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**Vertical Integration: an exploratory study in supply networks**

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**Abstract:** With the diffusion of new business forms in the 90's, such as the lean manufacturing system, firms had a tendency in direction towards a higher flexibility in production and management. That caused the change in the vertical bureaucratic structures for the horizontal company, modifying the previous paradigm, that of competition between business units. The formation and the development of enterprise networks gained relevance and one of the main tendencies is the Supply Chain Management (SCM) studies. Recent events, in prominent corporations researched in this work, show the advancement in horizontal integration and the beginning of a new process of vertical integration, differently than had been proposed in the past. This article reviews the literature related with supply chain design, and through a qualitative and exploratory study proposes a theoretical framework that enables a more detailed vision of the possible stages of the dynamic evolution of supply chains.

**Key-words:** Vertical Integration; Supply Networks

## **1. INTRODUCTION**

The economic crisis from the 70's decade resulted from the exhaustion of the mass production system causing the restructuring of the organizational strategies in the 80's decade. With the diffusion of new business forms in that decade, as the lean production concept and the increase of the power of the consumers had a tendency in direction to a higher flexibility in output and management. The motive of those transformations was the growing changes in the technological, political, and economic environments in that decade. In the 90's, to world competition was increased significantly, resulting in more pressure for production and management flexibility. That caused the change of the vertical bureaucratic structures for the horizontal company, modifying the previous paradigm, of that the competition gave between

business units. The formation and development of net companies gained relevance and one of the main tendencies that is intensifying, is the study of the Supply Chain Management. The project of the value net of a company was seen traditionally as a static activity, through from the assembly of a fixed group of suppliers and the channels of distribution to maintain the competitive advantage. But the change in the technology and in the markets rhythm made obsolete that approach. Academics as Fine (1999) proclaim that the competitive advantage is temporary, therefore that is a product that should be earned repeated times. And that require the constant disintegration and reintegration of the organizations, with the frequent change in combination of the financial, technological, structural and human resources, because each player in the value net seeks some temporary competitive advantage.

In Clockspeed, book published by Fine in 1999, is introduced the concept of evolutive speed, essential for the comprehension of the supply chain dynamics. Accordingly to the author, each productive sector possesses their own evolutive cycle of life (clockspeed), measured by the speed with that new product, process and organizational structures are introduced. The microprocessors sector has a higher speed when compared to the automotive sector. A personal computer has an approximate life cycle of six months, while a car has life cycle from four to six years. To face those changes the companies constantly should be developing new competences and capabilities to face the inevitable changes that they will come in the front. Accordingly to Fine (1999), is necessary to the company learn how to concentrate straightly in two priorities: a) exploit the present capacities and competitive advantages and b) build, of new, deliberate and conscious form new capacities for the inevitable moment in that the old capabilities not more constitute in competitive advantage. Is necessary to the organization has ability to build a temporary series of competences. Examining from the historical evolution, mutation, survival and extinction of entities in peculiar markets, Fine presents the model of the double helix, a infinite double cycle that explains the changes in supply chains. The

model proposed by Fine (1999), presents a cycle between vertical integrated companies inhabited by big corporations, and disintegrated horizontally inhabited by small and innovative companies (Figure 2).

The Double Helix model presents an inter-relation between the industry organization and the architecture of the product. When the industry is organized in a horizontal form, the architecture of the product tends to be modular, and when the sector is organized in vertical form, the architecture of the product tends to be integral.

A modular product is the one that possess components that can be interchanged, in function from the patronization of interfaces and also of a certain patronization of his functionalities. The way as the components work in assembly is defined by the product architecture. The components of a modular product can be perfectly form isolated. In a modular product, each element from the functional structure of the product is mapped to a physical component. As example of a modular architecture is the microcomputers, where the functionality permits some flexibility, but the interfaces are rigorously specified, so that is possible mount a system with peculiar products of manufacturers.

A product of an integral architecture is not built with standardized components, but of a quantity of components and subsystems projected specifically to be utilized in a determined project. Those components perform many functions. In that case, there is a complex mapping of elements from the functional structure to the physical components. Products with integral architecture should be developed like a system and his components and subsystem are usually projected by a project philosophy “top down”. These products should be created by teams strongly integrated. An airplane is an example of integrated product; where the structures perform multiple functions. The wing of a plane, by example, beyond the basic function of sustentation, shelters others subsystems, as fuel tanks, turbines and landing equipments.

