A Study on the Market Reaction Ability of the Manufacturing Supply Chain

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ABSTRACT

Supplier coordination and market reaction ability have become topical subjects in recent years. The goal of the coordination and cooperation of the firms in a supply chain is to be able to rapidly respond to market changes. The subjects of this study were Taiwanese manufacturing firms with complete experience of the supply chain activities of being the upstream supplier and the downstream customer. Structural equation modeling (SEM) was used to establish the supply chain strategy model, and validate the causality and interaction effect weights of the state of environment, coordination and reaction ability between firms. The empirical results suggested that market resource environment competition has a positive impact on supply chain coordination and product development integration, while supply chain coordination has a positive impact on product development integration and market reaction ability. Finally, product development integration was found to have a positive impact on market reaction ability. The empirical results could provide a reference to firms in reviewing the impact of market resource uncertainties on individual firms before developing the supply chain strategic directions.

Keywords: Market competition; Supply chain coordination; Product development integration; Market reaction ability

INTRODUCTION

With the development of globalization and information technology, product life cycles have shortened significantly while information transfer and the demands on market reactions have become increasingly faster, thereby resulting in enormous changes of enterprise supply chain systems. Enterprises must diagnose their supply chain management system to fit the changing environments and improve the operation processes of the overall supply chain system. In recent years, researchers and practitioners have paid attention to how supply chain coordination, product development integration and market reaction ability improve the performance and competitive advantages of supply chain management. However, related theoretical and empirical studies are quite limited.

Therefore, from the strategic point of view, this study divided the supply chain management process into the three stages of state of environment, coordination, and reaction ability to explore the development of supply chain strategy and establish the supply chain strategy model accordingly, with the goal of improving supply chain strategy performance. For firms, the key issue should be how to enhance the overall supply chain flexibility and efficiency, with the customer as the orientation (Walter, 2006). When the environment of the supply chain changes or the overall supply partners’ strategy shifts, the stability of
the relationships in between firms can be affected. If relationships between firms remain stable, what firms need to do is to review the environment, the strategies of the other firms, and changes in ability, in addition to maintenance of the existing relationships, so as to understand the challenges and threats of the environment to the overall supply chain. Therefore, how to understand and react to the environment will become a necessary issue of supply chain system. Numerous studies have discussed reaction methods and strategies in the late 1990s and early 2000s (Hines et al., 2002; Korhonen et al., 1998; Lummus & Vokurka, 1999; Williams et al., 2002).

Several conditions can create a successful supply chain system. One is the market-oriented system of cooperation, which depends on the internal coordination between firms of the supply chain (Day, 1994; Kohli & Jaworski, 1990). Day (1994) pointed out that a high-profit firm should have a number of capacities, including internal-external integration, external-internal integration, and the ability to expand. Similarly, in the supply chain system, firms of the supply chain system should cooperate to create profit and space by working together. In particular, in recent years, due to the booming development of business and industry, the environment and industry have changed rapidly. As a result, the concept of exclusive benefits has been challenged. Firms may not survive if they do not follow the trend, identify the problems, or find solutions to the problems.

In addition to coordination, the integration of product development is also a very important issue. In recent years, with the market changes, price is no longer the major consumer or business market demand. Today’s manufacturers, in response to consumer demands, are more concerned about product development and quality. Therefore, product development integration has become an important issue of supply chain management. Dowlatshahi (2000) argued that manufacturers should spare no efforts in suppliers, purchasing, design, and manufacturing to effectively integrate suppliers’ resources and abilities and promote supplier involvement in product development, so that product development performance can be effectively improved.

Most studies have confirmed that supply chain coordination has a significant impact on supply chain performance. However, from the perspective of strategic management, the environmental dynamics can affect the ultimate supply chain performance. In addition, from the market-oriented viewpoint, the enhancement of supply chain performance depends on the supply chain firms’ internal coordination and integration. Hence, this study suggested that a supply chain able to effectively improve market reaction ability should start with the review of market environment resources and establish coordination (supply chain coordination) and integration (product development integration) relationships with the partner firms. Accordingly, this study explored the relationships in between market resource environment competition and supply chain coordination and product development integration, and further discussed the impact of supply chain market reaction ability, with the aim of proposing some specific recommendations.

