
Local institutions, local networks and the upgrading challenge. Mobilising regional assets to supply the global auto industry in Northern Mexico

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Abstract: Ever since the 1980s, Mexico assumed a relevant role in the manufacturing of automobiles for North America. The current crisis in the world's auto industry has inflamed the controversy about the sustainability of a development strategy based on industries driven by transnational corporations, especially as this industry has become highly concentrated, driven by a small number of very large assembly firms and a privileged group of globalised transnational suppliers.

Taking this controversy as background, a case study was designed to analyse the role of local suppliers within the industrial complex led by Ford Motor Company in Hermosillo, Mexico. The article explores the mechanisms of knowledge transfer from Ford and its global suppliers to the local economy, the emergence of some small local companies providing knowledge-intensive services, and the role of local institutions and organisations to support the upgrading of the local suppliers.

Keywords: auto industry; transnational corporations; TNCs; local suppliers; technological learning; industrial policy.

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1 Introduction

The global crisis in the automobile industry in 2008–2009 has been a rude shock to those regions of Mexico that specialise in the manufacturing of cars and auto parts. The crisis has unleashed a wide debate on the viability and sustainability of a development strategy based on foreign investment and on industries driven by transnational corporations (TNCs).

Beyond the severe impacts of the current crisis, the controversy is also based in the fact that the automotive industry is highly concentrated, with a small number of very large assembly firms and a privileged group of globalised transnational suppliers. While increased globalisation was a major driving force for the recent evolution of the whole industry (trade liberalisation, the spread of information technologies, global sourcing), in the case of the vehicle assembly, the trend was one of increased regional integration within major international markets (North America, Europe, Asia).

As part of this process of global reorganisation, Mexico assumed an increasingly relevant role in the manufacturing of automobiles for the North American region. Aside for its geographic proximity with the USA, Mexico became a highly attractive location for global automobile assemblers because low production costs came associated with high productivity levels, thereby, making this country a critical location in the bitter struggle for market share in North America.

It is widely thought that this process has reinforced the control over the automotive supplier chain by a limited number of TNCs, creating higher barriers to entry and limiting the opportunities for local firms to join the higher value added links of these chains. Nonetheless, the relocation of a greater number of global suppliers also creates a greater density of interactions with local economies, which should have some spillover effects that could increase local learning and opportunities for local firms.

This article is based in a case study designed to identify the presence of technological and knowledge spillovers and the creation of local firms within the automotive complex led by Ford Motor Company plant in Hermosillo, a city of the northern border State of Sonora, in Mexico.

The relevance of this case lies in the fact that the automotive complex in Hermosillo is an important piece in Ford's strategy to recover its share in the market of subcompact cars in the USA, where Japanese cars are becoming increasingly more popular. Even at a time when the company is undergoing its worst crisis in the past 100 years – with a drop of over 40% in US sales and a decrease of more than 50% of its production during the first months of 2009 – the operations in Mexico remain one of Ford's most viable strengths in its inevitable (and now increasingly urgent) reorganisation. It is therefore of great interest to consider both the spillover effects of the Ford complex on the local economy to date – and the role of local actors including state agencies in promoting positive interaction and indigenous economic development – and also the formulation of Mexico's policies to palliate the immediate impact of the crisis.

The analysis proceeds as follows: Section 2 presents the conceptual framework used in the study and summarises 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, focusing 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; Section 6 analyses the role of some local organisations recently created to support the upgrading of local small and medium-sized enterprises (SMEs) linked to the auto industry; and Section 7 presents the conclusions of the study.

2 TNCs, local learning and entrepreneurship

The Mexican debate on technological learning and entrepreneurship 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 al., 2006).

The debate has fed mainly on two analytical approaches. One influential perspective is the global production networks (GPN) approach that emphasises the international linkages between companies operating in worldwide production and distribution systems (Gereffi and Kaplinsky, 2001; Ernst and Kim, 2002).¹ Within this perspective, 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). Without neglecting 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 the TNCs cannot internally create all the capabilities needed for global competition, a critical aspect of competitiveness is the ability of a firm to find suppliers of specialised services outside the company. This can run from simple subcontracting at 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 supplying TNCs. '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, (2002), p.1020].

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 one of the problems raised both by the innovation systems and the business systems approaches, insofar as the absorption capacity of the local companies not only involves features of the businesses themselves, but also the characteristics of the local economy and its institutional framework.

