HYBRID SUPPLY CHAINS IN EMERGING MARKETS: THE CASE OF THE MEXICAN AUTO INDUSTRY

M.G. Cedillo-Campos[1*] and **A. Pérez-Araos**

[1]Department of Industrial and Manufacturing Science
COMIMSA (National Council of Science & Technology), Mexico
gaston.cedillo@comimsa.com

[2]Department of Industrial and Systems Engineering
Tecnológico de Monterrey, Mexico
perez-araos@itesm.mx

ABSTRACT

A framework of analysis in order to analyse hybrid supply processes operating in an emerging market context is presented. A case study approach, based on abductive reasoning, is used with data collected through process mapping and interviews. The findings are that, under hypercompetitive conditions, the alignment between strategic and tactical sourcing strategies is a result of an integrative process of differentiated advantages that local suppliers can provide. Finally, it provides a detailed analysis of how supply networks and local conditions interact, about which only a small number of studies have been published.

OPSOMMING

'n Ontledingraamwerk vir hibriede voerkanaalnetwerke in 'n ontluikende markkonteks word voorgehou. 'n Gevallestudie word gevolg op grond van prosesuiteensetting en onderhoude. Die bevindinge is dat onder hipermededingingstoestande, die belyning tussen strategiese en taktiese bronstrategieë die resultaat is van gedifferensieerde voordele wat deur plaaslike leweransiers voorsien kan word. Laastens word 'n gedetailleerde ontleding van die wisselwerking tussen voerkanaalnetwerke en plaaslike toestande voorgehou.

[*]Corresponding author

1. INTRODUCTION

In a highly effective supplier integration process, the local business environment in which a plant is located becomes crucial for sustainable competitive advantage. This is mainly true in cases where firms have to face the complexity caused by dynamic interactions between local and global supply chain entities. In the new production systems, the capability to compete on time is leveraged by the sources of knowledge or key information that a firm needs to stay competitive. However, they are available outside the company itself. The evidence presented in this paper shows that firms have to achieve advantage by leveraging sourcing, taking into account the variety of linkages between OEMs and local suppliers. In fact, sourcing is a critical element for any supply chain in both manufacturing and service industries, as refers Benton [4], Monczka et al. [2] and Krause et al. [3].

The purpose of our work is to offer an analytical model that tries to serve as a tool in the identification of relational factors, articulating the dynamic competitiveness of an automotive cluster. It maintains that it is possible to generate economic benefits of a systemic nature, which, according to Dyer and Singh [4], can be called 'relational rent'. The systemic model proposed here is based on the ability to gain relational profits through the systemic articulation of the specific competitive advantages of each of the members in a supply network. According to Gereffi, et al. [5]:

> *the value chains are not static and they depend on the details of how interactions between value chain actors are managed.*

The right integration of competitive advantages is a fundamental part of the dynamic development of differentiation competencies. In fact, we argue that performance in a global supply chain can be leveraged through a hybrid process integration of local supply chain partners.

The rest of this paper is organised as follows. In the next section, the existing literature on the supply strategies used by the automotive participants when searching for a better competitive position in the market is discussed. Then we will discuss the methodology employed. The case study and the findings are presented first by developing and discussing a typology of supply strategies and their morphological differences, which are linked to the developed classification. Finally, conclusions and future work are presented.

2. LITERATURE REVIEW

This section reviews the literature, and presents a reference framework from a global perspective. The main objective is to understand the dynamic approach that automotive companies in Mexico are adopting in theirs supply strategies.

From a traditional point of view of plant location, competitiveness is a static matter. Only cost reduction, tariffs and tax incentives, production technologies or advantageous access to certain markets can provide economic benefits. Nevertheless, in an uncertain environment, this focus eliminates the competitive viability of supply networks in the long run. On the other hand, from a dynamic viewpoint, it is through innovation in different processes within the supply chain, and the capability for integrating different structures of production systems, that new and specific competitive capabilities can be created in the long term.

In reality, the competitive environment is a system with dynamic complexity. It results in a constant combinatory evolution that includes industrial systems and the local environment in which they are immersed. As argued Hamel and Prahalad [6], this process of reconfiguration reveals the paradigm that all organisations possess a temporal set of competencies, of which only a part have a strong differentiation value in the market. Certainly, highly competitive companies like Toyota or IBM have demonstrated that all competitive advantage is temporary, and should be subject to a constant process of

adjustment. In fact, unpredictable demand, new sources of risk and more competitive markets become the norm.

Although there is a large number of studies related to the development of global supply chain strategies, in many cases only a few key factors for market success are taken as their basis. The structure of demand is not the same in all competitive contexts. Generally, the importance of local differentiation factors is not given sufficient weight when building competitive advantage in a global logistics network.

Some authors as Christopher [7], Christopher and Towill [8] and Mason-Jones et al. [9] estimate that the strategies of agile supply chains are appropriate when faced with the need for quick answers to changes in demand, and when the level of customer service is a key factor for market success. Similarly, other authors as Holweg and Pil [10], Miemczyk and Holweg [11] and Womack, et al. [12] emphasise the fact that 'lean' type supply chains are adequate when we need to eliminate waste and when product cost is a key factor for success with the consumer. Other more specifically conceptual developments presented by Naylor et al. [13] and Vonderembse et al. [14] seek to integrate the advantages of both previous focuses, resulting in a hybrid approach. In our time, considering only certain market-driven factors in a standardised way may not be enough to develop effective global logistics strategies. As Thun and Hoenig [15] argue 'The trend towards lean supply chains results in low inventories achieved by close collaboration with customers and suppliers on the one hand, but leads to high vulnerability on the other hand since turbulences in the supply chain can barely be compensated without safety stocks'. Other authors as Bhatnagar et al. [16], Bhatnagar and Sohal [17], Bowersox and Closs [18], Ferdows [19] or Khurana and Talbot [20] consider from a multidimensional approach that the performance of a supply chain is affected by regional factors, beginning with the responsiveness of production systems of local suppliers with which production sites are operating.

