Revista Internacional de Organizaciones (RIO)
Nº 4, June 2010, 71-86
http://www.revista-rio.org
ISSN: 2013-570X
eISSN: 1886-4171

Transnational corporations and local learning: creating local capabilities from the global automotive industry

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Abstract
Ever since the 1980s Mexico has been taking on an increasingly important role in the manufacture of automobiles for North America. As this industry has become highly concentrated, driven by a small number of very large assembly firms and a privileged group of globalized transnational suppliers, the benefits for the host localities have turned into a controversial issue. With this controversy as the background, a case study was designed to analyze the role of local suppliers within the industrial complex led by the Ford Motor Company in Hermosillo, Mexico. This article explores the mechanisms of knowledge transfer from Ford and its global suppliers to the local economy, and the emergence of small local companies that provide knowledge-intensive services.

Keywords: *technological learning, knowledge transfer, global production networks, transnational corporations, automotive industry*

Resumen
Desde los años 1980 México ha adquirido una mayor importancia en la industria del automóvil en Norte América. A medida que esta industria se ha ido concentrando en torno a un reducido número de grandes empresas ensambladoras y un grupo privilegiado de suministradores transnacionales globalizados, los beneficios para las localidades receptoras se ha convertido en una cuestión controvertida. En este contexto se presenta el caso en el que se analiza el papel de los suministradores locales dentro del complejo industrial liderado por Ford Motor en Hermosilla (México). El artículo explora los mecanismos de transferencia de conocimiento de Ford a sus suministradores globales en la economía local, y la aparición de pequeñas empresas locales que ofrecen servicios de intensivos en conocimiento.

Palabras clave: *aprendizaje tecnológico, transferencia de conocimiento, redes de producción globales, empresas multi-nacionales, industria del automóvil.*

1. Introduction

The automotive industry is highly concentrated, with a small number of very large assembly firms and a privileged group of globalized transnational suppliers. While greater globalization was one of the major driving forces behind the recent evolution of the whole industry, in the case of vehicle assembly the trend was toward increased regional integration within major international markets.

It is widely thought that this process has reinforced the control that a limited number of transnational corporations (TNCs) have over the automotive supplier chain because it has created higher entry barriers and limited the opportunities for local firms to join the higher value links of these chains. Nonetheless, it is also evident that the relocation of a greater number of global suppliers creates a greater density of interactions with local economies. These interactions should have some spillover effects, which could increase opportunities for local companies.

As part of this process of global reorganization, Mexico assumed an increasingly important role in the manufacture of automobiles for the North-American region. As well as its geographic proximity to the United States, Mexico became a highly attractive location for global automobile assemblers because low production costs were associated with high productivity levels, thereby making it a critical location in the bitter struggle for market share in North America.

This article is based on a case study designed to identify the presence of technological and knowledge spillovers, and the links that major foreign assemblers had with local firms within the automotive complex led by the Ford Motor Company plant in Hermosillo, a city in the northern border state of Sonora in Mexico. After this introduction, section 2 presents the conceptual framework of the study and summarizes the literature on technological learning and entrepreneurship in the Mexican automotive industry; section 3 describes the evolution of the Hermosillo automotive complex within the context of the Mexican auto industry; section 4 deals with the methodology of the study; section 5 presents the results of the case study, with particular focus on the mechanisms of knowledge transfer from Ford and its global suppliers to the local economy, and the emergence of local companies supplying knowledge-intensive services; finally, section 6 presents the conclusions.

2. Transnational corporations and local learning

Under the influence of the international literature on learning and innovation, the Mexican debate on technological learning as a vehicle for regional and local develop-

ment has recently embraced the discussion about the role of TNCs as agents of knowledge and technology transfer (Carrillo and Hualde, 1998; Contreras, 2000; Dutrénit, *et alii* 2006).

The debate has been fed mainly by two analytical approaches. One influential perspective is the Global Production Networks approach (GPN).[1] The focus on global networks emphasizes the international linkages between companies operating in worldwide production and distribution systems (Gereffi and Kaplinsky, 2001; Ernst and Kim, 2002). Particular attention has been paid to the role of leading firms, or «flagships», that carry out functional integration and coordinate internationally dispersed activities (Gereffi, 1999). This approach has highlighted the limitations imposed on local development by the structures of corporate power, given the asymmetrical structure of global networks (Henderson, *et alii*, 2002; Humphrey and Schmitz, 2002).

