Technological Parks in Mexico: the Technopoli experience

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Abstract:

Technopoli could become the answer to certain social needs by making use of the potential and capabilities that the National Polytechnic Institute (IPN by its initials in Spanish) already has. Technopoli has as pivotal point, its current success incubating enterprises along with previous experience transferring the incubation model while counting with a solid financial support. It under these favourable conditions, in which Technopoli was established, that this initiative could make of the IPN an *avant-garde* institution. The design of this strategy also takes in count accumulated experience that other countries had when dealing with this topic. The axis of this plan and its functioning are competitiveness, innovation and culture.

In the structure of the Technopoli, the core performs multiple functions: Technology Observatory, Competitive Technology Intelligence, Incubation of enterprises, Information and Communication Technologies, Software and intelligent Services. All of these aspects are carried out with supporting institutions for funding, infrastructure, consulting units and technological services. Then all of them work as a system, whose main goal is to support the establishment of competitive technology-oriented enterprises that are capable of getting into the market successfully with innovative products and continue their activities for a long time. All of these actions aim to reinforce education and research and development activities within the IPN.

Keywords: Technology Parks, technology pole, emergent countries, innovation and universities.

Introduction

The process of technology change in which our society is currently immersed is characterized by an unprecedented speed and dynamics that along with the globalization process and economic integration have disrupted in all areas of human activity. Due to this dynamics, the wealth generating factor has changed from natural resources to intangible assets like knowledge and information, this can be seen in the growing contribution of the services sector to the Gross National Product of all countries, this a clear sign towards the transition to a knowledge-based society.

In this setting, the role of universities has changed, as a result of the need to learn to manage technologies to reinforce cooperation with their surroundings. The predominant university model in the 21st century, named by Smilor “the enterprising university”, is aware of the needs of the surroundings and, therefore, will set in motion regional and national development.

With this strategy in mind, universities will offer education that will be transformed into: commercial products or research results that can be used by the scientific and industrial community; academic and industrial consulting; patents and licenses of academic research transferred to the industry or even the creating of Spin-offs based on patented technologies. Examples if this are: the *Silicon Valley* (built around Stanford University and California University) and *the Route 187* (located near Massachusetts’s Institute of Technology, the University of Boston and Harvard University). For this reason that authors like Etzkowitz y Leydesdorff (1997), claim that we are witnesses of the second academic revolution, whose axis lies in the commercialization of knowledge generated in the universities to what they have named the “Triple Helix” (composed by industry, government and universities and whose driving force is innovation).

It is in this context, that new initiatives have been appearing since the late seventies, such as: innovation clusters, science and technology parks, technology poles, intelligent cities and more recently learning regions and milieus. All of these have in common the participation of universities; and their scale, characteristics and performance is decided by the strategies and planning set by the organizations and government supporting them.

These changes have made of innovation the axis in the strategies of several enterprises. However, their competitiveness depends on the flexibility and mobility of the creative potential as well as the available marketable knowledge of a given enterprise. It is in this setting that the function of universities has changed, providing a privileged role in society.

In the famous Silicon Valley and the Route 187 in the United States, where the development of new technologies generated a large number of technology based enterprises, applying the science and technology generated in the nearby universities. With this, the university acquired a new position in the regional and technological development of the nations (Saxenian, 1996).

The IPN, as the principal institution of technology education in Mexico, during its 75 years of history, has coined four important characteristics that constitute its fundamental capacities. First, the IPN's technological profile, derived from the joint of education with scientific and technological research, has made of the Institute the national leader in technology education and training. Second, the quantity, quality and job of the IPN's alumni have affected the productive, economic and social sphere of the country. Third, the Institute's objectives and social responsibility, tending and supporting the least favored social strata and regions in addition to the traditional Institute's academic and education role. And finally: IPN's research and technology development activities providing timely response to the challenges that Mexico faces.

IPN's activities are also closely connected to the world trends, where the wealth generating factor has changed from natural resources to intangible assets as knowledge and information. The IPN

have a strong presence in the industrial, social and regional areas, besides its success incubating new enterprises; arisen the need to promote and restructure, with a systematic approach, the efforts that by means of the IPN can be the communicating vessels that will make of innovation the axis propelling Mexico's entrance to the society of knowledge.

