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STRATEGIES AND INTEGRATED COMPETENCIES IN SUPPLY CHAIN MANAGEMENT OF THE AUTO INDUSTRY

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INTRODUCTION

During the last decade the competition in manufacturing has increased in all of the industrialized regions of the globe and today, even for the current leading or lean organizations, it is not possible to assure a long term solid position in the marketplace. External and internal discontinuities and the increasing expectations of customers and stakeholders continually threaten established market positions and also create new territories for achieving competitive advantages. In this context, Supply Chain Management (SCM) has been recognized as a new major forefront for effective competition.

Today the corporation's supply chain represents a complex array of business processes, decisions, partnerships and resource commitments that should be viewed in a strategic way, beginning with the customer's needs, and culminating with its fulfillment. Therefore, companies should make compatible their corporate strategies with the ones for the supply chain that they belong to, considering the many implications towards a successful SCM.

Together with the recent growth of interest concerning the SCM, the interest about several strategic decisions embraced by the SCM has increased. For some authors, the alignment of

corporate strategy of a company and its SCM strategy is a critical factor in the company's success. The corporate strategy should drive the SCM strategy and, on the other hand, the SCM strategy should support the corporative strategy. There should be an alignment between each company's supply chain strategies with the ones of its supply chain partners. This alignment should be obtained by involving the supply chain members in order to establish common goals along the entire chain.

In this context, this article presents two basic purposes:

1. to provide a review and analysis about the contemporary concept of SCM strategy, focusing on the automotive industry, and
2. to provide a review and analysis concerning to the development of new competencies along the supply chains in the auto industry, mainly to support its SCM strategies.

The analysis presented in the article is based on relevant contributions to the theme provided by the related literature illustrated and enriched by examples obtained in automotive plants in Europe and in Brazil.

A basic conclusion from the article is that the definition and revision of a company's SCM strategies and its implications in the company's supply chain competencies is becoming a frequent subject within the agenda of those professionals responsible by the SCM in the auto industry.

The article first describes briefly SCM and then it introduces the current supply chain competition logic and analyses the supply chain strategies. The effects in the automotive industry and two case studies are presented and analyzed next. The last section sets out the authors' final remarks and conclusions.

SUPPLY CHAIN MANAGEMENT

According to Lee (2001), the 70's have often been viewed as the decade of quality improvement when companies began to invest heavily in quality improvements, and Total Quality Management became a buzzword. In the 80's, with quality becoming a given practice, the competitive landscape shifted to lean manufacturing, focusing on concepts such as just-in-time, flexible manufacturing, and zero inventory, in order to achieve manufacturing excellence. In the 90's, market globalization, shortening product life cycles, and the disintegration of many industries created the race to improve the supply chain.

In this direction, new practices in SCM have been recently implemented worldwide in an attempt to simplify and improve the supply chain effectiveness. This has been conducted in a competitive context characterized mainly by the consolidation of a globalized economy and the existence of a new set of competitive needs, which have introduced new barriers and standards for competition (i.e. customized products, environmental questions, rapid development and delivery of new products, conciliation of higher quality with lower price, etc.). This environment

of hyper competition has demanded a clear definition of company focus and priorities, as well as the development and maintenance of distinctive competencies in the whole supply chain.

SCM can also be understood as an upgraded extended and holistic vision of the traditional material management embracing the entire supply chain in an integrated management approach. It presupposes that companies must redefine their competitive and functional strategies with regard to their position (as suppliers and/or customers) in the supply chain in which they are inserted.

The basic objective of SCM is to maximize the synergy among all the parts of the supply chain in order to serve the end costumer more effectively, either by reducing costs or by enhancing value. In order to reach this purpose, companies have search to align and join distinctive competencies in the entire supply chain. From this perspective, competition is currently being focused on supply chains, instead of on companies. In other words, this means a change of competitive model to a "virtual business unit" model and this virtual network can provide many of the benefits of vertical integration without the losses in cost and flexibility. It is essential that the participant business units (companies) establish a strategic alignment including the business goals along the whole supply chain, in a consistent and integrated way. This means that it is necessary to focus on the supply chain core business through the correct determination of the business unit's core and integrated competencies. This implies a new configuration for the relationships among supply chain members to allow these companies to integrate SCM capabilities from their upstream and downstream connections.

It is notable that SCM has attracted much attention from both the academic and the business sectors in recent years, but the concept has sometimes still been interpreted as a synonym of Logistics, which is inaccurate, for the scope of SCM is clearly far broader than that of Logistics. According to Cooper et al. (1997), leading corporations implementing state-of-the-art SCM understand it to encompass more than Logistics, that is, SCM partnerships involve more processes and functions than does integrated logistics management. In fact, SCM embraces new practices, such as ESI (Early Supplier Involvement) and new systems, such as CRM (Customer Relationship Management), which clearly extend beyond the natural scope of Logistics. It is possible to state that SCM is a contemporary and, basically, a strategic approach to overall manufacturing management and has given rise to interesting innovations in most companies around the world. It can be noted that SCM is the holistic integration of the business process through the demand chain, and that its purpose is to meet end customer requirements more effectively. Many companies that are leaders in SCM performance have maximized the synergy among all the elements of the demand chain either by reducing their costs or by enhancing the value of their products. To achieve this goal, many companies have sought to align and join different competencies throughout the demand chain (Pires, 1998).