**RESEARCH BACKGROUND AND HYPOTHESES**

Market dynamics and resource environments will affect an organization’s reaction and state (Milliken, 1987), especially in the face of market resources and environments of high uncertainty, in which inter-firm coordination and information sharing among firms becomes even more important. According to Dess & Beard (1984), from the resource dependence perspective, a more intense competitive environment means more input of different resources and output of different forms, and thus the resource obtaining and processing will be more complex. Based on market dynamics, firms need more agreements. The organization theory has extensively discussed the impact of environment on the coordination and agreements of the organization (March & Simon, 1958; Pfeffer & Salancik, 1978). Based on the above studies, this study proposed the following hypothesis:
H1: Market resource environment competition has a significant and positive impact on supply chain coordination.

Product development integration and development should change with market demands. The inter-supplier integration can enhance product customization ability. Supply chain restructuring can help the supply chain get closer to the customers, because the logistics and physical distribution activities of the wholesalers, distributors and manufacturers are integrated. When the market resource environment competition is more intense, product development integration becomes more important. McGinnis & Vallopra (1999) emphasized that inter-firm involvement and integration is important to product development. To meet the demands of a highly competitive market resource environment and consumption, increase product innovation and transfer speed, and enhance product reaction strategies, firms of the supply chain should closely communicate, coordinate and share information (Bharadwaj et al., 2007; Cline & Guynes, 2001; Kulp et al., 2004). Therefore, this study proposed the following hypothesis: H2: Market resource environment competition has a significant and positive impact on product development integration.

Hong et al. (2005) pointed out that supply chain partners’ coordination and knowledge sharing can promote product development productivity. By taking the place of the expertise, experience and insight of a single specific manufacturer, the shared experience of the supply chain firms can enhance information quality and knowledge content (Brown & Eisenhardt, 1995; Dougherty, 1992; Jaworski & Kohli, 1993). Stuart (1993) also pointed out the level of cooperation between supplier partners can affect the improvement of productivity and competitive advantages of the supply chain, and thus affect the overall time of a product development project (Hartley et al., 1997). Based on the above, this study proposed the following hypothesis: H3: Supply chain coordination has a significant and positive impact on product development integration.

The adoption of coordination occurs because the members of an organization are mutually dependent and interactive. Supply chain coordination includes information processing and coordination in between firms. The supply chain coordination can help shorten the supply chain’s production lead time and help firms effectively communicate with suppliers and customers, to promote the relationship ability (Lawson et al., 2008), process flexibility (Rosenzweig et al., 2003), and product innovation capability (Koufteros et al., 2007). All of these can be helpful to supply chain flexibility and market reaction ability. Therefore, this study proposed the following hypothesis: H4: Supply chain coordination has a significant and positive impact on market reaction ability.

Daft & Lengel (1986) argued that the information development of an organization provides a reasonable linkage of product development in early planning, design and manufacturing. In product development and integration, if members of the supply chain system can actually cooperate with each other, it can reduce the reaction time to rapidly respond to the changing market environment (Mikkola & Skjøtt-Larsen, 2006). Firms can enhance the quality of their reaction to external market changes by product innovation and development (Koufteros et al., 2007). Teece et al. (1997) indicated that a successful firm should be able to respond to the market in real time and should have rapid and flexible product innovation and development to effectively coordinate and distribute competitiveness. These abilities, called dynamic capabilities, can be used to face market changes in real time and accelerate innovation. The roles of management are emphasized, including the adaption and restructuring partners’ skills, resources and functions in response to the global environment. As mentioned above, the internal product development integration of the supply chain can help improve the market reaction ability of the firms of the supply chain, and thus, this study proposed the following hypothesis: H5: Product development integration has a significant and positive impact on market reaction ability.
RESEARCH DESIGN

This study developed four scales to investigate manufacturing firm’s market resource environmental competition, supply chain coordination, product development integration, and market reaction ability. By randomly sampling companies in Taiwan’s manufacturing industry, the empirical data were obtained through a questionnaire survey. The research framework is shown in Figure 1.

Data were collected from the manufacturing managers of Taiwanese manufacturing firms through a questionnaire survey. A total of 118 company samples were received. Among the respondents, males accounted for 66.1% of the total, and females accounted for 33.9%. Most of the respondents were aged 41~50 (33.1%), followed by 31~40 years old (32.2%), 51~60 years old (19.5%), 21~30 years old (12.7%), and 61 years old and above (2.5%), suggesting that the respondents were mostly in the age group of 31~50. Most of the respondents had college degrees (67.8%), followed by master’s degrees (32.2%), suggesting that most of the managers were enrolled in on-the-job further education programs and had at least a college education. Regarding the years of establishment of the companies, most had been established for 21 years or above (55.1%), followed by 11~15 years (22.0%), 16~20 years (10.2%), 5~10 years (9.3%), and less than five years (3.4%), suggesting that most companies had a history longer than 20 years. In terms of registered capital, most companies had a capital of NT$100 million to NT$1 billion (41.5%), followed by NT$2~NT$5 billion (23.7%), NT$1~NT$2 billion (18.6%), NT$10~NT$50 billion (6.8%), NT$10~NT$100 million (5.1%), and NT$5~NT$10 billion (4.2%). As the measurements of the variables were based on previous literature and the questionnaires collected the opinions of the departmental directors or senior managers, the survey was representative to a certain degree.