Today it is clear that the configuration of supply networks according to local context, and the related sourcing decisions, are sources of potential global competitive advantage. Nevertheless, our review of the literature and the research found important gaps in analyses of hybrid supply processes from a principle of co-evolution between the industrial system (supply network) and the business climate system (local conditions). Another issue not examined in previous research concerns the local key determinants of automotive system dynamics from a logistics point of view in an emerging economy – such as Mexico, a key player in the NAFTA area. While there is a trend to broaden the scope of standardised models by incorporating a few market drivers, there has been only a limited attempt to identify different local variables in order to conceive specific and original logistics strategies. Thus, considering a multidimensional approach, the question arises whether the typology of hybrid supply strategies and production systems in their current organisational format can support the dynamic competitiveness currently needed by global assembly plants located in Mexico.

3. METHODOLOGY

In accordance with Jankowicz [21], the most pertinent research methods and techniques depend on the problems and the fixed objectives. In this paper, based on an exploratory investigation, our main objective was to identify and study the factors that drive dynamic competitiveness in automotive supply chains, in order to build an analytical model. According to the 'theoretical toolbox' proposed by Shook et al. [22], the model was built on both systems theory and network theory. In fact, Bertalanffy [23] explains that, from a systems theory approach, the organisations are a group of interconnected entities that interact together to supply products and services. In that sense, our research considered that the interactions between every entity have effects over the entire system; as a result, the nature of the effects is determined by the nature of interdependence between firms' supply processes. From the network theory viewpoint, centrality is a key aspect, because it determines the status of a firm through the network. In the automotive industry, assembly plants have a high central position along the entire supply chain. In fact, Hult et al. [24]

argue that “being central within a network would seem to offer the potential to enhance the four key competitive priorities within supply chains: speed, quality, cost and flexibility”, key priorities that our model take into account.

Considering the originality of the question studied, we used a qualitative research approach. Because it is flexible, it was applicable to a deep analysis of the different aspects of a phenomenon not yet established in the literature. In fact, Yin [25] argues that “a case study is an empirical enquiry that (1) investigates a contemporary phenomenon within its real life context, especially when (2) the boundaries between phenomenon and context are not clearly evident”.

In accordance with Eisenhardt [26] and Yin [27], our decision to adopt a case-study-based approach following an established framework was driven by two main factors. First, case-based research in operations management and logistics research is well established as Ellram [28], Meredith [29], and Voss, Tsikriktsis and Frohlich [30] prove in their work. The second motivation was the lack of previous automotive research linking feedback between the industrial system and local conditions from a global standpoint. Consequently, as said by Ghauri and Gronhaug [31] and Maxwell [32], a qualitative research approach was more appropriate for going deeper into the different aspects of this new focus of analysis. According to Meredith (1998), an exploratory case approach is an appropriate alternative where “the variables are still unknown and the phenomenon not at all understood”.

Operationally, we refer to the methodological proposition of Thiétart [33]. As a result, the research went along an abductive or hybrid process suitable for decoding complex systems. As Jick [34] proposes, a multi-method triangulated research approach was developed, comprised of both qualitative and quantitative methods. In consequence, the integration of the area of study observed and the research into theoretical knowledge took place simultaneously throughout the investigation.

In the first phase we performed a qualitative analysis using exploratory interviews involving 15 experts, in order to understand the internal processes of the automotive system and the local system. In this way, starting with a global approach, we deepened our analysis until we were able to trace a level of local study that would give us a better understanding of our research problem. Thus we identified a research framework. It showed that the dynamic competitiveness from a logistics point of view is significantly impacted by the feedbacks between the following three main factors (See figure 1): a) Structure of the demand; b) Structure of the production; and c) Structure of the supply network.

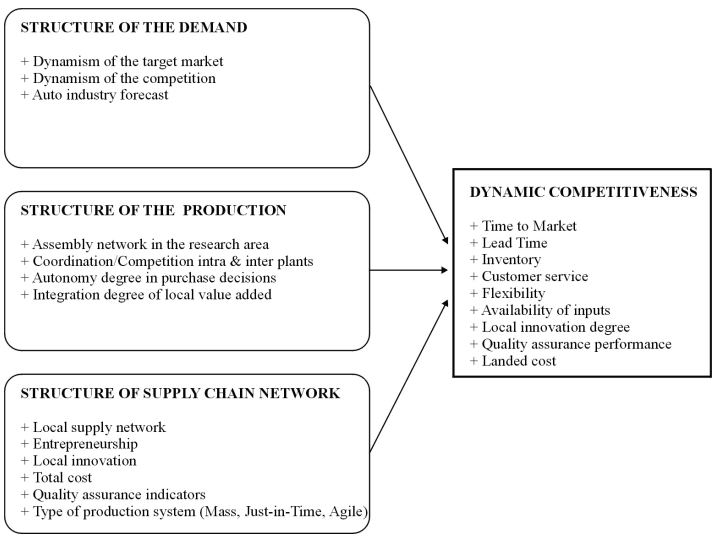

Figure 1: Research framework

In the second phase, based on the work of Ackoff [35], Bertalanffy [23], Durand [36] and Sterman [37] we developed process mapping research strongly influenced by the systems approach. Our interest was in decoding the set of privileged ties that make up the structure within the organisational architecture of the automotive supply chains being studied.