Effective SCM practices have been implemented worldwide in an attempt to simplify and improve supply chain efficiency. Positive results have been attained by:

- Restructuring and consolidating the supplier and customer base. This generally means reducing the number of and deepening the relationship with a group of companies willing to develop a partnership aimed at achieving a synergetic result. For example, the Modular Consortium implemented by Volkswagen and seven module suppliers at

its new truck and bus chassis plant in Resende, Brazil, has quickly become a benchmark for radical outsourcing practices, involving major restructuring and consolidation of the supply chain (Collins et al., 1997; Pires, 1998).

- Sharing information and integrating infrastructure with customers and suppliers. This allows for just-in-time and just-in-sequence deliveries and lower inventory levels, and is based on the joint use of systems such as EDI (Electronic Data Interchange) and ECR (Efficient Consumer Response) by suppliers, customers, and logistics operators. The practice of keeping in-plant representatives at the customer's facilities has resulted in a better balance between the customer's needs and the supplier's production planning.
- Finding joint solutions to problems and involving suppliers from the beginning of new product development, based on practices such as ESI (Early Supplier Involvement).
- Aligning the company's competitive strategy and general performance with the reality and goals of the entire supply chain.

It should be noted also that all the new SCM practices have been implemented in a competitive context characterized by a consolidated globalized economy and a new set of competitive needs, which have introduced new barriers and standards for competition (e.g., customized products, environmental constraints, fast development, obsolescence of old and introduction of new products, demands for higher quality coupled with lower prices, etc.). This context has forced companies to clearly define their focus and priorities, and to develop and maintain distinctive competencies within the product demand chain.

SUPPLY CHAIN STRATEGIES

The current supply chain competitive model

The high degree of competitiveness and turbulence predominating today in the business environment has significantly augmented the strategic importance of good management in every type of organization.

Since the early 1980’s, the management of many manufacturing companies has been based on the model that establishes three basic levels of strategy, i.e., corporate strategy, competitive strategy and functional strategies.

From the manufacturing standpoint, corporate strategy has usually focused on business diversification, business profitability and business synergies within the corporation.

From the standpoint of competition, companies have often adopted Porter’s (1980) concept of competitive advantage, which focuses on competition among individual business units. The two basic and mutually exclusive strategies proposed were cost leadership and product/service differentiation. According to Porter (1980), companies should avoid practicing these two approaches simultaneously in the same business so as to avoid getting stuck in between.

Functional strategies lie on a functional level, such as manufacturing, finance, marketing, research and development.

The SCM clearly has a wider strategic scope and is based on a competitive model that differs significantly from the traditional form of competition among business units, such as that proposed by Porter (1980).

Porter's model is based on the logic that competition is established between isolated business units and/or isolated companies. Recently, one of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. Business management has entered the era of inter-network competition. In other words, instead of brands versus brands or store versus store based on conventional business units, it is now suppliers-brand-store versus suppliers-brand-store, or supply chain versus supply chain (Lambert and Cooper, 2000; Cristopher, 1992; Pires, 1998).

From the standpoint of SCM, competition currently focuses on productive chains rather than on companies, which means a shift in the competitive model from the "conventional business unit" to a "virtual business unit" model. This "virtual enterprise", created along the productive chain, aims to gain many of the benefits of vertical integration without its traditional losses in cost and flexibility (Vollmann & Cordon, 1996). It should be kept in mind that the basic objective of SCM is to maximize the synergy between all the parts of the demand chain, either by reducing costs or by enhancing product value, without becoming stuck-in-the-middle, as the above-described model proposed by Porter (1980) suggests.

According to the supply chain competitive logic, companies must refocus their efforts away from conventional business units paradigms, centered around transaction management and parochial performance metrics, toward strategies that recognize that to achieve competitive advantage companies must work together across enterprise boundaries and should optimize and integrate the supply chain business processes and innovative capabilities that preempt the competition and open whole new areas of competition space (Ross, 1998).

In this emerging competitive environment, the ultimate success of the single business will depend on management's ability to integrate the company's intricate network of business relationships. Increasingly, the management of multiple relationships across the supply chain is being referred to as SCM. Strictly speaking, the supply chain is not a chain of business with one-to-one, business-to-business relationships, but a network of multiple business and relationships. The SCM offers the opportunity to capture the synergy of intra and inter-company integration and management. In that sense, SCM deals with total business process excellence and represents a new way of managing the business and relationships with other members of the supply chain (Lambert et al., 1998).

The introduction or consolidation of the supply chain competitive logic has been essential to achieve a supply chain competitive advantage. According to the Global Supply Chain Forum, SCM is the integration of key business processes from end user through original suppliers that

provide products, services and information that add value for customers and other stakeholders (Lambert and Cooper, 2000).

Effectively managing supply chains means that companies must create market-winning partnerships with other companies that promote the competitive advantage of the whole channel system. They must also know how to utilize technology to coordinate internal activities with those of their trading partners. Networking information and synchronizing the capacities and resources to be found in each channel node permit the exploration of new regions of competitive space and unassailable market leadership (Ross, 1998).

Within the supply chain competitive logic, the supply chain's performance regarding the final customer depends on the contribution and the role of each member of the chain. Thus, a corporation should fully understand and advance its supply chain contribution so that its performance in the chain could add value to the final customer.