However, the operational logic of global networks creates spaces for local actors. Although it does not neglect the power relations that subordinate local agents, the GPN approach does not underestimate their capacity to influence the configuration of these networks (Ernst 2000; Gereffi 1999; Schmitz, 2004). Since TNCs cannot create all the capabilities needed for global competition internally, a critical aspect of competitiveness is a firm's ability to find suppliers of specialized services outside the company. This can run from simple subcontracting on the assembly line all the way through to sophisticated engineering or design processes (Ernst and Kim, 2002).

There is increasing evidence about the experiences of product and process upgrading on the part of local companies that provide TNCs with services. «Local producers learn a great deal from global buyers about how to improve their production processes, attain consistency and high quality, and increase their speed of response to customer orders. This upgrading effect is particularly significant for local producers new to the global market» (Humphrey and Schmitz, 2004: 356). Only when they have developed their own capabilities can local suppliers effectively absorb the knowledge disseminated by the leaders in the global network, so the effectiveness and the speed of the transfer will depend not only on the quantity and quality of the knowledge transferred by the leaders but also on the local suppliers' capacities to absorb that knowledge.

This last aspect is closely related to the second approach, that of innovation systems and business systems, insofar as the absorption capacity of the local companies involves features not only of the businesses themselves but also of the local economy and its institutional framework. Innovation systems emphasize the role of technological trajectories and institutional assets in collective learning. Geographical proximity and relationships between actors enables the interchange of knowledge and create an

1 The GPN perspective is closely linked to the Global Value Chain (GVC) approach. They both have their origin in the Global Commodity Chain (GCC) approach, initially formulated by Gary Gereffi. For a review of the similarities and differences between the GVC and GPN, see Henderson, *et alii* 2002; Coe, *et alii* 2004; Sturgeon, *et alii* 2008).

institutional environment which encourages learning and innovation. This approach argues that learning and the accumulation of technological capabilities are crucial for national and regional competitiveness, and that innovation is an interactive process involving actors, institutions and social norms (Nelson, 1986; Lundvall, 1992). A similar but broader view of the social and cultural embeddedness of economic performance is provided by the national business system approach, which links innovation trajectories within the economy to the development of particular forms of institutional framework organization at the national level (Lam, 2002; Foss, 1999). Both the innovation system and the business system perspectives have underlined the crucial role of national institutional arrangements in shaping the innovative performance of firms and economies.

The link between these two different perspectives or approaches is their emphasis on the interactive and embedded nature of learning and innovation. The local society in which the GPN works is important in two aspects. Firstly, it defines the density of the TNC's interactions with the local economy, either by interacting with the existing companies and institutions or by stimulating the creation of new local networks of social and economic relations (Henderson *et alii*, 2002). Moreover, by interacting with the TNCs, local agents can expand their agency and modify their terms of participation. Insofar as they satisfy the operative needs of the GPN, they can at the same time promote their own participation and upgrading by mobilizing the knowledge embedded in social networks (Sturgeon *et alii*, 2008). Crucial for interactive learning is the role of tacit knowledge «which is difficult to create and transfer in the absence of social interaction and labour mobility [and] constitutes the most important source of learning and sustainable competitive advantage in an increasingly globalised knowledge-based economy» (Lam, 2002: 81).

In the automotive industry, a decisive factor in defining the opportunities for new manufacturing regions arises from the process of concentrating production in a small group of firms. Global sourcing and the transfer of some design responsibilities have shaped new patterns of relationship between producers and suppliers. The need to achieve global presence and to reinforce technological capabilities has accelerated the restructuring of the automobile parts industry, and a series of mergers and acquisitions have given rise to a handful of giant companies with privileged relationships with the assemblers.

One important change in the location pattern of the industry is the OEM strategy to build assembly plants closer to the target markets in order to adapt more accurately to customer needs, take advantage of both national and local incentives to attract foreign investment, and make the most of the cross-country cost differential. This reorganization is further encouraged by the transition from integral to modular manufacturing. Assemblers and suppliers have developed a concept of the automo-

bile as a complex system which can be broken down into discrete parts, or modules, containing not only the components of a subsystem but also a quantity of specialized knowledge (Camuffo, 2003).

