Endogenous competences and linkages development

Erbes, Analía, Tacsir, Ezequiel and Yoguel , Gabriel
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Endogenous competences and linkages development[?]

Analía Erbes[1]
Ezequiel Tacsir[2]
Gabriel Yoguel[1]

Abstract

In this paper we analyze empirically the influence of firms' endogenous competences in the existence, quality and results of the linkages between firms and different types of agents. Using survey data from 170 firms belonging to the steel making and automotive production networks in Argentina, we show that the level of endogenous competences influences the linkages' quality, objectives and results. Higher level of competences generates more virtuous linkages and influences the objectives that firms are after when interacting. Without certain minimum competences, firms only relate commercially and do not form links aimed to exchange knowledge or innovate. Better standing in terms of competences positively affects the probability of being involved in technological transfer agreements and cooperation agreements aimed at innovation. Being involved in useful interations requires previous competences, defining a vicious circle that calls for public intervention and policy implementation.

1. Introduction

The quest to generate and maintain dynamic competitive advantages involves putting innovation processes at the center of the scene. At the same time, it requires interaction and cooperation since information and knowledge produced and owned by

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Erbes: aerbes@ungs.edu.ar; Tacsir: tacsir@merit.unu.edu and Yoguel: gyoguel@ungs.edu.ar.
[1] Instituto de Industria, Universidad Nacional de General Sarmiento, J.M. Gutierrez 1150, Los Polvorines, Prov. de Buenos Aires, Argentina.
[2] UNU-MERIT, Keizer Karelplein 19,6211TC Maastricht, Netherlands.

different agents and institutions needs to be combined and complemented (Lundvall, 1992; Freeman, 1994; Potts, 2000). Thus, the social and economic environment can either constrain or foster innovations. Agents are induced to search for new and profitable interactions, making innovation a collective phenomenon. In such a setting, the capabilities to collaborate, interact and absorb knowledge are decisive to both individual performance and for the introduction of new products and processes (Antonelli, 1999; Fagerber, 2003).

Last decade saw innovation surveys and researchers in developing countries concerned about the existence and depth of cooperation. Fostered by quite pessimistic descriptions about the weakness of the national innovation systems, many agencies set policies primarly focused on promoting interactions and linkages between different agents.[3] However, many times the policies implemented disregarded the fact that interactions are of different nature. Different types of linkages not only produce distinctive effects but also require diverse competences and capabilities.

Specifically, those relations that exceed a strictly commercial nature and seek to establish alliances and (informal and formal) cooperation among agents result fundamental for developing competitive advantages. Networks may facilitate access to specific competences and generate knowledge exchanges that are expected to improve firm's competitive position and knowledge stock (Hagedoorn and Duysters, 2002; Mowery et al, 1996; Caloghirou et al, 2004). In turn, this improved profile will make the firm a more attractive partner and we expect to find it involved in more sophisticate and virtuous interactions (Cowan and Jonard, 2008).[4]

Nonetheless, these mentioned exchanges do not occur automatically. They require having certain capacities or meeting a specific threshold of endogenous competences. Endogenous competences and its development become functional in two main directions. First, competences are intangible assets that can foster interactions via offering capabilities that can result complementary to the partner's own stock.

[3] Although presenting differences and diverse denominations, the IADB clusters promotion, Technological Advsories (Consejerias tecnológicas), cluster policies and Arranjos productivos are some to be included in this group.

[4] Different studies centered on the formation of alliances stressed the need of knowledge complementarities between the partners to observe these cooperations to emerge and be mantained. Specially, Cowan and Jonard focuses on alliances and joint innovation phenomena.

Second, without certain minimum level of competences (even if assuming that knowledge stock is perfectly and freely available) it could not be absorbed and used productively (Nooteboom, 2000; Yoguel and Boscherini, 2001).

The role assumed by interactions and their determinants have been analyzed by many contributions from diverse theoretical and analytical perspectives. One of the central elements were consensus exists, is the need for interactions between agents for the generation of innovations and new pieces of knowledge. Hence, developing capacities constitutes a fundamental competitive tool. In this context, both the endogenous production of knowledge and the acquisition from the surrounding environment are the central activities of the firm (Caloghirou et al, 2004).

Developing relations with other agents is presented as a need and a possibility open for the firms. Firstly, interactions are required for expanding the naturally bounded portfolio of competences that the firm has access to (Penrose, 1959; Richardson, 1972). In this sense, firms require to access to complementary knowledge that would ease the innovation process (Coombs and Metcalfe, 2000; Laursen and Salter, 2004; Mowery et al., 1996; Caloghirou et al, 2004; Teece, 1992; Santoro and Gopalakrishnan, 2000). Secondly, interactions and linkages enable to diversify the firms' learning repository, strengthening their competitive advantages (Hagedoorn and Duysters, 2002; Argote and Ingram, 2000; Nooteboom, 2000).

In the conception of the firm as a repository of competences (Penrose, 1959; Hamel, 1991) or routines (Nelson and Winter, 1982), several factors determine the existence and complexity of the linkages developed by the firm. In this sense, the possibility to complement and articulate knowledge between interacting agents varies according to their cognitive and structural characteristics.

Related to the existence of interactions, different contributions stressed the importance and specificities associated with factors such as firm size (Tether, 2000; Kleinknecht and Reijnen, 1992), belonging to a group, (Mohnen and Hoareau, 2002) and sectoral dynamics (Gulati, 1999). However, most of the received literature explains the existence of linkages by focusing on the magnitude of the R&D investments or the existence of structures associated with it. In here, a positive

relation between R&D expenditures, formal structures and linkages with surrounding agents is stated (Cummings and Teng, 2003; Kleinknecht and Reijnen, 1992; Laursen and Salter, 2004; Tether, 2000; Mohnen and Hoareau, 2002).

The interest on R&D expenditures is related to the direct association established in this literature between these efforts and the development of endogenous competences. This leads to consider a second determinant in development of the linkages: the capacity to appropriate and successfully use acquired knowledge. Previously mentioned studies state a positive relation between the absorptive capacity (Cohen and Levinthal, 1990) and the reduction of the cognitive distance (Nooteboom, 2000), on one side, and the involvement in production and knowledge networks, on the other.

Hence, meeting a certain threshold of endogenous competences allows interactions and the further expansion of capabilities. Under this same logic, if we consider that different types of agents differ in terms of their own capabilities and endogenous competences, interacting with other type of agents will induce dissimilar knowledge accumulation.