The SCM plays here an integral role in achieving the alignment between the corporate and supply chain strategies because it spans the key corporate functions as well as the links with the company's suppliers and customers (Evans and Danks, 1998). For many companies, the redefinition of managerial focus underlined by the development of new technologies have established a supply chain logic since the potentiality to generate competitive advantage is not anymore bounded within the limits of a single company, but between the companies that belong to the same supply chain. To achieve this competitive advantage, companies need to implement the SCM logic and to extend their corporate vision and respective strategies beyond the company's four "walls", establishing supply chain strategies with a SCM approach. Within this scenario, many companies recognize today the importance of incorporating supply chain strategies with a holistic view of their chain into their overall planning process. Managers in companies across their supply chain take an interest in the success of the other companies. They work together to make the whole supply chain competitive. They have the facts about the market, they know a lot about competition, and they coordinate their activities with those of their trading partners. They use technology to gather information on market demands and exchange information between organizations (Lummus *et al.*, 1998).

Supply chain strategies

Although there are different definitions of strategy, it is usually accepted that the term strategy is concerned to the direction and scope of an organization over the long term: which achieves advantage for the organization through its configuration of resources within a changing environment, to meet the needs of markets and to fulfill stakeholders expectations (Johnson and Scholess, 1999).

As pointed earlier, corporate strategy has usually focused on business diversification, business profitability and business synergies within the corporation. The corporate strategy also concerns to the definition of the main policies and plans for achieving the company's goals. This strategy determines the different business where the company will act, the allocation of corporate resources to each of these business, the type of economic and human organization the company expects to be, and the nature of the contribution it intends to make to its shareholders, employees,

customers and communities. Every activity taking place in the company should be linked to its corporate strategy, if not, it should be banished (Andrews, 1984; Watts *et al*., 1992).

The development of supply chain strategies takes place after the definition of the corporate strategy and they play today an important role to support and to achieve the corporate strategy's goals. From these high level goals, a set of detailed objectives can be developed for each business process within the supply chain establishing supply chain goals. This cascading method helps integrate the supply chain processes with the overall enterprise direction and provides measures for monitoring and execution (Lummus *et al*., 1998).

The goal of integrated supply chain strategy is to create manufacturing processes and logistics functions across the supply chain as an effective competitive weapon that cannot be easily duplicated by competitors (Tan, 2001). The article's authors extend this definition to the creation of functions that can improve not only manufacturing processes and logistics functions but also all the others supply chain business processes. This can be represented by the development of integrated supply chain capabilities.

The development of these capabilities is an important part of a company's supply chain strategy. Within this, companies are integrating additional capabilities from their immediately adjacent upstream (first tier suppliers) or downstream (first tier customers) supply chain companies via joint marketing arrangements, joint product development programs (Early Supplier Involvement), collaborative initiatives such as Just-in-Time (JIT), Just-in-Sequence (JIS), Vendor Management Inventory (VMI) and Collaborative Planning, Forecasting, and Replenishment (CPFR), supplier and customer involvement in critical decisions, supplier integration (Electronic Data Interchange, EDI), supplier co-location (supplier and industrial parks), among others (Rice and Hoppe, 2001). This concerns not only to the internal supply chain cost and service capabilities but also to the chains network design.

Developing a supply chain strategy is predicated on understanding the elements of sourcing strategy, information flows (internal and external), new product co-ordination, concurrent procurement, teaming arrangements, commodity/components strategies, long-term requirements planning, industry collaboration, and staff development (Khalfan *et al*., 2001).

It is important to emphasize, "one shoe size doesn't fit all". Companies and supply chains differ in their business strategies and value propositions. A supply chain that has a low cost value proposition should not unduly emphasize flexibility and responsiveness metrics, since they could detract from that chain's fundamental competitive strategy. Similarly, one that innovates technology should not unduly emphasize cost factors, since they could detract from that chain's strategy. It is critical that the specific metrics chosen (and target goals along those metrics' dimensions) should align with the chain's business, product strategy and value proposition. Hence, if the strategy used is to be low-cost, then the relevant metrics could be cost, capacity utilization, labor productivity, information accuracy, etc. If the strategy is to be flexible and responsive, then the relevant metrics could be order response time, order change flexibility, product mix offerings, re-planning times, and expediting capabilities (Hausman, 2001).

A taxonomy of supply chain strategies

In spite of being an important research object with an increasing appearance in the literature, the term "supply chain strategy" has not been used with the same meaning among different articles. Authors use different perspectives to identify these strategies and to group them into a formal classification. This section presents briefly some of these papers.

Kopcazk and Lee (1995) identified seven supply chain strategies (regional approach, local approach, logistics partnerships, vertical integration, development of the distribution network, postponement, and establishment of local factories) adopted by many companies in the Asia Pacific Region in order to attend global challenges like product variability, logistic inefficiency and information distortion. This work focused on these challenges concerning different chains and addressed supply chain strategies developed by companies to face them.

