THE GEORGE WASHINGTON UNIVERSITY

THE CENTER FOR LATIN AMERICAN ISSUES

MINERVA PROGRAM
SPRING 2015

ALEJANDRO FRANCO SEGURA

"THE ROLE OF THE CLUSTERS, SCIENCE PARKS AND INCUBATORS AS BOOSTERS OF THE REGIONAL ECONOMIC DEVELOPMENT IN THE STATE OF HIDALGO"

Advisor: Ph.D. Nicholas Vonortas

The opinions expressed in this paper reflects research efforts towards understanding the role of the clusters, science parks and incubators as boosters of the regional economic development and does not necessarily express the views of Hidalgo's Government.

INDEX

Introduction

Mexico is committed to pressing for higher levels of well-being for all its citizens. This should be able to raise their productivity and competitiveness. There is the conviction that investment in science and technology is a fundamental tool to access a knowledge-based economy of welfare. In this knowledge-based economy, the productive activities are based on the creation of high added-value goods and services.

A knowledge-based economy is the one whose operation is based way predominantly in the production, distribution and use of knowledge and the different processes of creation, transfer and diffusion of knowledge (OECD 1996) in the productive sectors.

Likewise, it is important to note that the economic development of the nations that today are pointing to better prospects for global growth, they have opted for innovation as a pillar of development and this has improved the living conditions of their inhabitants and a significant improvement in productivity reflected in the quality of life and social well-being.

Mexico, has undertaken these international experiences as good practices, thus it has strengthened its actions in the economic sphere in the development and promotion of strategies oriented to the knowledge-based economy, in order to boost their levels of competitiveness by focusing their efforts on economic, on the basis of scientific and technology existing capabilities, as well as support for the private sector and its investment in this area.

Aware of these processes, the State of Hidalgo has focused on its growth and development way consistent with the national vision of fostering a knowledge-based economy, therefore the State of Hidalgo has promoted in the current administration projects of scientific and technological infrastructure such as the Pachuca City of Knowledge and Culture, the Science and Technologic Park of Hidalgo, The National Center of innovation in the Textile and Clothing Industries and the projects that are underway as the Agricultural Biotechnology Research Center and The Logistics and Transport Center Research (Business Partner by Georgia Institute of Technology).

On the other hand, the state of Hidalgo has made significant efforts in the investment of intangible assets, such as the Technology Transfer Office (TTO), The Technology Observatory of Hidalgo, Technology-Based Incubators, The University-Industry Link Center among others.

Indeed, the State of Hidalgo should continue fostering in the next years continuous innovation system improvement, including the budget emphasis that may be required to apply at different times for the coherent and harmonious development of its different components.

These actions must be supported in a horizon of long-term, which exceeds the space of action for a Government, with the aim of continuing in the line of action constitute innovation as key factor requires efforts in different sectors (university, business and government) in order to increase the rate of productivity growth and thus contribute to the economic development of the State of Hidalgo.

In this document is addressed in a general way, the situation that prevails in the area of science, technology and innovation (STI), as well as the different actions that are driven by the two levels of government (federal and state executive branch), in order to figure out the importance of investment in infrastructure in the fields of science, technology and innovation and its key role within the actions in the economic sphere, as well as to identify the need to generate ties which come together the efforts of way horizontal and transverse of the different actors involved in the STI and the various processes of creation, dissemination and transfer.

1. The New Forces of Development

1.1. The Spatial Organization of Production

Adam Smith (1776) an other classical economists in the latter third of the 18th century – during the industrial revolution and at time when the formation and expasion of national markets took place – gave great importance to natural resources and pointed out the appearance of new kinds of firm organization, forming a local productive system. Likewise Schumpeter (1934) wrote in the early 20th century, during the electric revolution, when inventions and innovations transformed the manufacturing economy that gave way to a profound restructuring of productive activity, and integration consolidated itself with the increase in international trade, the intesification of capital flows, and the expasion of Multinational Corporations (MNCs); he stressed the role of the innovative entrepreneur as well as that of innovations in product, process, and organization in the development process. Marshall (1890) pointed out the importance of large firms and organization of production model that allows for economies of scale in local firms systems.