In this context, we analyze empirically the influence of firms' endogenous competences in the existence, quality and results of the linkages between firms and different agents of the innovation system. We show that the level of competences influences the linkages' quality, objectives and results. At the same time, better standing in terms of competences positively affects the probability of being involved in technological transfer agreements and cooperation agreements aimed at innovation. Hence, being involved in useful interations requires previous competences, defining a vicious circle that calls for public intervention and policy implementation. To perform this analysis we use data from a self-designed survey where 170 firms belonging to the steel making and automotive production networks in Argentina were interviewed.[5]

[5] These firms have been interviewed along a research proyect on innovation and employment of production networks financed by the Argentinean Ministry of Science, Technology and Innovation.

2. Theoretical framework[6]

The interrelationship between endogenous competences and linkages is analyzed using the complex systems approach applied to economics (Silverberg et al, 1988; Dosi, 1991; Foster, 1993; Dosi and Kaniovski, 1994; Dosi and Nelson, 1994; Rizzello, 2003; Witt, 1997; Lazaric and Raybaut, 2005; Foster 2005; Antonelli, 2007). This approach allows understanding the morphology and dynamics of economics systems characterized by (i) diversity and heterogeneity of skills and routines of its components, (ii) temporal irreversibility, as a result of a dynamic ruled by a non-ergodic path dependence, (iii) disequilibrium interactions among system components, (iv) the presence of institutional rules, learning, discoveries and selection operating as coordination mechanisms that allows change and reduce radical uncertainty, and (v) heterogeneity at the micro level induced by innovative processes where agents interact in a non-lineal fashion and in disequilibrium conditions. From this perspective, evolution and change are led by two fundamental properties: self-organization and adaptation (Foster, 2005).

These properties are emerging properties, not reducible to the system's components. The idea of emergency is defined in opposition to the methodological reductionism that explains aggregate behavior and evolution after the analysis of its individual components. The complex systems generate "hidden" variables that are not evident when studying their isolated parts. Therefore, describing a complex system requires not only knowing the functioning of the components but also how they relate themselves in a non-linear and not mechanistic perspective.

The **property of self-organization** refers to the ability of complex systems to create order out of equilibrium through feedback mechanisms (Prigogine and Stengers, 1984). The features of deterministic and non-ergodic path dependence (Antonelli, 2007) explain why the complex systems are sensitive to initial conditions and disturbances occurring along its path, which leads to a diversity patterns of behavior in the long-term dynamics affecting the overall system (Dosi and Kaniovski, 1994; Antonelli 2007). In this context, self-organization property allows systems to

[6] This framework is mainly based on Erbes et al (2008).

(re)generate themselves based on their internal structures, namely their routines and path dependence, and their interactions between its components. In other words, it evolves as a result of internal incentives. This property may acquire static or dynamic characteristics depending on whether the objective is to replicate the existing routines or generate other entirely new.

The **adaptation property** of a complex system refers to its ability to conduct frequent reconfigurations to meet the transformations that are generated in the environment they belong to. Thus, adaptation produces changes that are *a priori*, a response to external incentives. The more developed is this property, the greater are the chances of obtaining benefits from changes in the environment, without adversely affecting the trail developed by the system. This property explains why a system can sustain a range of variability in its performance and being still capable of surviving.

Self-organization and adaptation properties define a complex system but their order of complexity depends on the level reached by absorption and connectivity capacities and the dynamic interaction between them. These properties are very important because they constitute a nexus explaining how capacities lead to change processes that occur at the micro, meso and macro levels.

These properties are the result of different types of interactions generated within a specific pattern that is defined in terms of the evolutionary history of the system.

Absorptive capacity of a given system refers to the "[…] ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1989). This capacity is not only related to the possibility of accessing existent knowledge but also implies the ability to distinguish useful pieces of it, and of generating new knowledge. As a consequence, absorption is not a capacity that can be developed automatically or that is equally accessible by every single system. Instead, it requires generating and developing previous capacities, on an evolutionary path. In this sense, it could be assimilated to the ideas about the building of routines (Nelson and Winter, 1982), dynamic capabilities (Teece and Pisano, 1994) and endogenous competences (Roitter et al, 2007).

At the same time, **connectivity capacity** is related to the potential of the systems for establishing relationships and generates interactions with other systems with the sole objective of expanding its own knowledge base. Thus, different development levels of this capacity define differential access to knowledge, resources and opportunities (Norman, 2002; Cullen, 2000; Grandori and Soda, 1995). As it happens with absorptive capacity, connectivity goes beyond a simple conception of interactions and relates to selected linkages and the priorization of specific relations with other systems according to the advantages and potential that they are believed to offer. Characterizing the level of connectivity capacity require quantifying connections and linkages exhibited by different agents at different aggregation levels. However, we should stress that the proper quantification of this capacity requires giving different weight and importance to different types of linkages. Specifically, those interactions aimed at increasing the level of endogenous competences of the agents of the system should present a bigger importance. In that sense, both objectives and agents should be ranked according to the connectivity potential to generate additional knowledge and increase the original absorption capacity.

Absorptive and connectivity capacities present mutual feedbacks. Those systems with higher level of development in their absorptive capacities tend to be more open and capable of sustaining a higher density of relations with other systems. Despite the existing bi-directionality, it can be argued that absorptive capacity is a necessary condition for the development of connectivity.

When connectivity and absorptive capacities reach important levels of development, the system can exploit the environmental conditions -including opportunities and risks- and achieve structural change processes, apropriability and creative destruction. For this to happen, it requires communication channels that allow the systems to react to changes and feedbacks, both positive and negative. Positive feedbacks allow the system to absorb systems that improve its endogenous competences (introducing energy that decreases the entropy). Negative ones generate reactions to external impulses that injure the self-organizing dynamic, increasing the entropy. In these cases, the agents of the system develop resistance more than adaptation mechanisms.

2.1. The network as a complex system

The discussion about the role of knowledge in the development of dynamic competitive advantages and for the appropriation of quasi-rents emphasizes the importance of a new organizational architecture in the form of networks as a way of organizing the economic activity. At the same time, new institutions enable the transformation of the Schumpeterian entrepreneur, passing through the Chandlerian organization, into a productive network where change and innovation are not generated inside the organization but by means of learning ocurring in their nodes and interconnections (Langlois, 2003).