RESEARCH RESULT

Reliability analysis

The Cronbach’s α reliability coefficient and confirmatory factor analysis was used to illustrate the reliability and validity of the scales of the major research dimensions in this study. First, the Cronbach’s α reliability coefficient was used to test the scale reliability. The Cronbach’s α for market resource environmental competition was 0.938, that for supply chain coordination was 0.685, that for product

Figure 1: Research Framework
development integration was 0.940, and that for market reaction ability was 0.885. Overall, the reliability level of the various scales was close to or higher than the acceptance level of 0.7 as suggested by Nunnally (1978), indicating that the question items of the various scales had good reliability.

Next, confirmatory factor analysis was used to get the construct combination reliability and extract the variance. The factor loadings of market resource environmental competition, supply chain coordination, product development integration and market reaction ability all reached the significance level. The combination reliability was 0.943, 0.682, 0.953, and 0.865, respectively, and the extraction variance was 0.767, 0.354, 0.836 and 0.617, indicating that the internal consistency of the indicators was acceptable.

Validity analysis

This study used confirmatory factor analysis to verify the model fitness. A GFI in the range of 0.80-0.90 is considered reasonable, and a GFI of 0.90 or higher is regarded as evidence of better fitness (Joreskog & Sorbom, 1989). An NFI above 0.9, a CFI above 0.9, and RMR are used to reflect the overall residual of the response theoretical hypothesis model. A smaller RMR value indicates better fitness of the theoretical model and the observation model. In general, the RMR should be lower than 0.08 to be acceptable. According to the confirmatory factor analysis results of this study, the GFI, NFI and CFI values for all dimensions were above 0.9, and the RMR was lower than 0.08. The factor loadings of various dimensions reached the significance level, suggesting that the convergence validity was acceptable. Moreover, no correlation coefficient between constructs was 1, which suggested that the dimensions were actually different rather than being the same construct. Hence, it could be concluded that the dimensions had good discriminate validity.

Hypothesis test

This study applied SEM to further validate the causality dimensions and test the hypotheses proposed in this study. The advantages of SEM include the ability to review the significance of causal paths in addition to reviewing the fitness of the overall model and data. In the context of the overall model, it can review the hypothesis of individual paths. Regarding the model fitness indicators, the GFI was 0.966, the NFI was 0.920, the CFI was 0.925 and the RMR was 0.048, indicating that the overall model fitness level was acceptable. The SEM analysis results are shown in Figure 2.

![Figure 2 Inter-variable relationships of the overall model](image-url)
Regarding the model fitness indicators, the GFI was 0.966, the NFI was 0.920, the CFI was 0.925 and the RMR was 0.048, indicating that the overall model fitness level was acceptable. Regarding H1, according to the validation results, the path coefficient of market resource environment competition having a positive and significant impact on supply chain coordination was 0.182 (p<0.05), indicating that market resource environment competition has a significant and positive impact on supply chain coordination. This suggested that more intense market competition could result in stronger coordination behavior of supply chain firms. Therefore, H1 was confirmed.

Regarding H2, according to the validation results, the path coefficient of market resource environment competition having a significant and positive impact on product development integration was 0.448 (p<0.001), indicating that market resource environment competition has a significant and positive impact on product development integration. This suggested that more intense market competition could result in stronger product development integration between supply chain firms. Therefore, H2 was confirmed.

Regarding H3, according to the validation results, the path coefficient of supply chain coordination having a significant and positive impact on product development integration was 0.300 (p<0.001). This indicated that supply chain coordination has a significant and positive impact on product development integration and suggested that stronger coordination in between firms of supply chain could result in stronger product development integration. Therefore, H3 was confirmed.

Regarding H4, according to the validation results, the path coefficient of supply chain coordination having no significant and positive impact on market reaction ability was -0.038 (p>0.05), indicating that supply chain coordination has no significant or positive impact on market reaction ability. Therefore, H4 was not supported.

Regarding H5, according to the validation results, the path coefficient of product development integration having a significant and positive impact on market reaction ability was 0.572 (p<0.001), indicating that product development integration has a significant and positive impact on market reaction ability and suggesting that stronger product development integration in between firms in the supply chain could result in stronger market reaction ability. Therefore, H5 was confirmed.