One of the consequences of this is that the functions of manufacturing plants and suppliers and the relations between them have transformed, creating incentives to transfer the design and manufacture of components to suppliers (Takeishi and Fujimoto, 2002). This has led to more outsourcing, which requires greater coordination with the suppliers and gives them greater importance in the global network. Modularization and outsourcing are closely related, since suppliers are increasingly likely to design, produce and deliver complete modules, while assemblers reduce their investment to a minimum and concentrate on the engineering of the vehicle, the quality of the product, and customer services. «The modularization of design, production and organization is closely related to how, while trying to save costs, reduce risky investment, and manage the institutional constraints deriving from globalization, OEMs and suppliers partition their tasks, defining a new international division of labor» (Camuffo, 2003: 2). The implications of these changes for the local economies are ambiguous, since such strategies lead to a re-centralization of technologically intensive activities in developed countries and global suppliers, and reduce opportunities for small local suppliers (Quadros and Queiroz, 2001; Sturgeon *et alii*, 2008).

On the other hand, several studies have shown how participation in GPNs encourages knowledge and technology transfer. In Eastern Europe (Lorentzen *et alii*, 2003), China (Ivarson and Alvstam, 2005) and Mexico (Dutrénit, 2006; Lara and Arellano, 2007), suppliers integrated into global networks increase their accumulation of technological and managerial knowledge. For local companies, links with TNCs are based on hierarchy, but are evolving and interdependent relationships at the same time. By collaborating with TNCs, local companies are often provided with vital technological and organizational training that they can use strategically to develop their market networks and their innovative capacity in the home market (Ivarson and Alvstam, 2005).

Research on the Mexican automotive industry has addressed the topic of technological learning only very recently. A study using data from national surveys found that since the creation of NAFTA learning has intensified: in particular, formal training for workers has increased, and greater quantities of machinery and automated equipment are being acquired (Vallejo, 2005). Lara, Fuji and García (2004) found that during the transition from integrated to modular manufacturing, seat suppliers relied on a strategy of technological upgrading, by changing from labor-intensive to capital-intensive processes. Lara, García and Arellano (2007) found a process of technological co-evolution between TNC global suppliers of seats and machine shops in the central region of Mexico.

Local entrepreneurship linked to the automotive industry has only been marginally dealt with. Contreras (2000) found some cases of managers and engineers who started their own businesses on the basis of the knowledge and social networks they acquired during their experience as employees of TNCs. Dutrénit and Vera-Cruz (2004) found knowledge spillovers from TNCs in the machine shop industry, and documented some cases of TNC employees who later established their own local companies. Bueno (2004) found that some local companies in Toluca had been marginally incorporated into the supply chain as manufacturers of moulds, tools, and components. Echeverri-Carroll (2008) found that during the transition to free trade, many large firms in Monterrey adopted strategies such as concentrating on core competencies, thus creating the opportunity for skilled workers to create their own small startup companies (Echeverri-Carroll 2008).

3. Ford Motor Co. in Hermosillo

Ford Motor Co. was the first firm to set up an assembly plant in Mexico City in 1925; a second plant was set up in 1932, and in 1964 the company built an industrial complex in Cuautitlán, in the outskirts of Mexico City. During the period of Import Substitution (1950-1982), Ford controlled almost 26% of the Mexican automobile market. Since it peaked at 38% in 1988, its participation has been declining continuously, reaching 15% in 2000 and 7% in 2005. This was a consequence of the success of the Asian firms operating in Mexico, and also of the growing imports, which now account for almost 76% of all vehicles sold in the Mexican market.

Currently, Ford Motor Co. has four locations in Mexico: their central administrative offices in Mexico City, the Cuautitlán industrial complex, an engine manufacturing plant in the northern state of Chihuahua, and the stamping and assembly plant in Hermosillo city. The company employs close to 5,000 workers, three quarters of them in the Hermosillo plant.[2]

The Cuautitlán plant is an old industrial complex. It was built in 1964 in response to government requirements for national integration (Carrillo, 1993) and with the objective of producing for the domestic market. After 1983, and over a period of 15 years, the complex was subject to major adjustments to automate the assembly process and to introduce lean manufacturing. The company took considerable trouble to introduce major organizational changes; in particular, the Total Quality Control system clashed with the detailed and complex job descriptions for qualified and specialized workers whose func-

2 The city of Hermosillo is the capital of the state of Sonora, one of the five Mexican states on the border with the United States. Henceforth, references to «the region» allude to the state of Sonora, while «North America» refers to the US-Canada-Mexico «trade region» as is usual in international political economy studies.

tions were protected by union officials. In 1982 the complex had a very strong union with more than 7,800 members. Only five years later, labor restructuring had cut the number of jobs by a half, and by 2007 there were only 900 employees remaining.