The third phase included 22 semi-structured interviews with a structure of questions based on the research framework. It was applied to the executives of assembly plants, to Tier 1 and Tier 2 suppliers, to service providers, and experts in the academic and governmental areas. The objective of this phase was to understand the systemic feedbacks from a qualitative viewpoint.

Given the importance of assembly plants and Tier 1 suppliers within the automotive value network, field observation was based on a representative sample. This was mainly because of the cluster effect that they generate in the local economic environment. This approach was set up when two conditions were present:

1. When there was a large population of actors, making complex the qualitative data collection for each unit analysed.
2. When it was more important to obtain a global understanding of the automotive system behaviour in the region.

The research was based on in-depth process mapping at the regional logistics operations, complemented with a total of 35 semi-structured interviews in the same number of different automotive companies. In a later step, and through recurrent identification of actors, we defined a final sample of 18 main actors that are directly involved in the evolution of the automotive value network being studied. Of these, four are assembly plants, seven are Tier 1 suppliers, and nine are Tier 2 suppliers. The companies analysed are found in the central-western region of Mexico. This region is made up of the states of Jalisco, Guanajuato, Michoacan, Zacatecas, San Luis Potosi, and Queretaro.

4. ANALYSIS AND FINDINGS

The objective of this section is to analyse our findings based on the research framework and methodology approach that was explained in the previous section. For this purpose, we first present a brief description of the research context. In this way, a connection is made between the bibliography used for our research and our field work. Second, we also present the observational model used and the key performance factors identified in the supply chains studied. Finally, we have done an analysis that links global supply chains to the local system through local suppliers.

A study by J.D. Power and Associates [38] revels that among the emerging automotive countries, the Mexican automotive industry has achieved an important position in economic benefits as well as productive flexibility and quality. As information from the U.S. Department of Commerce [39] showed, these aspects have made Mexico the fourth most important vehicle exporter to the US market in 2006.

Considering both the assembly of automobiles and the manufacturing of auto bodies, motors, parts, accessories, and rubber products, the automotive industry represented 17.3% of the GNP for Mexican manufacturing in 2008. As statistics from INEGI [40] show, this industry represents 21.4% of the total value of Mexican exports, and employs 13.4% of the people working in the manufacturing sector, accounting for more than 1 million jobs. In fact, 79.2% of automotive products are exported, 70.8% of them to the US market. From 1989, the year in which the signing of the automotive decree marked the change in policy from substitution of imports to the promotion of exports, to the year 2001, the production of automobiles nearly tripled from 438,620 to 1,208,994 units (see Figure 3).

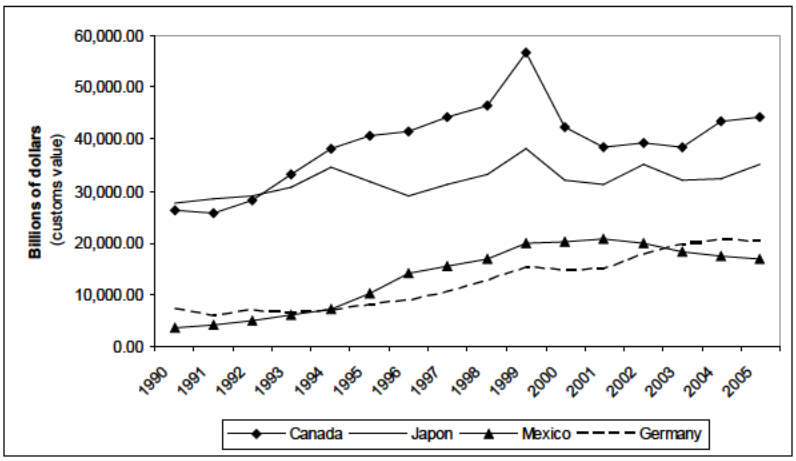

Figure 2: US automotive imports
(US Department of Commerce 2006)

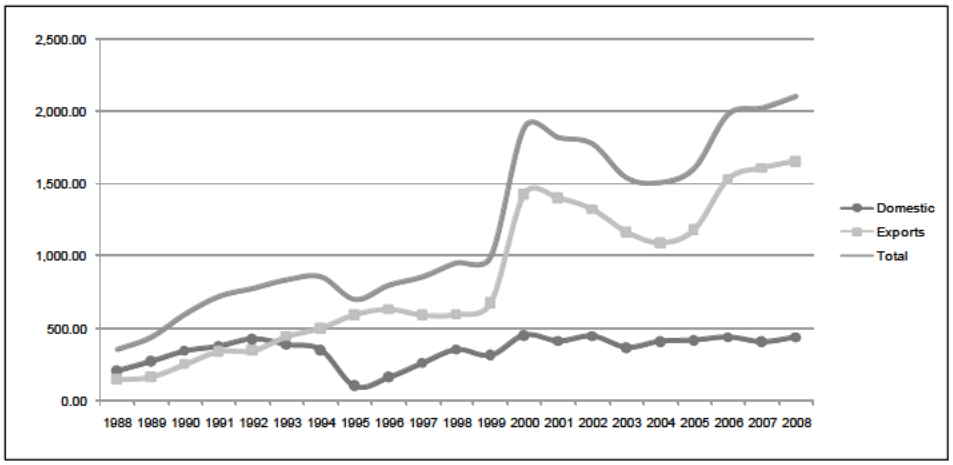

Figure 3: Total automotive production by market type in thousands.
AMIA [41] and INEGI [40]

After NAFTA was put into effect in 1994, the majority of production was destined for export. After an economic crisis in December 1994, internal demand was reduced and the export focus became much more important in the productive strategy of automotive firms in Mexico.