We consider a productive network as a particular form of articulation of firms where one or several of them act as organizers (from now on, nucleus) and a set of stable and long-term relations established with suppliers and customers, with other firms and with the institutional system. The key dimension in the conceptualization of the network is the continuous economic exchanges between the mentioned agents, related to production, circulation and appropriation of knowledge. Those exchanges, beyond typical sale-buy relationships in a given market, occur thanks to either self-organizing phenomena or because of the existence of a (one or more) coordinating agent. The main potential advantage of a productive network structure comes from the generation of shared tacit and codified knowledge as a consequence of commercial relations (Rullani, 2000; Nonaka and Takeuchi, 1995, Cowan et al., 2004).

In this sense, knowledge (creation, diffusion, appropriation and accumulation) constitutes a critical element for the competitive strategy of the nucleus and the survival and development of the other agents of the productive network (i.e., suppliers, customers, institutions directly related, etc.). Nevertheless, its presence can be either important or scarce. In the first case, a new type of productive network, knowledge network, is configured (Erbes et al., 2006; Yoguel et al., 2001). The latter case constitutes a weak network. The network idea, then, relates to an array of situations; the more virtuous extreme is characterized by important endogenous competences, fluid linkages mechanisms both between their components and interphases with other agents of the NSI, and high-quality employment. These dimensions, as a whole, explain the generation, diffusion and appropriation of

knowledge and the possibility of enjoying quasi-rents. In this sense, the productive network constitutes a different concept than the sum of the microeconomic attributes of the individual firms and institutions that integrate it, being placed in a mesoeconomic level.

3. Networks characteristics and history

Automotive and steel-making industries have a rich history in Argentina, allowing many to consider them as "traditional" manufacturing sectors. These sectors share a similar history and both suffered important recent transformations evolving towards a similar productive network configuration.

The large-scale automotive industry begun in the country in the 1950's and since then it was characterized not only for its influence in both the employment levels and value added, but for its technological importance, being the source of technological and social management innovations implemented in other economical activities (Motta et al, 2007). At the same time, even when the steel-making industry started as an almost handcraft type of production oriented to the manufacture of specific intermediate goods around the end of the 19th century (Bisang, 1989; Bisang and Chidiak, 1996), its true impulse will only occur in the mid years of the last century during the protection offered by the import substitution industrialization (ISI) policy implemented.

Specifically, the articulation of the automotive network with the rest of the productive structure suffered important modifications. Mainly, the recent years exhibited a reduction in the technological gap, significant changes in the learning and innovation management processes, a rise in the imports of inputs and components, increase in the labour productivity and a substantial disintegration of the local network of suppliers. At the same time, the linkages formed with other firms tended to be limited and of a highly hierarchical nature.

In relation to the network organization, the automotive industry involves a multiplicity of agents belonging to different industrial sectors producing under the

direction of the terminals. These firms are the network's nucleus and dictate the productive standards and the main linkages' features. Nowadays, the main international producers have productive plants in the country (GM, Volkswagen, PSA, Ford, Renault, Toyota, Fiat-Iveco and Daimler Chrysler). Nevertheless, and despite having relatively updated technology, they operate on a smaller scale and with a lower degree of automatization than other plants abroad.

Even when the autoparts manufacturers involve something like 400 firms, and 40,000 employees, the sector is heavily concentrated: 30% of the firms are responsible for 70% of the total production. Similarly to what happen with terminals, the more important international firms are present in the country.

Generally, the commercial exchanges between the terminal and the local suppliers are not based on explicit contractual relations, but on agreements –generally designed unilaterally- where quality and price are the main conditions. These relations tend to be highly unstable, short in time and characterized by frequent changes in production orders, affected by the market fluctuations.

Even when the design of new products is made outside the local network, the current emphasis on quality and processes fostered important changes in work organization. The aim of this is to produce more participation of workers and higher levels of flexibility enabling a better knowledge generation and circulation. These aspects occurred in parallel to the transition from a local/regional model towards a more global regime.

Several studies agree on characterizing the network as weak (Catalano and Novick, 1998; Novick and Yoguel, 1998 and 1999; Yoguel et al, 2001; Albornoz and Yoguel, 2004; Motta et al, 2007). This feature is believed to occur as a result of the importance assumed of subsidiaries of international firms both as terminals as the main suppliers. In this context, fundamental parts of the learning process occur within the multinational corporations. However, this low prevalence of "non-price" interactions between nodes of the network does not imply their total absence. Case studies of specific terminals indicate that the nucleus do provide assistance in issues related to quality and, to a lesser extent, in the development and design of products

and work organization (Motta, 1999; Novick, Yoguel and Marin, 2001). Anyhow, in most of the cases, phenomena such as technical assistance or technological transfers to suppliers are not the result of an approved or intentional and coherent policy inside the network.

The steel making production network is characterized by an important level of concentration in four agents (Siderca, Siderar, Aceros Zapla, Acindar) that act as articulators of a complex network that includes a variety of suppliers of inputs and raw materials, and customers. Two of these firms (Siderar which is specialized in flat laminates, and Tenaris in seamless tubes) belong to the same conglomerate (Ternium, formerly Techint) owner of other firms both locally and internationally. In relation to their own endogenous competences, we can say that Tenaris presents higher levels than Siderar, fact that impacts in the type of demands and requirements that they impose on their own suppliers (Borello et al, 2007).

In general terms, despite presenting important levels of external insertion and systemic development of dynamic competitive advantages, the steel making network controlled by the firms belonging to Ternium also shows specific weaknesses related to the linkages between the nucleus and both suppliers and customers (Schneuwly, 2004). The recent sectoral history is characterized by important improvements in the labor productivity, mostly acquired via the reducing the workforce in an environment where the majority of the suppliers are SMEs.

Specifically, the firms acting as nucleus managed to increase their internal level of competences, in parallel to a constant and decided increase in their international presence. Thus, this evolution can be signaled and analyzed with the creation and evolution of the "Centro de Investigación Industrial" (CINI, stands for Center for Industrial Research) – one of the industrial research and development centers of Tenaris –. CINI's projects concentrate a significant portion of Tenaris R&D initiatives (new product development, the optimization of existing products and the optimization and development of production processes). Also, these projects cover different disciplinary areas -steel metallurgy, computational mechanics, fracture mechanics, surfaces, coatings chemistry and nanotechnology. Additionally, CINI connects the steel factory and techno-scientific networks (Seijo, 2008). In this sense, Artopoulos

(2006, p. 16) states that the CINI center managed to address the most innovative academic fields related to the steel industry (e.g. computational mechanics) without suffering the influence of the most traditional academic fields. The objective of this knowledge network is to produce new knowledge, submit papers to conferences and scientific journals and to produce mechanical technology for tubular products and steel manufacture as well as furnace technology. At the same time, and aiming to modify the behaviour of their clients and achieve joint improvements, they developed the ProPymes program.