Looking under the light of a logistic perspective, there are three essential supply chain strategies a company should make toward satisfying customer service goals in terms of products, logistics services, and information systems (adapted from Ballou, 1999, in Min and Keebler, 2001). The first is the inventory strategy, which is responsible for forecasting, storage fundaments, inventory decisions, purchasing and supply, scheduling decisions and storage decisions. The second is the transportation strategy, which is responsible for transport fundaments and transport decisions. The third is the location strategy, which is responsible for locations and the network planning process.

Frohlich and Westbrook (2001) define five supply chain strategies under the perspective of the arc of integration between upstream suppliers and downstream customers: inward-facing, periphery-facing, supplier facing, customer-facing, customer-facing and outward facing. In the inward-facing supply chain strategy, the integration level is very low and companies work as an isolated business unit, while in the periphery-facing strategy this integration in a little bit broader but still too low for SCM goals. In the outward-facing strategy the companies develop their activities intensely integrated to the rest of the chain with a complete SCM view, while in the customer facing strategy this integration is focused on the companies' downstream connections and on the suppliers facing strategy the integration is focused on the companies' upstream connection. This work evidences that the widest degree of integration with both suppliers and customers had the strongest association with the performance improvement.

A broader view of supply chain strategies can be obtained in Evans and Danks (1998). They divide these strategies into four key dimensions:

1. Sourcing strategy: determines where and how products are made. It has a significant impact on the company's product and service cost structure and associated risks. The formulation of a sourcing strategy requires consideration of make or buys decision (which products/components should be manufactured and which should be purchased?), capacity management (where should plants and suppliers be geographically located and what capacity should exist at each?), and manufacturing management (how should production be organized and managed?).
2. Demand flow strategy: defines the linkage between the company's customers and the sources of the products and services that the firm provides to the marketplace. There

are three elements to formulate a company's demand flow strategy: demand planning (what level of production and inventory should be maintained to meet customer demand?), channel design (what channel structure meets customer expectations most profitably?), and supply chain configuration (what is the optimal number, role, location and linkage of each supply chain member?).

3. (3) Customer service strategy: deals with how the firm responds to the need and expectations of its customers in a manner that maximizes profitability. Formulating a customer service strategy involves addressing three steps: revenue management (how should we respond to customer expectations to maximize market share and/or pricing margins?), customer service segmentation (what levels of service does each customer segment expect?), and cost-to-service (what is the cost of responding to the service expectations of each customer segment?).
4. (4) Supply chain integration strategy: establishes the degree of integration of a company's information, finances, operations and decision making with those of the participates in the company's supply chain, including retailers, wholesalers, dealer, distributors, manufacturers, suppliers and supply chain services providers. The answers to three questions form the foundations of a supply chain integration strategy: to what degree should the firm integrate across its supply chain; what types of supply chain integration are required, should supply chain integration be pursued "physically" or virtually.

Core competencies and capabilities

During the last decade Gary Hamel and C.K Prahalad published a series of articles on core competence at the Harvard Business Review and the concept quickly became an important subject within the context of the supply chain strategies.

Vollmann (1996) stated that these authors define core competence as the collective learning in an organization, especially understanding of how to coordinate diverse production skills and integrated multiple streams of technologies. Hamel & Prahalad (1990) identified core competence as having three basic elements, that are, (1) it provides potential access to a wide variety of markets, (2) it makes a significant contribution to the values that customers appreciate in the products and services, and (3) it is difficult for competitors to imitate. Then, a basic question to identify core competences are "what makes you different from your competitors?"

Another interesting question is that competencies and capabilities can be differentiated. Stalk et al. (1992) pointed out that competencies and capabilities represent two different but complementary dimensions for an emerging subject for corporate strategy. Both concepts emphasize behavioral aspects of strategy in contrast to the traditional structural model, but core competence emphasizes technological and production expertise at specific points along the value chain, while capabilities are more broadly based, encompassing the entire value chain. In this context, capabilities are visible to the customer while core competencies rarely are. For instance, customer can see the capability of a company in developing and delivering rapidly new products (time-to-market) but cannot see its core competence in simultaneous engineering that provide this capability.

Vollmann (1996) states that a competence is the ability to integrate technical, managerial, and other expertise with capabilities, processes and knowledge, with a more strategic than operational focus and enabling specific strategic responses. Examples include information management to support customer partnership developments, joint ventures management to better integrate a new business concept, and simultaneous engineering to speed time-to-market. On the other hand, capability can be defined as the accumulated skill, know-how, learning and culture associated with integrating and operating particular processes to obtain synergies, with a more operational than strategic focus. In this case examples include managing partnerships with customer and suppliers, operating manufacturing planning and control systems, and innovation in products and processes.

THE SUPLLY CHAIN STRATEGIES IN THE AUTOMOTIVE INDUSTRY

Supply chain strategies and its general implications in the automotive industry

The presence of common or overlapping suppliers in the supply chain of the automotive industry limits its ability to source unique capabilities and complicates the task of aligning business strategies and sharing information. The automaker plays an important role in this chain, acting many times as the channel master by coordinating the chain's processes and activities. In order to achieve supply chain mastery, automakers have redefined their strategy making supply chain capabilities the core of the business model (Copacino and Byrnes, 2001). This requires both creating new strategies and bringing the company's core activities into alignment with this new business model. All of these activities have a strong influence in the success among a supply chain competition and have been recently considered in the automaker corporative strategy. Many automakers have managed to increase their own performance and the one from their supply chain by employing supply chain strategies and combining them with the holistic view of SCM.