CONCLUSIONS

Supply chain business strategy is an issue receiving increased attention in the industry and scholars (Eng, 2006; Fugate et al., 2006; Quesada et al., 2008; Swink et al., 2007). This viewpoint emphasizes the development and strengthening of long term and mutually beneficial relationships in between firms rather than the short term and intermittent trading method underlined in traditional marketing. According to the contents of previous chapters, it could be concluded that supply chain coordination and integration is the key factor of the survival and growth of the manufacturing supply chain, especially in regard to the trends of more market competition and fewer market resources, in which the importance of coordination and integration to the enhancement of competitiveness in the manufacturing supply chain should be raised. For firms, the building of long term cooperation relationships can improve the flexibility of the supply chain to reduce market risk as well as enhance the market reaction ability of the overall supply chain to have more sources of profit. Therefore, how to develop the coordination and integration of firms in the supply chain has become a topic of increasing concern to the industry.

Figure 2 shows that market resource environment competition has a significant and positive impact on supply chain coordination and product development integration. The path coefficients were 0.182 and 0.448, respectively. This suggested that a higher degree of market environment change and competitor...
density could enhance supply chain coordination and product development integration. More intense industrial competition environments represent larger inputs of different resources and outputs of different forms, and thus the obtaining and processing of resources will be more complex (Dess & Beard, 1984). When the market resource environment competition is more intense, the product development integration becomes more important.

Supply chain coordination has a significant and positive impact on product development integration. The path route coefficient was 0.300. This suggested that better supply chain coordination could enhance the restructuring of product development, which was in line with the arguments of Brown & Eisenhardt (1995), Hong et al. (2005), and Jaworski & Kohli (1993). In addition, supply chain coordination has no significant and positive impact on market reaction ability. The path coefficient was -0.038. However, as shown in Figure 2, supply chain coordination will affect market reaction ability via product development integration. The indirect effect was 0.172, which was higher than the direct effect of supply chain coordination on market reaction ability. This suggested the impact of supply chain coordination on market reaction ability is mainly through product development integration, and that the key to market reaction ability is product development integration. In addition, product development integration can directly affect market reaction ability. The effect was 0.572, suggesting that product development integration contributes considerably to market reaction ability.

This study emphasized that various supply chain strategic activities exist in sequence. To enhance supply chain strategy performance, in the development of supply chain strategy, enterprises should establish supply chain coordination activities according to the competition environment before being reflected in its market reaction ability. The empirical results of this paper could provide a reference to firms in reviewing the impact of market resource uncertainties on individual firms before developing the supply chain strategic directions. This paper made up for the inadequacies of previous studies. Previous studies on supply chains seldom used market reaction ability as the performance measurement indicator. However, the current environment is rapidly changing. Issues such as the financial tsunami and the European credit crisis have emerged one after another and as a result, supply chain environment scanning and market reaction ability have become relatively important. This study explored the development of market reaction ability as well as identified key factors affecting market reaction ability as product development integration.

Regarding contributions to the industry, the findings of this study confirmed that product development integration is the key factor triggering market reaction ability. Since product development integration is a cross-organizational level factor, firms in a cooperative relationship should perceive the goodwill and faith of the other members and should be satisfied with the relationships. Moreover, supply chain coordination is an important determining factor of product development integration. The architecture of this paper pointed out that the degree of supply chain coordination could affect the relevant activities of product development integration, and thus affect the market reaction ability of the overall supply chain.

**FUTURE RESEARCH SUGGESTIONS**

This paper only discussed the manufacturing industry as the research subject; therefore, the findings of this paper cannot be generalized to other industries. Numerous previous studies have explored the relevant factors and results of supply chain coordination. This paper proposed major features from a market-oriented perspective, without including other major features. Therefore, follow-up studies should
explore other key features, such as cooperation time, relationship quality, and product characteristics, as well as the impact of other interference variables on supply chain coordination, restructuring and market reaction ability, such as the scale of cooperation. Finally, from the strategic viewpoint, the manufacturing industry in a highly competitive environment can achieve differentiation through closer relationships. The creation of a long term cooperation relationship could be beneficial to the manufacturing industry. The findings of previous studies and this paper confirmed that supply chain coordination and restructuring is the major determinant factor of market reaction ability. The creation of a good cooperation relationship could enhance the overall performance of the supply chain. Therefore, in their interaction with partners, firms should be able to perceive the reliability and good intention of each partner to develop and maintain stable cooperation relationships. Subsequent studies should expand the model of this paper by integrating the viewpoint of relationship marketing to expand the research width.

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