The Hermosillo plant contrasts dramatically with that of Cuautitlán, which began operating in 1986, with an investment of US $500 million. The goal was to build a specialized factory, with an annual production capacity of 130,000 vehicles, to service the foreign market. It was part of Ford's «world car» project, the objective of which was to reduce the gap with the Japanese companies. The stamping and assembly plant in Hermosillo was designed from its inception to operate with the Toyota Production System. During the next 20 years, the plant underwent various expansions and reorganizations, but always managed to maintain a high quality operation compared to other plants in North America. The most important of these expansions occurred in 2005, when 1,200 million U.S. dollars were invested to introduce three new models (the Ford Fusion, Mercury Milan, and Lincoln Zephyr), increasing the production capacity to 300,000 vehicles per year. The new flexible manufacturing system placed the plant at the forefront of global automotive technology, and the first-tier supplier network was reorganized to manufacture the new models using the modular manufacturing model. The number of workers increased from 2,000 to 3,800. With an investment of US $400 million, a new industrial park was also created for 20 first- and second-tier transnational suppliers. These firms employ close to 4,000 additional workers in the city of Hermosillo.

This expansion was part of Ford's strategy to cope with intense competition from the Asian firms in the market for sub-compact cars in North America. The strategy included reducing costs and raising the quality of their vehicles, in an attempt to recover ground in a segment where the «big three» of the United States (including Chrysler and General Motors) were systematically losing ground to the Asian brands.

4. Methodology

The study was carried out from May 2005 to July 2006 and consisted of semi-structured interviews and a sample survey of small and medium-sized enterprises (SMEs) in Hermosillo.

The first series of interviews was conducted with 4 directors and managers at the Ford Motor Co. and 10 TNC managers in Hermosillo. In the interviews with the TNC managers, numerous local companies supplying the TNCs were mentioned; as a result of this information, 12 more interviews were carried out with owners of small local companies supplying specialized services for the Ford plant or its transnational

suppliers. Another 30 interviews were conducted with engineers and managers who at some point in their careers had been employed at the Ford Hermosillo plant. The interview format was biographical and focused on career paths.

The final phase of the study consisted of a survey of 166 SMEs, selected according to the following criteria: *a)* they had to be located in Hermosillo; *b)* they had to be micro, small or medium-sized businesses;[3] *c)* they had to be involved in one of the 17 activities (sub-branches, in the INEGI classification), mentioned by the TNCs as the main sources of materials and services provided by local companies, excluding cleaning, security, transport and industrial canteen services. Some results of the study, specifically those related to the creation of new local, knowledge-intensive companies are presented in this article.

5. Knowledge transfer, social networks and new local firms

The literature on *maquiladoras* [4] has extensively analyzed the factors that inhibit regional companies from entering the supply chains for the new electronics and automotive industries led by TNCs in Mexico: the inability of local businesses to meet quality standards and delivery times; the purchasing policies of the TNCs, which gave privileges to their global partners and suppliers over local companies, and the absence of an industrial policy that might promote the creation of technological and entrepreneurial capabilities in local companies (Wilson, 1992; Carrillo, 1998; Dutrénit *et alii* 2002; Carrillo and Contreras, 2004).

