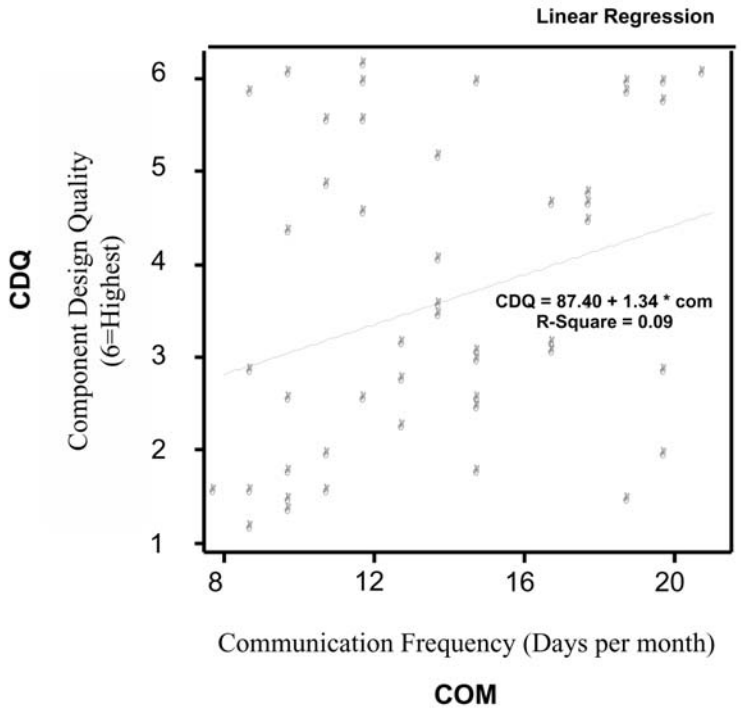
As shown in Figure 3, the significance level (p = 0.000) reported in the correlation matrix is smaller than the chosen significance level of alpha 0.01, and so the null hypothesis (Slope = 0) was rejected. This shows that there is a positive relationship between CDQ and EKN in the population of American auto suppliers represented by the

Figure 1. Hypothesis 1 Correlation Matrix

		CDQ	COM
CDQ	Pearson Correlation	1	.306*
	Sig. (2-tailed)	.	.030
	N	50	50
COM	Pearson Correlation	.306*	1
	Sig. (2-tailed)	.030	.
	N	50	50

*Significant at 0.01 level (2-tailed)

Figure 2. Hypothesis 1's Regression Line in a 2-D Scatter Plot



sample. Figure 4 shows a two-dimensional scatter plot with CDQ as the dependent variable and EKN as the independent variable.

As assumed in hypothesis 3, a component development project in which an automaker performs a higher level of internal coordination should display a higher level of component design quality.

$$H0 : \rho qi = 0 \quad Ha : \rho qi > 0$$

where

- ρ, rho is the population correlation coefficient for the paired variables,
- q is the component design quality (CDQ), and
- i is the internal coordination (INC).

As shown in Figure 5, the significance level (p = 0.004) reported in the correlation matrix is smaller than the chosen significance level of alpha 0.01, and so the null hypothesis (Slope = 0) was rejected. This shows that there is a positive relationship between CDQ and INC in the population of American auto suppliers represented by the sample. Figure 6 shows a two-dimensional scatter plot with CDQ as the dependent variable and INC as the independent variable.

The results support hypotheses 1, 2 and 3: COM, EKN, and INC are all positively related to CDQ. As shown in Table 2, COM has a negative correlation coefficient with EKN and INC, indicating that communication may be needed because the engineers do not have enough knowledge about the component (low EKN) or do not have good internal coordination.

Summary

American automakers and suppliers were widely seen to have cooperative practices, such as long-term inter-firm relations. Therefore, this study provided a convenient avenue for exploring the linkage of partnerships in managing automaker-supplier relations in the American auto indus-

Figure 3. Hypothesis 2 Correlation Matrix

		CDQ	EKN
CDQ	Pearson Correlation	1	.499**
	Sig. (2-tailed)	.	.000
	N	50	50
EKN	Pearson Correlation	.499**	1
	Sig. (2-tailed)	.000	.
	N	50	50

**Significant at 0.01 level (2-tailed)

Figure 4. Hypothesis 2's Regression Line in a 2-D Scatter Plot

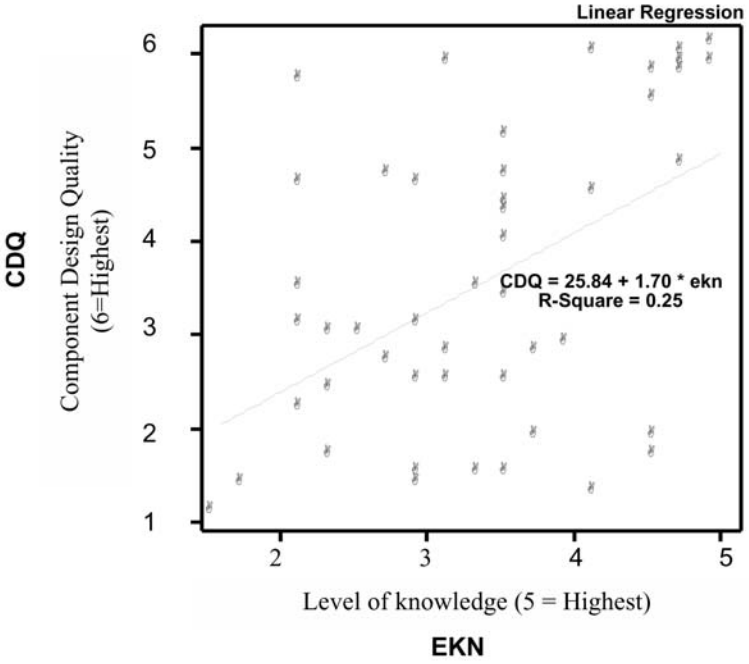


Figure 5. Hypothesis 3 Correlation Matrix

	CDQ	INC	
CDQ	Pearson Correlation	1	.402**
	Sig. (2-tailed)	.	.004
	N	50	50
INC	Pearson Correlation	.402**	1
	Sig. (2-tailed)	.004	.
	N	50	50

**Significant at 0.01 level (2-tailed)

try. In order to stress the importance of partnership linkage between the automaker and the supplier, the survey instrument was geared toward the level of quality in component development projects. The researchers attempted to probe this unexplored area, drawing on data collected from the American auto industry.