4.1 Evolution of sources of competitive advantage

At the beginning, automotive localisations sought to install production sites that maximised strategies for the intensive use of inexpensive labour and increased plant capacity. Even though this strategy continues, the evolution of this industrial system has obligated assembly plants to look at other options. Thus, as Carrillo and Ramírez [42], Carrillo and Lara [43] and Layan [44] identified, in a second phase, investments were made that reinforced the first strategy and, at the same time, improved production quality and flexibility. The objective was to reduce the impact of uncertainty in demand and thus improve the global financial performance of the value chain.

Using a sustained export strategy, the automotive OEMs whose plants were in the north of the country sought to be close to the main market, and at the same time to facilitate interaction with plants located in the south of the US. In a third and current step, there is a slow integration of the Mexican production with global supply, production, and distribution networks. The search for logistics relational rents has become an important factor in competitive advantage.

Statistics from INA [45] show that currently, the Mexican automotive supply chain is made up of: a) 13 international vehicle assembly companies; b) 345 Tier 1 suppliers; c) 655 Tier 2 and Tier 3 suppliers. In fact, of the 1,000 auto part supply companies, only 30% are run with Mexican capital.

4.2 Types of supply processes

One of the main consequences of the competitive environment in the automotive industry is the dynamic structure of the supply chains. Ever more suppliers are called in to make up more links in the supply chains. Therefore, suppliers must constantly develop capabilities in order to be faster in becoming involved in the automotive growth.

The three main elements repeatedly mentioned by the managers in interviews were: a) Capability to engineer and develop new products; b) Capability to satisfy demand adequately; c) Capability to optimise costs in a continuous manner (see Figure 4).

In fact, there are four types of supply processes, according to two essential classifications identified by Dzever et al.[46] and Saives [47]: a) the availability of materials, supplies, components, or systems; b) the quality of the logistics system in its responsiveness to demand. From this standpoint there is a direct correlation between the degree of specificity of inputs and the degree of incidence of local competitive advantage in the global supply chain.

First, the geographic dimension, which involves specificities due to: a) taking advantage of competition in price or technology over products of a certain region (Zone I); b) use of materials from a specific origin in order to guarantee the quality (Zone II); c) limits related to the transportation of products. This is the case for heavy or very large products that must be delivered just in time, and that require assembly processes near the assembly plant (Zone III).

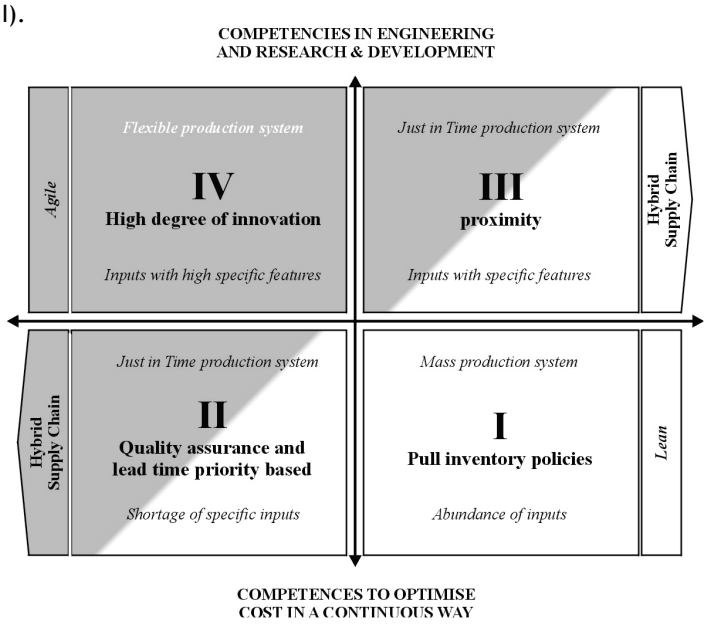

Figure 4: Typology of supply process

Second, the technological dimension, which involves specificities with high added value as perceived by the end customer, and which involves: a) proximity, whether it be cultural, organisational, geographic, or strategic, where the reduction of transaction costs is the main objective (Zone III); b) the degree of innovation of a product, or the relative specificity of compliance with specific regulations (Zone IV).

4.3 Types of links to the local system

Through field work we were able to see the existence of four relational focuses that guide assembly plants in their interaction with suppliers (see Figure 5). In the first place, for goods with low differentiation value that are supplied by mass production systems with the capacity for constant cost reduction, the supply process is guided by opportunistic behaviour (Zone α). In this zone we find the majority of Mexican SME (small and medium-sized enterprises) participating as suppliers within the automotive supply chain. The relational dependency of international OEMs with respect to this type of supplier is minimal. Competitiveness in the supply process is based on the consolidation of competitive advantages based on low cost. A purchasing company based only on this type of competitiveness, according to Veltz [48], is known as a nomad company, since its degree of commitment-dependency on the local system is minimal.