The perspective of the innovation systems emphasises the role of technological trajectories and institutional assets in collective learning. Geographic proximity and relationships between the actors enables the interchange of knowledge and create an institutional environment which encourages learning and innovation, 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 posed by the national business system approach, which links the innovation trajectories within the economy to the development of particular forms of organisation of institutional frameworks 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 strands is given by their emphasis in the interactive and embedded nature of learning and innovation. The local society in which the GPN works is relevant in two senses. In one sense, it defines the density of the TNCs interactions with the local economy, whether that be by interacting with the existing companies and institutions or by stimulating the creation of new networks of social and economic relations in the place (Henderson et al., 2002). But, furthermore, as the local agents manage to satisfy the operative needs of the GPN, they can at the same time promote their own insertion and upgrading, by mobilising the knowledge embedded in social networks (Sturgeon et al., 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), p.81].

But learning and upgrading takes place in specific contexts of power asymmetry. The relationships among local companies and TNCs are crucially influenced by the model of governance within the production network. Governance can range from 'networks of direction' to 'networks of mutual dependence', resulting in a very different patterns of local development (De Propris et al., 2008).

In the automotive industry, a decisive factor in defining the opportunities for new manufacturing regions arises from the process of concentration of 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 have 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 original equipment manufacturers' (OEMs) strategy to build the assembly plants closer to the target markets, in order to fit more accurately the customer needs, take advantage of the national and local incentives to attract foreign investment, and make the most of the cross-country cost differential.² This reorganisation is further encouraged by the transition from integral to modular manufacturing. Assemblers and suppliers have developed a concept of the automobile 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 specialised knowledge (Camuffo, 2003).

One of the consequences of this is the transformation of the functions of and relations between manufacturing plants and suppliers, creating incentives to transfer the design and manufacture of components to the suppliers (Takeishi and Fujimoto, 2001). This has meant greater use of the practices of outsourcing, determining greater coordination with the suppliers and greater importance for the suppliers in the global network.

Modularisation and outsourcing are closely related, since suppliers are increasingly likely to design, produce and deliver complete modules, while assemblers reduce to a minimum their investment and concentrate on the design and engineering of the vehicle itself, the quality of the product and customer services. 'The modularisation of design, production and organisation is closely related to how, while trying to save costs, reduce

risky investment, and manage the institutional constraints deriving from globalisation, OEMs and suppliers partition their tasks, defining a new international division of labour' [Camuffo, (2003), p.2].

The implications of these changes for the local economies are ambiguous, since such strategies lead to a recentralisation of technologically intensive activities in developed countries and global suppliers, reducing opportunities for the small local suppliers (Quadros and Queiroz, 2001; Sturgeon et al., 2008).

On the other hand, several studies have shown how participation in GPNs encourages knowledge and technology transfer. Both in Eastern Europe (Lorentzen et al., 2003) and in China (Ivarsson and Alvstam, 2005) or in Mexico (Dutrénit et al., 2006; Lara et al., 2007), suppliers integrated into the global networks increase their accumulation of technological and managerial knowledge. For local companies, the links with the TNCs are based on the hierarchy, but at the same time these are evolving and interdependent relationships. Local companies' collaboration with TNCs often provides them with vital technological and organisational training that the local firms can use strategically to develop their market networks and their innovative capacity in the home market (Ivarsson and Alvstam, 2005).

Local entrepreneurship linked to the automotive industry in Mexico has been only marginally addressed. Contreras (2000) found some cases of managers and engineers who started their own businesses based on the knowledge and social networks acquired during their experience as employees of the TNCs. Dutrénit et al. (2006) 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 (2005) found that some local companies in Toluca (Central Mexico) have 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 in core competencies, creating the opportunity for skilled workers to create their own small start-up companies (Echeverri-Carroll, 2008).

