New configurations in the Argentine automobile industry: the tension between production and business strategies

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Introduction

Research on Argentine automobile industry was successively focused on its economic structure (Sourrouille, 198à and Kosacoff, 1998; Lugones and Sierra, 1997, etc.), the historical evolution of its production (Katz and Lengyel, 1996), the different behavior of the complex subsectors (Kosacoff et al, 1999; Novick and Yoguel, 1998), labor relations (Catalano and Novick, 1996, 1998; Battistini, 2000), or the mechanics of production networks creation and linking (Novick and Yoguel, 1998; Yoguel, Novick and Marin, 2000).

In this paper our purpose is to make a deeper analysis of the mechanisms of adaptation to the local context or hybridization (Abo, 1994; Boyer, 1998; Boyer et al., 1998) several firms are implementing in Argentina. With this aim, we have studied in two selected cases the rationality of the transfer made by carmakers in its own factories, and the particular links established among the network firms. Our starting point is that the study of different original production models is enriched when it does not limit itself to carmakers’ settlement but also covers the relationship they have with their suppliers.

This paper aims at assessing the differences or similarities in generating competencies among the suppliers in two networks from the same industrial sector. The theoretical hypothesis of the study is that the characteristics of the new information- and communication-intensive technological paradigm, as well as changes in demand (diversity increase and permanent market fluctuations), redefine the production rationality of the firm and of the competence-achieving process. These characteristics imply a revaluation of the learning process in increasing the competitiveness of the firms and in their appropriation of quasi-rents.

This revaluation of the learning process has two consequences on our analysis. First, the learning process becomes a strategic tool for achieving competitiveness and “virtuous flexibility” in the firm as a whole and in its human resources management. The second consequence is a methodological one: the analysis of innovation-centered competitiveness shifts relevance from the individual firm to the network. This change in the unit of analysis requires to study power relations building within the network.

Specifically, in the automobile industry the network is made up of a coordinating enterprise and a number of goods and services suppliers. Presumably, the cooperation between them would permit to attain more efficiently the ultimate goal of the firm (profit maximization) by establishing more complex forms and mechanisms with a larger synergetic capability. Learning processes articulating both the internal organization of

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the firm and its networking have a central role within a systemic context. If it is accepted that synergies and intra-network externalities are vital in improving the individual and collective performance of the firms, it is obviously important to identify and evaluate, both qualitatively and quantitatively, real learning processes. It is also necessary to differentiate the dynamics of each firm from the relationship between the coordinating enterprise and the rest of the network.

We shall call "linkage style" the connection between the individual firm and the coordinating enterprise. Linkage styles account for the network externalities and synergies. They are taken to be the connecting link in the process of development of organizational and technological competence in the firms that make up the production network. Within each studied firm, other reciprocally connected dimensions are clearly distinguished: they are the innovation capability and the prevailing type of labor organization. The relation between these is governed by knowledge and the technological, organizational and business know-how each firm has accumulated, as well as by the efforts it has realized to progressively increase its competence. It follows that training efforts are relevant to that interconnectedness.

An increasingly important part of the firm's competitiveness is based on its ability to learn, to appropriate for itself a good amount of the knowledge its production activity involves. This process may mean to transform knowledge in quasi-rents or in a profit rate consistent with its accumulation path. To achieve this, the firm must develop a work process model and a peculiar mechanism for the creation of technological and organizational competencies (innovation capability) allowing it to generate, circulate and appropriate experimental and coded knowledge, thus increasing its comparative advantages in the market.

In the long term, the economic performance of any industrial firm is increasingly associated to its technological and organizational capability. The understanding of the way any industrial structure functions requires the comprehension of the particular nature of that capability (a mix of implicit and explicit knowledge), its dependence on the firm's background and the way it is articulated within the domain in which the firm is operating. It is very important, then, to analyze the technological and organizational development processes of the firm in different contexts.

In this paper, the process of learning and appropriating a production system is understood as a form of "hybridization". Through this process, some components of the original model or functional equivalents are transferred, but in solving the situations created in the real-world institutions of the targeted country they are redefined.

The question this paper tries to answer is when there is a "virtuous hybridization" and when there is a mere adaptation not intending to lay the foundations for a learning process or a common culture or consensus. Depending on this, the hybridization of a technological-production model may or may not become socially successful. In other words, it may or may not be able to establish a mechanism for allocating efficiency and efficacy in a way that is fair to the agents involved in the system. Each original industrial production model acts as an unstable system made up of social, technological and organizational components.

As concerns the settlements that took place in the Argentine automobile industry, the main questions made in this paper are the following:
Was it a process of production system application and adaptation, with the resulting interconnectedness between factors, or was it a partial and fragmentary assimilation of isolated and nonsystemic mechanisms?

How do the main dimensions of the original production model operate and what is the role played in the process by different agents (workers, trade unions, suppliers, etc.)?

What are the knowledge building and dissemination processes within the transplanted plant and how do these processes evolve in the relationship with suppliers? Are they learning processes that enrich the rest of the network, or are only partial and sectorial appropriations by the headquarters?

Do these processes tend to increase the excellence of original models, or on the contrary, the new hybrids lack the most “virtuous” dimensions of the original model?

The paper is structured in the following way. The first section describes in a stylized way the development of original industrial models in the two enterprises discussed in this study, Volkswagen and Toyota, and provides some elements to understand their adaptation to the Argentine conditions. To that end, differences both with the original models and between the hybrid forms created are shown. The second section completes the analysis of hybridization examining the information and knowledge dissemination among the coordinating enterprises and their respective network suppliers, as well as the form and relevance of competence building. After some conclusions, there is finally a methodological appendix explaining the approach taken and a statistical appendix including some results from the econometric models with which several hypotheses have been tested.

1. Hybridization processes in Argentina: the cases of Toyota and Volkswagen

Two carmakers and their respective suppliers’ networks have been chosen for study: Toyota Argentina (from now on TASA), first settled in the country in 1995, and Volkswagen Argentina (from now on VWA), which after the Autolatina experience (a joint venture with Ford for South America) resettled in Argentina as an independent firm in the same year..

Both firms chose Argentina as part of a strategy associated to the global regional stage of automobile enterprises within the Mercosur (Novick and Yoguel, 1998). This stage is characterized by the resettling of some firms that had previously left the Argentine market and by the arrival to the country of Toyota as a newcomer. Both firms began or reinitiated their operations in the global regional market at the same time. Their headquarters had a particular historical background and a production model based on conceptually and practically different strategies of human resources management. Besides, both organizations had had successful and failed experiences in the transplantation of their respective models (Jurgens, 1998; Shimizu, 2000; Mishina, 1998, etc).
1.1 The settlement of Toyota Argentina

The settlement approach applied by Toyota Argentina followed a number of procedures already used by its headquarters in markets about which it lacked operational knowledge. In the beginning, it became associated with a long-dated local bodywork manufacturer (Cairolli) that knew the market very well. This firm was able to transmit it the codes and signals of the local market and help it to decode them, but was not going to become neither its supplier nor its competitor in the long term.