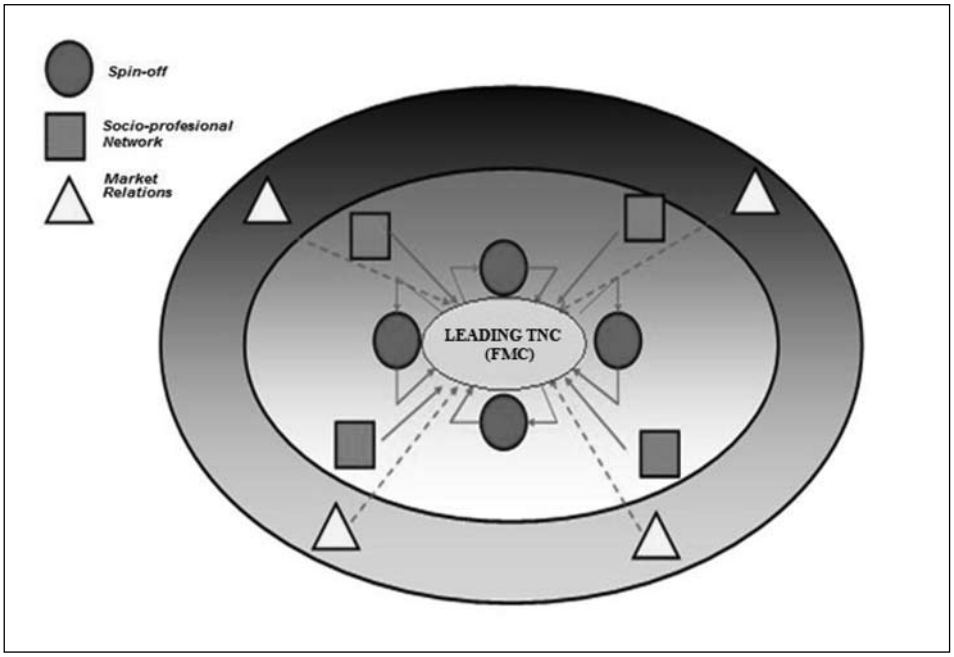
In spite of these limitations, a handful of knowledge-intensive small local companies have emerged in the supplier network of TNCs in the automotive sector. In the survey to SMEs in Hermosillo, we found 99 companies supplying products or services linked to production, of which 16 were companies specialized in the automotive industry and the rest served other industries as well as the auto industry. More than 90% were micro or small businesses (50 employees or fewer) and 63% started operations after 1994. The most numerous group was made up of machine shops (37), followed by engineering services (27) and industrial maintenance services (23).

3 The definition of SMEs used here is the one used by INEGI, the official Mexican statistics agency: micro, from 1 to 10 employees; small, from 11 to 50 employees, and medium, from 51 to 250 employees.

4 «Maquiladoras» are industrial plants which import raw materials and components for processing or assembly in Mexico and then re-export them, primarily to the United States, paying taxes only on the value added. This is one of the main sources of direct foreign investment in Mexico and is the main source of industry growth since the 1980s.

Three mechanisms were identified by which local firms became part of the automotive supply chain: *spinoffs* by former TNC employees; *socio-professional networks* in the region; and the creation of capabilities through conventional *market relations* (Figure 1).

Figure 1. Three Mecanisms for the creation of local suppliers



Spinoffs

One of the most frequent mechanisms by which local companies join the supplier pool involves companies created by engineers who have worked at the Ford plant.[5] Since the start of their operations in 1986, the company sought to recruit young engineers, preferably recent university graduates. The ex-employees interviewed were between 23 and 28 years old when they were hired by Ford. At the moment of the interview, their average age was 38.4, with an average of 2.7 jobs during their careers and an average of 15.8 years since starting their first job. For half of them, the Ford plant was their first job, and for more than 30% the automotive company was their second job. The average duration as employees of Ford was 6.3 years.

5 «Usually… a spin off has been simply been defined as a new firm whose founder has left his previous job to start a business of his own. This definition does not explicitly require that direct transfer of technology has taken place between the spin-off and the parent company. The basic assumption [is] that the business idea leading to the formation of a new firm derives in some way from the previous employment of the founder.» (Lindholm, 1997: 660). This broad definition of a spin-off is used here.

The time they spent with Ford turned out to be a very formative experience, since it gave them the opportunity for professional development in a global company using advanced manufacturing and organizational techniques. The experience had proved very useful, not only because of the technical and administrative knowledge they acquired but also because of the relationships that they built with other employees, managers, and suppliers. Of the 30 engineers interviewed, 16 had left Ford to start their own companies and 14 to take up managerial positions in other companies. They all stated that their main reason for leaving Ford was the prospect of improving their professional position, be it through the offer of an attractive position in another company or as a result of their own business project.[6] In some cases, their position as employees did not prevent them from having their own business activity, since six of the new businessmen created their own company while working at a TNC.