3 Ford Motor Co. in Hermosillo

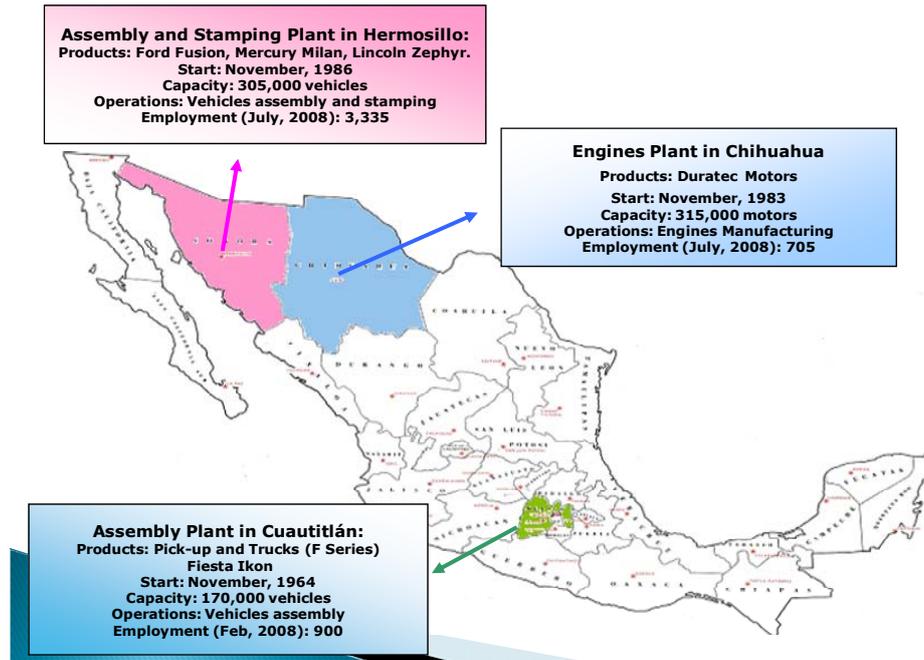
Ford Motor Co. was the first firm to set up an assembly plant in Mexico City in 1925; a second plant was set up in 1932, and in 1964, the company built an industrial complex in Cuautitlán, in the outskirts of Mexico City.

Currently, Ford 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 in Mexico, three quarters of them in the Hermosillo plant³ (Figure 1).

The Cuautitlán plant is an old industrial complex, built in 1964 with the objective of producing for the domestic market and in response to government requirements for national integration (Carrillo, 1993).⁴ After 1983, and over a period of 15 years, the complex was subject to major adjustments focused on automation of the assembly process and the introduction of the Toyota Production System (TPS). The company made efforts to introduce major organisational changes, an adjustment that clashed with the

detailed and complex job descriptions for qualified and specialised workers whose functions were protected by union officials. In 1982, the complex had a very strong union with more than 7,800 members. Only five years later, labour restructuring had cut the number of jobs by a half, and by 2007, there were only 900 employees remaining.

Figure 1 Ford Motor Co. plants in Mexico (see online version for colours)



The Hermosillo plant contrasts dramatically with that of Cuautitlán. This plant began operating 1986, with an investment of US\$500 million. The goal was to build a specialised factory, with an annual production capacity of 130,000 vehicles, to service the foreign market. It was part of Ford's 'world car' project, whose objective was to reduce the competitive gap with the Japanese companies. The stamping and assembly plant in Hermosillo was designed from its inception to operate with the TPS. Without excluding some conflictive episodes, the local branch of the Ford Workers National Union were much more collaborative with the management. During the next 20 years, the plant underwent various expansions and reorganisations, while always maintaining a high quality operation compared to other plants in North America. The most important of these expansions occurred in 2005, when an investment of 1,200 million US dollars was made to introduce three new models (the Ford Fusion, Mercury Milan and Lincoln Zephyr), increasing the production capacity to 300,000 vehicles per year.

This expansion was part of the Ford strategy to cope with intense competition from the Asian firms in the market for subcompact cars in North America. The strategy included reducing costs and raising the quality of their vehicles, in an attempt to recover participation in a segment where the 'big three' of the USA (including Chrysler and General Motors) are systematically losing ground to the Asian brands. A new flexible manufacturing system was introduced, in order to allow faster changes of the models being assembled within the same assembly lines and the first tier supplier network was

reorganised to produce the new models according to the modular manufacturing system. 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.

4 Methodology

The article is based in a case study carried out in 2006 and complemented in 2009. The first phase of the study consisted of conducting 14 semi-structured interviews with managers at Ford Motor Co. and its transnational suppliers in Hermosillo. In the interviews with the TNCs managers, numerous local companies supplying TNCs were mentioned; as a result of that information, 12 additional interviews were carried out with owners of small local businesses supplying specialised services for the Ford plant or to its global suppliers. The average length of these interviews was 70 minutes. Lately, a final set of 30 interviews were conducted with engineers and managers (26 men, four women) who at some point in their careers had been employed at Ford and who left to create their own companies. For this group, an occupational trajectory interview format was designed and the average length was 90 minutes.