4. Data description

The results presented in this paper arise from a specially designed survey that included 170 firms belonging to automotive and steel-making production network.[7] Specifically, we aimed at surveying whether the firms establish or not linkages, with which type of objectives and with what observed effects.

First, the firms have to answer whether they have established or not some sort of extra-commercial linkages. The different listed agents that the interviewees could indicate as linkages partners include: a) domestic suppliers; b) domestic customers; c) international suppliers; d) international customers; e) sectoral chambers; f) consultancy firms and consultants; g) network nucleus; h) universities and; i) technological centers. The first four agents, together with the nucleus, were

[7] The third and latest Argentinean innovation survey does not incluye any question about the existance of linkages or interactions. Then, only individual surveys can provide this information. Our work is an attempt to bring back to the scene this fundamental topic.

aggregated in a category named 'Commercial Agents'. Agents "e)" and "f)" are part of a constructed category labeled "Supporting agents". The final two institutions are aggregated in "Science and Technology institutions".

Additionally, each firm had to inform about the objectives aimed with its relations. For those firms that declared a linkage with some other agent different from its network nucleus, different objectives were considered. These included: a) to obtain new customers; b) to obtain new suppliers; c) to hire good employees; d) to obtain information about the business climate; e) to access technological information; f) to develop products; g) to develop exports; h) put in place training processes; i) to obtain funds; j) to develop information circulation networks; k) exchange knowledge. By giving to the mentioned objectives different weights,[8] we were capable of constructing an indicator that describes the quality of linkages for each firm. Specifically, we obtain a continuous indicador about the linkages quality that gives different weight to different objectives. In some parts of our analysis we used an ordered indicador where the value 0 represents the inexistence of linkages; 1.Low-quality linkages; 2.Medium-quality linkages; and 3.High-quality linkages.

At the same time, we constructed an equivalent indicator to characterize the relation with the production nucleus. Here, we took into account the following dimensions: a) the support provided by the nucleus to the development of innovation processes;[9] b) technical assistance and transfer of technology from the nucleus;[10] c) joint R&D activities; d) using nucleus' infrastructure for tests and experimentations.

Finally, firms' endogenous competences are characterized by the jointly consideration of the level of development achieved in labour organization, quality management, training activities and R&D structure.[11]

[8] Objectives assume different significance according to each agent. This methodology allows taking into account the specificities that the relation with each type of agent assumes. Different weights were considered, and the presented results are robust in relation to different specifications (see Erbes and Yoguel, 2007).

[9] We consider the support for process innovation, product innovation, organizational innovations and commercialization innovation.

[10] The dimensions included are: technical assistance and technological transfer in product, process, design, quality, training, labour organization and commercialization.

[11] The labour organization took into account different dimensions of the labour process in terms of workers' autonomy, processes aimed at acquiring experiences and teamwork. Quality considered the

5. General description of linkages

Innovation surveys in Argentina show the weaknesses of the articulation schemes among firms and between these and the other agents of the NSI (Bisang et al, 2002; Lugones and Peirano, 2004; Motta et al, 2006, among others). Particularly, only a small proportion of the enterprises developed a cooperation agreement aimed at producing R&D. In this setting, the most recurrent linkages are commercial and those objectives aimed at searching for information and performing essays and tests or developing training processes. This low level of sophistication of the existing linkages is also associated to the evidence that states that both financing and information tend to be internal.

Taking these data as a framework, the first step in our analysis consists in studying the characteristics of the informed interactions. Considering the variety of agents and possible objectives of the interactions, we expect to find an overwhelming majority of linkages. However, the aggregate analysis of the existing interactions shows the existence of lower level of linkages: 52% of the firms have established a relation with any another agent either local or international. [12]

When we consider the prevalence of linkages by type of agents, we observe that domestic suppliers and domestic customers are the most mentioned partners (87% and 83%, respectively). As a consequence, we find that most of the interactions are with agents that belong to existing commercial relations. It is important to mention that regression analysis shows that the likelihood of forming linkages in aggregate terms is not related to the firm's level of endogenous competences.

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existence of processes control, culture towards quality, and the use of tool for improvement and innovation. For both training and R&D, we considered the existence and level of formality that these activities exhibited inside the firm. Specifically for the first case we analyze the presence of diagnosis, planning and development activities concerning training.

[12] Later we will show that despite this high figure, interactions tend to be limited when objectives are considered.

A characteristic that we consider of relevance is the fact there are firms that have informed forming links but proved to be incapable of distinguishing the objectives aimed with this relation. In the same direction, if we categorize linkages as 'high' or 'low' quality in terms of the objectives seeked with the relation, we observe that only 7% declared to participate in relations that can be qualified as of 'higher-quality'. Then, from 52% of total agents engaged in interactions with other agents, only a minority is of sophisticate nature. In this context, we see that automotive network outperform the steel making, where we do not find agents forming higher quality linkages.[13]

The objectives more mentioned are those related to exchange knowledge (52%), acquiring information about the business climate (46%) and obtaining new customers (45%). In all these aspects, the level of endogenous competences does not explain the establishment of linkages. However, competences explain the formation of those linkages aimed to circulate information (declared by 39% of the firms) and to develop products (11%).

The linkages that the surveyed firms established with the networks' nucleus are rather small. Specifically, 75% of the firms either do not connect with the nucleus or have low quality connections. It is worth noticing that the two considered sectors have important differences: there are no firms that belonging to the steel making industry that have declared either medium or high quality linkages.

Interactions with other firms can be estimated taking into account four different types of agents: a) domestic suppliers, b) international suppliers, c) domestic customers and, d) international customers.

In relation to domestic suppliers, 87.5% of the firms declare to have some sort of extra-commercial relationship. However, there is an overwhelming presence of relations characterized by a low quality level. The main objective of these linkages is to establish new suppliers. The firms belonging to the automotive industry, however,

[13] It is worth noting that evidence compiled during the last decade indicates that the steel-making industry used to outperform those firms in the automotive network.

are significatively more present in those relations aiming to develop new products or secure funding.

At the same time, 45.5% of the firms declared linkages with international suppliers, although these relations are of low quality. Again, obtaining new suppliers is the most important objective of the relationship (47.1%). The firms in the steel-making sector are more interested in obtaining information about the business climate and in product development than those in the automotive industry. This latter group seems to be more focused on producing exports and obtaining funding.