Although the scope of SCM has been across firms of the whole chain, this management logic is usually firstly implemented in parts of the chain, normally done by the stronger member. Great improvements have been accomplished in the automotive industry leaded by the automakers and implemented mainly with their auto-part suppliers as a result of the establishment of the supplier facing supply chain strategy (Frohlich and Westbrook, 2001). In spite of the wider degree of integration done mainly between the automakers and their upstream connections, the development and integration of supply chain capabilities are guided by the final customer desires, aiming the "build-to-order" manufacturing strategy instead of the traditional "make-to-stock" of mass production. This pull system targets a shorter customer order cycle and higher flexibility within supply chain activities.

The speed of the customer order cycle determines the amount of buffer stock required to meet the demands of customers unwilling to wait more than the two weeks usually regarded as acceptable for a vehicle. Since the scope of customer order goes from the dealers through sales and marketing to production, then back through distribution to the dealers again, managing all the resource constraints on the way, it is a fearsomely complex process. Redesigning this process along pull-based lines requires a complete rethink of all the existing roles, relationships, behaviors, responsibilities, incentives and systems support at every point. Ultimately the

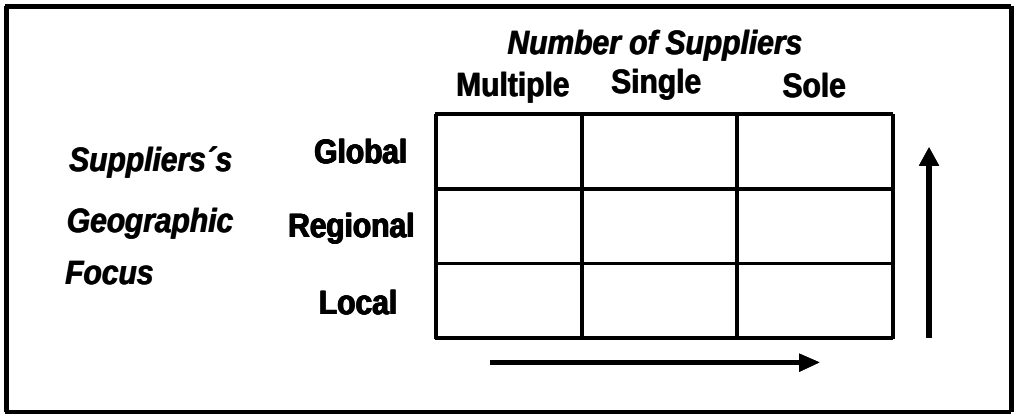
rethinking must extend right back to product design and development where significant contributions can be made to manufacturing flexibility and new possibilities can be created for customizing vehicles as close as possible to the point of sale (Reynolds and Eisenfelder, 1998).

The next section of the article will focus on the description of some models and frameworks developed with the purpose of explaining the transformations that have guided the supply chain strategies in the auto industry. Three models and / or references concerning the supply chain strategies were choose to illustrated the analysis provided by this article.

The supplier profile matrix

The supply chain strategies can be discussed and illustrated by the "supplier profile matrix", a conceptual model developed by Collins et al. (1997) to explain the options of supplying relationship in the automotive industry. The model exhibited in Figure 1 illustrates nine different options in the supplier-customer relationship, concerning the geographic focus (rows) and the number of suppliers involved in the partnership (columns).

Figure 1.- The supplier profile matrix (Collins et. al, 1997)



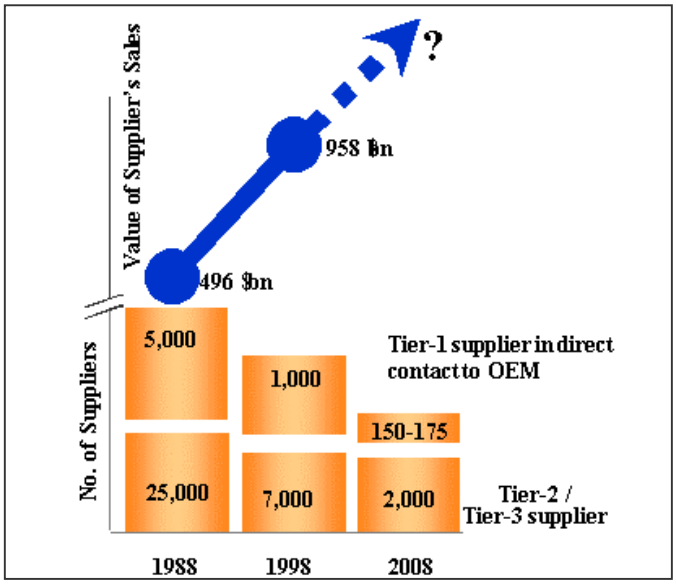
It is important to note in the model that the "single" case means that the customer has more than one qualified supplier, but decides to buy from only one, while in the "sole" case the customer has just one qualified and exclusive supplier. This movement from "single" to "sole" position clearly represents a growth in the commitment of partnership. The arrows illustrate the current tendency moving partnerships towards the "sole-global" position, which has been leveraged mainly by the global sourcing and follow sourcing policies.