The second phase consisted in the compilation of a directory of small and medium-sized companies supplying products and services linked to production, and the application of a sample survey to those firms, selected according to the following criteria:

- a they are located in Hermosillo
- b they are micro, small or medium-sized businesses
- c dedicated to the products and services mentioned by the TNCs as the main supplies provided by local companies.⁵

The sample size resulted in 166 companies and the questionnaire applied contained 48 questions divided into eight sections:

- 1 origin of the business
- 2 main products and production processes
- 3 main customers
- 4 competitiveness strategies
- 5 links with transnational businesses in the automotive sector
- 6 staff preparation and training
- 7 technological capacities
- 8 links with local institutions.

Finally, some of the TNCs managers and local owners interviewed in 2006 were revisited in early 2009, in order to collect information on two specific topics: the relevance of the regional policies and local institutions in their current operations, and the strategies developed to confront the current crisis of the auto industry.

5 Knowledge transfer, social networks and new local firms

The literature on *maquiladoras*⁶ has extensively analysed the factors inhibiting regional companies to enter the supply chains for the 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 suppliers over local companies, and the absence of an industrial policy which might promote the creation of technological and entrepreneurial capabilities in local companies (Wilson, 1992; Carrillo and Hualde, 1998; Dutrénit et al., 2006; Contreras and Carrillo, 2003).

In spite of these limitations, an emerging phenomenon in the region is the appearance of a handful of knowledge-intensive small local companies incorporated in the supplier network of TNCs in the automotive sector. In preparing the survey of local SMEs, a total of 293 local companies participating as suppliers were identified, although the majority of them were providing general services such as cleaning, security, transport and so forth. Lately, 99 local SMEs were found as supplying products or services linked to production, of which 16 were companies specialised in the automotive industry and the rest serving 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 were machining shops (37), followed by engineering services (27) and industrial maintenance services (23).

It was possible to identify three mechanisms for the incorporation of local firms into the automotive supply chain: *spin-offs* by former TNC employees, *socio-professional networks* in the region and the creation of capabilities through conventional *market relations* (Figure 2).

5.1 Spin-offs

One of the most frequent mechanisms for the incorporation of local companies into the supplier pool involves companies created by engineers previously working in the Ford plant.⁷ 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.

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 organisational techniques. That 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.

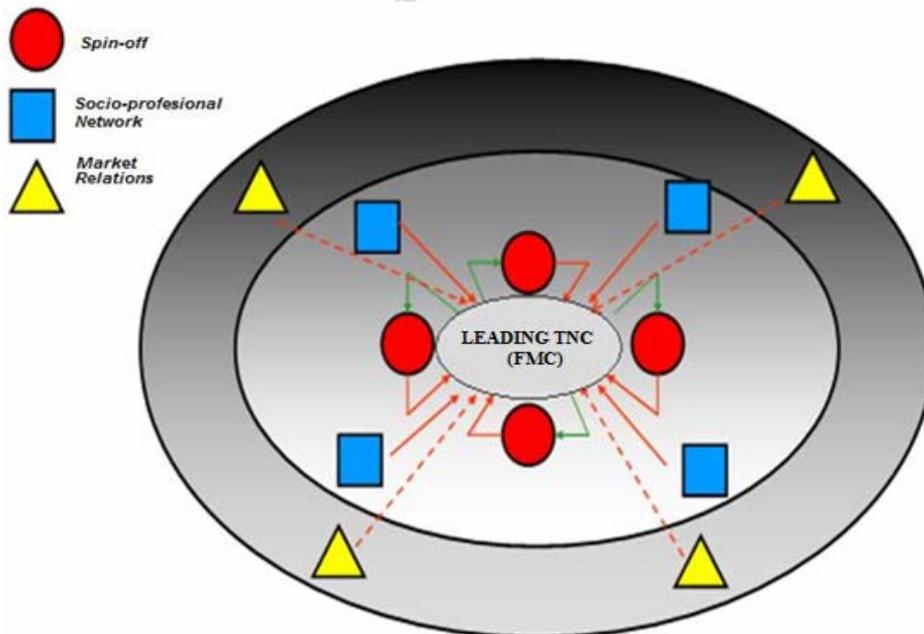
Of the 30 engineers interviewed, 16 had left Ford to start their own companies and 14 to take managerial positions in other companies. All expressed the main motive for leaving Ford as being the prospects for improving their professional position, be it through the offer of an attractive position in another company or as a result of their own

business project. In some cases, the position as employees does not exclude own business activity, since six of these new businessmen created their own company while working as employees at a TNC.