As well as emphasizing the technical or organizational aspects of the knowledge acquired at Ford, all those interviewed referred to the «culture of quality» as their principal source of learning. It is worth remembering that, in its time, the plant was designed as a state-of-the-art plant at world level. Not only was the production process highly automated (95% of welding operations were carried out by robots, and 90% of stamping was automated), but the entire process was also organized according to the principles of Total Quality Control and Just in Time (JIT), which means a complex structure of coordination and administrative standards appropriate for JIT and the handling of massive information flows. The experience of working in the plant, then, had been a source of intense technical knowledge in such specific areas as welding and stamping, or such generic areas as software and quality control.

Another type of knowledge acquisition is the coordination of processes, an area involving a wide range of technical knowledge, but especially organizational abilities. The relationship with suppliers and other Ford plants involved in the design and development of the models assembled in Hermosillo means a complex structure of information flows and interactions between multiple actors. During the first five years of operation, the plant established a Just in Time system even though it received 65% of its materials and parts from Japan. The organization required to keep the factory routines in place was considerable. The communications technology was also a novelty in the regional context, as the plant was one of the first to introduce a corporate IT network for communications in real time and, years later, the first to use an intranet network.

6 Questioned about the support given by Ford Motor Company to these employees leaving the company to become entrepreneurs, the Hermosillo Plant General Manager said: «They are good engineers… we don't want to shoot our own foot; but since they are in the business, we are pleased to take advantage of their experience and good working». Jorge Islas, Personal Interview. March 21, 2007.

Trained in conventional academic programmes, the Ford engineers were not only provided with empirical contact with advanced technologies and organizational methods by the company, but also constantly had their knowledge updated through formal training in areas such as statistical process control, reduction of inventories, manufacturing cells, quick model changes, Just In Time, predictive maintenance, elimination of waste, teamwork and continuous improvement, amongst others. This training is an asset which the engineers take out into the regional environment when they leave the company. An example of one of these new companies is *Integración Robótica y Mantenimiento Industrial* (IRMI), founded by five industrial and electronics engineers who had worked at Ford since it opened in 1986. Between 1999 and 2000 these engineers gradually left the company, each one starting their own business, dedicated to maintenance for stamping and welding equipment, process automation, installation and equipment maintenance for paintwork and electro-mechanical installations. In 2003 these five micro-businessmen joined together to form the IRMI Group, which began with 17 employees, with Ford as its only customer. By the end of 2007 it had 340 employees and had also become a supplier for other large Ford suppliers such as Collins and Aikman, Magna, Martinrea and Antolín, as well as the new Toyota plant in Tijuana.

Socio-Professional Networks and Market Relations

The second mechanism is based on the action of socio-professional networks. In their daily operations, TNCs require frequent interaction with (and even the formation of) social and professional networks in the local community. Over time, corporation employees and various local people, institutions, and companies weave a network of relationships through which information flows and experiences are transmitted.

When speaking about their relations with local suppliers, an experience common to all TNC managers is the need to turn to local companies to deal with problems with equipment or facilities, especially in the face of failures or breakdowns, but also in order to optimize maintenance time and costs. In unexpected situations, using the original suppliers of the equipment or turning to the corporation itself in search of solutions is expensive and time consuming, given that the technicians have to travel from the United States or Japan, and the cost of repairs is determined by hourly labour cost. Besides, the proximity of local suppliers allows them to monitor and eventually to make specific adjustments to the work carried out.

In such circumstances managers usually turn to their social networks —relatives, friends or professional links— in search of ways to solve problems as quickly and

cheaply as possible. Furthermore, the growing *endogenization* of the bodies of management has made this practice even more common. In the first years of their operation, over half of the plant managers were Japanese and from the USA, but they were gradually replaced by Mexican managers. Currently all the plant managers are Mexican, most of whom graduated from local universities in the state of Sonora.

One case which illustrates access via socio-professional relations is *Kinematics*, a company set up in the year 2000 by a professor from the University of Sonora. Given his solid academic reputation in the area of design, when some of his former students achieved managerial positions in the Ford plant, they began to consult him about adjustment and adaptation problems in some pieces of equipment. On the basis of these jobs as a consultant, he was commissioned to carry out larger adjustments in an industrial manipulator used by the Lear Corporation (one of Ford's large suppliers) to place the seats in the Fiesta model. This commission culminated in the complete re-design of the manipulator, and the company Kinematics was created to this end. Since then, this company has specialized in the design and manufacture of industrial manipulators, growing from 6 initial employees in 2000 to 135 in 2007. As well as diversifying its clients, in 2007 it won an international tender to design and manufacture the manipulator with which the hybrid Ford Fusion batteries will be installed.