Argentina is chosen to produce light pick-up trucks in four versions, which combined with different types of engines, allowed the potential manufacturing of 20 variants. In TASA the scale of production is very low. The potential output of this plant scarcely reaches 20,000 units of the Hilux pick-up per year; at present the annual output is 15,000. Thus, the market for this light pick-up began to grow in Argentina though the product was especially targeted to the Mercosur.

The initial product chosen, the range of variants and the production scale show that this settlement was planned in the context of a low investment. It is also interesting to note that in TASA case the Toyota Production System (TSP) is transplanted to an assembly plant and not to a manufacturing one. The Japan headquarters would supply to this assembly plant 50% of the most complex components and subsets of the product, that is, those with the most sophisticated development or the highest value added. Thus, the headquarters kept for themselves the market of the leading-edge technology innovations in both products and processes. The firm imports from the Mercosur regional market 10% of all parts and components while the remaining 40% is provided by local suppliers. The local supply has grown from 30% to 40% in the last years.

The plant is directly connected with the Japan firm not only through its purchases, but also through the management control established by its Japan mother-plant, which is responsible for the selection, buying and delivery of the main supplies and inputs, and for the daily monitoring at a distance of its production and market processes.

Several studies have investigated the principles and methods of the TPS both in its evolution through different historical stages and in the configurations it adopted when transferred to other countries as a set of leading principles and as a system (Shimitzu, 2000; Mishina, 1998; Florida et al, 1998; Coriat, 1991, etc).

The leading principles of TPS functioning aim at creating a new type of social relations between the employees and the firm, and between the firm and its suppliers. Rather than founding the relationship on economic production principles, the goal is to build a different social bond. This implies creating a consensus, which, if genuinely applied, may give rise to a new culture in the fields of labor-management, industrial and business relations. The goal is to build consensus based on the integrity and truthfulness of the other part's behavior even when both parts may diverge in their interests. This consensus-building is fundamental for the commitment to suppliers, to productivity as a rule for the distribution of wage and utilities increases, to reduce work to the level needed and to solve abnormalities in products and processes.
The greatest difficulty to introduce the TPS in cultures that are different from the Japanese is precisely the social construction of industrial relations and supply links based on these principles. Besides, the latter are put into action through their articulation with the main sociotechnical components of the model. However, they are only tools to materialize the functional principles of the model mentioned above. In this sense, if these technological devices are transferred without being articulated with the functions stated as principles, the result is either an unsuccessful hybridization or the construction of an actually different production system.

Some elements of the TPS are useful for carrying out the system functional principles. They are: JIT (just in time); JIDOKA (autonomization, that is, the power of any cell to stop the process at any stage to cope with problems or mistakes); KAIZEN (continuous improvement in processes, products, supplies and logistics); teamwork in the cells (a cell or kumi is made up of +/- 15 workers) and in sections divided in groups of cells (han); training considered as a way to improve flexibility and to carve out a career within the firm; the assurance of a stable employment for a large amount of workers; wage incentives according to evaluated and proved expertise; and support to the company union.

When Toyota transfers the TPS as an innovative production system to foreign plants (Mishina, 2000), it generally makes it through the following procedure. A successful mother-plant settled abroad is chosen to be in charge of adopting the leading principles of the transfer; client-oriented production criteria preserving the original quality are established; stable job generation and improvement in employees' welfare are promoted. In terms of human resources, a demanding selection of people with a professional profile, well-disposed to learning and teamwork, is privileged; development is sought through on-the-job training; communication is encouraged and open-door policies are applied in building the work environment, etc.

The social relations system to be created aims at building a consensus or an implicit contract between workers and management that may assure stable employment avoiding over-employment; maximizing the efficiency of the firm by eliminating waste in all components; designing production and organization lines with compensations consistent with value added; work flexibilization; training and continuous improvement opportunities to support the firm's actions; and encouragement of self-sufficiency in problem-solving. The development of production systems is often founded on autonomization and work standardization, based in their turn on centers of costs for each group unit.

In order to support the above mentioned criteria of suppliers' linkages, development is achieved through having more than one supplier for each component, through the open book management (full knowledge of the supplier's prices and costs) and through an association strategy (Toyota transfers the TPS to suppliers with the purpose of reducing its own costs).²

² The requisites to be a mother-plant or tutor of the transfer are to manufacture the same kind of product or to have done it in the past, do develop the tools for the management of the mother-plant sponsoring, and to be able to monitor the establishment and growth of the new plant.

³ Toyota's approach to the standard cost is minimalist while its focus on cost planning is very strong.
In Toyota, all functions have the aim of supporting the TPS. Production is the center of Toyota’s universe and the firm’s success depends on the effective support given by other functions to the production system.

1.2 The evolution of Volkswagen Argentina

Volkswagen Argentina (VWA) had a particular evolution. In 1979, it bought the plants Chrysler had in Buenos Aires Province when the American firm left the country. Afterwards, in 1985, it associated with Ford giving rise to Autolatina for Argentina and Brazil. There was a merging of personnel and management with the American firm, which had much more weight than the former in Argentina at that time, while in Brazil the inverse was true. WV Brazil had been one of the first factories of the German enterprise abroad, having an important share of the motor vehicles market since the sixties.

Beyond the difficulties this merging had for joining together four cultures (the American, the German, the Brazilian and the Argentine), there was in Autolatina a clear splitting perceived inside and outside the firm of the former workers and managers of VWA. Therefore, when the splitting took place, VWA workers, and also many of its cadres of department heads and managers, stayed with the firm.

At the end of 1994, after the splitting of Autolatina, VW built its assembly plant on a piece of land used by the old consortium VW-Ford in the past, adapting it to the assembling of middle-range vehicles such as the Gol and Polo.

The industrial production system adopted from the very beginning of the plant building (1994) consisted in associating some suppliers to the assembly line. This arrangement was inspired on the modular system developed by López de Arrotúa the "López model", as Posthumus (1997) calls it in an automobile plant of the firm settled in Spain and in a truck one located in Rezende, Brazil (Arbix and Zylbovicius, 1997).

The headquarters permission to establish a plant in Argentina was granted in a period when "it would have been easier to import finished vehicles from Brazil", where the firm had a larger operational base. However, the creation of the Mercosur and the legal regime of Argentine automobile industry had a crucial influence. At that time, the negotiations favored Argentina, since Brazil accepted the Argentine norms on import compensation. The initial strategy of VW was to manufacture the vehicles in Argentina, to export most of them to Brazil and to import from it a similar amount of finished vehicles in order to increase the mix offered in the domestic market, as well as to import sets and subsets from its Brazilian plants so as to optimize de division of labor within the regional market.

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4 They even identified themselves by the icon of a green frog superimposed to the firm trademark.