The results of testing hypothesis 1 showed that there was a positive relationship between CDQ and COM in the population of American auto suppliers represented by the sample. Communication is a key variable for product development research. As shown in the results, automakers and suppliers who communicate more often display a higher level of component design quality. It is also important to emphasize that both internal and external communication are needed for optimal product development. Effective coordination through frequent communication between the automaker and the supplier is crucial for successful component development. The more frequent the communication with their suppliers, the shorter their model cycle. In order to obtain higher performance in component development, it is preferable that there be guest engineers at the suppliers' sites during the earlier stages of product development. Overall, extensive communication between automakers and suppliers significantly optimizes the development of components.

The results of the testing of hypothesis 2 show that there was a positive relationship between CDQ and EKN. The results indicated that a component development project in which an automaker's engineers have a higher level of knowledge of the component could display a higher level of component design quality. EKN is the total level of the automakers' engineers' knowledge of developing components for vehicles. It is interesting to learn how some automakers establish and maintain a higher level of knowledge than others. Automakers miss opportunities to gain relevant knowledge when the actual tasks of detailed design are carried out by outside suppliers. The more the engineering tasks are shifted to the suppliers, the lower the retention of an automaker's knowledge. On the other hand, suppliers also need a high level of knowledge to solve problems jointly with automakers. Developing knowledge about how the component should be integrated for a particular vehicle is a factor which will allow suppliers to gain a competitive advantage in design. In addition, automakers can achieve better designs when both their suppliers and their engineers have extensive knowledge.

The testing of hypothesis 3 showed that there was a positive relationship between CDQ and INC. The results indicated that a component development project in which an automaker performs a higher level of internal coordination could display a higher level of component design quality. Importantly, an automaker needs the capacity to coordinate various activities effectively, both internally (within the organization) and externally (with a

Figure 6. Hypothesis 3's Regression Line in a 2-D Scatter Plot

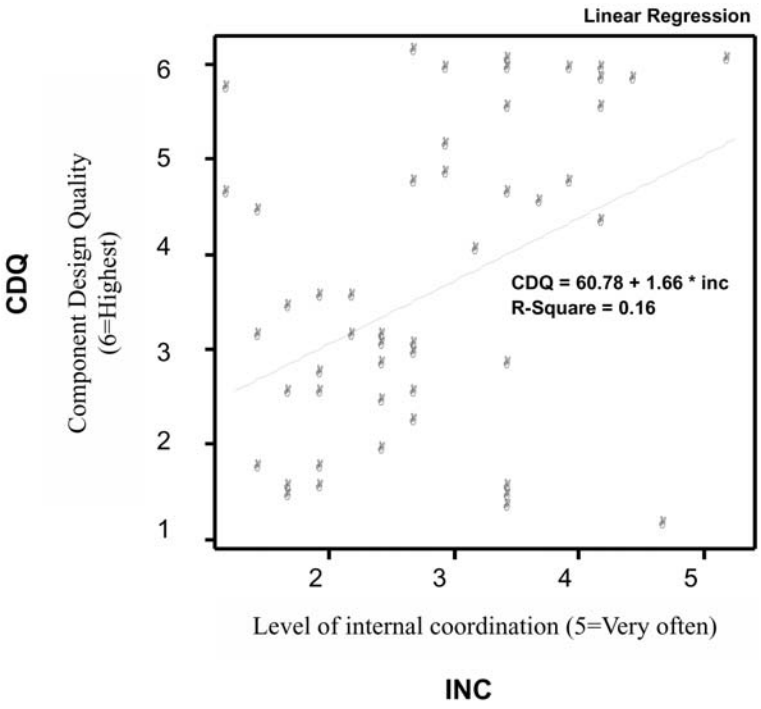


Table2. Matrix of Correlation Coefficients (n = 50)

	CDQ	COM	EKN
CDQ: Componentdesign quality	-		
COM: Communication frequency	0.306*	-	
EKN: Engineers' knowledge	0.499**	-0.156	-
INC: Internal coordination	0.402**	-0.110	0.327

* Significant at 0.05 level (2-tailed)
** Significant at 0.01 level (2-tailed)

supplier) in order to achieve better component design quality.

The topic of this study, the linkage of SCM partnerships in the automotive industry, emphasizes collaboration between automakers and suppliers. This collaboration brings significant benefits to organizations, in terms of both reduced costs and increased product quality. To outperform competitors, a firm needs to build, maintain, and improve its own capacities to coordinate diverse activities effectively.

Recommendations

Future research is needed to explore the importance of technological leadership at the component level in the automotive industry. This will provide information about component innovation, which is important for both automakers and suppliers. It is also recommended that future research include an investigation of the cost of policy implementation. This study focused on component development performance and internal coordination, and it would be interesting to carry out a follow-up cost analysis in order to evaluate the impact of these practices on financial performance.

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