For this reason, taking in count the environment in which the IPN is immersed, the development of the Technopoli, a technology development pole, could become an essential element to turn the IPN not only into an internationally-known academic institution, due to the quality of the education and research that it offers, but also will make of the Institute an important actor of the national innovation system. This strategic vision will make of the IPN an *avant-garde* institution, ahead of other institutions in the world, in being part of the solutions that society currently needs to fulfill.

The present work presents, besides this introduction, a review of the role of the universities and how the Technopoli's strategy adds up to this trend; in the third section an analysis of the technology parks evolution in Mexico is made. Finally, in the fourth part it is described how the Technopoli operates and some of the learned lessons are then discussed.

2. Framework

The relationships established between the academy and industry are by themselves a set of activities whose main goal it to generate goods and services as a result of agreements, alliances and cooperation among organisms of the social and industrial sectors, as well as with other Institutions of Higher Education and Research Centers.

However, the relationships between industry and academy have evolved. At the beginning industry was not in contact with the universities and innovations depended on daily activities performed by employees and workers and were related to their work and introduced improvements in the used machines and tools.

At the end of the 19th century this situation changes, and some big firms set up laboratories with employees dedicated to the development of technologies as electricity, steam engines, automobiles and other transportation and communication devices. Then, knowledge emerges as a rising productive force, where the enterprises used as a competitive advantage the creation and development of new products and processes (Freeman and Soete, 1997 and Lopez, 1997).

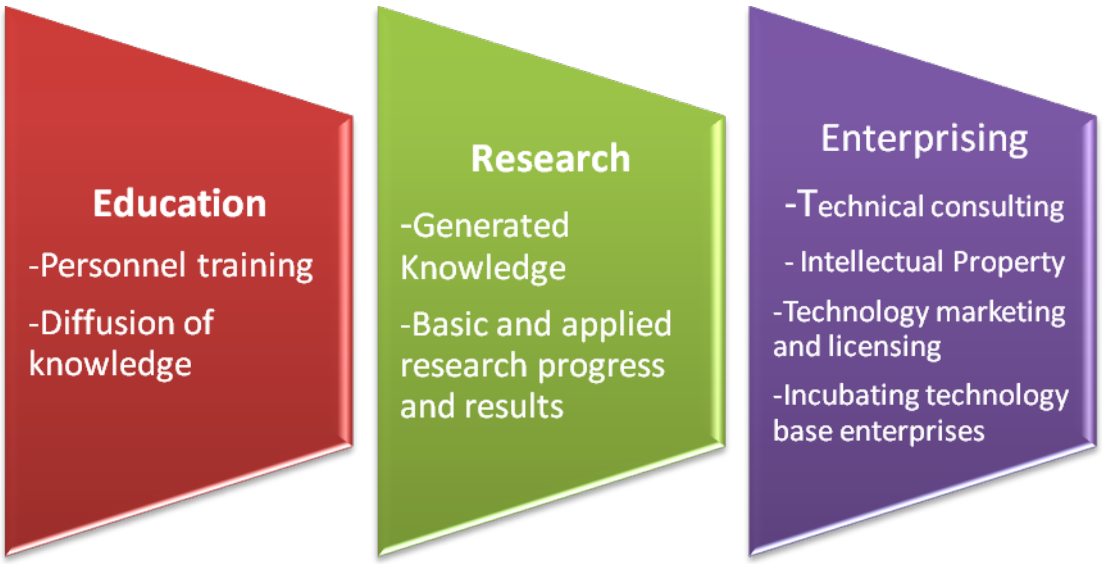
This trend and the increasing need to sources of knowledge, while satisfying the increasing requirements of society, favored the conditions to make of innovation a multidisciplinary and collaborative approach among the different actors of the innovation system (Gibbons et al, 1997).

For this, it was necessary to set in motion a new innovation process based on knowledge, where university will play an active role derived from solutions to the socioeconomic problems, increasing the applied research and technology development for the industrial and social sector.

In this scheme, a university becomes an actor with major interactions with its surroundings, while it makes stronger bonds with the industrial and social sectors. The promotion and strengthening of interaction with society is what is known as “the third mission” of a university, and is related to the other two missions: education and research. In this way, the universities started to learn how to manage technologies and this created stronger bond and cooperation with their surroundings.