5 According to reports from VW officials.

6 Before the restrictions imposed by Brazil, it exported almost 70% of its production. In 1998 this figure was reduced to 30% and in 1999 the reduction was considerably larger.
The plant had been designed for an annual output of near 130,000 vehicles but it is currently working with only one daily shift and with an idle capability of almost 50%. Until 1999 there were two daily shifts and the output was of almost 500 vehicles per day.

The settlement of the plant in Argentina took place at a time in the history of the German firm in which foreign markets were vital for it, though they had been losing ground since 1997. According to Jürgens (2000a), "one of the changes that took place in the firm structure in 1994 was that regions became costs departments represented in the Board of Directors by other members of management; thus, the Africa-South America region is represented by López, who was at the time manager of logistics and production optimization. The Argentine settlement depends on the Brazilian plant and does not have much autonomy to make decisions related to the buying of inputs and car parts".

Historically, the VW strategy (Jürgens, 2000a) was shaped by three elements: 1) a popular, standard, low-price model (the "Beetle") designed to a considerable amount of consumers; 2) decision-making structures in which the State and trade unions had much weight; and 3) a specific kind of social relations. The management structure has always been considered as an example of German neo-corporatism. Social relations are markedly harmonious, in a degree that goes beyond the joint management framework so basic to the German labor relations model. Two other features of the VW system are the great influence of trade unions and the effective power of the internal committees. Jürgens thinks these three elements, such as they have evolved until the mid nineties, still have a structuring role.

Structurally, a close cooperation between management and the internal committee was needed to put into action the industrial model of VW. The structural neo-corporatist decision-making scheme, with its particular rules on property a heritage from the firm's history, made easier to affirm this cooperation and allowed the beginning of a new stage of harmonizing long-term strategies.

Professional training is another clear-cut feature of the neo-corporatist German system. The dual model methodology used in German high-school level gives each pupil the chance to learn several trades and professions alternating schooling with jobs. Thus, people are both efficiently trained for production tasks and academically well evaluated as to their professional competence. This facilitates their almost direct entry to the labor market. In many experiences of German firms settlement abroad, training came to be a major element, as in the plant of Puebla, Mexico, in the one of SEAT in Barcelona, Spain, and also in the preparations to open the one in Shanghai (Jürgens, 1998).

As regards work organization, debates on teamwork began in the eighties taking into account that productivity and quality were consistent with the standards achieved in

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7 In 1994, 59% of sales revenues came from foreign markets, as against 73% in 1967. In 1994, 53% of total output was manufactured beyond the German borders, though 59% of the total number of the firm's wage earners and 69% of its investments were German (Jurgens, 2000).

8 Any purchase higher than u$s 50,000 was consulted with Brazil through videoconference.

9 The conceptualization of the Volkswagen model at the international level is based in Jürgens (1998, 1999, 2000).
the best manufacturing firms in the world. According to Jürgens, restructuring policies focused on other dimensions. For instance, the decentralization of management through centers of cost with local managers, who had decision power on quality matters; also, the product development process was reorganized so as to integrate the goals of quality and efficaciousness in product creation itself through a number of product optimization measures known as "continuous improvement processes" (CIP).

Two other pillars simultaneously sustained the German system: flexible technology and high-skilled labor. The goal was to use these two elements to develop intelligent work structures in order to achieve quality diversified products at lesser prices. This was the "virtuous circle" according to which, as many analysts thought, the German success was to be explained by their high wages competing with the low wages generally paid through much of the '80s. Thus, high technology and a better professional training were going to be the main solutions in settlements abroad.

How did German firms transplant these concepts to other countries? In VW plants abroad there was neither a systematic attempt to emulate the skills/technology assault nor a different approach to production modernization. Instead, they tried to arrive at a compromise between high technology solutions and the conditions existing in those countries (Jürgens, 1998).

New technologies played an important part in plants settled abroad in the '90s and strategies adopted from the Japan model began to be introduced. There was a breakdown with traditional models: work organization was structured through "cells" with the use of kaizen, continuous improvement, quality responsibility, visual control techniques, etc. The plant in Martorell, Spain, was the first to employ workteams, kaizen, JIT with suppliers, etc. since 1992, and also the first in organizing itself around the modular consortium structure.

The settlement of some plants out of Western Germany, such as Mosel I in former East Germany, had some features similar to those of the Argentine plant. According to Jürgens (1998), Mosel failure is to be attributed to the lack of a clear mission guiding its strategy. Investment prospects were discussed and reduced several times, and the plant had to compete for output orders with other plants in a diminishing market. It had very few opportunities to develop a coherent production system because it was worried by uncertainties and constraints. The goal of making it into a learning laboratory could therefore not be achieved.

The similarity with the Argentine case comes from the decision to build a plant for a growing regional market following, albeit only partially, a modular consortium model. The investment resources came from the region itself. The production goal was fairly rapidly achieved, but there were strong demand fluctuations in these years and many projects could not be implemented. As we mentioned above, as a result of this the plant is working at half its capability and its survival is always endangered.

It was not until 1993 that teamwork was experimentally introduced in Wolfsburg, limiting it to some sectors only. It cannot be said that it was considered a strategic factor in restructurating production organization.
1.3 Main differences between the two cases

It can summarily be said that in the Argentine automobile industry there is a coexistence of some firms (clearly brownfields) that had their origin in the import substitution model but were afterwards bought or taken over again by their headquarters, and new investments established in the same geographical areas but acting as greenfields. The former have a long-standing personnel and their labor relations model is based on more strict collective agreements as regards occupational status, working day regulations and compensation system. The latter not only introduced new unstable contracts (in connection with new regulatory frameworks) but subscribed more flexible collective bargainings, including rules concerning daily and weekly working time, a drastic reduction in the number of brackets, productivity estimations differentiated by sectors, a lower union involvement, etc. Greenfields (with the exception of Fiat Argentina) were characterized, among other things, by new recruitment strategies, looking for young people with a higher instruction level, little or none labor background and preferably no union involvement.

The firms we have studied belong to one or the other of these categories. While VW came to the country in the mid seventies and did not form part of the first international automobile investments of the previous decade, Toyota was one of the new investments of the nineties. This meant quite a few differences both in labor relations and in human resources management. Though the VW plant begun operating in 1995, its organizational, social and production model had some similarities with the one implemented in the past, and the heterogeneity of its origins (plant, time, country) and cultures cut through all levels.

Our comparative study focused on the personnel profile, the strategy followed for contracting and training, the work organization, the relationship with the union and collective agreements.

Personnel profile

In the case of TASA it was the local management who defined the personnel requirements for a newly settled assembly plant: young people, mainly males, with full high-school instruction (from technical, commerce or general schools), without any experience in the industry (which also meant without common “work vices”) and for a high percentage of which (50%) this was their first job. Technical workers were recruited among college students of engineering and some other careers from universities situated in the area of influence of the plant. Choosing young people meant that the purpose was to create a pioneering group whose interests, motives, values, belonging and work concepts were very different from those of industrial workers older than 35.\(^{12}\)

On the other hand, in VWA the personnel had a mixed profile, since a great part of it (80%) were older people from the old plant, who had worked in the different

\(^{11}\) More detailed information can be found in Catalano and Novick, 1995; Novick and Yoguel, 1998; Novick and Yoguel, 1999, etc.

