

Using Knowledge-Based View to Explore the Impact of Supply Network in Automotive Industry

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ABSTRACT

The articulation of supply networks, as an extension of supply chains, seeks to accommodate and explain the commercial complexity associated with the creation and delivery of goods and services from the source of raw materials to their destination in end-customer markets. The concept of supply network describes the mess and complexity of networks which are involved lateral links and two-way exchanges, and included a broad, strategic view of resource acquisition, development, management, and transport. This research focus on what is a supply network and how supply networks can be created operation under knowledge-based view. A theory framework was discussed in the literature review in the automotive industry and operation of supply network. Then, use automobile industry as studies and complements the strategies between assembly companies and in which's dependent and complex suppliers (component firms) in Taiwan's. Finally, the results show that these relationships of the automotive network are not confined to the pursuit of short-term economic imperatives of cost reduction but embrace innovations in design and technology, creative research and development and quality improvement.

Keywords: supply network, knowledge-based view, strategy

INTRODUCTION

Supply chains, the network of firms that contributes both inbound and outbound products and services along an industry value chain, had drawn increasing attention from organization theorists since the 1980s. Since the late 1980s, researches in various fields have been concerned with developing an understanding of organizations' abilities to manage, and manage in the networks of organizations kinked by economic exchange (Harland, 1996). Competition is changing from firm level to network level: firms take parting in end product supply networks that compete against alternative end product networks. Drucker (1997) indicated the network changes business control because of scratching and mixing the ownership of the economic units. Moreover, the participating companies in the supply networks may not remain the same over the product life-cycle (Hewitt, 2000). Over the past few years, relationships between suppliers and assemblers in the West and have been transformed. The automotive industry has undergone considerable technology and organizational change. On the assemble side the traditional Fordist methods of production have largely been replaced by various hybrids of Japanese lean production methods as assembles try to satisfy an increasingly diversified pattern of demand for vehicles (Womack et al., 1990; Boyer and Freyssenet, 2002). And the growing tendency for outsourcing has led to a significant increase in the number of partners that participate in global supply networks. Furthermore, the companies that participate in the production of a product variant can change over time, for example, the fluctuations of currency rates or minor changes in the product designing (Andel, 2001). The situation in Taiwan is the same- large assembly firms have out-sourced an increasing percentage of work to large suppliers- in this

sense it is modular- but then force suppliers to co-locate with their assembly plants. In many respects it is design work that ties the production network together. Because the suppliers are increasingly responsible for the design of large sub-systems of the car, a high degree of interdependence is created between the assemblers and the large suppliers: the assemblers cannot easily build a particular model in a new location without the suppliers that were involved originally; the suppliers are driven to co-locate by their need to reach production volumes to justify the expense of development.

This had been the major implications throughout the industry value chain. In particular there is much greater interdependency between assemblers and supplier. We may consider the subject under the following heads: First, introduce the supply network and examine the rationale for network from a resource perspective. Then, we link the knowledge base view of individual firms with product innovation. Finally, use automobile industry as studies and complements the strategies between assembly companies and in which's dependent and complex suppliers (component firms) in Taiwan's. These relationships of the automotive network are not confined to the pursuit of short-term economic imperatives of cost reduction but embrace innovations in design and technological creative research and development and quality improvement.

LITERATURE REVIEWS

Supply Networks

The term “supply chain management” was used originally in the early 1980s (Oliver and Webber, 1992; Houlihan, 1984) to refer to the management of materials across functional boundaries within an organization but was soon extended beyond the boundary of the firm to include “upstream” production chains and “downstream” distribution channels (Womack et al., 1990; Womack and Jones, 1996; Harland and Clark, 1990; Christopher, 1992). Supply networks could define as sets of supply chains, describing the flow of goods and services from original sources to end customers (Harland, 1996). The relatively recent incorporation of the term ‘network’ into supply chain management reflects an attempt to make the latter wider and more strategic by harnessing the resource potential of the network in a more effective manner than competing firms (Cunningham, 1990; Harland,1996). And from the above figure the supply chain is likely in the level 3 (as figure 1) and supply network (as level 4) encompass the mess and complexity of networks include a broad, strategic view of resource acquisition, development, management, and transport.