The new automotive supplier's scenario

The competitive environment in the auto-parts business intensified significantly in the early and mid-1990s, as vehicle manufacturers increased their efforts to reduce the numbers of suppliers. By the end of the last decade, the number of auto-parts manufacturers delivering direct to each vehicle manufacturer have been reduced significantly.

The decrease in auto-parts supplier numbers did not mean that large numbers of companies simply went out of business through lost orders, although a few did. The majority was compelled to accept an adjustment in their position in the supply chain. In effect they were relegated from the role of tier one supplier to that of tier two, or in some cases, tier three. The relative status of the different suppliers is illustrated in Figure 2. This shows not only the dramatic reduction in supplier numbers over the past ten years, but also forecasts that the number of tier one suppliers in direct contact with vehicle manufacturers will stand at only 150-175 companies by 2008. By that time, the suppliers in tiers two and three will number only 2,000. Another interesting feature presented in Figure 2 is the current and predicted values of parts supplied to vehicle manufacturers in Europe. This has increased dramatically from $496bn in 1988 to $958bn in 1998 and is projected to continue on this steep growth path. The majority of the value increase is attributable to the outsourcing by automakers. (Gormezano, 2000).

Figure 2.- Number of suppliers and their sales growth potential (European original equipment parts markes' association, CLEPA, in Gormezano, 2000)



The reduction in the number of autoparts suppliers and the growth of the value of their parts supplied are normally established according to the stairs of transformations, next model to be analysed.

The stairs of transformations

This model proposed by Collins et al. (1997) represent the different transformations required of suppliers and automakers as they move towards a 'sole-global' relationship position at the supplier profile matrix described previously at this paper. It was developed under the perspective of the current outsourcing movement in the auto industry.

On top of each stair step is described the activity being conducted while underneath is the goal to be achieve. To move from one stair up to the next means that suppliers must develop not only the competencies necessary to perform the particular activity, but also those necessary to improve the activity's performance as well, which means also learning how to do better things.

To climb the stairs, both partners need to agree on an agenda of improvement in order to create and maintain joint core competences at each step. Then, it is important to determine who to play with and what to play. This means having particular attention to the selection of partners, the correct linkage of competences, and the implementation of an agenda of improvement to climb up and also enlarge the stair steps.

The Table 1 illustrates the four steps of the stairs and its activities and goals towards the construction of a genuine partnership by both automakers and suppliers.

Table 1.- The steps of the Stairs of Transformations (based on Collins et. al., 1997)

Stair	Automaker		Supplier	
Step	Activity	Goal	Activity	Goal
1	Outsourcing	Cost Reduction	Assembly	Conformance
2	Infrastructure Simplification	Operational Focus	Logistics	Assembler Schedule Support
3	Competence Reconfiguration	Strategic Focus	Backward Integration into New Manufacturing	Functionality
4	Genuine Partnership	Virtual Integration	Design	Breakthrough Cost / Benefit

ANALYZING THE SUPPLY CHAIN STRATEGIES IN THE AUTOMOTIVE INDUSTRY

This section of the article has the purpose of analyzing recent cases within the automotive industry from the perspective of concepts and models focusing on supply chain strategies exposed earlier. Two cases will be briefly analyzed, one embraces Europe and the other Brazil.

Upstream logistics optimization in an automotive plant in Europe

A vehicle manufacturer located in Europe has included in its corporate plan the launch of a new model that should be available to the market in next few years in order to replace its current one. The development of this new model is considering not only the model by itself, but also an extended view of its supply chain. This extended view is considered an essential driver by the vehicle manufacturer towards a customer orientated product, achieving thus goals like reducing the customer order cycle to 10 working days and offering the customer a high range of choices/options that can be changed until 6 days before the vehicle is delivered from the plant. Within this extended view, the vehicle manufacturer identified areas where supply chain

capabilities could be improved and upstream logistics was pointed as very important to increase the chain's performance, and with this, the competitiveness of this new model. The Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) was invited to join the project team with the goal of optimizing the material flow among the vehicle manufacturer model's plant and its suppliers. This has involved IPA in decisions concerning the selection of supplier shipping points, the determination of purchasing quantities and inventory levels, the timing of supply flows, the space location, the necessary information required, and the selection of the transport methods.

The project involves not only the vehicle manufacturer but also their first tier suppliers and, sometimes, their second tier suppliers. In general the issues concerning the second tier supplier are just monitored by the vehicle manufacturer and the management is done directly by the first tier suppliers. Within this project, the vehicle manufacturer, here acting as a channel master, intends to integrate its logistics process with the ones of its main suppliers in order to improve many supply chain metrics like cost reduction, product and supply delivery reliabilities, and the responsiveness to demand, as the emphasis is flexibility. According to the project goals, key performance indicators have been established between the vehicle manufacturer and suppliers (like the lead time reduction for the supply of many components and the establishment of lower inventory levels base on some hours for Just in Time and Just in Sequence supply basis) as well as detailed work plans to meet these goals.

The project team is designing an integrated logistic network with a special attention to 50 components. A profound analysis was done for these 50 components considering variables like their volume, variants, price, location and reliability of the suppliers, and transportation risks in order to choose the right supply method (e.g. JIS, or JIT, or warehouse delivery with the sequence done by the vehicle manufacturer).