\(^{12}\) Managers informed that in TASA the average age was 28 years, while among the manual workers or team leaders it was 23 years.
factories the firm had throughout its history. The situation was not the same in the
gearboxes and transmission devices factory VWA had in Córdoba province. There, since
the mid ’80s, recruited workers had an instruction level corresponding at first to ten years
of schooling (it comprehended the first three high-school years) and then to the complete
intermediate school level. This VWA’s factory was one of the first companies to
implement direct personal interviews to evaluate behavioral, attitudinal and other
competencies (Novick, 1991). Here too, after being recruited workers went through an
important training process in which they were taught the firm’s production philosophy,
first in the Argentine plant and then in German factories. Therefore, it is apparent that
the two VWA plants in Argentina (the finished car plant and the gearboxes and
transmission devices factory) had different human resources strategies.

Training strategies

TASA used on-the-job training, by which the whole factory becomes a large
classroom. According to the reports of various managers of different levels, training
received by the first recruitment groups was meaningful. It included both theoretical and
practical elements, and lasted two to three weeks according to the sector the person
was going to work in. The training leader was very well acquainted with the Toyota
training system and able to make fulfill its demanding requirements. Training tasks in the
assembly line designed to solve production problems, either for continuous
improvement or for time reduction, were very frequently undertaken. Recent interviews
let us know that this training effort was significantly reduced later on, especially that
designed to new workers, who had been recruited through temporary contracts and were
only given on-the-job training.

In the case of VWA, both the type of training offered and the relevance it had in
the original model and in other transplants had been different than in TASA. In Germany,
training is based upon a kind of alternation known as “dual model”; and in other places,
such as the factory of the “New Beetle” in Mexico, it is given much more weight and
relevance than in Argentina. It is to be discussed if the differences derive from the
complexity of the car model produced or from the basic skills of recruited workers. In the
case under study, training is nonsystematic and unrelated to process improvement.

Labor relations and human resources management

There are important differences between both firms in this dimension. TASA
management system builds upon its human resources management policy, while VW is
underpinned by labor relations. Thus, in spite that in both cases there are significant
differences with the original model, both firms follow the main features of it as far as
social relations are concerned.

This is shown in the categories appearing in the following summary table:
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<td><strong>Professional categories</strong></td>
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<td><strong>Working day</strong></td>
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Though in both cases a greater connection with the basic dominant principles of the original model is seen, it will also be of interest to indicate in what points they have gone farthest away from that model.

1.3.1 Specific features of TASA adaptation

The most noteworthy differences with the original model are locally adopted cultural redefinitions in terms of work organization and of TPS functional principles or patterns. It could be perceived that very often the headquarters did not understand local labor culture and as a result there were confrontations and disagreements between managers of both parts. Those belonging to the human resources area had difficulty in interpreting the headquarters concerning labor and social laws that protect our country workers, as well as local usage and practices regarding holidays, vacations, ways of spending and controlling working hours. In the Japanese model, there are incremental seniority benefits that are not granted automatically with the passage of time but according to an evaluation of accumulated and accredited professional experience. However, in recent negotiations the trade union imposed some other criteria, such as an increase in the number of positions within each category (five for team members and five for team leaders), taking into account some type of performance and seniority evaluation and, particularly, creating mechanisms to incentive workers.

Therefore, wage increases are no longer directly related to the productivity principle, as in the original model. At present, the pattern of wage increase is not defined by that principle, but through collective bargaining based on the traditional pattern of labor relations in this sector. In the TPS the productivity principle is linked to a series of systemic procedures that aim at reducing the "standard work time" for each task. These procedures are promoted through kaizen methods of continuous improvement of
processes, products and inputs, and through those established to reduce process and product abnormalities. Wages are no longer the expression of productivity increases. The incentive to reduce the standard task worktime and to correct the abnormalities is some kind of group or individual prizes (of low value) for implemented suggestions.

An issue which has a direct relation with the adaptation of the model is worth mentioning. The attempt was made to transplant the arithmetic formula for productivity compensations or prizes with the same algorithm used in Japan. However, for this formula to be *rightly and adequately* employed the plant must have an optimal production scale, a standardized output and correct measures of its productivity. In the first years after its settlement, TASA had not developed any of these possibilities. In the end, workers would only get 15% of the productivity increase, because there was no way of measuring it. Demand fluctuations prevented the standardization of production, and as TASA had agreed not to fire people, measuring productivity as the amount of hours worked per each assembled pick-up actually resulted in a productivity decrease rather than an increase.

In its relationship with the trade union, TASA also attempted to establish consensus and mutual trust based on agreement fulfillment. Union leaders say that the agreements they signed with TASA are more reliable than those reached with other car makers. As usual in Japan, TASA's hierarchical ladder has many levels. Supervisors do not control either labor discipline or technical tasks. Their role is that of facilitators who have a whole vision of the process and are thus able to give their well-informed support to the production "cell".

The group of supervisors is not homogeneous. Those who have worked in the company for a longer time have been specifically recruited for the position and do not work in the assembly line. All of them have had a five-month training period in Japan, in more automated lines than the Argentine ones, after which they immediately began to work as supervisors. A second layer of supervisors was internally promoted.

The work organization principles of polyvalence and the worker's right to stop the line (autonomous action) are considerably restricted in the Argentine case. The decision to stop the line is left to the supervisor only: neither the workers nor the team leaders are authorized and/or able to do that. Workers are polyvalent in the sense of extension of tasks. The cells in the line are much smaller than in the original model: they consist of three to seven people and have a team leader; the supervisor controls two or three cells.

Another "hard" component of the system is the technology used, directly suggested by the Japanese mother-plant and introduced without any negotiation with local management. The only adjustments made locally are those aimed at line balancing. On the other hand, it must be emphasized that given its production scale the plant has a lesser degree of automation than other ones, since in its case a massive inclusion of robotics is not justified.

13 Though TASA had to cope with many crises after its settlement, it has never fired or laid off employees, but some times these were required to turn over or to devote themselves to maintenance tasks or social services.
1.3.2 Specific features of the German model adaptation

In WVA the hybridization process seems to be more diffuse. Its model is not as orthodox as that of Toyota, the firm has a longer history in the country, and the German model is also being revised concerning both work organization and the relationship with suppliers (Jürgens, 2000b). The adaptation of the German firm will be examined here taking into account only three factors: the modular consortium, work organization and the system of labor relations.

Work organization is based on a modular system which in turn is divided in cells, though the old system of individual allocation of jobs coexists with the new one. Each cell is composed of around ten workers and has a polyvalent character, having a more skilled instructor or coach with a higher degree of specialization. A supervisor this being the first category that is out of collective agreements controls every cell in the module.