In the second place, we identified a supply process in which the relative specificity of products requires the establishment of trust-based relationships (Zone β). In this case, organisational, geographic, and cultural proximity are essential for participating in the supply chain. The bonds of trust between customers and suppliers are the result of an important relational frequency through time. This type of supply process is based on the stability of the conditions of trust that have strengthened the relationship (price, quality, compliance, etc.).

In the third place, we identified a supply process in which abundance is limited to a geographical region, and in which the relationship between those involved is guided by commitment (Zone γ). In this case, the purchasing company establishes stable relationships within a framework of trust that allows them to pass from a process of purchasing based on best price to the forming of a bilateral relationship that ensures price, quality, and frequency of supply. We should mention the important role that cultural proximity between the actors in the supply chain, and the limited temporality of the contractual relationship, play in the internal processes of the companies surveyed.

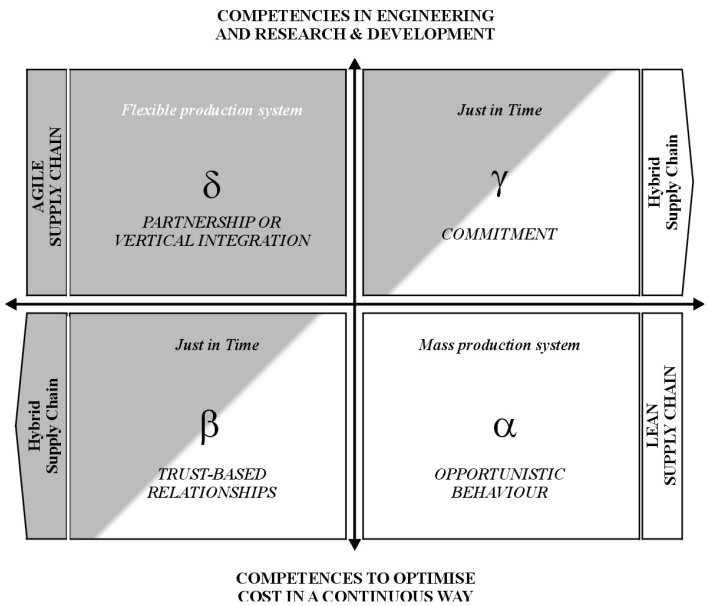

Figure 5: Type of linking with the local system

In the fourth place, when special characteristics of components are involved, the supply process is based on partnership (Zone δ). This process is the result of the integration of products that have high differentiation in innovation, giving an important level of added value to the final product. Due to this, the control that the assembly plant exerts on this supply process is the highest we observed.

Of the different types of links between the industrial system and the local system that we observed, this research identified that the competitive factors needed to take part successfully in a global supply chain within the automotive sector depend greatly on the type of link between OEMs and the local productive networks. Four types of links are possible: a) opportunistic; b) trust; c) commitment; d) alliance. Consequently, our findings prove that a relational variety (trust-based relationships, commitment, partnerships) exists inside the relational model (development model) detected by Flynn et al. [49].

In the first type of link, the integration of supply chains based on OEMs' opportunistic behaviour (selection model) requires various elements of differentiation from Mexican SMEs in order to become competitive: a) continual reduction of production costs; b) high performance of the regional logistics systems; c) trustworthiness of information systems and strategic watch; d) centralisation of the purchasing function; e) implementation of performance indicators common to all local actors involved.

First, the logistics system helps to strengthen the coordination and cost competitive advantage through on-time deliveries to the customer's assembly line. Information systems facilitate functional integration in the supply chain. Second, the strategic watch systems support analysis of the evolution of buying prices, technological tendencies, and location of clients and suppliers. It increases the negotiation capacities and the networking effect of local actors. Finally, the centralisation of purchasing, built into this opportunistic focus, is a factor that may increase competitiveness and negotiating capacity for small local actors.

In the second type of link, trust-based relationships, the OEMs that we analysed look for profitability based on a constant volume of production, as well as higher flexibility in production processes. From this standpoint our work verified that one of the necessary elements of success (in order to be accepted in this kind of relational model) is the capacity to react quickly to demand with high quality products at competitive prices. Nevertheless, within this type of relationship an important barrier to cooperation, identified in the past by Belzowski [50] and verified in our study, is the barrier that arises when a Tier N supplier is directly elected by the assembly plant and communication is established between them. Sometimes the Tier N does not respond to directives sent out by the Tier 1. This reduces flexibility and coordination within the supply chain management of the Tier 1 supplier, and consequently affects the global performance of the value chain.

In the third type of link, relationships based on commitment are found in companies whose products have a greater level of engineering and respond to a more dynamic market. These companies integrate supply chains with a higher degree of variability in demand. As a preventative measure, when faced with the uncertainty that is part of this type of relationship, companies establish stable relationships within a defined legal framework. Competitiveness is ensured only if the costs linked to the establishment of stable relationships are recovered through demand on the part of the final consumer for the top products in the category. In reality, it is the technological specificity of the final products that favours the integration of more stable relationships, in which the degree of innovation in engineering and development of new products is important. This relational way of integrating a supply chain is pertinent to innovative products that require the adoption of efficient organisational forms that are compatible with the purchasing companies, forming relational proximity.