At this point, early supplier involvement (ESI) has been playing an important rule towards achieving the model's supply chain goal. The suppliers were involved in the process 25 months ahead the production, influencing many decisions within the new process, so that the new material flow planned could significantly reduce the customer order cycle with out increasing the shortness of supply risk and cost and making the whole process more flexible and reliable.

In spite of this ESI, the partnership between the vehicle manufacturer and its suppliers in this case is reaching the third step of the stairs of transformations with its main focus on upstream logistics. This process is implicating in a reduction of the numbers of the vehicle manufactures direct suppliers and, jointly with outsourcing activities concerning some components and mainly sub-assembly, is enhancing the value of the product of these suppliers.

The modular consortium of VW's truck and bus chassis plant in Resende

This plant that was inaugurated in November 1996, introduced into the automotive industry the innovative and as yet unique modular consortium model, which delegates the responsibility for the final on-line modular assembly of the vehicle, the operational investments, and the management of the module supplier chain to seven module suppliers. The automaker provides the facilities and is responsible for the coordination of the plant and for new product development, marketing, and final vehicle testing. Before the new plant became operational,

VW's truck and bus operation sourced its components from 400 suppliers. With the new plant, VW reduced the number of its direct suppliers to seven, and outsourced many of its activities to these first tiers suppliers, including the assembly of the final vehicle. This represents a new scenario for the automotive suppliers where there is a reduction in their number and a growth in the value of their parts supplied to vehicle manufacturers, as presented before in the paper.

The reduction in the supplier base led to some interesting situations, such as the case of the module supplier called Power Train, created by two traditional diesel engine competitors (MWM and Cummins) to supply VW's new plant. VDO, the traditional German supplier of speedometers and tachometers, implemented major expansions of its competencies in VW's Resende plant, becoming the body module supplier, and is responsible for 60% of the items that go into the assembly of VW's trucks (Pires, 2001).

From the supplier profile matrix standpoint (Figure 1), at Resende plant the module suppliers (first tier suppliers) have clearly moved from the "local-multiple" to the "local-sole" position, and their expectation for the future is move to the "global-sole" position, accompanying the automaker in new plants worldwide. This movement represented by the modular supply approach and implementation of pioneering modular consortium, has brought challenges and business opportunities for all the partners in the plant.

When the plant was inaugurated in November 1996, the automaker had 17% of trucks market share in Brazil and today it have approximately 30%, reaching a position very closed with the leader company. During this trajectory the truck and bus chassis became officially a business segment of the corporation, achieving another status instead of a business of the company in Brazil. For most observers it is clear today that if, in the near future, the automaker decides to construct a new plant to produce trucks and bus chassis in another part of the globe, probably most of the module suppliers in Resende will follow it and move the "global-sole" position.

Furthermore, it is important to not that the existence of a global-sole partnership do not means that all the relationship of the plant are conducted under this basis. Always it is possible to find a set of relationship embracing the others eight options of the supplier profile matrix.

From the stairs of transformations perspective, the Resende plant inaugurated with the automaker anxious for promoting a radical outsourcing of processes (embracing the assemble of vehicles) to reduce cost and implement a successful strategy based on the lower price. At that time, the module suppliers were challenged to assume quickly the vehicle assembly area to produce in conformance with the vehicle project specifications. Five years after the plant inauguration, it is possible to state that currently the partnership among the automaker and the module suppliers is reaching the fourth stair step, with the joint development of new vehicles and consolidation of the partnership. The break trough cost / benefit for module supplier such as VDO is clear. The company created a core competence supplying the automaker with the cab module which clearly aid it to recently became the cab supplier of GM at the new automobile's plant in the south of Brazil. Moreover, it is important to note that although the partnership in Resende has reached the last stage, there is still a series of subjects, concerning the three initial steps of the stairs, challenging both automaker and the module suppliers.

On the other hand, the concepts of competencies and capabilities have been part essential of the plant since its project stage. Most of the module suppliers were selected based on its background of core competencies. During the last five years they have constructed a productive system with core competence and capabilities in assembling vehicles conciliating a relative high level of flexibility with lower production cost. The customers and the competitors have watched mainly decreasing time-to-market, increasing volume of build-to-order vehicles and product prices commonly lower than the competitors.

FINAL REMARKS

Supply Chain Management (SCM) has been recently established and companies must now have a broader view of their business considering the supply chain of their product during the development of their corporative strategies.

Aligning the corporate strategy of a company and its supply chain strategy is a critical factor in the company's success. The corporate strategy drives the supply chain strategy, and the supply chain strategy enables the corporative strategy. It is also critical the alignment between each company's supply chain strategy with the ones of its chain partners. This last alignment can be obtained by involving the supply chain members in order to establish a chain's shared view and common goals (Evans and Danks, 1998).

In spite of different classifications, supply chain strategies generally concern to the integration and optimization of the supply chain business processes developing capabilities that generate competitive advantage in a way that cannot be easily duplicated by others supply chains competitors. This is normally obtained with SCM enablers like collaboration through partnerships, share of information through the chain's members using information technology, coordination of business processes activities with other members of the supply chain establishing a multi-functional structure along the chain, and establishment of common performance metrics for the supply chain.

The automotive case studies identified policies and plans established by automakers that included supply chain aspects in order to achieve their corporative goals. The cases where limited to automakers and their upstream connections but can be easily used to illustrate the current trend of establishing supply chain strategies in the contemporary automotive industry.