Jobs are designed by the MTMA’s methods in the Department of Industrial Engineering, which studies the potential overloading of a job for its incumbent. The individual workload is revised on a daily basis so as to achieve greater efficiency. However, in the workload evaluation an important part is played by the personnel feedback through their representatives and the trade union experts, who make the claims regarding overloading, unhealthy positions, etc. The final application times and the design itself are completed after knowing the implementation results.

The settlement of the plant was based on the notion of modular consortium. In 1998 there was in place a fourfold system of parts supplying, composed of: (a) the associates, integrated in the assembly line; (b) those who deliver subsets directly to the firm; (c) local or foreign suppliers who deliver through a "consolidator" (a subcontracting logistics firm), and (d) components sent directly by other branches and delivered in line by the consolidator. Security, buffet, cleaning and other services were being outsourced.

At first, there were sixteen associated firms, in 1998 only eight of them remained and from 2000 on there was practically none, since several stages were insourced. By way of example, in 1995 the staff of the associated firms was of 1,000 people, in 1997 it was of 769 and in 2000 of 115.

In the area of labor relations, the German model is based on the joint management of workers and the firm, through which trade union representatives have a central role in the general management of the firm and, in particular, in the introduction of new systems of work organization and technology, as well as in the discussion of strategic plans and the settlement of new plants.

In the Argentine case, the trade union (Smata) also had a major role in the history of the plant and in the building of the modular consortium. The union has a high membership and a high degree of representation and representativeness. Smata played a dual role in the introduction of the consortium and in the relationship with the associates. First, it prevented the implementation of the original idea of reducing almost by 20% labor costs of the workers under Smata agreement. It even extended this protection to the workers of the consortium firms, who had a lower wage cost because they belonged to other collective agreements. By getting that all associated firms’ workers were included in the same terms of Smata’s agreement, thus being on equal terms with respect to wages and work conditions, the union strategy and political action
prevented the cost reduction and, by the way, enlarged union membership. At the same time, it signed agreements with the associated firms and constantly negotiated new conditions with the firm. With its involvement, the union facilitated the outsourcing and the establishment of the modular consortium.

We have tried to summarize the main differential factors in two aspects: on the one hand, regarding the differences with both firms’ original models, and on the other hand, regarding the differences between the hybrids as local production systems. Now we will underline some common features identified in institutional characteristics and in the type of local agents involved.

1.4 Common characteristics of the adaptation processes

1.4.1 The trade union participation

In the first place, the role played in both firms by the trade union that embraces all carmakers workers in the country should be emphasized. Historically, this union has changed the tradition of “company unions” [sindicatos de empresa] by transforming them in “unions by company” [sindicatos por empresa].\(^{14}\) Negotiations “by company” in this sector derive from the international carmakers proposal to encourage the creation of company unions in the sixties. The trade unions action changed this proposal into a negotiation “by company” with a single centralized union. This mechanism allowed the union to accept articulated negotiation models more quickly than any other union group, as they agreed with historical negotiation practices.

In the two cases under study, the trade union played a very relevant role. In the case of the Japanese enterprise, it attempts to establish individual contracts at a global level in which both parts accept commitments concerning the TPS (on the one side, a commitment to stability; on the other, an involvement with production and quality). In the Argentine case, those commitments were included in some of the principles established in the collective agreement, to the point that the Toyota philosophy extends through the first ten pages of the agreement. Even when those principles have a mere declarative character, they set up the labor and production model to be followed.

Nevertheless, in spite of the agreement, the firm did not plan to accept the union presence. The goal of the human resources policy is to make the union increasingly unnecessary to the fulfillment of the workers’ claims.\(^{15}\) At the time of the settlement (1995-1996), it had been difficult to have the amount of representatives candidates that corresponded to the amount of workers under the agreement, and the elected Internal Committee (Claims Committee) had only three members, even when according to the amount of workers the proportional figure was five. At present, all delegates’ positions

\(^{14}\) The Japanese model of company unions [sindicatos de empresa] refers to a labor relations system that is managed exclusively within the plant or production organization. Instead, the “union by company” [sindicato por empresa] is a system that, in spite of being able to negotiate agreements within the firm, depends on a branch or industrial sector trade union. In the Argentine automobile industry, agreements are signed both by the firm’s internal committee and by the regional or national union (Catalano and Novick, 1996).

\(^{15}\) However, 35% of the young new employees affiliated with Smata. This is a low rate if compared with the membership in other automobile plants in the country, but it is high if compared with the one prevailing at the time of the settlement.
are filled and by the time the new agreement had to be negotiated there was a massive attendance to the workers’ assemblies.

As already said, in the case of the German firm which had a longer and more important tradition in the area of labor relations the union struggled and won a hard fight to obtain the homogenization of wages and work conditions for the individuals who worked in the firm, whether they belonged or not to Volkswagen. Besides, through its researches on task overloading, the union is influential in determining the design and content of jobs. The number of accords already signed by the firm and the union representatives is very high, a fact that indicates a strong and dynamic participation and involvement.

1.4.2 Flexibility regulation

Both firms have made use of several regulations and government employment schemes whose goal is, among other things, to reduce labor costs by diminishing employers’ contributions and leaving aside some social security benefits for workers. Both of them employed these procedures to flexibilize labor costs in their contracting activities and in their recourse to labor market mediators (employment agencies, etc.). In this aspect, the similarities in the local behavior of both firms contrast with the conditions found in their countries of origin and also in their major transplants, where job stability is the main feature in labor relations systems and human resources policies.

1.4.3 Market size

Another common characteristic of both firms is that they are used to a production scale much larger than those of the domestic market and of the region as a whole. The problem is not circumscribed to scale, though; this is a market with permanent fluctuations of a significant degree, which interfere with the general strategies of firms and their expansion plans. Another exogenous factor that limits investment or expansion projects is the changes and uncertainties in regulatory frameworks.

2. The relationship with suppliers: main differences in the VWA and TASA networks

Two elements led us to include in our study the suppliers of parts and any other input to the carmaking industry. First, the change in the purchasing procedures developed by the firms in industry transactions are based on sets and subsets, rather than on isolated parts and the new relationship established with suppliers. Second, the globalization of this sectorial market and the requirements it sets up with respect to scale, quality, lead times and delivery prices.

Data included in the network analysis correspond to 67 suppliers of TASA and VWA (see Box 1) which were analyzed with the methodology described in Annex 1. The way in which production models are adapted and hybridized is thus completed through this stylization that takes into account the form in which the model of the relationship with suppliers has been transplanted.

A number of factors allowing to describe, in each of the cases under study, linkage styles in the matrix of the car makers-local suppliers network have been
identified. An attempt was made to quantify this relationships in order to evaluate in a
precise way the degree in which models actually implemented were similar or different.
At the same time, the aggregated quantification of the development level of technical
and organizational competencies of suppliers generally permits to begin to elaborate the
firm and network model for the Argentine automobile industry as a whole (see Table 1).