Thus, the predominant university model in the 21st century, named by Smilor and Gill (1986) "the enterprising university", is aware the needs of its environment and drives the regional and national development. In this model, the universities offer education that then will be turned into commercial products or research results that can used by the industry or the scientific community, technical consulting, patents and licenses of academic research applied in the industry, or even creating spin-offs of some patented technologies. The figures 1 show the different missions of the Academy

Figure 1. Missions of the Academy



Some examples of the enterprising university model are the Silicon Valley (built by Stanford's University and the University of California) and the Route 187 (located close to the Massachusetts's Institute of Technology, University of Boston and Harvard University); in Washington : the Orange country, etc. (Saxenian, 1996 and 2009; Feldman, 2007)

3. Technology Parks in Mexico

A technology pole, technology parks or techno pole is an initiative that brings to one location: high technology, research centers, firms and universities, as well as financial institutions, to promote the contact between them. When interacting with each other, they have a synergistic effect, from which new ideas and innovative technologies could emerge, and will later promote new enterprises. The technology poles form local productive systems where new technologies can be created in a more efficient manner than in any other place, and they are based on the cross fertilization theory.

A technology pole is a group of organizations sharing a common interest in all the aspects of the development: from the research at a laboratory up to manufacturing and marketing in these poles, predominate small and medium firms with their offices, laboratories and manufacturing areas. According to Komninos (2002), the defining elements of a techno pole are communication and cooperation, based on networks, institutional arrangements, “soft” actions like business intelligence, technology competences, financing of innovation and providing advanced technology services. Another important element is the observation activities to monitor the industrial progress, the results of research and development (R&D) of other centers on new products, technology abilities and political frameworks for that promote these developments.

The technology parks are one of the different options to create favorable conditions to form production networks for the generation of knowledge. In the recent years, it has been emphasized the many benefits and advantages that technology parks offer, even though they do not substitute the traditional industrial areas like industrial districts.

Historically, the collaboration between industry and universities in developed countries has a long tradition. On the other hand, emerging countries like Mexico, the relationship industry-academy started not long ago and has rendered diverse and scant results. (Álvarez, 1995) Universities and Institutions of Higher Education (IHE) with support of the National Council for Science and Technology (CONACYT, for his initials in Spanish) at the beginning of the nineties put into practice a series of programs and policies that were in great part unidirectional (with only public funding), or bipartite but conceived as "islands" and this approach reduced the initial impact of these initiatives and their evolution was slow.

Since 2001 the Mexican government made a strategic change, leaving the later approach and focusing on the industrial process with a systematic vision: going from the promotion up to the industrial processes. From this, a new series of initiatives were created as the PyME Fund from Secretary for Economy; the Innovation Fund, the Mix Fund and the program AVANCE from CONACYT; that along with some other initiatives in Jalisco, Nuevo Leon and Baja California (just to mention some of them); sought to imitate the strategy followed in places like California and Boston

in the USA; Cambridge and West London in Great Britain or Sophia and Antipolis in France, among others (Pérez and Márquez, 2006).

These initiatives, IHE and follow some elements to concentrate infrastructure as it has been observed in successful cases in other countries, however, these duplicates have been implemented as isolated poles or "islands" that seek to put into action their environment, therefore their impact is reduced mainly because they lacked more local interaction or collaboration.

In other countries, like in China and Taiwan, the government did a great financial and institutional effort to repatriate highly qualified personnel. This brought back some migrants that were formerly employed at Silicon Valley by offering all kinds of facilities and opportunities, which included an integral settling package (infrastructure, schools, housing, manufacturing facilities and services for ICT's, etc.) to replicate of the Californian success (Saxenian, 2007).

Mexico has joined the technology parks initiative as a development alternative, which seeks to attract investment, R&D and knowledge to increase the productivity of the high technology sector.

Nowadays, there are about 24 parks and clusters in Mexico, which are distributed in 16 states, even though most of them are located in certain north and central regions of the country in the following states: Jalisco with 4, Nuevo León with 3 and Chihuahua, Sonora and the Federal district each one with 2 (SE, 2009). As it can be seen in the figure 2, the states that concentrate the technology parks in Mexico are in the north and central region of the country.

The creation of these parks and clusters is tightly connected to the development of Information Communication and Telecommunications Industry (ICT), and has merged efforts from three levels of government (federal, state and local government) and in some cases was supported or promoted by some industrial associations. (SE, 2009)

Figure 2. Distribution of the technology parks in Mexico

Source: based on reports from the Secretary of Economy (2009).

