

INFLUENCE OF TRANSNATIONAL ENTERPRISES IN THE UNIVERSITY-INDUSTRY COLLABORATION: THE SONORA-MEXICO CASE

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ABSTRACT

This paper analyses the role of Transnational Enterprises in the University-Industry collaboration by studying five universities, 126 enterprises in the metal mechanic area and government agencies in the Northwestern state of Sonora, Mexico. It proposes a methodological tool to measure the University-Industry collaboration. The results suggest that Ford Motor Co. has been determinant for important structural changes in local universities within the scope of the Triple Helix model.

Key words: university-industry, collaboration, triple helix

1. Introduction. Developing countries are increasingly interested in understanding and stimulating the direct insertion of knowledge in productive processes. Some of the features which define this insertion are: multidisciplinary work, academic research focused on its use in the productive sector and the confluence of three essential stakeholders: university, industry and government, which will guarantee a positive feedback between the academic community and the productive sector. This paper approaches the study of the linkage between universities and industry in Sonora.

The state of Sonora is one of the five states that constitutes Mexico's northern border region. Due to trade openness and to the North American Free Trade Agreement (NAFTA), this is one of the regions that have recorded the highest growth. A trend in this region's industrial model seems to be to move from a simple assembly and unskilled work to advanced manufacturing operations. Nevertheless, one must highlight that the

advanced companies coexist with a majority of maquiladora assembly plants, so-called of *first generation*, that are based on cheap labor.

Over the last two decades of the XX century, Sonora left behind the primary sector-based structure with a majority involvement of local capital and transitioned towards an economy based on export manufactures with foreign investment. The new industrial activities, like maquiladora assembly plants and the automotive industry, shaped a new economic space linked to the global production rationale (Bracamonte and Contreras 2008). Particularly, local economic development is closely linked to the North American economy and to direct foreign investment, especially under the form of exporting maquiladora assembly plants.

2. Conceptual Framework. The concept of Global Production Network (GPN) is of interest in the analysis of this phenomenon, regarding the rationality of the knowledge flow and transfer.

GPNs have acted as a catalyst in the spreading of international knowledge. The latter due to the quick access, at a low cost, of resources, skills and capabilities that are complementary to their competitiveness. Leading companies in the GPNs have the need to upgrade the skills of suppliers and once the supplier has successfully upgraded its capabilities, it creates an incentive for the leader to transfer more sophisticated knowledge. It is not only a matter of knowledge transfer, but that transfer should also be complemented with the internalization of said knowledge (Ernst and Kim 2002).

For an optimal knowledge transfer to occur, local interaction networks are required which determine the innovative performance of local firms. One resorts to the concept of National Innovation System (NIS) for a description of these networks, where institutions provide the training and education systems for capacity building.

Three of the main institutions in the NIS are government authorities, HEI and local firms. For this reason, the Triple Helix Model that makes reference to the positive feedback among the main institutions in this linkage. (Etzkowitz and Leydesdorff, 2001)

One assumes the formation of gained knowledge capacities in the making up of local innovation systems, in particular, scientific and technological knowledge, so called Regional Knowledge Spaces (Casas and Luna, 2001). That is, firms that understand and recognize the knowledge generated at universities, government authorities that strengthen and promote the linkage between industry and university and the commitment

between these stakeholders for the development of the town.

3. Methodology and Data. In the Sonora case, the establishment of a Local Knowledge Space was studied considering the main five Higher Education Institutions (HEI) in the state, 126 firms in the metal mechanic industry (MMI) and the government areas that promote university-industry linkage in the state. Interviews were conducted there, with the persons in charge of these institutions.

The higher education system in the state is relatively young (the first university was founded in 1942); a way of measuring the science and technology resources generated in Sonora is through the number of bachelor degree graduates for these areas. In addition, graduates are compared to the number of inhabitants in the state, 29 graduates for every 10 thousand inhabitants; the state enjoys a favorable situation compared to the national average (of 22.7 for every 10 thousand). Especially, concerning the science and engineering area, the local education of trained human resources is also above the national average. The data presented is a reflection of a high concentration of better-trained human resources in the technological and scientific research field, and at the same time, of a small group of institutions that are focused on said field.

Scientists that reside in the state of Sonora were ranked ninth place in terms of the national production of scientific papers, quotes and impact factor during the 1992-2002 period. Sonora has also contributed to confirm the national scientific trend: The large disciplines that produce scientific

papers in the country are: medicine, physics, plants, animals, and chemistry. The state still faces problems of a limited applied research and a weak linkage with the productive sector in spite of the consolidation process of top-level researcher groups, and their out-standing scientific production. A vestige of the above is that despite the high number of specialized publications produced in the state, until 2002 only two patents had been registered. The application of scientific knowledge to the needs of the state's productive sector is still scarce and embryonic.

The characteristics of the parties involved in the collaboration, if compared to the situation in 2004 of the membership of researchers from Sonora to the National Researcher System¹, three years later, the total number grew 65.4 per cent, which accounts for an important increase in the quality of the research that is conducted in the state.

Concerning the situation of firms, especially of the metal mechanic industry² (MMI) in Hermosillo, which was the center point of this research, out of a total of 126 firms, 37 (29.4 per cent) sell their products or render services to the automotive sector. Of the total MMIs that carry

1 *Sistema Nacional de Investigadores*. A program by CONACYT that provides academic recognition and salary increases to the researcher.

2 This branch of industry was chosen due to its potential relation with the automotive industry. out more complex processes, 29 firms (23 per cent) are devoted to the manufacturing of parts; eight firms are devoted to maintenance of industry (6.3 per cent) and only three firms (2.4 per cent) design and manufacture molds and dies.