Box 1. Panel aggregated data

The panel of firms included in the two networks under study is composed of 67
suppliers from different segments, 42 of which sell to VWA and 25 to TASA. Given the
nature of the Argentine automobile industry complex, eight firms in the panel are
suppliers to both enterprises and some of them are also suppliers to other carmakers in
the country. The annual sales of plants supplying both networks average 18 million
dollars, but those plants belong as a rule to multiplant enterprises whose annual sales
are significantly larger. The size of TASA suppliers is only 7% larger than the average,
demonstrating the greater relative weight of SME suppliers in the VWA network. Most
suppliers of both networks belong to FDI firms, a fact that became even more acute in
the '90s since in 45% of them there have been a property change in the period.
International firms originally owned already 20% of them.

In the Toyota-suppliers relationship, there were difficulties in building the JIT as a
basic component into the model to be transplanted. As other firms employing
autochthonous forms of the JIT, Toyota had to develop a logistics of its own, collecting
the suppliers' deliveries on a daily basis as a way to assure that they came in time. The
paradox of the JIT system in the Argentine case is that it depends on Japanese parts
and spares, but when distances are so long the JIT is canceled and there is the need to
have monthly stocks. Thus, while JIT is in order for supplies coming from Argentine
sources (40%), for those coming from Japan (50%) and Brazil (10%) there must be
monthly stocks. In transplanting the model to Argentina, the JIT system applied to
suppliers adopted some particular characteristics. TASA is not able to assure big
purchases to its providers since its project is still small. TASA coped with this negotiation
weakness by assuring long-term supply contracts, which in some cases covered a five-
year period ahead.

We analyzed linkage styles in the first place, and then three meaningful dimensions for
the development of suppliers' competencies: (i) training systems; (ii) type and scope of
the prevailing work organization model and significance of consensual agreements; (iii)
innovation capability.

2.1 Linkage styles in both networks

One element to study the way in which agents link with each other is the
existence or nonexistence of contracts and the degree of symmetry they have. A second
element is the import of knowledge and information generation and dissemination
among the inner and outer network agents.

When the methodology used (see Annex 1) was applied to suppliers of both networks, it
could be seen that the level of linkage with suppliers was clearly low (0.29 in TASA and
0.22 in VWA),\textsuperscript{16} showing the little development of non-price linkages and of informal exchanges among the agents. The TASA network performance is somewhat higher at this, which could be explained by the weight the relationship with suppliers has in the original production model. Even when it is not always the same, it manifests itself as a relevant dimension leading to formal medium-term contracts that do not exist in the rest of the industry. Moreover, these contracts have exit clauses partially protecting the suppliers' interests and are performed in spite of macroeconomic fluctuations.\textsuperscript{17}

In the VWA case, we could not find in the literature many studies on the relationship with suppliers, but the present trend in German automobile firms is to encourage the suppliers' involvement already in the product design stage, without waiting to the pilot project stage (Jürgens, 2000b), and to make medium-term contracts. In Mexico there is a strong relationship between the three largest German firms and global suppliers of the same country; this does not seem to apply to the Argentine case, probably because of the complementariness with Brazil (Brazilian suppliers have not been included in the study), the type of product and the domestic market scale.

The indicator of linkage styles we have found shows that the flow of capacities and experiences between carmakers and their suppliers is not very relevant. Therefore, the potential synergies and actual externalities of the automobile industry network do not seem to be strategic elements in the current configuration of networks interwoven around TASA and VWA.\textsuperscript{18} Besides, in Model 1 (see Statistical Appendix) it is verified that linkage styles of TASA and VWA networks are not significantly different, meaning that both models approach to the weakest extremes of each network (Yoguel, Novick and Marin, 2000), whose main features are a low interaction level and the absence of mutual enrichment.

Technological linkages outside the network (with institutions and other agents) are slightly more important among VWA's suppliers than among TASA's (0.24 vs. 0.18), though these differences are not statistically significant either.\textsuperscript{19} Some factors explaining this difference are a stronger formal cooperation and the frequency and intensity of linkages with other institutions. On the other hand, informal conversations with other agents tending to augment the firms' competencies and their technological transfers are comparatively similar.\textsuperscript{20} A possible explanation of that difference is each carmaker's background in the region: it is only natural to expect that the VWA network model is better articulated with the rest of the production system.

\textsuperscript{16} As the methodological section describes in detail, the aggregated indicator goes from 0 (no linkage) to 1 (maximum linkage).

\textsuperscript{17} The original model is one explanation, the other being that it is not easy to find suppliers able to satisfy TASA demands for a very small output.

\textsuperscript{18} According to the conclusions of researches on this and other sectors (Motta et al., 1998; Bisang, R; Gutman, 2001), the remaining networks show similar results. This may be attributable to the characteristics of the Argentine automobile industry complex.

\textsuperscript{19} The aggregate indicator of linkages outside the network is the same for both firms (the probability of acceptance of the hypothesis of no association is 42%).

\textsuperscript{20} These agreements are more important in the VWA network (probability of acceptance of the hypothesis of no association, 42%), while informal linkages with other agents are similar in both (59%).
The technological presence of the carmaker in the network is substantially larger in the case of TASA (0.34 as against 0.22 in VWA). This coincides with the views of both firms' suppliers and with the adaptation of TPS in Argentina, singled out by more patterned and fluid linkages than other models. The global indicator of linkage styles reveals that the network built around TASA has in general a slightly more dynamic (though smaller) structure of linkages than that of VWA (0.24 vs. 0.18).

The most influential elements affecting differences in carmakers' linkage styles are the highest level of technical assistance given by TASA to its suppliers in order to guarantee quality and work organization (0.56 vs. 0.27), and, in a lesser degree, its assistance for product and process development (0.35 vs. 0.23). On the contrary, the indicators of assistance for training and technology transfer are very low. Finally, even when the use of infrastructure by VWA's suppliers doubles that of TASA's, differences between specific models are not significant.

2.2 Technological competence in the network firms: innovation capability, work organization and training processes

The indicator of the individual firm's development of technical and organizational skills in any network is relatively high. In the aggregate, when innovation capability, training efforts and the prevailing work organization model are integrated, the score amounts to 60% of the maximum level.

The indicator assessing training efforts is slightly higher than that for innovation capability and work organization. This reveals that suppliers follow a well-thought strategy as regards training, its scope and the different hierarchical levels involved. Differences between the two networks in these dimensions are not significant (see Table 2), though the indicator of work organization for TASA is 8% higher than the sample average.