Independent of the emphasis on the technical or organisational aspects of the knowledge acquired at Ford, all those interviewed always referred to the 'culture of quality' as their principal source of learning. It is worth remembering that at its time this plant at Hermosillo was designed as a state-of-the-art plant at world level. Not only was the production process highly automated (95% of welding operations carried out by robots and 90% of stamping automated), but also the entire process was organised according 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. In this way, the experience of working in the plant meant a source of intense technical knowledge acquisition in such specific areas as welding and stamping or such generic areas as software and quality control.

Another type of knowledge acquisition refers to the coordination of processes, an area involving a wide range of technical knowledge, but especially organisational abilities. The relationship with suppliers and with 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 JIT system despite receiving 65% of its materials supplies and parts from Japan. As well as the organisation required to keep the factory routines in place, the communications technology itself turned out to be a novelty in the regional context, as one of the first companies to introduce a corporative IT network for communications in real-time and, years later, the first to use an intranet network.

Figure 2 Three mechanisms for the creation of local suppliers (see online version for colours)



Trained in conventional academic programmes, the Ford engineers were not only put through empirical contact with advanced technologies and organisational methods by the company, but also constant updating through formal training in areas such as statistical process control, reduction of inventories, manufacturing cells, quick model changes, JIT, 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 this new companies is *Integración Robótica y Mantenimiento Industrial (IRMI)*, founded by five industrial and electronics engineers who had worked at Ford since its opening in 1986. Between 1999 and 2000, these engineers gradually left the company, with each one starting their own business, dedicated to maintenance for stamping and welding equipment, process automation, instalation and equipment maintenance for paintwork and electro-mechanical instalations. In 2003, these five micro-businessmen joined together to form the IRMI Group, which began with 17 employees, with Ford as its only customer. At the end of 2007, it already 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.

5.2 *Socio-professional networks and market relations*

The second mechanism is based on the action of socio-professional networks. In their daily operations, the presence of TNCs involves the frequent interaction with (and even the formation of) social and professional networks in the local community. Over time, the 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, a common experience to all the managers at Ford and its transnational suppliers 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 control 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 USA 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, be they relatives, friends or professional links, in search of ways to solve the problems as quickly and cheaply as possible. Furthermore, the growing *endogenisation* of the managerial staff has made this process more likely. In the first years of their operation, over half of the plant managers were Japanese and from the USA and they were gradually replaced by Mexican managers. Currently, all the plant managers are Mexican, most of them graduated from local universities in the State of Sonora.

Finally, the third mechanism is based on *market relations*. This arises out of the operational needs of TNCs as they seek local suppliers capable of offering low cost, flexibility and quality. Usually, TNCs require general services such as cleaning, security, cafeteria and so forth. Because of their nature, these sorts of services tend to be acquired in the local marketplace, frequently through competitive processes. However, the lead companies also require more specialised services, such as maintenance, equipment repair, machining, programming, logistics, automation processes, among other services.

Belonging to a socio-professional network or having been employed by Ford can facilitate participation, but in some cases, the link is established outside of social networks, starting instead through conventional market relations. When the local socio-professional networks do not offer those options, the company must turn to the marketplace to search for local suppliers.

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 those jobs as a consultant, he was commissioned to carry out larger adjustments in an industrial manipulator used by Lear Corporation (one of Ford's large suppliers) to place the seats in the Fiesta model. This commission culminated in the complete redesign of the manipulator and the company *Kinematics* was created to this end. Since then, this company has specialised in the design and manufacture of industrial manipulators, growing from the six initial employees of 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.

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 assembly lines, a conflict of movements in the welding robots. On the basis of those jobs, its portfolio of customers grew within the automotive cluster and towards industries in different parts of the country and its staff grew from the initial two 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 Local institutions, the upgrading challenge and the global crisis

The success of these enterprises, given the weak linkages between local and global industries for high value added activities, prompted the attention of the state and federal governments. Having identified the opportunities for local suppliers, Mexican Government, as well as local actors and institutions have developed efforts to promote the upgrading of the functional and strategic relevance of the local supplier pool within the value chain. In this section, we summarise the main issues regarding the programmes created to support the local companies and the policy developments to deal with the current crisis.