Between 2004 and 2008, the technology parks in Mexico have generated an investment of about 47 million of dollars (mdd), which is approximately 91.1 % of the funding provided in 2008 to the Program for the development of the software industry (Prosoft). (SE, 2009)

From these parks, 14 were creating thanks to the collaboration among the federal and state government with some private firms. All the other parks, they have also additional investments in IHE.

4. **The Technopoli's case**

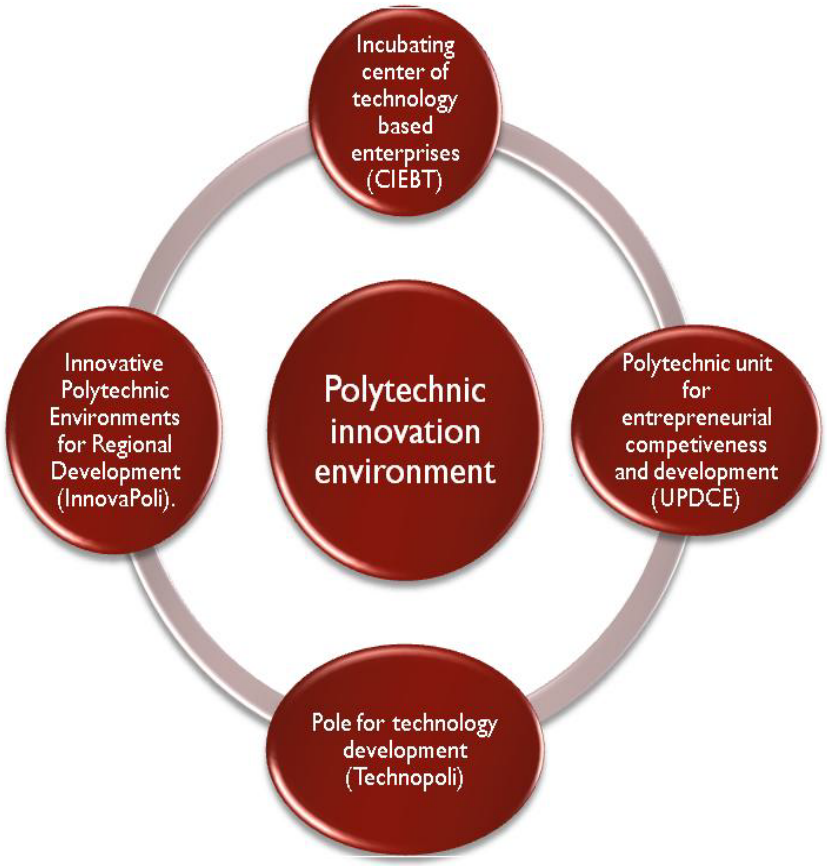
At the IPN, aware of the social needs and of world trends, the current administration has put forward initiatives aiming to incorporate the enterprising university model.

In the first years, the relationship between the IPN and the industry was a complementary activity. Then since 1986 the IPN began formally to interact with the industry. It was not until the beginning of the 21st century, when the IPN successfully started incubating technology based enterprises named CIEBT (at the incubating center of Technology Based enterprises, by its initials in Spanish) and through the UPDCE (Polytechnic Unit for Entrepreneurial Competitiveness and development, by its initials in Spanish); that this role becomes relevant. Today, the innovation activity in the IPN is closely related to its environment and it is recognized as a fundamental part of the activities and goals of the Institute.

Recently, the IPN's administration has set in motion two strategies aiming to incorporate an enterprising university model to the institute (IPN, 2010), by two mechanisms:

1. Institutional Polytechnic System for Entrepreneurial consulting, which offers strategic and synergistic technical consultation to firms, and include expansion and promotion areas for micro, small and medium Enterprises (SME's), and the social sector through the CIEBT, UPDCE and the Pole for technology development (Technopoli). Then all of these elements work in a coordinated and systematic manner to stimulate and promote the knowledge generated in the Institute so that it is useful and has an economic impact in Enterprises and firms.
2. Innovative Polytechnic Environments for Regional Development (InnovaPoli). It is a new project focused on the creation of environments that support innovation in the regions of influence of the Institute. With this initiative, the Institute will promote coordination with the already existing regional and local projects; the main elements of this initiative can be seen in figure 3.