Accordingly to Fine (1999), is a narrow relationship between the product architecture and the supply chain architecture. The supply chain and product architectures tend to align in the integration / modularity spectrum. The integrated products tend to be developed and built in integrated supply chains, while the modular products tend to be projected and built in modular supply chains. The architectures of the product and of the supply chain tend to be mutually reinforced, or be, the modularity from the product architecture encourage manufacturers utilize modular supply chains. The existence of a modular supply chain stimulates the development and the use of modular products. Accordingly the author, when the sector structure is vertical and the product architecture is integral, the forces that act in the way from the horizontal configuration and modular product: a) entrance of niche competitors, that expect conquer distinct industry segments; b) the difficulty to maintain in the front of the competitive technological dimension with several products; c) the organizational rigidity and inflexibility.

From the same point of view, when a sector presents a horizontal structure, the forces that will direct for the vertical integration and the product integrated architecture will be: a) the technical advancements in a subsystem, capable of promptly transform in scarce merchandise and confer power to its holder; b) the market power of a subsystem that stimulates the integration from the engineering with others subsystems in the way to develop integrated and patented solutions; c) the forces exercised by powerful subsystems suppliers and by individual firms developing its own technologies.

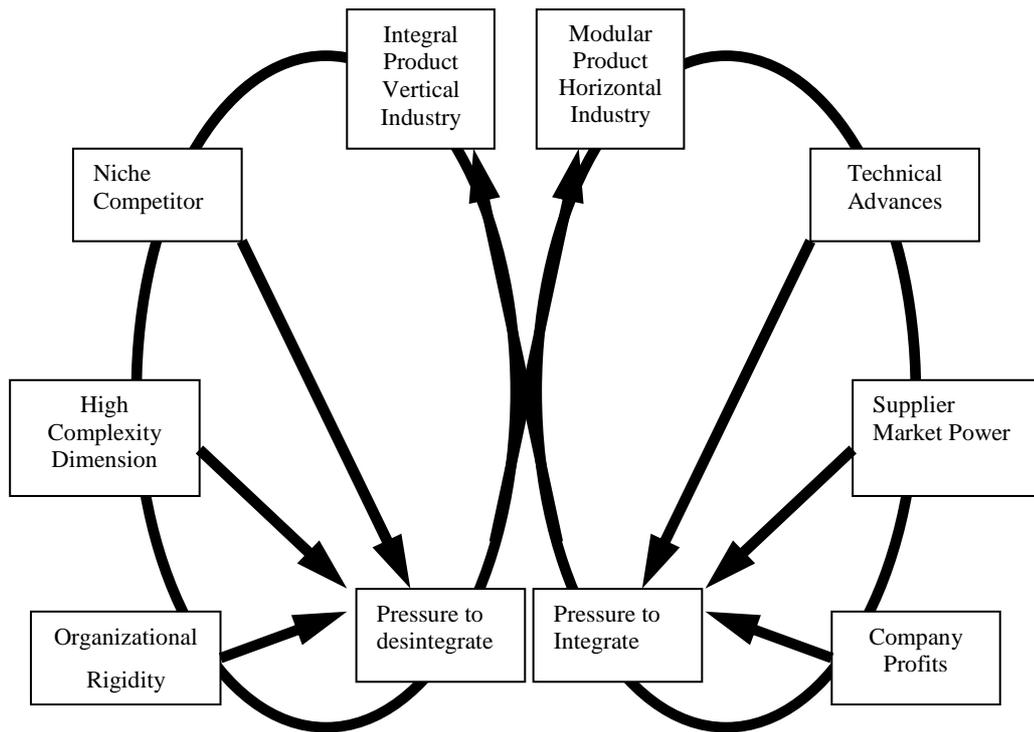


Figure 1 – Adapted of the double helix model (Fine, 1999).

This model constituted a powerful tool for the supply chain diagnosis, in the way to study the integration of a determined sector. That enables a tool for the supply chain strategic planning of any company. Follow, will be related a study that is being driven in two companies, under the perspective of the double helix model, for an evaluation of its respective supply chains.