The expansion of the Ford stamping and assembling plant in Hermosillo in 2005 gave rise to a number of organisations and programmes devoted to upgrading local SMEs and integrating them into the supply chain of the automotive industry. These organisations

provide consulting services and technical support, in addition to training and links to financial resources. But they also have an important role to play in creating an environment of trust and security by creating collaborative networks among different stakeholders. These networks improve the flow of information among local participants, facilitating mutual learning and providing an environment that nurtures greater interaction and collective knowledge.

Three of these organisations are particularly relevant in the case of the region's automotive industry (see Table 1). The first of these is Sistema de Asistencia Tecnológica Empresarial (SATE), which in English translates into Technological and Entrepreneurial Support System, which began operating in Sonora in 2006. SATE is a national programme run by the Mexico-United States Foundation for Science; it seeks to support the upgrading of the SMEs and their incorporation into global markets. During its first two years of operations in Sonora (2006–2008), this programme helped 45 enterprises, mainly metal mechanical and IT companies, by deploying 'technological and business consultants' to help them identify their market niches, improve their business planning, and strengthen their technological and entrepreneurial capabilities. The consultants also provide advice on innovation and the development of new products.

Table 1 Organisations and programmes created to support the upgrading of local companies within the auto industry value chain

<i>Institution (and year of creation)</i>	<i>Scope</i>	<i>Focus</i>	<i>Source of funds</i>
SATE-Sonora (2006)	Local branch of a national programme operated by the Mexico-US Foundation for Science	SMEs Support for the development of new products, new processes and entrepreneurial capabilities	Federal funds for SMEs State funds for economic development
CIAAS (2007)	State-based institution created by a coalition of knowledge intensive SMEs	Local suppliers of auto and aerospace industries Research and development, networking and market research	Federal funds for innovation and technology transfer State funds for economic development
CEDIAM (2008)	Local branch of a Monterrey-based Center for Development of the Auto Industry, operated by a private university	Global suppliers and local SMEs Research and development, and business incubator	Federal funds for science and technology State funds for economic development

The main task of SATE's consultants is to link the public, private and academic sectors. In the case of the 45 enterprises that have availed themselves of the programme, the general model initially required the consultants to identify enterprises with 'development potentials'; more recently, however, it is the enterprises themselves that request the aid of the programme. Jointly, the enterprises and the consultants identify the former's needs and opportunities in order to, for example, become suppliers for a transnational enterprise or expand their client portfolio among businesses with strict requirements concerning

quality and timely delivery. Once these needs and opportunities have been identified, the technical advisor helps the enterprise decide the course of action to take and to find the needed resources in Mexico and/or the USA. These resources may include training courses, contacts with potential clients, and – above all – financial resources to improve processes and products. One of the main tasks of the consultants is to let enterprises know where these resources may be found, how to apply for them (a process that may be complicated and time consuming), and then how to monitor the management of these funds.

The second organisation in the order of its creation is the Centro para la Integración de la Industria Automotriz y Aeroespacial en Sonora (CIIAAS), which translates into Center for the Integration of the Automotive and Aerospace Industry in Sonora, which began in 2007 as a result of the initiative of a group of local businesses which were already providing technological services to the large enterprises of automotive sector. As a result of the significant growth of transnational aerospace enterprises in Sonora after 2001, these businesspeople decided to include the aerospace industry within their purview. Their goal is thus to promote and support local businesses to facilitate their integration into the production chain of the automobile and aerospace industries.

CIIAAS began operating with funds from the Mexican Foundation for Innovation and Transfer of Technology in Small and Medium-Sized Businesses (FUNTEC) and the Sonora State Ministry of Economy, although its goal was to generate its own resources over the longer term. In addition, in 2008, it began seeking support from the National Council for Science and Technology (CONACYT) for research and development in technology. One of the first activities of CIIAAS was to promote the creation of a ‘Regional Alliance’ of businesses, institutions and research centres in the State of Sonora as well as in other states in Northeast Mexico. The purpose of the Alliance was to develop collaborative projects, including:

- a projects related to technological development and technology transfer that will allow small businesses in the region to compete in the production chain of the automotive and aerospace industries
- b projects to create human capital through academic programmes, practical workshops, research, continuing education and the granting of scholarships to train those needing special skills
- c projects to identify and monitor technological trends in these industries, assess the opportunities for local businesses and evaluate outcomes of projects developed by CIIAAS.