In the fourth type of link, relationships based on partnerships, local companies interested in integrating supply chains for highly innovative products must develop capacities for

anticipating market evolution. In this case the creation of synergetic networks is a significant approach.

Due to the fact that industrial systems become more and more complex and the market environment becomes more and more unstable, industrial systems must simultaneously face competition based on time, price, availability, and quality. If we add to this the relational instability of the local network, the complexity increases.

As a result and according to Vega-Redondo [51], automotive companies generalise the imitation of best practices as a survival strategy. Nevertheless, the variety of possible solutions that allow competitive integration of a supply chain requires a wider focus on the context of competition where participation is present. In this way, it is more important to consider the wide range of factors that allow total supply cost reduction than to just consider the lowest purchase price per component acquired. A balance must be found between components supplied locally and those imported from other countries.

The advantages of forming local supply networks seem obvious. In reality, assembly plants located in Mexico comply simultaneously with the denominations of local content and globally preferred suppliers. As Cedillo et al. [52] identified, the lack of competitive Mexican suppliers strengthens the tendency to put international suppliers in close proximity to assembly sites, or to use suppliers from other parts of the world. In the assembly plants we observed, the percentage of imported components is very high, but mandatory for the ensuring of site competitiveness (see Figure 6).

INPUTS					OUTPUTS			
Origin			Type	Car Maker	Product	Destination		
Mexico	*Canada and/or USA*	*Outside of NAFTA region*				*Mexico*	*Canada and/or USA*	*Outside of NAFTA region*
100%	0%	0%	Components Motors Systems	**GM de Mexico** *(Silao)*	Light vehicles	10%	85%	5%
30%	60%	10%	Components Motors Systems	**Honda de Mexico** *(El Salto)*	Cars Motorcycles Components	45%	52%	3%
35%	30%	35%	Components Motors Systems	**Nissan Mexicana** *(Aguascalientes)*	Cars	43%	40%	17%
10%	0%	90%	Components Motors Systems	**Scania de Mexico** *(San Luis Potosi)*	Trucks	100%	0%	0%

Figure 6: Logistics mapping of the assembly companies studied

In the case of Mexican SMEs, which represent 48% of the automotive companies in the country, participation in the automotive value chain is only 1% (see Table I). For them, the identification of factors that allow them to form part of a larger number of global supply networks is a first and vital step towards building systemic intelligence in the Mexican context. This means that a proactive focus on relational operations is important.

Actually, there are different factors that reduce the capacity for developing local competitive advantages in the global supply chain of OEMs operating in Mexico. First, there are the short-term relationships between certain supply chain actors. Second, there is the

great lack of interest on the part of OEMs to understand the problems of local suppliers. Third, there is great variability in the demands of OEMs on suppliers. Fourth, there is the low interest on the part of SME suppliers in investing in innovation.

AUTOMOTIVE INDUSTRY IN MEXICO	Economic units	Production total	Value added
		Million of US Dollars ($1 US = 10.8 peso MX)	
Personnel	**1,410**	**$5,983**	**$1,585**
0 – 10	48 %	1 %	1 %
11 – 50	27 %	1 %	2 %
51 – 250	16 %	6 %	7 %
251 – 1,000	7 %	17 %	20 %
1,001 plus	2 %	75 %	70 %

Table 1: Participation of Mexican small enterprises in the automotive value chain

Two of the main general lines of action that are still needed at the base of small Mexican suppliers are: a) developing a culture of total quality and innovation as a dynamic business development lever; b) establishing a focus of supply chain collaboration in operations management.

5. DISCUSSION AND MANAGERIAL IMPLICATIONS

The main contribution of this study leads to several important insights for manufacturing firms that participate in complex industries. The automotive industry illustrates that a diversity of supplier relationships is required for assembly products. Consistent with D'Aveni [53], faced with the hypercompetitive economic context of the automotive networks, it is not only necessary to have better organised hybrid processes, but also dynamically to integrate the set of differentiated advantages that local actors can contribute to the competitiveness of any industrial system. According to Eisenhardt and Martin [54], in moderately dynamic markets, the evolutionary emphasis is on variation. Our analysis indicates that SMEs in emergent markets as Mexico should identify the relational approach of their clients in order to focus on efforts for developing specific advantages. Switching suppliers often becomes a competitive strategy only for firms based on static advantages (transport cost, government subsidies, exchanges rates, labour rates, and taxes).

Through our review of the literature, we can see that – although there are a number of important studies related to the development of strategies for global supply chains – in many cases only a few key factors for market success are taken into account. The importance of the local differentiation factors in building the dynamic competitive advantage of a global logistics network is still not fully appreciated by the automotive industry in Mexico.

Taking the automotive industry as a case study, this work presented an analysis framework that serves as a tool to identify factors that allow the articulation of dynamic competitiveness, a framework designed from a systemic intelligence approach. The tendency towards flexible organisation in production obliges automotive companies to adopt a systemic approach, in which logistics competencies are a strong differentiation factor.

Due to the abandoning of the paradigm of mass production in favour of a paradigm focused on time-to-market, deep-seated modifications come about in the organisation of value networks and in the way inter-company cooperation is handled. In fact, our investigation confirmed that dynamism in the automotive supply chain does not go without change, and depends on the conception, organisation, and implementation of the chain through

interactions between local and global actors, as well as on the way in which information technology facilitates these interactions (Gereffi 2005).