Fig. 3 Components of the Innovative Environment of the IPN



The IPN created in 2009 the Pole for Technology Development (Technopoli), whose main goal is to have an active role in the industry, especially in the high technology sector. The creation of the Technopoli required an initial investment of around 6 mdd from which 44.8% were provided by the Secretary of Economy and the rest by the IPN from resources coming from the Fund for Scientific and technology research.

Technopoli is a geographical cluster for innovation and management of the flow of technology and knowledge among the IPN, its academic units, its research centers and external firms, enterprises and markets. Technopoli promotes the creation and growth of technology based enterprises in two ways: incubating new enterprises and by the centrifugal generation of companies that link commercial technology based organizations, enterprises and highly specialized laboratories with

researchers and technologists. At the same time, Technopoli offers hosting services for enterprises thus promoting generation and diffusion of knowledge; thus aiming to generate products from innovative technologies.

Located in an area that concentrates a large part of the students and teachers and researchers of the Institute, the Technopoli is in close communication with the areas with connections with the industry in the IPN. Furthermore, Technopoli works through a functional and innovative system that supports the linkage of the technology processes with the commercial activity helping the development and marketing of technologies for domestic and international markets.

In the Technopoli, the core performs multiple functions: Technology Observatory, Competitive Technology Intelligence, Incubation of enterprises, Information and Communication Technology services, Software and intelligent Services. The other elements of the Technopoli, besides the core, are the following areas: technology specialized services (solutions for the ICT's and digital art, technology and innovation management), technology projects (financial broking and technology promotion) and Technology Intelligence (business intelligence, observation and future technologies).

The Technological Observatory of the Technopoli provides easy access to knowledge for the development of innovative and competitive products and high technology; and it aims to find commercial and funding opportunities. With the data provided by the Observatory, an analysis and follow-up of the performance of industrial sectors and indicators are made; besides this research and informative services are provided about national and international data, all this helps to find possible opportunities for the products crested by the “tractor” firms and enterprises located in the Technopoli.

The Unit for design and development of software and hardware is a space suitable to develop innovations in the area of Information and Communication technologies (ICT's). This unit offers a strong platform well as, suitable equipment and infrastructure. This unit currently counts with a certification as training center in Java technologies, which was supervised by Sun Mycrosystems. The creation of software, in this area of the Technopoli, will promote the creation of new technology

based enterprises (TBE) and the training center will provide trained leaders with certification in project development in ICT's.

The area that deals with the system for entrepreneurial Intelligence, seeks to develop high technology enterprises, and is focused on the creation and management of knowledge, the generation of innovation groups and sharing patents. This area promotes collaboration, strategic alliances and interacts with corporations, big firms enterprises and technology parks.

The Technopoli also have the Unit for Digital Art and 3D design and production. This area is a space for highly specialized and competitive training that promotes the production of creative multimedia, graphic and web design, 3D animation, digital audio and video.

Additionally, the Technopoli offers the possibility to extend the operations of the CIEBT and could become a virtual Incubator for enterprises, as well as of a special area for the Network *Emprendia*, which is a network that incubates enterprises at the most prestigious universities in Latin America. The Technopoli has two pavilions and each one has more than 500 m^2, and can accommodate up to 20 “tractor” enterprises. The architectural design of the building is inspired by the Aztec calendar, and it forms part of a complex that includes the UPDCE, the Center of nano and micro technologies and CIEBT.

5. Learned Lessons

The role of the university has changed drastically, not only due to the world trends but also to the local needs of industry and society. For this reason, they have become an increasingly relevant actor that propels the innovation system.

The Technopoli was created as a fundamental element that will affect the flow of the high technology in Mexico. It will also improve the impact, interaction and collaboration of the institute with the industry. With these actions, the Technopoli will transform the IPN into a dynamic actor in the innovation system in Mexico.

The strength of the Technopoli lies in the experience gained while tending the demands of the environment, and due to the close relationship that the IPN has with the main actors of the industrial and social sector. Thus making easier to interact and communicate with the industry, which has allowed providing prompt answers and solutions for the social and industrial sectors.

The challenges that the Technopoli faces can be seen not only as operative but also financial and of expansion. In the middle term there is the possibility to have some other regional branches in other states. New branches of the Technopoli's could be created virtually wherever a technology park is located near an IPN's academic or research unit.

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