Table 2. Main indicators of network behavior in the Argentine automobile industry (TASA and VWA)

<table>
<thead>
<tr>
<th>DETERMINANTS OF COMPETENCIES GENERATION AND DISSEMINATION IN THE NETWORK</th>
<th>VOLKSWAGEN</th>
<th>TASA</th>
</tr>
</thead>
</table>

21 Model 2 (see Statistical Appendix) shows that suppliers-coordinating enterprise linkages are slightly higher in TASA than in VWA (probability of acceptance of the null hypothesis, 10%).

22 Model 3 (see Statistical Appendix) shows that the probability of acceptance of the hypothesis of no association between technical assistance received and belonging to a certain network is only 3%. Thus, the test confirms that TASA's technical assistance is greater than VWA's. On the other hand, there are no differences between the two groups as regards assistance for suppliers' development.

23 The probability of acceptance of the hypothesis of no association between this variable and belonging to any network is 39%.

24 In evaluating if belonging to the network is a differentiating element in each of these dimensions, the conclusion is that only innovation capability is significant, while for work organization and training levels there is no correlation.
<table>
<thead>
<tr>
<th>1. AGGREGATED LINKAGES STYLE</th>
<th>0.22</th>
<th>0.29</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 WHOLE LINKAGES WITH CARMAKER</td>
<td>0.22</td>
<td>0.34</td>
</tr>
<tr>
<td>TRAINING ASSISTANCE</td>
<td>0.15</td>
<td>0.19</td>
</tr>
<tr>
<td>QUALITY AND WORK ORGANIZATION ASSISTANCE</td>
<td>0.27</td>
<td>0.56</td>
</tr>
<tr>
<td>PRODUCT AND PROCESS DEVELOPMENT ASSISTANCE</td>
<td>0.23</td>
<td>0.35</td>
</tr>
<tr>
<td>TECHNOLOGY TRANSFER</td>
<td>0.08</td>
<td>0.01</td>
</tr>
<tr>
<td>USE OF COORDINATING ENTERPRISE INFRASTRUCTURE</td>
<td>0.24</td>
<td>0.11</td>
</tr>
<tr>
<td>1.2 LINKAGES WITH OTHER AGENTS</td>
<td>0.24</td>
<td>0.18</td>
</tr>
<tr>
<td>FORMAL COOPERATION</td>
<td>0.06</td>
<td>0.32</td>
</tr>
<tr>
<td>INFORMAL CONVERSATIONS</td>
<td>0.27</td>
<td>0.33</td>
</tr>
<tr>
<td>TECHNOLOGY TRANSFER</td>
<td>0.22</td>
<td>0.19</td>
</tr>
<tr>
<td>LINKAGES WITH INSTITUTIONS</td>
<td>0.06</td>
<td>0.20</td>
</tr>
<tr>
<td>2. COMPETENCIES LEVEL IN THE NETWORK FIRMS</td>
<td>0.61</td>
<td>0.59</td>
</tr>
<tr>
<td>2.1 INNOVATION CAPACITY</td>
<td>0.59</td>
<td>0.57</td>
</tr>
<tr>
<td>2.2 WORK ORGANIZATION</td>
<td>0.50</td>
<td>0.96</td>
</tr>
<tr>
<td>2.3 TRAINING EFFORTS</td>
<td>0.67</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Source: Authors' elaboration based on data from a survey among TASA and VWA suppliers. 

As to innovation capability, the most relevant factors are: (i) assuring quality, a prerequisite for the existence of the supplier, and (ii) the complexity of the development activities, since these are increasingly delegated in suppliers. In both cases, factor scores are 70% of maximum levels. TASA network firms are slightly superior concerning quality, while the opposite situation prevails as regards development. Significantly lower figures are recorded for new products development (slightly higher for TASA suppliers) and the use of the carmaker infrastructure and laboratories (the higher importance of test laboratories in VWA accounts for the considerably larger figure of the latter). As to work organization, there are not significant differences in the corresponding factors: percentage of workers grouped in cells, main responsibilities of each cell, hierarchical model and polyvalence type in the work process. Finally, the factors considered (structure, length, amount of money allocated, content and evaluation) did not show any differences between both networks' suppliers as regards training.

In sum, the application of this methodology to both networks of suppliers shows the significant weakness of each carmaker's linkages and bilateral relations with the firms composing the respective network.

3. Conclusion

The comparison between the present scenario of carmakers-suppliers relationships with that prevailing in the first period of automobile industry -going from settlement to the crisis of the import-substitution model- is quite interesting. Especially, it highlights the degree of system openness or closeness, the relevance of local suppliers' development, the relative autonomy of carmakers from the international network and the kind of prevailing regulations.

When carmakers began their settlement in the country at the late fifties, they were closed systems poorly related with international process and product technology, which emphasized mainly the suppliers' development with a relative autonomy from their
headquarters. Within that framework, learning focused on a productive business exclusively oriented to the domestic market, with only a few models and very small quality requirements. Nevertheless, the process of adaptation tended to widen the gap between the leading-edge headquarters and the local firms. When the crisis of the import-substitution model began, relationships with suppliers were increasingly more rigid and hierarchical.

The network configuration of the nineties shows significant differences on the axes mentioned. On the one hand, the network is clearly more open. It is also more strongly connected and gets information and knowledge inflows from abroad in its process and product technology. This process is the result of: i) the kind of regulations applied from 1995 on favoring imports of subsets and finished vehicles, and ii) the transnational character of most suppliers, who had strong bonds with their headquarters. In this new scenario, business are centered around regional markets, with a considerable increase in both carmakers and suppliers' intrafirm trade. As a consequence, the network is much more open. Its relative autonomy from the international network and the relevance of its linkages with local suppliers have diminished. At the same time, differences between the local models and prices of manufactured cars and trucks related to the international standards have also decreased. However, because of the weight of key components imports in both subsectors of the complex, the trading business became more central.

Regarding the questions posed at the beginning of this paper, it may be said that:

- These are not integrated systems made up by interlinked factors. They do not make use of partial isolated factors either. In our view, they are composed of subsystems with their own inner rationale, derived from: (i) the original production models; (ii) the regulatory frameworks in target countries; (iii) the degree of development of local agents and actors; and (iv) the role of local networks in the whole business rationale. These subsystems are part of production models and carmakers-suppliers' relationships that can only be understood by apprehending their headquarters' global strategies and relationships. In that sense, local adaptations are opening systems having a small degree of freedom. The technological, social and organizational subsystems of each of the discussed networks and individual firms are coherent but have low economical and technological decision-making autonomy. For example, high relative innovation capability and training efforts at multinational local suppliers, as shown in this paper, are more the consequence of the headquarters' strategies than of the local carmakers' or institutions' behavior. This kind of subsystems are consistent with the low linkage found between carmakers and their suppliers.

- Major features of original production models tend to be sustained, though adapted to local conditions. In the case of TASA, relationships with suppliers and relevance of work organization continue to be central elements, in spite of being an assembly plant of a much reduced scale and with a lesser degree of automation than other factories the firm has abroad. In Volkswagen's case, the original features of the labor relations model, the cooperation mechanisms and trade union involvement are also
kept in the adaptation. Besides, each carmaker has adapted itself to the local agents found at settlement (type of trade union and suppliers) in terms of the original models.