## **2. THE MOTIVATOR FACTORS FOR SUPPLY CHAIN ARCHITECTURE REDESIGN**

Which would be the motivators factors for that certain companies reaching a horizontal integration, turn around and seek to verticalize their production? Fine (1999) detached some factors explained above. Beyond those factors, one motivator for that change would be the dependence from the original company manufacturer of the supplier's components. If this

dependence occurred in non strategic components would be irrelevant, but the strategic components for the company, would mean a dependence situation. The reasons for that dependence will have occurred are: mistaken decisions of the past regarding what was or not strategic and what should be outsourced; technological pattern changes that gave power to supplier; reduction of the suppliers number which led to a reduction in the number of companies able to supply a determined set of components. In this way it is possible to simplify which would be the possible decisions about what components should be outsourced by the company (see figures 2). Components of high economic value and strategic role are candidates of insourcing; non strategic and low economic value components are probable candidates of outsourcing; low economic value components with a high strategic role are potential candidate of insourcing; and high economic value components, with low strategic role level has potential for future harvest.

<i>Strategic Role / Economic Value</i>	<i>Strategic</i>	<i>Non Strategic</i>
<i>High</i>	• Insource	• Harvest
<i>Low</i>	• Insource	• Outsource

Figure 2 – Economic Value and Strategic Role Matrix

**3. CASE STUDIES**

Dynamic examples of evolution in the supply chain of companies can be seen in several regions. Specifically this work studies the transformations in the supply chain of large tractors manufacturing company situated in the Sao Paulo state (Company A) and of a large

Italian multinational company of the apparel sector (Company B). The companies will not be identified, due to the nature of the study being conducted. These studies have the intention to serve as subsidize for the research of the author of this work. Therefore, this work indicates directions that will be followed with the research. As follow, will be discussed the implementations of actions toward a shift in their respective supply chains.

### **3.1 COMPANY A**

The company was founded in United States about 1890, when two inventors experienced several forms of steam moved tractors for use in the agriculture. In 1955, the corporation realized its second investment outside of the United States, acquiring an area in the city of Sao Paulo, where built its first factory in Brazil and there, in 1960, began manufacture equipment. In 1973, the company acquired an area in the interior of Sao Paulo state, where began function in 1976 its second factory. From that date initiated a slow movement toward outsourcing of the productive activities. In 1993 his industrial and administrative operations in the unit of the interior consolidated all operations objecting simplify process and reduce costs, to increase to competitiveness of his products in the world. About 2000, the corporation developed a general strategy. The Brazilian business unit visualized four big challenges to for the strategy implementation: the flexibility improvement, higher velocity, low materials cost and higher quality. The main search was the flexibility improvement. The mission was summarized in offer the best conditions for clients, supplying specialized and recognized superior products - services and the capacity of react quickly to the changing necessities of clients. The company visualized that should be improved the performances of delivery and at the same time speed. To develop this strategy was necessary increase the relationship with the supply chain and work jointly with suppliers for the reduction of the

lead-times. In second place, the materials costs should reach and be maintained in world levels. In third place, the quality should be maintained on the basis of a productive chain with world performance class. Initially the company carried out a restructure of the supply chain. This restructure consists in simplifying-reducing the productive chain with the objective of improve efficiency. Two essential objectives for this supply chain restructure are: 1) segmentation of productive activities, allowing the company to liberate and direct the resources and competences for better a better response to the competitive challenges; 2) work with a few number of suppliers in the short term, enabling the increase of business volume with those selected suppliers that was integrated to the system. The supply chain strategy necessarily passed for a supplier's development. In this strategy was desirable that suppliers produce in world quantities. Predominantly, the suppliers were eliminated and not become sub-suppliers. Regarding product quality, was required also the suppliers certification by the quality system of the company. While reduced supply base, the company initiated a consolidation phase with the remaining suppliers. The consolidation of supply chain is defined like a deepening and straiten in the relations with suppliers. This signified that the old adversarial relations were necessary become more cooperative. The suppliers that remained with the company after 1996 had an increase, in the majority of the cases, of the business volume. The company stayed more attractive for the remaining suppliers which resulted to supply a better service, attending the performance and investment demands of the company. This enabled that the company demands increased, mainly in the capacity of support requisitions variations, new investments, the delivery of higher quality and the capacity of fulfill terms. Clearly is show, how interdependence are the actions between the company and their suppliers. Had also an increase of the dependence from the company to the suppliers. Not always the company has product requests that justify the main part do the production, in this way part of production is manufactured attending the forecasts. If the

company follow the tendency to produce attending to requests, flexibility on the part of their suppliers becomes crucial. When the company opted to outsource part of production, the company also opted for become dependent in the competence of others. Some years after initiated the Supply Chain Management process, the company propose the purchase of the main material supplier. However, the company decides that the supplier should not be incorporated by company. This maintenance of supplier's independence had the objective to keep the costs reduced and avoid the loss of flexibility inherent to the large bureaucratic organizations.