Domestic suppliers are mentioned as linkage partners by 83.2% of the surveyed firms. Among these, majority (79%) only participates in low quality relations. The most mentioned objective is to obtain new clients. Enterprises in the automotive sector are more oriented to develop products, exports and training, while those in the steel-making aim to participate in the circulation of technological information.

Linkages with international clients were mentioned by 48% of the firms. Again most of them are of reduced quality and the most important goal is to obtain new clients. Similar to the case for domestic clients, those relations aimed to develop new products and exports are more important for the firms in the auto industry.

In relation to sectoral chambers, 61% of the firms declared to have some sort of interaction with these institutions. Similar to the case of firms, interactions seem to be of lower relative quality, but the most relevant objectives are the search for technological information and information about the business climate. Automotive sector are significatively more active on these relations.

At the same time, 47% of the firms established linkages with consultancy firms or consultants. Again, these relations tend to be of a low relative quality. It is important to mention a difference between the two sectors: while an important proportion of firms in the automotive sector declare to establish links with consultancy firms aimed at training, only a small group of the steel making has this behaviour. This difference accounts for a more intensive use of certain outsourced services, related to bigger firm structure.

In relation to technological centres, 48% of the firms declared some sort of link with them. As happen in the previous cases, these relations are mostly of a low relative quality. This is explained by the emphasis put on obtaining technological information. It is important to mention that the two sectors considered behave differently in relation to the use of these institutions as an input for the development of innovative processes. On the one hand, the firms that belong to the automotive weave relate to technological centers to develop new products and training activities. On the other hand, the steel-making sector uses these institutions for the sake of accessing information.

Universities are linked with 45% of the surveyed firms. The quality, again, is low. Nevertheless, objectives such as acquiring technological information and exchanging knowledge are important. The exhibited relevance of universities as source of training and good employees highlights the importance of the traditional way of interacting with these institutions. As in other dimensions, the automotive sector is more active and demanding.

6. High-quality linkages: with whom and how?

After presenting an exhaustive account of the linkages declared, we set as our goal to understand how exhibiting certain minimum level of endogenous competences influences linkages (both in terms of their formation and characteristics). Our methodology is to construct different generalized logistic regression models that present the linkages complexity for type of agent as the independent variable. The aim of this analysis is to observe whether the establishment of relatively more demanding linkages with non-commercially related agents is explained by competences levels or not. We consider the level of endogenous competences and control variables related to foreign ownership, sector and size as explanatory variables for the complexity of the linkages for the different agents.

Specifically, and treating the quality level (as defined previously) for the linkages

established with those agents of type *i*, **linkqual$_i$**, as an ordinal dependent variable that can take only three possible values (i.e. non-existing, low-quality, high-quality), the generalized ordered logit model estimates a set of coefficients (including one for the constant) for each of the *(m – 1)* points at which the dependent variable can be dichotomized.[14] The probabilities that *linkqual$_i$* will take on each of the three values are equal to:

$$P(linkqual_i = \text{non-existing}) = F(-x\beta_{\text{non-existing}})$$
$$P(linkqual_i = \text{low-quality}) = F(-x\beta_{\text{low-quality}}) - F(-x\beta_{\text{non-existing}})$$
$$P(linkqual_i = \text{high-quality}) = 1 - F(-x\beta_{\text{low-quality}}).$$

Being $x\beta = \beta_{compendo}\, comp_i + \beta_{sector}\, sector_i + \beta_{employ05}\, employ05_i + \beta_{FDI}\, FDI_i$, where:

$comp_i$ indicates the level of endogenous competences for the firm *i*;
$sector_i$ stands for the sector that the firm *i* belong to*;*
$employ05_i$ represents the *firm* size measured by the number of employees in 2005;
FDI_i indicates the percentage of foreign ownership of the firm *i*.

Table 1 presents the estimation results for the different variables used to explain the linkages quality for different agents. We differentiate the variable representing the endogenous competences from the control variables.[15]

type of agent	**Endogenous competences**	**Control Variables**	**Prob. lr**
Aggregate linkages	(+)***		***
Network nucleus	(+) ***	FDI: (-)***	***
Domestic Suppliers		Sector[a]: (-)*	*

[14] The use of generalized ordered logit models responds to both a practical problem and presentation problem. Specifically, frequently the assumption of proportional odds equired to performed ordered logit regressions is violated by the data. Standard advice in such situations is to go to a non-ordinal model. Unfortunately, such models tend to be less parsimonious and more difficult to interpret. To solve these problems, and present the same type of strategy for the different regressions presented, we make use of the gologit2 package for STATA that provides an alternative by estimating partial proportional odds models. For further details see Williams (2006).

[15] For every estimation of this paper, we present the marginal effects of the different significant variables as tables in the annex. Each table presented here is expanded in those presented in the Annex.

International Suppliers		FDI: (-)**	**
Domestic Clients			
International Clients			
Sectoral Chambers	(+)*	Sector: (-)**	**
Consultants	(+)***		***
Technological Centres	(+)***	FDI: (+)*	**
Universities	(+)**		*

Table 1. Sign and significance levels for the variables explaining the quality level of the linkages for the different type of agents considered. Notes: [a/] 0 automotive and 1 steel making. Significance: * 10%, ** 5%, *** 1%.

In this sense, the higher the level of competences, the more likely is that the linkages becomes more sophisticate with those agents that are not already members of the commercial network of the surveyed firms (domestic and international suppliers and clients). On the opposite, the level of endogenous competences does not affect linkages' quality with existing commercial agents. Then, current commercial interactions are determined by a different logic that the one that determines the search of competences improvement.

Besides, the level of endogenous competences is particularly relevant to understand the linkages' quality with networks nucleus, consultants and technological centers and universities. Also, belonging to the automotive network induces better linkages in the case of domestic suppliers and sectoral chambers. In the case of international suppliers, only sector is relevant to explain likages'quality.

In relation to the structural variables studied, sector and FDI constitute factors that determine the existence of linkages with some of the agents considered. On the one hand, the pertenence to the steel-making network negatively affect the linkages quality with chambers and local suppliers. On the other hand, foreign ownership is related to better linkages in the case of technological centers while inhibits high-quality linkages with nucleus and international suppliers.

The linkages quality does not present differences in terms of firm size. Hence, the weaknesses of linkages in both quantity and quality (see section 5) are present for the whole pool of firms, no matter their size.