The spatial organization of production is a process associated with the strategy of the most dynamics firms, the dynamics of development forces, and the process of development. Increased competition in markets and the search for investment returns stimulate the firms to adopt innovation as well as make good use of the resources (including intangibles) and specific assets of cities and regions. Thus, the transformation of the organization of production is conditions not only by the introduction of innovations and knowledge in the productive systems, in transport and communications, and in the markets, but also by the change in institutions and urban development, as shown below in the analysis of each stage of industrial devlopment (Vázquez-Barquero, 2010).

Alfred Marshall (1890) witnesses the economic, social, and technological transformations of the late 19th and early 20th centuries.

He analyzed the concentration of the specialized industries in specific localities, and based his writings on those of Adam Smith (1776). The basic explanation for the agglomerations of firms in an industrial district lay in the fact that geographical proximity stimulated the creation of specialized labor, the circulation of ideas and knowledge among the different firms in different productive activities.

Hoover (1948) synthesized the advantages of agglomeration of firms, by combining the effects of internal and external scale economies in his interpretation. Following Marshall, he pointed out that internal economies of scale were the result of the efficiency of large firms in the management of inputs for manufacturing a growing number of goods for a wide market. He also added that external economies of scale were produced as a result of the location of the firms of a certain sector in a specific locality, and of urbanization economies associated with the agglomeration of a variety of industries and services in a city.

All of these ideas led to an economic development paradigm that was widely spread over decades by identifying it with the industrialization processes through investments made by both the large firms in large cities and public administration in large infrastructures.

Yet, even though the idea that development is produced thanks to the investment made by industrial firms has been maintained, one of the great contributions of Shumpeter (1939) has been forgotten, namely that long-term development can only be generated whether innovations and knowledge are introduced in the products, processes and forms of organization.

1.2. The Innovation Cluster Phenomenon

Clusters are geographically localized concentrations of firms in related sectors that do business with each other and have common needs for trained workers, infrastructure and technology. Although the cluster concept predates Porter by nearly a century, and the cluster phenomenon itself is as old as history, Porter popularized it so effectively that since his book appeared the cluster concept has come to dominate the economic development thinking in advanced countries, including the United States.

The states have been the primary movers in the widespread and growing practice of fostering innovation clusters as an economic development tool. In his seminal 1990 book *The Competitive Advantage of Nations,* Michael Porter argued that in advanced economies, regional "clusters" of related industries—not individual companies or sectors—are the primary source of competitiveness, export growth and rising employment and income levels.[1]

[1] Best Practices in State and Regional Innovation Initiatives: Competing in the 21st Century Washington, DC: The National Academies Press, 2013.

Likewise, Michael Porter (1998) offers this succinct definition of clusters:

Geographical concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, associated institutions (e.g. universities, standards agencies, and trade associations) in particular fields that compete but also cooperate.

More generally, clusters are agglomerations of people, firms, institutions, and other economic actors working in a similar field who interact in a relatively small region.

Indeed economic dynamism and innovation are precisely the qualities that attract policy makers to aid cluster formation. High paying jobs, high economic growth, market dominant companies with export potential, and the prestige of being an international technological leader, are just some of the reasons high-tech clusters are so valued. A cluster can become a global center for the activity performed there, drawing investment from across a nation and the world.

The integration of world markets has also contributed to the development of service cluster in certain international cities like Sao Paulo, Buenos Aires, Mexico City, Santiago, Beijing, Singapore, and Shanghai.

It can see that the geographic concentration of firms – in districts, complexes, and clusters – is constantly experiencing a transformation and change process, which is associated with the creation and diffusion of innovation and knowledge as well as with a change in market dynamics (Vazquez – Barquero 2010)

Some relevants examples of such dominant are following:[2]

- Silicon Valley
- Bangalore (Electronic City, Whitefield)
- Silicon Wadi
- Daedok Innopolis
- Ciudad del Saber
- Route 128
- Research Triangle

[2] Vonortas. N. (2015) Technology Creation and Diffusion, Slides - Class. Spring 2015.