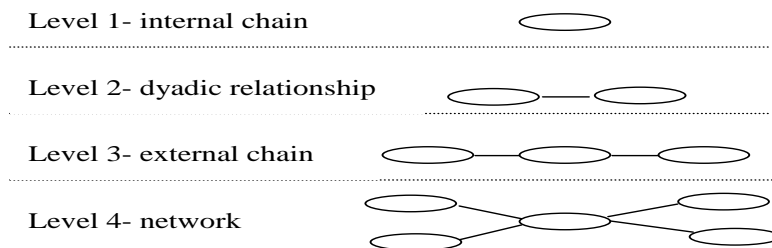


Figure 1: The type of chain

Supply network comprise chains through which goods and services flow from original supply sources to end customers (Harland, 1996). Supply networks encompass the mess and complexity of

networks involving lateral links and two-way exchanges, and include a broad, strategic view of resource acquisition, development, management, and transport. Supply networks are increasingly complex as multiple companies, as well as companies from different continents, participate in a product's delivery process. Furthermore, Ebers and Jarillo (1998) indicated that supply network and competitive interaction tend towards long-term purposeful arrangements in order to obtain long-term sustainable competitive advantage. This reflects two observations. Firstly, there has been renewed interest in linking supply networks with interconnected relationships (Harland et al., 2004). Networks of interdependent relationships can be developed and fostered through strategic collaboration with the goal of deriving mutual benefits (Chen and Paulraj, 2004; Dyer, 2000). Secondly, opportunism (Walter et al., 2003) and dependence asymmetry (Narayandas and Rangan, 2004) may undermine a firm's network strategy in various ways. However, research on cooperative and competitive relationship in such networks remains limited.

Knowledge-Based View

Recently there has been a resurgence of interest in the role of the firm's resources as the foundation for firm strategy. This interest reflects dissatisfaction with static, equilibrium framework of industrial organization economics that has dominated much contemporary thinking about business strategy and has renewed interest in older theories of profit. There are several advances ideas occurred. At the corporate strategy level, theoretical interests in economies of scope and transaction costs have focused attention on the role of corporate resources in determining the industrial and geographical boundaries of the firm's activities. In the business strategy level, explorations of the relationship among resources, competition, and profitability which including the analysis of competitive imitation, the appropriateness of returns to innovations, the role of imperfect information in creating profitability differences between competing firms, and the means by which the process of resource accumulation can sustain competitive advantage. Knowledge has been investigated under several monikers, including organizational learning, market orientation, and the knowledge creating company. From the firm's resources view that knowledge can serve as an intangible strategic resource and, as such, is crucial to effort to create value in a unique, inimitable, and nontransferable way (Wernerfelt, 1984; 2005).

In network research had shown that research scientists indeed use strong and weak ties to share knowledge across organization boundaries, particularly if their organizational boundaries, particularly if their organizations are not direct competitors (Bouty, 2000), and formal collaborative ties between firms increase the innovation output of biotechnology start-up firms (Baum et al., 2000; Powell et al., 1996; Shan et al., 1994). Networks shape not just innovation output, but also innovation input such as R&D investment. Recently studies turned therefore to networks and innovation within traditional industries.

Characteristics and Structure of Network

A single company could not produce the whole end product by itself. This also effects the investment decision making in different parts of the network; the needed resources and capabilities are divided among many companies. Companies are searching for more efficient and effective ways to be competitive in the fast developing markets and in the face of stiff competition. The individual companies operating in the network are dependent on the resources of the other network companies, and the possibilities of the individual organization to utilize these resources are determined by their place in the network. In this perspective, network identification is mainly based on the type and the number of ties or collaborative relationships entertained by any given firm with other institutions or with a central or

pivotal agent (Gulati and Gargiulo, 1998; Owen-Smith and Powell, 2004; Powell et al., 2005). The network has a certain structure that consists of customers' and their direct and indirect suppliers' who possibly have supply relations to each other. Partnership is a widely used typical term for a certain development stage of companies' cooperation. The difference between partnership and network relationship is the context of companies' cooperation. Network relationship is a supply relation between companies taking part in a network and having one or more common objectives. Many researchers of inter-organizational business networks view "network" as a form of organizing in which legally autonomous organizations have high levels of interdependence and co-operative working; it is an alternative to markets and hierarchies (Ebers, 1997). Based upon this viewpoint, it is the bonds between organizational actors, ties between resources, and links between activities which identify it as a network. There are three different elements of network structures. First, the nature and role of communication between network members, and the extent to which a network is design to achieve strategic level purposes for its member (Johnston, 2006; Drucker, 1997; Ebers and Jarillo, 1998). According to them networking is operation between partners who commit themselves to each other's long term future. Secondly, focus on the process and mutual interaction between firms and on represents the business. Third, examine how network structures and interactions may help or hider the network itself to achieve a beneficial which could fit between task requirements and the environment.