The third institution is the Centro para el Desarrollo de la Industria Automotriz (CEDIAM), which translates into Center for the Development of the Automotive Industry, founded by the Monterrey Institute of Technology, one of Mexico’s most important private universities. CEDIAM began operating in Sonora only in 2008, but it is based on a similar effort which the Institute has operated in Toluca (in Central Mexico) for years and which involves the participation of the main transnational automotive enterprises operating in the region, as well as local businesses and institutions. Its operations are carried out by four major participants: the federal and state governments, industrial organisations from the automotive sector, local and national enterprises that are linked to this sector, and the academic sector (universities, national laboratories, research centres).

CEDIAM's activities centre on incubating businesses, and providing support, consulting services, and other aid to existing enterprises. Its scope includes the following:

- 1 increasing competitiveness through advice and training in areas such as cost reduction, development of providers, quality control and monitoring the supply chain
- 2 design, development and testing, by carrying out projects for the design of products and the development of prototypes, including instrumentation and testing
- 3 research, development and innovation in areas including materials, manufacturing processes, energy sources, motors, emissions, intelligent systems, and safety and comfort standards
- 4 the development of human resources, both professional and technical.

These three organisations share a recent history (because of the widened expectations that accompanied the expansion of the Ford plant in Hermosillo), as well as the goal of strengthening the technological and managerial capabilities of local enterprises. In addition, they reflect the emergent processes of creating networks and institutions through which businesses and local agents can increase their capacity for collective learning and broaden their ability to absorb the technology and knowledge disseminated by TNCs.

These early efforts, however, have been seriously threatened by the global crisis that has afflicted the automobile industry and that has had a particularly harsh effect on enterprises based in the USA. After the second half of 2008, many of the efforts to consolidate and upgrade high value added local businesses were instead refocused on assuring the mere survival of these businesses. At the midpoint of 2009, both local and transnational suppliers are still using government funded programmes in order to improve quality standards of services provided to the automotive cluster, but mainly for lowering costs of labour force training and avoid unemployment as an effect of the dramatic decline in US demand in 2009.

The Mexican Government's reaction to the current crisis in the auto industry has been relatively quick, although limited, amidst a flood of demands for support from diverse economic sectors and social actors affected in Mexico by the severe crisis in the US economy. Governmental support to the automotive industry is focused on three fronts:

- a the Employment Preservation Program (EPP)
- b the creation of a fund for bank loans and guarantees
- c diverse complementary programmes at the local (state) level.

For global assemblers and suppliers the main support is centred in the EPP, created in January 2009. With an initial fund of \$200 million, this programme has the objective of avoiding massive layoffs in response to sales downturns, absorbing part of the payrolls of companies forced to implement production shutdowns. The mechanism implies that, instead of laying off excess workers, companies sign an agreement with the federal government to retain them, with the condition that they be paid two-thirds of their wages for the duration of the shutdown. One-third is covered by the federal government and other third by the company, with the remaining third considered to be the worker's contribution to overcoming the crisis.

Pressures from the business sector led to the expansion of the programme in April to include, in addition to manufacturing firms, first tier raw material supplier companies as well as manufacturing companies that had personnel adjustments in late 2008 (and not only in 2009).

Another programme is operated by *Nacional Financiera*, the federal government's development bank. It was placed into operation in February 2009 and is oriented toward supporting financial intermediaries and distributors to palliate the downturn in vehicle consumption in the national market. This fund amounts more than \$800 million dollars, with one portion consisting of credit lines for providing temporary liquidity to the primary financial intermediaries in the auto sector and automobile distributors, and other portion consisting of bank and stock-exchange guarantees. In addition, *Nacional Financiera* operates a programme for replacing fleets of cars and trucks, specifically directed to SMEs.

Finally, state governments where the assembly plants are located are implementing emergency actions to support the auto supply chain, although with very limited resources. Their actions have been mainly directed to participate in federal programmes such as the 'SMEs Fund', a generic programme directed to small companies which have been increasingly relevant to the auto sector since numerous local supplier companies are using this fund for their training processes, equipment acquisition, and new processes and product development. Under the present conditions, however, these funds are being used primarily to avoid laying off workers. For example, several of the small businesses that used to be growing have now requested public monies to divert some of their production workers towards maintenance tasks, with the hope of reincorporating them into production once the crisis is over.