Finally, the third mechanism is based on *market relations*. The operational needs of TNCs require them to seek local suppliers capable of offering low cost, flexibility, and quality. Usually TNCs require general services such as cleaning, security, catering, and so forth. These sorts of services tend to be acquired in the local marketplace, frequently through competitive processes. However, the leading companies also require more specialized services, such as maintenance, equipment repair, machining, programming, logistics, automation processes, among others. Belonging to a socio-professional network or having been employed by Ford can facilitate participation, but in some cases the link is established through conventional market relations. When the local socio-professional networks do not offer certain options, the company must turn to the marketplace to search for local suppliers.

An example of incorporation through the market is *Asesoría Integral de Ingeniería* (AIISA), founded in 1991 and dedicated to network design, software development and automation processes. The relation with Ford began in 1992 through maintenance jobs on the IT network. Subsequently it was involved in the replacement and programming of PLCs and achieved a stable relationship as a consultancy firm as a result of a problem in the welding robots on the assembly lines. On the basis of these jobs, its portfolio of customers grew within the automotive cluster and included industries in different parts of the country. Its staff grew from the initial 2 employees to 24 in 2007.

While the companies created through spin-off type processes start off from an organic relationship with the leader company, those which join the supply chain through socio-professional networks and through the market follow a more contingent path, in a sequence which requires repeated experiences of efficient response to provide the basis of a relationship of trust.

6. Conclusion

Studies on technological learning and the upgrading of local companies within networks governed by TNCs show the double character of GPNs. On the one hand, they limit, subordinate and frequently exclude the participation of local companies but, on the other, they are a vehicle to global markets and a means for acquiring technical knowledge. This research found that from the 1990s, a handful of local companies in Hermosillo began to join the automotive supply chain. This process involves a set of new, local, knowledge-intensive companies in activities such as software development, process automation, device design, precision machining, and engineering services, among other activities. These new companies have generally been in existence for fewer than 10 years and have developed technological and entrepreneurial capabilities within the industrial environment of the *maquiladoras* and the automotive industry itself. The companies were created by new local entrepreneurs, whose training was acquired on the job in the industry and who did not have connections with wealthy families or traditional firms in the region. The common pattern is that leading companies need to transfer technical and managerial skills to their local suppliers in order to qualify them to meet demanding quality standards. Once the local companies manage to enhance their capabilities, these new competencies become an incentive for the leading company to transfer more sophisticated knowledge and processes to the local supplier.

The reshaping of the automobile industry (based on concentration, modularization, and outsourcing) is an opportunity for local, knowledge-intensive companies linked to the supply chains to emerge. The driving force behind this process is the effort by TNCs to reduce costs by locally outsourcing some of their production activities, and the creation of new local companies is, in some way, a by-product of internal restructuring in large TNCs, rather than the result of a coordinated strategy by local entrepreneurs. But even if the new local companies are small, and their impact on the global production network still marginal, they represent a new and potentially beneficial turn for the local economy. So far the knowledge acquired has allowed some local SMEs not only to participate in higher niches of the auto value chain but also to diversify their activities and clients, supplying other Mexican and transnational industries

and thus becoming less dependent on the automobile TNCs. The automotive industry in itself is probably a very narrow environment for the consolidation and upgrading of small and medium-sized local companies, given the limits imposed by the TNCs in their control over the critical materials parts and processes, but the technological and entrepreneurial learning through these links allows some of them to acquire the tools with which they can consolidate as viable companies in global markets.

In the last few years, these new local companies have been able to create some national and local awareness on the potential for developing high value added supplier networks in the region. But the modest attempts to create public and private programs and organizations to stimulate the consolidation of these networks have been insufficient so far because, in their interaction with the local economies, TNCs impose on their suppliers not only a relentless price squeeze but also a demanding policy of quality standards. How well such networks may be consolidated will not be determined merely by the evolution of the relationships between firms in the marketplace. It will also depend on the governance solutions designed to resolve common problems and supply the collective goods needed to sustain a more balanced local-global system, including supplier training and development.

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