CASE STUDY

A theory framework was discussed in the literature review in the automotive industry and operation of supply network. According to earlier research (Zheng et al., 1998; Lamming et al., 2000) provided a conceptual model for the creation and operation of supply networks. The core of the model contains nine different types of network activities that organizations can perform in coordinating and managing supply networks. These activities are: partner selection, resource integration, information processing, knowledge capture, social coordination, risk and benefit sharing, decision making, conflict resolution, and motivation. Harland (2001) used two key measures: the degree of supply network dynamic and the degree of focal company supply network influence. Two measures for the supply dynamic dimension were used: operations process characteristics and market conditions. Operations process dynamics were measured in terms of process variety and volume; market dynamics were measured in the terms of frequency of new product launches, number of competitors supplying similar products, and ease of switching. The degree of focal firm supply network influence was measured by the extent to which respondents perceived that their supplier or customers were too large or too powerful for them to influence. According to above literature reviewed, the model highlighted three contextual variables that my influence the supply network of the Taiwan's automotive industry: market environment, product and process, and network structure. Next, a theory framework was discussed above three variables to present the relationship between assembly companies and its suppliers.

Market Environment

Recently, market environment become significantly more volatile and more complex in market structure. Three inter-related characteristics of the market for new automobiles are especially important: highly cyclical, long-term changes in demand, increasing market segmentation and fragmentation. Taiwan automotive components firms confronted considerable difficulties at home. In the early years of growth, firms in this segment of the automotive sector benefited from strong government support and

extensive technical linkages with Japanese firms. Subsequently, OEM firms remained reliant on foreign partners for advanced technology, and the small market constrained growth. Rising labor costs from the 1980s onwards, the rapid development of China, and accession into the World Trade Organization (WTO) have forced Taiwanese automotive assembly manufacturers, such as YML to begin searching for new survival strategies. As in many advanced industrial nations, moving offshore is one of the most popular strategies for promoting sustained growth and taking advantage of flexible supplier networks, strong operations management capability, obtaining orders for higher value-added products and making long-term relationships with internationally branded automakers (Berger and Lester, 2005, p. 100). Furthermore, Taiwanese foreign investors began relocating extensively in China in the 1990s to lower production costs. Taiwanese automotive components firms then followed, relocating labor- and scale-intensive assembly activities in China while retaining knowledge-intensive and small batch production within Taiwan. Relocation in China also helped Taiwanese suppliers to take advantage of Chinese supply networks, enabling them to connect with Japanese and American assembly manufacturers operating in the country (Li and Sadoi, 2008).

Product and Process

As we observe the production method found that modularization have involved in this industry. The modularization often involves heavy outsourcing and requires the interchanging of modules. Increasing technological complexity has led to the recognition by the OEMs that they do not necessarily have the knowledge expertise to construct modern cars entirely on their own and so closer relationship with suppliers is required. OEMs and suppliers realize that collaboration has to be for long-term benefits which are perceived as mutual and interdependent. Mutual commitment is strengthened where supplier performance strongly affects the OEM's competitiveness which in turn strongly influences the supplier's business. The structure of automotive industry in Taiwan consists of upstream, midstream, and downstream segments working together cooperatively in a consolidated chain as portrayed in figure 2 below. The up-stream companies in this industry are steel, rubber plastic, electrical parts, electric machinery, glass, and paint industries, and their down-stream buyers are car manufacturing companies. The automotive industry has distinguished itself as a comprehensive industrial supply chain. In Taiwan, assembly industry and automobile component not only are main parts in automotive industry but also the midstream of automobile supply chain. 90% (or over 80%) of the cars domestically produced in Taiwan are developed by Japanese automobile manufacturers and produced by joint ventures with them. The Taiwan automotive manufacturing industry currently produces about 53422 vehicles per annum and accounts for 5.50% of the global output. It consists of four vehicle producers: FML, Kuozui Motors, Ltd., Yulon Motor Co., China Motor Co., Ford Lio Ho Motor Co., Ltd. (Taiwan Institute of Economic Research 2005/12). Linking the manufacturers to end customers is a large number of dealerships. Servicing these core groups is a large number of other parties such as designers, marketing consultants and logistics providers.

Taiwan's automobile component companies are after-sales oriented and sell into the international marketplace using their own sales force. Others focus on OEM (Original Equipment Manufacturing), ODM (Original Design Manufacturing) and OES (Original Equipment Service) and to follow the manufacturing plans of the car companies. Some companies do commit to researching and developing automobile parts and providing target markets with those parts. The component firms supply main products such as bumper, parts mold metal parts, grille etc to automotive manufacturing industry oversea. The firms which produce the automotive accessories occupied around 85% to 90% of accessories market

in the world, there is around 40% of total production in Taiwan's firms. The bumper, parts mold metal parts, grill; those are the products which have more competitive than other countries in the international automobile accessory market.