Then, the logistic regression models allow highlighting the importance that endogenous competences acquire for defining the existence and quality of established linkages. Those firms that present higher levels of endogenous competences –in terms of labour organization, quality management, training and R&D activities- are those that developed higher quality linkages with agents directly associated with knowledge production. These results are in line with those from approaches developed by Cohen and Levinthal (1989 and 1990) in terms of absorptive capacity, and of Nooteboom (1999) based on the concept of cognitive distance. In both cases, agents' capacity to access to knowledge generated by others operating in the same environment constitutes a central element to explain knowledge exchanges.

7. Linkages, competences and technological transfers

Now, we turn our attention to technological transfer. In this relation, 54% of the surveyed firms declare to have received some kind of technological transfer. If we consider the relation between competences and transfers observe that an important proportion of those firms involved in technological transfers have higher levels of endogenous competences. In fact, 72% of those receiving transfer in the steel making and 68% of those in the same condition that belong to the automotive network, present higher endogenous competences.

When we analyze whether the level of endogenous competences of the firm is related to the probability of being involved in this sort of transfer, we find that the level of endogenous competences has significant and positive effects. This result is valid for both automotive and steel-making networks. At the same time, the presence of FDI affects positively this probability. However, firm size nor sector do not influence the probability of being involved in this type of transfers. Table 2 summarizes these results.

Variable	Sign and significance
Endogenous competences	(+)***
Sector[a]	
FDI	(+)***
Size	
LR	***

Table 2. Sign and significance levels for the variables explaining the probability of being involved in technological transfer or technical assistance relations with other agents. Explanatory variables: endogenous competences, sector, firm size and FDI. Notes: [a/]0 automotive and 1 steel making. Significance: * 10%, ** 5%, *** 1%. Table A2 in the annex presents the marginal effects.

If technical assistance and technological transfer are considered as expressions of high quality linkages, these results provide further evidence in the same direction that the previously offered in relation to aggregate linkages. However, certain specificities associated with the type of agent that provides the assistance, the objectives involved and observed results deserve to be presented.

7.1. Technological transfer by type of agent

The agent more frequently cited as the source of technological transfer (32% of the cases) is the network's nucleus. However, the existence of these exchanges taken as in aggregated terms is not related to the firms' level of endogenous competences. The technological transfer from agents related to the STI sub-system offers a similar portrait in relation to competences. These transfers are not only extremely rare (16% of the firms for universities and 13% for technological centres) but also not related with technological competences.

In this setting, the considered structural variables seem to be more important than competences as factors explaining the existence or not of technological transfers.

First, nucleus is a simple and easily accessible source of advice and assistance, being consulted specially by those firms exhibiting a bigger relative size. Secondly, those firms that belong to the steel-making network present a bigger tendency to receive assistance from technology firms and labs.

Differently, the assistance received from other firms (declared in 22% of the cases) is related to the level of competences. Here, the foreign and steel making firms are more likely to receive transfers from other firms in their environment.

type of agent	**Endogenous competences**	**Control Variables**	**Prob. lr**
Network nucleus		Size: (+)**	**
Technology firms and labs		Sector[a]: (+)**	**
Other firms	(+)***	FDI and Sector: (+)**	***
STI agents			

Table 3. Sign and significance levels for the variables explaining the probability of technology transfer or technical assistance for different types of agents considered. Notes: [a/] 0 automotive and 1 steel-making. Significance: * 10%, ** 5%, *** 1%. Table A3 in the annex presents the marginal effects.

7.2. Technological transfer by the objective of the relation

When we analyze the technology transfer and assistance relations by type of objective, we see that the most prevalent objectives are process technology (37% of the cases), product technology (36%) and quality (34%). The less frequent objectives

are design, labour organization and commercialization (17%, 15% and 11%, respectively).

The econometrical analysis shows that the existence of technological exchanges or assistance is positively related to the level of endogenous competences in the cases of process technology and quality. At the same time, while transfers associated with process technology are positively related with FDI, those aimed at quality are related with foreign property, size and belonging to automotive network. Table 6 presents the results for the probability of forming linkages for each different objective.

Objectives	**Endogenous competences**	**Control Variables**	**Prob. lr**
Process technology	(+)***	FDI: (+)**	***
Product technology			
Design		FDI, Sector[a], Size:(+)**	***
Quality	(+)**	FDI***, Sector***, Size*: (+)	**
Training		Sector: (+)**	**
Labor organization		Size: (+)*	*
Commercialization			

Table 4. Sign and significance levels for the variables explaining the probability of being involved in technology transfer or technical assistance linkages for different agents considered. Notes: [a/] 0 automotive and 1 steel-making. Significance: * 10%, ** 5%, *** 1%. Table A4 in the annex presents the marginal effects.

Transfers associated with product technology and commercialization are independent of both competences and structural characteristics of the considered firms. While transfers aimed at design are positively related with the whole set of control variables (size, sector and FDI), being a member of the steel making network conditions the existence of transfers aimed at training. Finally, size positively affects the probability of receiving transfers aimed at labor organization with no difference in terms of endogenous competences.

In addition, the exhibited results are, in our opinion, heavily influenced by the configuration of the networks under study and the type of technology involved. As we said, the nucleuses are responsible for the articulation of the whole sector, affecting the array of products that their suppliers will produce, the processes involved and the quality requirements. Specifically, these two last are the realms where we observed the nucleus intervention as significantly related to the level of endogenous competences.

Hence, we observe that the interest that characterize the nucleus and their way of organizing the network generates that the technical assistance and technological transfer exchanges tend to be aimed at solving processes and quality issues for those firms who are relatively better performers in their own network. These exchanges tend to be more likely when we are dealing with foreign owned firms. Further evidence in this sense is provided in the following subsection.

7.3. Technological transfer by type of agent and the objective of the relationship

Those firms that are involved in technical assistance or technological transfer with the network nucleus are predominantly involved in exchanges aimed at processes (19%), quality (17%) and training (11%). The level of endogenous competences of the analyzed firms positively affects the probabilities of being involved in these last two objectives. Hence, and differently from the aggregate measure, we observe that competences play a different role when specific types of objective are considered Other objectives (such as design, commercialization and labour organization) are mentioned in less that 10% of the cases and not related to the level of competences.

Only very few firms are involved in technical assistance and technological transfer with other firms different from the nucleus (12%). However, these exchanges (at the aggregate level) are positively and significantly related to the level of endogenous competences. Specifically, this is explained by the relatively importance of exchanges related to training and quality, both significantly associated with endogenous competences.