### **3.2 COMPANY B**

The Company Group, is a garment producer and retailer based in Italy, has approximately 5,500 shops in 120 countries, 7,000 employees, manufacturing facilities worldwide and annual revenue of more than \$1.8 billion (Camuffo et. al, 2001).

In the 1980s, the company's tremendous growth with innovative marketing campaigns and outstanding financial performance and innovative strategies were captivating the press, scholars and practitioners around the world. For many years, it was the archetypal example of the network organization — that is, an organization based on outsourcing, subcontracting and, more generally, on relationships developed between a large company and several small producers and distributors, or both (Signorelli & Heskett, 1989).

Several factors contributed — and, to some extent, continue to contribute to the company success. First is their innovative operations-management technique, such as delayed dyeing. Second is its network organization for manufacturing. Networks of subcontractors (mainly small and midsize enterprises, many of which are owned, completely or partly, by former or current company employees) supply the company factories. That structure has lowered

manufacturing and labor costs, has reduced its risk (which shifts to its suppliers) and has given it unbeatable flexibility. Third is the network organization for distribution: the company distributes its products through agents, each responsible for developing a given market area.

If want to remain competitive in the new global arena, the company believe that it must have firsthand contact with the end customer, respond in real time to market changes and find new ways to ensure direct control over the supply chain (Camuffo et. al, 2001).

The company is retaining its network structure but is changing the nature of the network. Whereas its main competitors have stuck with outsourcing, the company is moving on vertical integration and centralization. The company is intending that it can remain flexible and achieve a high level of performance with more complex network architecture (Camuffo et. al, 2001).

Globalization also affects manufacturing, causing companies to bring certain operations in-house (in order to maintain control over the supply chain and to take advantage of economies of scale) and to relocate production abroad to take advantage of cost differentials, particularly for labor.

For its part, the company used to outsource the labor intensive phases of production, such as tailoring, finishing and ironing, to small and midsize enterprises (SMEs) located mainly in northeastern Italy. However, the company always kept in-house any strategic activities and operations that required heavy investment (weaving, cutting, dyeing, quality controls at entry and on finished goods, quality control of intermediate phases and packing).

However, in the apparel industry, time compression does not depend so much on the tailoring phase as on the supply of raw materials. Therefore over the years, the company has gradually increased upstream vertical integration to consolidate its textile and thread suppliers. Today, Benetton's main supplier of raw materials — which guarantees that it will provide 60% of the woven fabric, 90% of cotton knit fabric and 90% of carded and combed wool — is 85%

controlled by the company itself. Both upstream vertical integration and partnership relationships with external suppliers have made it possible for the company to exerted control over the quality and flexibility (Camuffo et. al, 2001).

#### 4. THE SUPPLY CHAIN ARCHITECTURE DESIGN MODEL

Our live is changed by time. Usually, time is seeing has dichotomy of nature history. This vision as an uninterrupted cycle of vertical and horizontal industries is a dichotomy vision. History is sequence of irreversible events that not repeat. Each moment is in a distinct place in a time series. This dichotomy is, maybe, to simple to explain the richness of the events. The Figure 3 suggests that if you look at the upper side, you only can see two dichotomy positions, vertical and horizontal, but if you look in more detail, time works as a spiral that never came back at the point of departure.

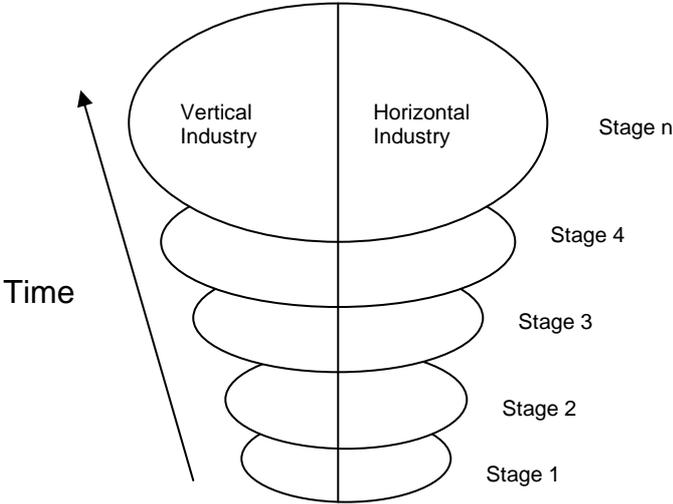


Figure 3 – Industry time spiral

The proposed theoretical framework in this study (see figure 4), enables more detailed vision of the possible phases of evolution of the supply chains.