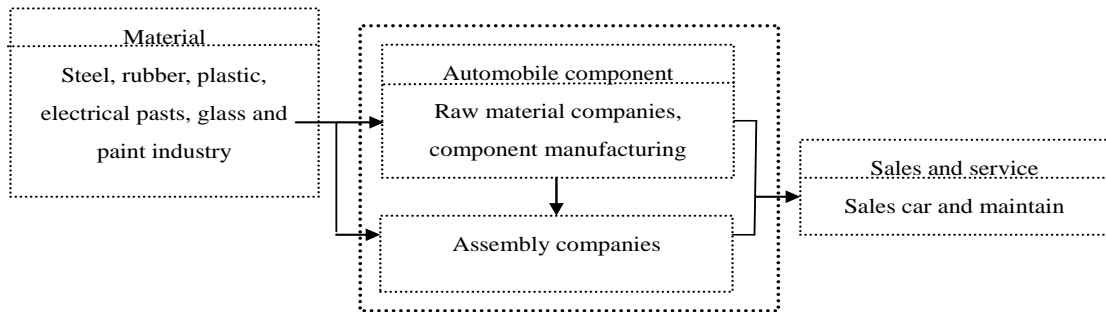


Figure 2: Structure of the Taiwan Automotive industry (source: ITIS)

In particular, the innovative capacity and degree of technological independence are critical because they are key determinants of Taiwanese firms' comparative advantage over the low-cost competitors in the regions that they are moving to and, perhaps more importantly, they will determine Taiwan industry's capacity for transforming what is left at home to higher order functions. Innovative capacity and technological independence, however, depend in part on how the Taiwanese firms originally acquired their technology and from whom. Table 1 shows the percentage of automotive component and assembly industry in recent five quarters.

**Table 1: Product value of the Taiwan automotive component and assembly industry
(In million US dollars)**

| | 3Q08 | 4Q08 | 1Q09 | 2Q09 | 3Q09 |
|---|--------|--------|--------|--------|--------|
| Assembly industry | 62.87 | 60.09 | 57.10 | 98.89 | 102.86 |
| (%) | 33.03 | 34.33 | 36.68 | 46.19 | 45.25 |
| Automobile component | 127.48 | 114.96 | 98.59 | 98.59 | 124.43 |
| (%) | 66.97 | 65.67 | 63.32 | 53.81 | 54.75 |
| Sum of assembly industry and automobile component | 190.35 | 175.05 | 155.69 | 197.48 | 227.29 |

Source: Ministry of Economic Affairs, R.O.C, Taiwan Institute of Economic Research (2009/12)

In assembly industry, process dynamics were caused by factors such as high process variety, including large numbers of configuration, or low volumes or both. Frequent promotional activity appeared to influence process dynamics. These moves have led to the development of specialization within the Taiwan supply industry. Although American-owned supplies have been keen to offer and benefit from the supply of modules and systems, many Taiwan suppliers have gained a technological lead as a result of the trend.

As table 2 shows the automobile components and assembly companies sell their products to vendors, agents, and automobile manufacturing companies domestically 51% and internationally 49%. The majority of which have contractual joint ventures with foreign makers, mostly from Japan and the export areas are in China and American. In 2000, over 86 percent of the 249,657 domestically made sedans were supplied by vehicle producers. The production values for the Taiwan automobile component and

assembly industry have been increasing yearly since 2001. Exports and production show steady and positive growth till in the third quarter of 2009.

Table 2: Export and import values of the Taiwan automotive component and assembly industry
(In million US dollars)

| | | assembly industry (% increase) | automobile component (% increase) |
|------|--------|-----------------------------------|--------------------------------------|
| 3Q08 | Import | 2.59(32.31) | 3.40(-24.07) |
| | Export | 1.35(16.49) | 10.32(-4.35) |
| 4Q08 | Import | 2.62(33.19) | 3.15(-36.12) |
| | Export | 0.89(7.03) | 9.15(-14.29) |
| 1Q09 | Import | 3.22(20.97) | 2.20(-54.61) |
| | Export | 1.38(6.33) | 7.64(-22.68) |
| 2Q09 | Import | 3.55(-6.1) | 2.78(-37.24) |
| | Export | 0.86(-34.08) | 8.09 (-24.73) |
| 2Q09 | Import | 4.13(59.26) | 3.29(-3.31) |
| | Export | 1.00(-25.48) | 8.86(-14.13) |