✅ It follows from the study that in each network, and presumably in the whole automobile complex, there is an important deficit as concerns the development and dissemination of knowledge. The carmaker-suppliers relationship is centered on demands related to price, quality and delivery time. Technical assistance is poor and there are few mechanisms favoring the development of non-price relationships among the different agents in the network. On the other hand, research and development efforts are basically made in both the carmakers and suppliers headquarters. This situation is partly explained by the headquarters policies related to market and technological innovation rights and to the characteristics of the assembly plant and its scale. However, suppliers include a considerable percentage of human resources designed to make incremental adaptations, and this is a progress with regard to the condition of the complex in the early nineties, when they were far off from the technological frontier both in design and in technology and quality.

✅ The local networks’ place is not determined only by internal factors like market size, degree of development of agents and/or geographic localization. Belonging to the global hierarchy is the key factor in explaining its position. Moreover, this factor determines an absence of learning processes in the local and regional networks, limiting their competitiveness and their opportunities to develop local-regional learning in order to generate new products, true business capacities and a freedom to search for niches in the international market. Anyhow, these new production systems and the new carmakers-suppliers relationship have given rise to learning processes in a certain degree. For example, there could not have been a logistics insourcing in VWA without "learning" from the supplier, whose original contract had been negotiated in Spain. In the same way, some of TASA suppliers have learnt from the market some issues that allowed them to make sales to other Argentine carmakers afterwards. But in many cases, the learning process has stopped when strategic reasons led the firms to go to Brazil or leave the region altogether.

✅ As to the question of whether original models are "ennobled" by the new configuration of models and networks or lose their most "virtuous" characteristics, the paper rises a number of points in terms of process and product technologies, social management technology and learning processes. It has been described that product technology is now approaching considerably the international frontier, with an import content of about 50% of the intermediate consumption, which reduces firm and network efficiency. Process technology is also approaching the frontier, though it is limited by the heavy assembly content in carmakers as well as in a great amount of suppliers. As regards social management technology, there is a trend to a greater enrichment and polyvalence of work organization models, though the delegation of responsibilities is still low. Work intensification is also noticeable. The trade union still acts as a
mediator but has lost weight as a powerful agent to negotiate better wage conditions. Moreover, the larger flexibility in contracting and in extending the working hours increases labor precariousness and risks.

As a whole, these factors lead us to assert that in the regional market of the networks under study there is a prevailing trading business logic pointing to short-term profitability. This logic works against a production rationale designed to build, as part of a larger-term strategy, a subsystem connected to the global system that offers opportunities for development, learning and the generation of comparative advantages. What is lacking in this scheme is an open process emphasizing the development of local and regional suppliers and entailing a redistribution of quasi-rents, with the consequent price reduction and the increase in finished vehicles exports outside the region.
Annex 1. Methodology for network analysis

In this annex, dimensions taken into account for the analysis of networks and the process of generation and dissemination of knowledge are described. First, factors needed to estimate linkage styles both between coordinating agents and their suppliers, and between the latter and other agents and institutions, are shown. Second, dimensions needed to evaluate the development of endogenous skills (innovation capability, work organization and training) are listed.

1. Linkage styles

(A) Carmaker-supplier linkage
This indicator is estimated through the six following factors:
- Involvement of carmaker in training activities.
- Type of technical assistance for quality and work organization.
- Support of coordinating firm to development activities.
- Use of infrastructure and laboratories of coordinating firm.
- Technology transfer.
- Contracting.

(B) Linkages with other agents
- Formal agreements.
- Informal linkages with agents.
- Institutions that are not part of the network.

2. Development of firms' endogenous competencies

2.1 Innovation capability
2.1.1 Potential competence of human resources for development
- Workers wholly dedicated to R & D as a percentage of the whole amount of workers.
- Percentage of high-skilled workers dedicated to R & D (called "innovation workers").

2.1.2 Existence or nonexistence of specific infrastructure (R & D laboratories)
- New product development.
- Relevance and complexity of development activities.
- Level of quality assurance processes.

2.2 Work organization
- Percentage of workers grouped in cells.
- Relevance of cells.
- Degree of cell autonomy.
- Extent of polyvalence.
- Relevance and complexity of turnover and polyvalence activities.

2.3 Training
- Type of skills
- Training costs as a percentage of sales.
- Involvement of less skilled human resources in training.
- Existence of a differentiated structure owned by the firm within its human resources area.
Annex 2. Statistical appendix

The following figures are the result of the application of econometric models to analyze the statistical difference in both networks' behavior.

Model 1. Values corresponding to the aggregate dimension of linkage styles are independent of the type of network considered

<table>
<thead>
<tr>
<th>LS // Dependent variable is VINTOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 1 51</td>
</tr>
<tr>
<td>Included observations: 57</td>
</tr>
<tr>
<td>Excluded observations: 8 after adjusting endpoints</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRM</td>
<td>0.072325</td>
<td>0.058373</td>
<td>-1.239026</td>
<td>0.2218</td>
</tr>
<tr>
<td>C</td>
<td>0.292078</td>
<td>0.052487</td>
<td>5.564765</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.233602
Mean dependent var 0.233602

Model 2. Linkages with the coordinating agent are somewhat stronger in TASA network

<table>
<thead>
<tr>
<th>LS // Dependent variable is VINNUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 1 51</td>
</tr>
<tr>
<td>Included observations: 62</td>
</tr>
<tr>
<td>Excluded observations: 5 after adjusting endpoints</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRM</td>
<td>0.116642</td>
<td>0.070139</td>
<td>-1.662999</td>
<td>0.1034</td>
</tr>
<tr>
<td>C</td>
<td>0.340741</td>
<td>0.062905</td>
<td>5.416771</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.059137
Mean dependent var 0.246920

Adjusted R-squared 0.037754
S.E. of regression 0.059137
Log likelihood 21.21496
F-statistic 2.765565
Prob (F-statistic) 0.103421
Model 3. Technical assistance is larger in TASA network than in VWA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-Statistic</th>
<th>Prob.</th>
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<td>EMPRESA</td>
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<td>0.129099</td>
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<td>0.117156</td>
<td>4.742034</td>
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</tbody>
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R-squared 0.090875, Mean dependent var 0.320261
Adjusted R-squared 0.072322, S.D. dependent var 0.364910
S.E. of regression 0.351467, Akaike info criterion -2.052855
Sum squared resid 6.052910, Schwartz criterion -1.977097
Log likelihood -18.01806, F-statistic 4.897984
Durbin-Watson stat 1.537088, Prob (F-statistic) 0.031576
References


Lugones, G. and Sierra, P.: *Cambios en la industria automotriz en los 90s*, Documento de Trabajo Nº 9, Instituto de Estudios Sociales de la Ciencia y la Tecnología, Universidad de Quilmes, 1998.