Not surprising but quite disappointing is the role of those agents (whether firms specialized in R&D, technology suppliers, universities and technological centres) specialized in the production and diffusion of science, technology and innovations. This type of firms is almost absent, being mentioned by less than 10% of the firms. In the case of universities and technological centres, firms' involvement is almost negligible and heavily (relatively speaking) focused on training and quality. Most of these interactions seem to respond to horizontal policies that do not distinguish between agents and their level of competences.

7.4. Technological transfers and technical assistance and their observed effects

Our analysis of the effects of technological transfers and technical assistance started by asking to categorize firms in three different groups: (a) firms that were not involved in this type of linkages; (b) firms involved but that do not report any effect from it, and (c) firms involved that observed effects from their involvement in this relation. The first result that deserves to be mentioned is the fact that there are almost no firms in the second group. Then, being involved in such a relation produces positive effects that are related to competences. Hence, a higher level of competences increases the probability of being a part of such an exchange (see table 4) and this generates positive effects.

These results hold for both the relations maintained with the network nucleus and other firms. Table 5 summarizes these results.

partner	**Endogenous competences**	**Control Variables**	**Prob. lr**
Network nucleus	(+)*		**
Other firms	(+)***	FDI: (+)*** and Size: (+)*	***

Table 5. Sign and significance levels for the variables explaining the probability of observing positive effects from technological transfers and technical assistance

linkages for different types of firms. Notes: [a/] 0 automotive and 1 steel-making. Significance: * 10%, ** 5%, *** 1%. Table A5 in the annex presents the marginal effects.

Those that received assistance from the nucleus highlighted as the more important positive effects on: (a) an increase in the acceptance level of their production and the decrease in the need to re-work it (83%); (b) an improvement in the productive process (81%); (c) an increase in the installed capacity (78%); (d) better chances to supply to bigger firms (75%); (e) better chances to generate new businesses (74%); (f) specific training (69%) and; (g) other quality improvements. Aspects (d) and (g) are related to endogenous competences.

8. Competences, need for cooperation and innovation

As stressed previously, we consider innovation and change as a cooperative and complex process. In this path towards better performance and more sophisticate activities, presenting competences is not only a mean but also a requirement. Cooperation and partnership require a minimum level of endogenous competences. At the same time, sectoral peculiarities and specificities of the economy under consideration are determinant of the type of interactions observed and their respective results.

The innovation surveys in Argentina present as fundamental obstacles for innovation the absence of funding and the lower prevalence of exchanges among agents (Bisang et al, 2002; Lugones and Peirano, 2004). In this sense, we observe that 67% of those firms that introduced innovations declared that they have had external support. A similar (majoritarian) percentage is present in every dimension of possible innovations (i.e., product, process, organization and commercialization). Always important, external support for innovation ranges between 62% and 70% of the surveyed cases.

As it is expected, the probability of being involved in these cooperative efforts is positively related with the level of endogenous competences (positively related and significant at 1% level). Specifically, receiving external support to introduce product and process innovations is related to competences. Table 8 summarizes these results.[16]

Even when do not analyze specifically this feature, we can expect that those firms that present a relatively higher level of endogenous competences are better equipped to profit existing opportunities from funding bodies involved in the funding of technological development and upgrading and innovation (FONTAR in the case of Argentina).

objectives of the external support	**Endogenous competences**	**Control Variables**	**Prob. lr**
Innovation	(+)***		***
Product innovation	(+)**	FDI: (-)*	**
Process innovation	(+)**	FDI: (-)*	***

Table 6. Sign and significance levels for the variables explaining the probability of receiving external support for different types of innovation. Notes: [a/] 0 automotive and 1 steel-making. Significance: * 10%, ** 5%, *** 1%. Table A6 in the annex presents the marginal effects.

9. Conclusions

This paper highlighted the key role played by competences development in the explanation of both existence and quality of those linkages aimed at increasing the agents' capacities. Specifically, the level of endogenous competences is particularly relevant to understand the linkages' quality with networks' nucleus, consultants, technological centers and universities.

[16] Only a few firms (13) declare to receive external support aimed to introduce organizational or comercial innovations. We discarded this type of innovations from our analysis.

In this sense, we show that presenting a minimum threshold of competences constitutes a necessary condition to observe that linkages are functional to competences improvement. Then, even when linkages could be potentially benefitial to increase the level of competences, linkages do not generate, *per se*, improvements in individual competence levels if the mentioned thresholds are not met. In the same line, focusing policy initiatives in only promoting linkages without paying attention to the objectives seeked or the characteristics of the production network that firms are immersed, limits the endogenous capacities development.

At the same time, without policies oriented to develop firms'competences or introduce connectors that facilitate complex interactions, only linkages that reproduce the existing commercial logic prevail.

Our analysis showed that technological transfer, cooperation and innovation phenomena are also dependent of meeting a minimum level of competences. Endogenous competences foster interactions that, in turn, facilitate innovation. Specifically, we observed that only those relations with firms that are not member of the own commercial partnership network depend of the exhibited level of competences. For both nucleus and suppliers and customers (both domestic and international), the existence of linkages is only explained by structural variables. These results make evident the weakenesses that both networks present and the heavy influence that existing commercial relations have in the processes of search and maintenance of technological transfer partners. Nucleuses act as organizers of production and exchanges inside their network without performing the same role in relation to knowledge exchange and generation. In the same line, we can speculate that the nucleuses do not have that much knowledge about the needs and capacities of their own suppliers. In this setting, the nucleus is more likely used by bigger firms.

Differently, those firms owned by foreign capital and members of the steel making industry receive transfers from other firms different from the nucleus or commercial partners.

In relation to the effects of the technological transfer, we show that those who exhibit a higher level of competences tend to manifest positive effects from technological

transfers. Hence, a higher level of competences increases the probability of being a part of such an exchange and this generates positive effects.

In the same vein, receiving external support for innovation depends on the previous competences, defining a vicious circle that calls for public intervention and policy implementation. Innovation is a cooperative event that requires assistance and cooperation: being involved in these cooperative efforts is more likely when the level of endogenous competences is high.

In an intervention-free environment, those that are in more need of assistance and cooperation would never be selected as partners in knowledge production and exchange relations, affecting their performance and survival opportunities. Hence, policy should be oriented to increase agents' competences, allowing better linkages and a higher probability of obtaining funding and support for innovation.

Then, policy should be about the generation of a dynamic market failure that would allow breaking the vicious circle of excluding those with limited competences. In this sense, two main complementary directions of intervention arise. First, supporting the generation of a minimum level of competences as a mean of increasing the likelihood of being selected to participate in knowledge exchanges and improving the capacity to profit from these bi-directional flows. Second, constructing translation and intermediating spaces that allows firms with lower relative competences to access to more virtuous linkages and partners.