Due to the fact that the competitiveness of SMEs is intimately linked to the attractiveness of the territories where they are located, a systemic approach that integrates the evolution of the automotive industrial system with the local territorial system is a basic requirement for the development of local dynamic automotive competitiveness. These results should provide useful guidelines for managers contemplating improvements in supply chain performance, as well as for local agencies contemplating investments in the improvement of the business climate.

5.1 Future directions

Future research could involve expanding the processes described in this work. Due to the fact that the concept of supply chain is a global approach, it is important to determine the factors that define the link between the local context and the rest of the logistics processes (production and distribution). First, a complete analysis of these two processes with our quantitative data, and then a focus that integrates them through analysis of the decision-making process, will allow us to understand and constitute better strategies for the integration of local competitive advantages into global supply networks. Second, as a result of this analysis and from a systemic point of view, the development of a causal model with a system dynamics approach will allow us to establish, evaluate, and simulate the potential relationships between the supply practices and the dynamic competitiveness of the different types of companies linked to the given supply chains.

6. ACKNOWLEDGEMENT

The authors thank Flora Hammer and Miguel Verdejo for several useful comments that improved this paper. At the same time, the first author gratefully acknowledges research grant CONACYT/130 895 from National Council of Science and Technology of Mexico in support of this research.

7. REFERENCES

[1] **Benton, W.C.** 2007. *Purchasing and supply management*. New York, McGraw-Hill/ Irwin.

[2] **Monczka, R., Trent, R. & Handfield, R.** 2005. *Purchasing and supply chain management*, Cincinnati, OH, Southwestern Publishing Co..

[3] **Krause, D.R., Pagell, M. & Curkovic, S.** 2001. Toward a measure of competitive priorities for purchasing, *Journal of Operations Management*, Vol. 19, pp. 497-512.

[4] **Dyer, J. & Singh, H.** 1998. The relational view: Cooperative strategy and sources of interorganizational competitive advantage, *Academy of Management Review*, Vol. 23, No. 4, pp. 660-679.

[5] **Gereffi, G., Humphrey, J. & Sturgeon, T.** 2005. The governance of global value chains, *Review of International Political Economy*, Vol. 12, No. 1, February, pp. 78-104.

[6] **Hamel, G. & Prahalad, C.K.** 1990. The core competences of the corporation, *Harvard Business Review*, May-June, pp. 79-91.

[7] **Christopher, M.** 2000. The agile supply chain: Competing in volatile markets, *Industrial Marketing Management*, Vol. 29, No. 1, pp. 37-44.

[8] **Christopher, M. & Towill, D.** 2001. An integrated model for the design of agile supply chains, *International Journal of Physical Distribution & Logistics Management*, Vol. 31, No. 4, pp. 235-246.

[9] **Mason-Jones, R. & Towil, R.** 1999. Using the information decoupling point to improve supply chain performance, *The International Journal of Logistics Management*, Vol. 10, No. 2, pp. 13-26.

[10] **Holweg, M. & Pil, F.** 2005. *The second century: Reconnecting customer and value chain through build-to-order*, The MIT Press.

[11] **Miemczyk, J. & Holweg, M.** 2004. Building cars to customer order – What does it mean for inbound logistics operations?, *Journal of Business Logistics*, Vol. 25, No.2.
[12] **Womack, J., Jones, D. and Roos, D.** 1990. The machine that changed the world, Rawlinson Associates.
[13] **Naylor, J., Naim, M. & Berry, D.** 1999. Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain, *International Journal of Production Economics*, Vol. 62, Nos. 1 & 2.
[14] **Vonderembse, M.A., Uppal, M., Huang, S. & Dismukes, J.** 2006. Designing supply chains: Towards theory development, *International Journal of Production Economics*, Vol. 100, No. 2, pp. 223-238.
[15] **Thun, J.H. & Hoenig, D.** 2009. An empirical analysys of supply chain risk management in the German automotive industry, *International Journal of Production Economics*. doi: 10.1016/j.ijpe.2009.10.010.
[16] **Bhatnagar, R., Jayanth J. & Yue C.P.** 2003. Relative importance of plant location factors: A cross-national comparison between Singapore and Malaysia, *Journal of Business Logistics*, Vol. 24, No. 1, pp. 147-170.
[17] **Bhatnagar, R. & Amrik S.** 2005. Supply chain competitiveness: Measuring the impact of location factors: Uncertainty and manufacturing practices, *Technovation*, Vol. 25, pp. 443-456.
[18] **Bowersox, D. & David, C.** 1996. *Logistical management: The integrated supply chain process*, New York, McGraw-Hill.
[19] **Ferdows, K.** 1997. Making the most of foreign factories, *Harvard Business Review*, Vol. 75, No. 2, pp. 73-88.
[20] **Khurana, A. & Talbot, B.** 1998. The internationalization process model through the lens of the global color picture tube industry, *Journal of Operations Management*, Vol. 16, Nos. 2 & 3, pp. 215-239.
[21] **Jankowicz, A.D.** 2000. *Business research projects*, 3rd edition, Thomson Business Press.
[22] **Shook, C., Adams, G. & Ketchen, D.** 2009. Towards a 'theoretical toolbox' for strategic sourcing, *Supply Chain Management: An International Journal*, Vol. 14, No. 1, pp. 3-10.
[23] **Bertalanffy, L.** 1968. General systems theory foundations, development, applications, New York, George Braziller.
[24] **Hult, G.T., Ketchen, D., Cavusgil, S. & Calantone, R.** 2006. Knowledge as a strategic resource in supply chains, *Journal of Operations Management*, Vol. 24, No. 5, pp. 458-75.
[25] **Yin, R.** 2003. Case study research: Design and methods, 3rd ed., Thousand Oaks, Sage Publications.
[26] **Eisenhardt, K.M.** 1989. Building theory from case study research, *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.
[27] **Yin, R.** 1989. Case study research: Design and methods, 2nd ed., Sage Publications.
[28] **Ellram, L.M.** 1996. The use of the case study method in logistics research, *Journal of Business Logistics*, Vol. 17, No. 2, pp. 93-138.
[29] **Meredith, J.** 1998. Building operations management theory through case and field research, *Journal of Operations Management*, Vol. 16, No. 4, pp. 441-454.
[30] **Voss, C., Tsikriktsis, N. & Frohlich, M.** 2002. Case research in operations management, *International Journal of Operations and Production Management*, Vol. 22, No. 2, pp. 195-219.
[31] **Ghauri, P. & Gronhaug, K.** 2005. *Research methods in business studies: A practical guide*, 3rd ed., New York, FT Prentice Hall.
[32] **Maxwell, J.** 1998. Designing a qualitative study, in: Bickman, L. and Rog, D. (eds), *Handbook of applied social research methods*, Thousand Oaks, Sage Publications.
[33] **Thiétart, R.A.** 1999. *Méthodes de recherche en management*, Ed. Dunod.
[34] **Jick, T.D.** 1989. Mixing qualitative and quantitative methods: Triangulation in action, *Administrative Science Quarterly*, Vol. 21, No. 4, pp. 602-611.
[35] **Ackoff, R.L.** 1971. Towards a system of systems concepts, *Management Science*, Vol. 17, No. 11, pp. 661-671.