REFERENCES

Andrews, K.R., *The Concept of Corporate Strategy*. Irwin Publishing, 1984.

Ballow, R.H., *Business Logistics Management: Planning, Organizing, and Controlling the Supply Chain*. Prentice - Hall, 1999.

Cooper, M.C., Lambert, D.M. and Pagh, J.D., Supply Chain Management: More Than a New name for Logistics, *The International Journal of Logistics Management*, Vol. 9, No. 2, 1997.

Copacino, W. C. and Byrnes, J. L. S., How to become a Supply Chain Master. *Supply Chain Management review*. September / October, 2001.

Cristopher, M. *Logistics and Supply Chain Management.* London: Pitman Publishing, 1992.

Evans R. and Danks A., Strategic supply chain management. In: Gattorna J.L. (Ed) *Strategic Supply Alignment: Best practice in Supply Chain Management.* Gower Pub Co, 1998.

Frohlich, M. and Westbrook, R. Arcs of integration: an international study of supply chain strategies. *Journal of Operational Management*. Vol. 19, 2001.

Gormezano, K., Original Equipment Automotive Components. *Industry InfoNet*, 2000.

Hamel, G & Prahalad, C.K, The core competence of the corporation. *Harvard Business Review*, May /June, 1990.

Hausman, W.H., Supply Chain Performance Metrics, to be published in Corey Billington, Terry Harrison, Hau Lee, and John Neale (eds.) *The Practice of Supply Chain Management*, Kluwer Academic Publishers. Accepted on 14 December, 2000, not yet edited but downloaded from http://www.stanford.edu/group/scforum/ at 16:15hs 11/23/2001

Johnson, G. and Scholess K., *Exploring Corporate Strategy - text and cases*. Fifth Edition - Prentice Hall Europe, 1999.

Khalfan M.M.A., Anumba C.J., Siemieniuch C.E., and Sinclair M.A. Readiness Assessment of the construction supply chain for current engineering. *European Journal of Purchasing & Supply Management*, No 7, 2001.

Lambert, D.M., Cooper, M.C. and Pagh, J.D., Supply Chain Management: Implementation Issues and Research Opportunities, *The International Journal of Logistics Management*, Vol. 9, No. 2, 1998.

Lambert, D.M. and Cooper, M.C., Issues in Supply Chain Management, *Industrial Marketing Management*, 29, 2000.

Lee, H.L. Ultimate Enterprise Value Creation using Demand-Based Management. *Stanford Global Supply Chain Management Forum*, SGSCMF-W1-2001, September, 2001.

Lummus R. R., Vokurka R. and Alber K. L., Strategic Supply Chain Planning. *Production and Inventory Management Journal*, third quarter, 1998.

Kopczak, L. and Lee, H., Global Supply Chain Management: Challenge and Responses in the Asia-Pacific Region. *Stanford Working Paper*, September 27, 1995.

Min, S. and Keebler, J.S. The role of Logistics in the Supply Chain, in: Mentzer, J.T. (Ed) *Supply Chain Management*. Sage Publications, 2001.

Pires, S.R.I., New Productive Systems in the auto industry: the managerial challenges of automakers and suppliers at three new Brazilian plants. *Proceedings of the Ninth GERPISA Colloquium*, Paris, 2001.

Pires, S.R.I., Managerial Implications of the Modular Consortium model in a Brazilian Automotive Plant. *International Journal of Operations & Production Management*. Vol. 18, No. 3, 1998.

Porter, M., *Competitive Strategy*. New York, USA, Free Press, 1980.

Porter, M., Clusters and the New Economics of Competition. *Harvard Business Review*, November, 1998.

Reynolds M. and Eisenfelder S., Reconfiguring the automotive industry supply chain, in Gattorna J.L. (Ed) *Strategic Supply Alignment: Best practice in Supply Chain Management.* Gower Pub Co, 1998.

Rice J. B. and Hoppe, R. M., Supply Chain versus Supply Chain: The Hype and the reality. *Supply Chain Management review.* September / October, 2001.

Ross, D.F., *Competing through Supply Chain Management: Creating Market-Winning Strategies through Supply Chain Partnerships*, Chapman & Hall, 1998.

Scavarda L.F., Freese J, Hamacher S., Pires S. and Sihn W., The Transition from Multi-domestic to Global Supply Chain Operations in the Automotive Industry of Emerging Countries. *Proceedings of the Twelfth Annual Conference of the Production and Operations Management Society*, March/April, Orlando, U.S.A., 2001.

Stalk, G.; Evans, P. Schulman, L.E. Competing on capabilities: the new rules of corporate strategy. *Harvard Business Review*, March / April, 1992.

Tan, K.C., A Framework of Supply Chain Management literature. *European Journal of Purchasing & Supply Management*,. No 7, 2001.

Vollmann. T. & Cordon, C., Making supply chain relationship work, *M2000 Business Briefing*, IMD-Switzerland, No. 8, pp4-5, 1996

Vollmann, T. E., *The transformation imperative: achieving market dominance through radical change*, Harvard Business School Press, Boston, 1996.

Watts C.A., Kim K.Y., and Hahn K., Linking Purchasing to Corporate Competitive Strategy. *International Journal of Purchasing and Materials Management*. Fall, 1992).