These interventions are aimed at providing currently non-available public goods for certain agents (such as knowledge codification) as to generate competences at the network level under the perspective of "club goods" that are necessary to improve the quality of the observed system.

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Annex: Sign, significance levels and marginal effects for the different estimations presented

Type of agent		Endogenous competences	Size	Sector	FDI	LR
Aggregate linkages	Sign and significance	(+) ***				***
	Outcome 0	-0.48				
	Outcome 1	0.38				
	Outcome 2	0.10				
Network Nucleus	Sign and significance	(+)***			(-)***	***
	Outcome 0	-0.55			0.24	
	Outcome 1	0.40			-0.17	
	Outcome 2	0.15			-0.06	
Domestic suppliers	Sign and significance			(-)*		*
	Outcome 0			0.13		
	Outcome 1			-0.019		
	Outcome 2			0.05		
International suppliers	Sign and significance				(-)**	**
	Outcome 0				0.249	
	Outcome 1				-0.238	
	Outcome 2				-0.011	
Sectoral Chambers	Sign and significance	(+)*		(-)**		**
	Outcome 0	-0.21		-0.183		
	Outcome 1	0.15		0.133		
	Outcome 2	0.05		0.05		
Consultants	Sign and significance	(+)***				***
	Outcome 0	-0.09				
	Outcome 1	0.01				
	Outcome 2	0.08				
Technological centers	Sign and significance	(+)***			(+)*	**

	Outcome 0	-0.42			-0.189	
	Outcome 1	0.36			0.161	
	Outcome 2	0.06			0.028	
Universities	Sign and significance	(+)**				*
	Outcome 0	-0.259				
	Outcome 1	0.24				
	Outcome 2	0.018				

Table A1. Sign, significance levels and marginal effects for the variables explaining the quality level of the linkages for the different type of agents considered. Notes: [a/] 0 automotive and 1 steel making. Outcome 0: Non-existing linkages; Outcome 1: Low-quality linkages; Outcome 2: High-quality linkages. Significance: * 10%, ** 5%, *** 1%.

Assistance		**Endogenous competences**	**Size**	**Sector**	**FDI**	**LR**
Technological assistance	Coefficient and significance	1.44 ***			1.21 ***	***
	Outcome 0	-0.356			-0.299	
	Outcome 1	0.356			0.299	

Table A2. Coefficients, significance levels and marginal effects for the variables explaining the probability of being involved in technological transfer or technical assistance relations with other agents. Explanatory variables: endogenous competences, sector, firm size and FDI. Notes: a/0 automotive and 1 steel making. Outcome 0: Non-existing assistance; Outcome 1: Existence of Assistance. Significance: *10%, ** 5%, *** 1%.

Assistance by type of agent		**Endogenous competences**	**Size**	**Sector**	**FDI**	**LR**
Network Nucleus	Coefficient and significance		0.001**			**
	Outcome 0		-0.0004			
	Outcome 1		0.0004			
Technology firms and labs	Coefficient and significance			1.32**		**
	Outcome 0			-0.111		
	Outcome 1			0.111		
Other firms	Coefficient and significance	2.057***	1.290**			***
	Outcome 0	-0.318	-0.199			
	Outcome 1	0.318	0.199			

Table A3. Coefficients, significance levels and marginal effects for the variables explaining the probability of technology transfer or technical assistance for different types of agents considered. Notes:

a/ 0 automotive and 1 steel-making. Outcome 0: Non-existing assistance; Outcome 1: Existence of Assistance. Significance: * 10%, ** 5%, *** 1%.

Assistance by type of objective		Endogenous competences	Size	Sector	FDI	LR
Process Technology	Coefficient and significance	2.332***			1.064**	***
	Outcome 0	-0.526			-0.240	
	Outcome 1	0.526			0.240	
Design	Coefficient and significance		0.002**	1.279**	1.304**	***
	Outcome 0		-0.000	-0.152	-0.156	
	Outcome 1		0.000	0.152	0.156	
Quality	Coefficient and significance	1.517**	0.002*	1.481***	2.17***	**
	Outcome 0	-0.313	-0.000	-0.294	-0.448	
	Outcome 1	0.313	0.000	0.294	0.448	
Training	Coefficient and significance			1.104**		**
	Outcome 0			-0.192		
	Outcome 1			0.192		
Labor Organization	Coefficient and significance		0.002*			*
	Outcome 0		-0.000			
	Outcome 1		0.000			

Table A4. Coefficients, significance levels and marginal effects for the variables explaining the probability of being involved in technology transfer or technical assistance linkages for different agents considered. Notes: a/ 0 automotive and 1 steel-making. Outcome 0: Non-existing assistance; Outcome 1: Existence of Assistance. Significance: * 10%, ** 5%, *** 1%.

Possitive effects by partner		Endogenous competences	Size	Sector	FDI	LR
Network Nucleus	Coefficient and significance	0.937*				**
	Outcome 0	-0.185				
	Outcome 1	0.004				
	Outcome 2	0.180				
Other Firms	Coefficient and significance	1.569***	0.001*		1.395***	***

	Outcome 0	-0.390	-0.000		-0.346	
	Outcome 1	-0.001	-0.000		-0.001	
	Outcome 2	0.391	0.000		0.348	

Table A5. Coefficients, significance levels and marginal effects for the variables explaining the probability of observing positive effects from technological transfers and technical assistance linkages for different types of firms. Notes: a/ 0 automotive and 1 steel-making. Outcome 0: Non-existing relation; Outcome 1: Existing relation but no-effects; Outcome 2: Relation and positive effects. Significance: * 10%, ** 5%, *** 1%.

External support by objectives		**Endogenous competences**	**Size**	**Sector**	**FDI**	**LR**
Innovation	Coefficient and significance	2.153***				***
	Outcome 0	-0.464				
	Outcome 1	0.464				
Product innovation	Coefficient and significance	1.369**			-1.177*	**
	Outcome 0	-0.318			0.273	
	Outcome 1	0.318			-0.273	
Process innovation	Coefficient and significance	0.77**			-1.550*	***
	Outcome 0	-0.169			0.338	
	Outcome 1	0.169			-0.338	

Table A6. Coefficients, significance levels and marginal effects for the variables explaining the probability of receiving external support for different types of innovation. Notes: a/ 0 automotive and 1 steel-making. Outcome 0: Non-existing external support; Outcome 1: Existence of external support. Significance: * 10%, ** 5%, *** 1%.