[36] **Durand, D.** 1979. *La systémique*, Coll. Que sais-je? No. 795, Ed. Presses Universitaires de France.
[37] **Sterman, J.** 2001. System dynamics modeling: Tools for learning in a complex world, *California Management Review*, Vol. 43, No. 4, Summer, pp. 8-25.
[38] **J.D. Power & Associates** 2003. *Mexico automotive plants outperform U.S. assembly plants in initial vehicle quality*, J.D. Power publication.
[39] **U.S.D.C. - U.S. Department of Commerce** 2003. *Automotive industry*, USDC publication.
[40] **INEGI - Instituto Nacional de Geografía e Informática** 2004. La industria automotriz en México, INEGI publication.
[41] **AMIA - Asociación Mexicana de la Industria Automotriz**. 2005. *Producción nacional de vehículos automotores*, AMIA publication.
[42] **Carrillo, J. & Ramirez, M.A.** 1997. Reestructuracuión, eslabonamientos productivos y competencias laborales en la industria automotriz en México, in: Novick, M. and Gallart, M. (eds), *Competitividad, redes productivas y competencies laborales*, Montevideo, OIT / CINTERFORD / Red Educación y Trabajo, pp. 355-392.
[43] **Carrillo, J. & Lara, A.** 2003. Evolución industrial del sector de autopartes en México y cambios en la división del trabajo, 11th GERPISA International Colloquium, Paris, France.
[44] **Layan, J.B.** 2003. L'intérêt stratégique des périphéries du système automobile européen, *11th GERPISA International Colloquium*, Paris, France.
[45] **INA – Industria Nacional de Autopartes** 2004. *Estadísticas*. INA publication.
[46] **Dzever, S., Merdji, M. & Saives, A.L.** 2001. Purchase decision making and buyer-seller relationship development in the French food processing industry, *Supply Chain Management: An International Journal*, Vol. 6, No. 5, pp. 216-229.
[47] **Saives, A.L.** 2002. Territoire et compétitivité de l'entreprise. Editions L'Harmattan.
[48] **Veltz, P.** 1993. Logiques d'entreprise et territoires: Les nouvelles règles du jeu, in: Savy, Michel and Veltz, Pierre (eds), *Les nouveaux espaces de l'entreprise*, DATAR-Editions de l'aube.
[49] **Flynn, M., Belzowski, B., Bluestein, B., Ger, M., Tuerks, M. & Waraniak, J.** 1996. *The 21st century supply chain, The changing roles, responsibilities, and relationships in the automotive industry*, The University of Michigan, Transportation Research Institute, Ann Arbor, and A.T. Kearney, Inc.
[50] **Belzowski, B.** 2005. Supply chain management: New competitive realities in the automotive value chain, *13th GERPISA International Colloquium*, Paris, France.
[51] **Vega-Redondo, F.** 1999. Markets under bounded rationality: From theory to facts, *Investigaciones Económicas*, Vol. 13, No. 1, pp. 3-26.
[52] **Cedillo, M., Sanchez, J. & Sanchez, C.** 2006. New relational schemas of inter-firms cooperation: The case of the Coahuila Automobile Cluster in Mexico, *International Journal of Automotive Technology and Managemen*t, Vol. 6, No.4, pp. 406-418.
[53] **D'Aveni, R.** 1994. *Hypercompetition: Managing the dynamics of strategic maneuvering*, The Free Press.
[54] **Eisenhardt, K.M. & Martin, J.** 2000. Dynamic capabilities: What are they?, *Strategic Management Journal*, Vol. 21, Issue 10-11, pp. 1105-1121.