	<i>Vertical Industry</i>	<i>Horizontal Industry</i>
<i>Integrated /Centralized</i>	<ul style="list-style-type: none"> <li>• A large parcel of the value chain is owned by the company;</li> <li>• Components are produced inside the company.</li> </ul>	<ul style="list-style-type: none"> <li>• A large parcel of the value chain is not owned by the company;</li> <li>• Strong electronic, cultural, geographical and organizational ties with suppliers.</li> </ul>
<i>Disintegrated /Decentralized</i>	<ul style="list-style-type: none"> <li>• A large parcel of the value chain is owned by the company;</li> <li>• Components are produced outside the company by organizational controlled suppliers.</li> </ul>	<ul style="list-style-type: none"> <li>• A large parcel of the value chain is not owned by the company;</li> <li>• Weak electronic, cultural, geographical and organizational ties with suppliers.</li> </ul>

Figures 4 – Supply Chain Architecture Design Model

The integrated or centralized horizontal industry has a characteristic of that a large parcel of the value chain is not owned by the company, who supplies their needs with external companies. The company in this square has strong geographical (as proximity), cultural (values, language), electronic (EDI-Internet links) and organizational (representatives in the plant) ties. The company doesn't need to have all this characteristics to be rolled in this quadrant, but is expected strong ties in some of them. A company in this stage advanced in the supply chain management practices with suppliers. The horizontal disintegrated or decentralized industry has like characteristic also that a large parcel of the value chain is not

owned by the company. Weak electronic, cultural, geographical and organizational ties with suppliers, characterize commercial transactions without the advance in the relationship with those. The vertical integrated or centralized industry is similar to the concept the vertical integration, where a large parcel of the value chain is owned by the company. Most part of the economic value is generated inside the company. There is a homogeneous culture from the company as a whole. The disintegrated or decentralized vertical industry has like characteristic that a large parcel of the value chain is owned by the company and components are produced outside the company by organizational controlled suppliers. These suppliers have their own culture and are allowed to seek other markets to sell their products. The objective of this situation is to keep the costs low, improve control and avoid lost of flexibility.

The Double Helix model is not considering that intermediate period of transformation by which the companies A and B that advanced in the horizontal integration and now were initiating a process of verticalization. That verticalization would not be the same of the previous vertical integration of the past as the Double Helix Model suggests. There would be a return to vertical integration, but to a peculiar form.

As example A, when the company was verticalized, most of the value chain was manufactured inside the company installations. After an intense process of outsourcing, the supply chain assumed a horizontal form, with most of the parts being manufactured by external suppliers. Subsequently it initiated a process of integration with their supply base, being an integration with geographical (suppliers proximity), cultural (meetings between representatives, visits), electronics (EDI, Internet) and organizational (quality systems) characteristics. The main motivator for that horizontal integration was the possibility of competes in Flexibility (of mix, volume, delivers and product/service). Accordingly to the Double Helix model there were pressures for a new vertical integration occurs, however,

companies would not be able produce internally their needs without a certain loss of Flexibility, and with higher costs. The solution found by these example companies would be the acquisition of these suppliers, but without a total absorption by the original company manufacturer of the product. If that occurred, the implication was the explained above. The better solution would be obtain control, but without the loss of identity in the supplier in way to preserve the flexibility conquered. With time there would be absorption from the company bought by the original manufacturer of the product, and the prediction of the Double Helix model would be confirmed, but not contemplating the intermediate phase called disintegrated or decentralized Verticalization.

## **5. CONCLUSION**

The value net project of a company was seen traditionally as a static activity with the assembly of a fixed number of suppliers and distribution channels to initiate and maintain the competitive advantage. But the rhythm of the changes in technologies and in markets did that approach obsolete. The competitive advantage should gained repeated times, and that requires the continuum disintegration and integration of organizations. Only with continuous change of company's resources, is possible to obtain the temporary competitive advantage.

The dichotomy vision as an uninterrupted cycle of vertical and horizontal industries is too simple to explain the events in these industries. This research proposes a more detailed vision of these cycles and suggests that should be study in more detail the changes that the supply chain passes.

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