Source: Taiwan Institute of Economic Research (2009)

Network Structure

The automotive industry has undergone considerable technical and organizational change. On the assembly side traditional Fordist methods of production have largely been replaced by various hybrids of Japanese lead production methods as assemblers try to satisfy an increasingly diversified pattern of demand for vehicles (Boyer and Freyssenet, 2002). This has had major implications throughout the industry value chain. In particular there is much greater interdependency between assemblers and suppliers. Taiwan's automobile component companies are after-sales oriented and sell into the international marketplace using their own sales force. Others focus on OEM and to follow the manufacturing plans of the car companies. Some companies do commit to researching and developing automobile parts and providing target markets with those parts. The Industrial Development Bureau of the Ministry of Economic Affairs established a Corporate Synergy Development System (C-S system) as a channel to promote business between small and medium enterprises in 1984. Since then, lots of automobile companies have registered in the system. The system increases the competitiveness of manufacturing industries by developing a cooperative network. The system also helps enterprises reduce purchase and production costs. The C-S system builds on an outsourcing relationship between hub factories, first-tier satellite factories, second-tier factories, and third-tier factories. Hub factories outsource parts to first-tier satellite factories, first-tier satellite factories outsource parts to second-tier satellite factories, and then second-tier factories outsource parts to third-tier satellite factories. This structure forms vertical segmentation in the industry and allows for greater flexibility while maintaining economy of scale. The corporate synergy system currently has 16 systems with 171 satellite factories. On the other word, the structure is greater flexibility and network is dynamic.

Supply Network Strategy

In recent years, the most significantly change has been the decision by assemblers to devolve responsibility for the design and manufacture of complete modules to first tier suppliers. This decision, propelled by desires to spread risks, to reduce capital expenditures, and to cost affectivity savings through realizing economies of scale when suppliers produce similar components for more than one assembler,

has substantially raised the barriers that aspiring first tier suppliers face. Because assemblers are seeking to use common platforms across all of their operations, they require suppliers that are able to co-locate in the various countries in which they produce.

Supply network dynamic were observed to originate in two important sources: internal operations process characteristics and external market condition. Internally, process dynamics were caused by factor such as high process variety, including large numbers of configuration, or low volumes and increasing technological complexity. Externally, dynamic were mainly determined by two factors creating uncertain demand conditions; a large number of competitors supplying similar products and high frequency of new product launches in the market. In this study, we analysis the low level of focal firm influence over the rest of supply network was caused by key factors. First, the direct network value added by the focal firm was low, as the firm produced low volumes relative to other players in the network. Second, the perceived indirect network value of the focal was low; the firm had a low profile or image in the network relative to its lack of drive of innovation. Based on previous two factors, dynamic networks tended to compete primarily on innovation rather cost. Additionally, rapid technological change in the automotive sector continues to impose challenges to how firms organize their production networks. Hence, it is also important to understand what integrates the pieces of the network—the “glue” that holds the network together. In this case the “glue” consists primarily of the information technologies that are the heart of modern retailing. From resource-based view supply chains provided assed capabilities for product and process improvements, Drucker (1985) emphasized that innovation is providing the necessary resources to create better value, which in turn, can transform the these resources into becoming more valuable resources as well as products or processes. In sum, supply networks of Taiwan automotive industry attempted to be moving towards improving the process of innovation via knowledge sharing.

CONCLUSIONS

Based upon the literature review above, a concept model has been proposed under knowledge-based view in complements the strategies between assembly companies and in which's dependent and complex suppliers (component firms) of Taiwan's automotive industry. Supply network is measured by two key measures that highlighted three contextual variables market environment, product and process, and network structure help us analyzing internal operations process characteristics, external market condition, and network structure. Lastly, this study pointed out that the information technologies as being a potentially critical source of comparative advantage for Taiwanese firms and dynamic networks tended to compete primarily on innovation rather cost. From resource-based view, supply chains provided assed capabilities for product and process improvements, some networks seemed to be moving towards improving the process of innovation via knowledge sharing. The innovative capacity and degree of technological independence are critical because they are key determinants of Taiwanese firms' comparative advantage over the low-cost competitors in the regions that they are moving to and, perhaps more importantly, they will determine Taiwan industry's capacity for transforming what is left at home to higher order functions. These supply networks of the automotive are not confined to the pursuit of short-term economic imperatives of cost reduction but embrace innovations in design and technology, creative research and development and quality improvement.

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