With regards to the market approach, 117 of the MMI (81 per cent) concentrate their sales in the internal state market, three of them (2.4 per cent) are in the national market and two (1.6 per cent) sell to the US market.

In the area of competitiveness, they are focused on market permanence and the least frequent actions are aimed at making incursions into foreign markets, which entails a quality certification to export their products.

Out of the total, 30 (18.2 per cent) have or are in process of obtaining certification, the most common is ISO and QS 9000. As for the learning strategies of the MMI, 64 per cent concentrate on staff training, followed by the carrying out of joint projects with clients in 71 firms (56.3 per cent) and with suppliers 48 (38.1 per cent).

Based on the above-mentioned evidence, one may state that of the firms in the metal mechanic industry in Hermosillo, one third sells its products to the automotive industry, but only three MMI conduct complex operations typical of this branch. Their sales are essentially in the state market and training is focused on their employees.

Regarding the MMI firms that were studied, one infers that out of the total firms, an average of 116 declared they didn't have a relation with HEI + RC (Research Center) and an average of ten assure that they conduct collaboration activities with these institutions. The empirical evidence shows that most of the relations in this field of the firms with HEI take place through curricular activities, chiefly internships, followed by firms that are clients of HEI and finally those related to design activities.

The evolution of collaboration with the HEI, depending on the size of the firms, is notable in the case of small firms (from 13 to 20 workers); they were 9 in 2003 and attained 15 in the year 2007, the number of micro and medium-sized enterprises remained almost the same. While the number of advanced-type firms is greater than intermediate and basic-type firms in terms of their links with HEI, that is, companies more devoted to design have had more collaboration experiences than those of a less complex type. MMI firms consider training the most relevant activity in terms of their collaboration with HEI.

With regard to the number of patents in the state of Sonora, the situation has been changing in the last few years. There seems to be a significant increase in the number of patents. During 2003 and 2004 one patent was registered per year, an increase is recorded as of 2006, attaining 20 patents in 2008 and 50 in 2009 (projected).

As regards the promotion of science and technology by government areas in Sonora, the federal agencies are the ones that channel more resources. The state government and CONACYT (National Council for Science and Technology) have constituted a triggering mechanism for the strengthening of the infrastructure for scientific research and technology transfer to producers, nonetheless, the budget allocated to this Council is not yet the one recommended by international agencies for a more adequate support of the HEI-industry linkage. Furthermore, the measures adopted by state authorities have been of a discontinued nature.

4. University-Industry Collaboration. The general terms of the features of the linkage between HEI and research centers with Sonora's productive sector, this part of the research was focused on five HEI that were selected based on their representation of the diversity of institutions in the state (public, private, technological, universities, autonomous and belonging to the national system).

Within the heterogeneous actions that take place in the selected HEI are: the year of their foundation that ranges from the 1940's decade to the 1990's decade. Likewise, there are variations in their enrollment from the largest (30 thousand) to the smallest (800). The most outstanding general information is that the year of institutional restructure of the linkage functions at HEI is very recent and took place in a very short period of time, from 2003 to 2006.

A methodological tool was developed to qualitatively evaluate the linkage of HEI with the productive sector; thus, similarities between HEI were measured and also things that are exemplary at each one of them. We took the total linkage activities of the selected HEI to build this tool, these activities were classified into four functions (curricular-related, structure-related, service-related and research-related), besides, a degree of complexity was associated based on the degree of interrelation with the productive sector, that is, on the greater or lesser information and knowledge exchange between the HEI and the productive sector. This made it possible to assign a total numerical value to each HEI concerning its linkage performance with Sonora's productive sector. It was also possible to separate each HEI'S

performance in terms of each one of the four linkage functions and to compare them.

The recently created programs like Entrepreneurs and Enterprise Incubator and the establishment of a single access route to the HEI for an expedite and institutional service to the productive sector were found in all of the selected HEI, with the exception of UNISON. We found that there is still no academic recognition of the linkage actions, thus, academicians show a lack of interest in them.

In addition, the curricular linkage function, which is the most widely used by the selected HEI, is followed by services that are characterized mainly by being supplied by the HEI to the productive sector. The services provided are not homogeneous, at some they have just been installed and at others products by *graduated enterprises* are available. The research function, although it is indeed the most complex and the one with the highest assigned value, is at the same time the least frequently recorded in the selected HEI.

The collaboration actions of these five HEI were in the context of the cases of the Ford Plant in Hermosillo and the Centro de Asistencia Metrológica (CAM) which have promoted the changes leading to collaboration with the HEI. The Ford Plant has participated in a range of actions, from curricular duty (university teaching at the Plant) to research (establishing an Automotive and Aeronautics Industry Park). Another influence by this Plant is that the development of some service firms has had its origin in the relations with curricular or service

activities and later new specialized service firms have emerged.

CAM also has an influence on the Ford Plant, given that, in terms of production quality, one of its needs is related to the accurate measurement of various production parameters. In particular, the head of this Center had his first experience as a teaching instructor at the Plant and later developed a metrology laboratory at his university. Currently CAM provides services to the Plant, to its supplier companies and to other types of companies.

What has also become evident in this study is the emergence of a local knowledge space and the beginning of a knowledge and information exchange network between industry, HEI and government areas, with the following characteristics: a) knowledge accrual both by firms and HEI; b) some firms are recognizing the role of the academia and the value of knowledge in solving production problems; c) formal and informal relations are developing between the various parties involved in the collaboration; d) there are some actions by government areas to encourage collaboration activities between HEI and the productive sector in Sonora.

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