7 Conclusions

Studies on technological learning and upgrading of local companies within networks governed by TNCs show the double character of the auto industry in emerging regions. On one hand, they limit, subordinate and frequently exclude the participation of local companies, but on the other hand, they constitute a vehicle to global markets and a mean for the acquisition of technical knowledge.

This research found that from the 1990s, a handful of local companies in Hermosillo began to be incorporated into 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 been in existence for fewer than ten 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 to wealthy families nor traditional firms in the region.

Even if the new local companies are small and their impact over the production network still marginal, they represents 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 (such as electronics, telecommunications and mining) and thus becoming less dependent on the automobile TNCs. The automotive industry in itself probably constitute a very narrowed 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 consolidate themselves as viable companies in global markets.

The efforts to articulate a policy to stimulate the upgrading of the local companies within the auto supply chain is very recent and has emerged only when some local firms succeeded in developing their own capabilities and became providers of high value added services. Two processes taking place from 2005 are particularly relevant:

- a the creation of local organisations oriented to the formation of collaborative networks by offering information, training, financing and coordination
- b the improvement of capabilities by local institutions and organisations to use national, regional and local programmes and funds to support local companies.

The emergence of the crisis in 2008, however, has led to a retrenchment in the array of policies and programmes that provided support; these are now focused on avoiding massive layoffs and business closures.

Midway through the year 2009, following a long technical work stoppage which resulted from the drop in demand, and even in the midst of a climate of uncertainty in which the continued viability of the automobile industry is being debated, the Ford plant in Hermosillo is preparing to begin assembling a hybrid of the Ford Fusion, one of the strong suits of the company in the region. These plans reinforce the belief that Hermosillo will continue to have an important role in Ford's strategy to recover its share of the subcompact market in the US. Moreover, the company's operations in Mexico appear destined to play an increasingly important role vis-à-vis the urgent need for the company to undergo a global reorganisation.

The reshaping of the automobile industry (based in concentration, modularisation and outsourcing) represents an opportunity for the emergence of local, knowledge-intensive companies linked to the supply chains. The driving force for this process is the effort by TNCs to reduce costs by outsourcing locally some of their productive activities and the creation of new local companies has been, in some way, a by-product of the internal restructuring in large TNCs, rather than the result of a coordinated strategy of local entrepreneurs or a coherent policy directed to create a competitive local supplier base.

So far, the modest attempts to create programmes and organisations to stimulate the local supplier base appears to be insufficient, given the challenges posed by the dynamics of TNCs in their interaction with the local economies, combining a relentless price squeeze and a demanding quality standards imposed on their suppliers. Past experiences with the *maquiladoras*, as well as Ford's own previous history in Mexico, are costly examples that the logic behind TNCs alone is not enough to promote local development: there must also be a concerted effort to appropriate the knowledge and technology from the transnational firms, furthering their global strategy while also taking into account local conditions and stakeholders, and to develop the institutional framework for local learning and innovation.

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Notes

- 1 GPN perspective is closely linked to the global value chain (GVC) approach. Both of them have their origin in the global commodity chain (GCC) approach, formulated initially in the works of Gary Gereffi. For a review of the similarities and differences between the perspectives of GVCs and GPNs, see Henderson et al. (2002), Coe et al. (2004) and Sturgeon et al. (2008).
- 2 In the case of the US companies operating in Mexico (Chrysler, General Motors and Ford), the last two aspects mentioned are the most important.
- 3 The City of Hermosillo is the capital of the State of Sonora, one of the five Mexican states located on the border with the United States. Henceforth, references to the 'the region' allude to the State of Sonora, while 'North America' refers to US-Canada-Mexico 'trade region' as is usual in international political economy studies.
- 4 National content demanded by the Mexican Government for automobiles assembled in Mexico was 50%; in 1989, the requirement was reduced to 36%, and in 1994, under the North American Free Trade Agreement, the national content dropped to 32% and was gradually reduced until its extinction in 2004.
- 5 The activities considered as linked to the productive process were: wood and plastic products; manufacture of metallic products; machining of metallic parts; manufacture of machinery and industrial equipment; engineering services; repair, instalation and maintenance of industrial equipment; IT consultancy services; software development; and handling of waste products and environmental remediation services. Excluded are cleaning, security, staff transport, canteen services and other general services.

- 6 'Maquiladoras' are industrial plants which import raw materials and components for processing or assemble in Mexico and then re-export them, primarily to the USA, 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.
- 7 'Usually... a spin-off has been simply 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), p.660]. This broad definition of a spin-off is used here.

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