- Washington DC
- Hsinchu Science and Industrial Park
- San Francisco's SoMa neighborhood
- Cambridge Mass' Kendall Square
- Lower Manhattan

Clusters are often described geographically, but it is not merely the proximity of related firms and institutions, which makes them successful. It is the social interaction between economic actors, which helps to drive innovation. A university may contain a brilliant scientist, a firm may retain a skillful lawyer or engineer, and a banker may possess access to great sums of capital, but if they never meet and discuss the ways that each may help the other a new innovative company is unlikely to be formed. In successful clusters, such collaboration and entrepreneurialism is profitably fostered (Vonortas and Rouge 2015).

Indeed, changes in the spatial organization of production are process related to the economic dynamic of the countries, regions, and cities. According to Schumpeter (1934), innovation is the key factor explaining both the spatial organization of production and economic development.

In other hand, is also important recognize that the increased of services, explains because the created intangible assets are replacing natural and created tangible assets as the main source of wealth, particularly in the case of developed economies.

Because of this, when the transformation and changes is introduced by key elements of the economy of knowledge, the difference between high and low technology industries is less significant. Knowledge in effect becomes heterogeneous merchandise, transforming the economic and social reality (Vazquez-Barquero et al; 2010).

Therefore, the explanation for today's distribution of economic activity and the interpretation of spatial organization of production lead necessarily to consider knowledge and information as forces for cluster development.

All of this leads to the idea of associating the cluster with the knowledge-based economy; otherwise clusters appeared because of the advantages that the knowledge generated by those firms, which work in an innovative atmosphere, can present.

As Boroughs argues (2015) Clustering also occurs because of the characteristics of four different kinds of knowledge relative to spatial proximity. These knowledge types are sometimes simplified as “Know-what”, “Know-why”, “Know-how”, “Know-who”. The first, “Know-what”, refers to an up to date understanding of the state of the field. Both with regard to technology and changing business conditions; a firm grasp of formal and informal business and science news and facts. Know-what is needed to under- stand what direction companies should be moving in and is critical for strategic planning.

Analytical or scientific knowledge makes up “Know-why” which can be thought of as explanation of the works of nature. Both “Know-what” and “Know-why” are codifiable, that is, they refer to knowledge amenable to being written down, codified, and transmitted.

Thanks to modern communication technology, codified knowledge can be transmitted around the world in a matter of seconds. Imagine a racing automobile; there is a great deal of information, which is transmitted about its qualities, specification, and care. This information can be found in blueprints, owner’s manuals, cost invoices, and in detailed engineering test data.

However, one would be hard pressed to take all this data and put together a championship Formula One racing team from even the most intelligent and athletic group of people unfamiliar with auto racing.

This is because a third kind of knowledge the “Know-how” is also critical. Tacit knowledge, also referred to as “learning through doing”, is not easily transferred over long distances. Such knowledge, like the ability of a mechanic to instantly diagnose an unusual engine problem or a driver to know exactly how much to engage the clutch when approaching a hairpin turn cannot be appropriated through reading a book. Tacit knowledge is said to be “sticky” not moving fast or far from those who have it. Many industrial processes involve a great deal of tacit knowledge. Only by working side by side or closely collaborating can individuals fully master the ability to efficiently complete certain tasks.

Finally, “Know-who” refers to who knows how to do what, that is, information linking individuals and organizations to a particular pieces of knowledge. Put differently, networking is the intimate knowledge of which individuals are truly important as innovators and institutional gatekeepers.

Reputation can be difficult to judge from afar. Media sources may report on scientists who are the most interesting to readers or "colorful" while ignoring those in the field who are truly driving progress. Similarly in government or corporate bureaucracies, someone who a certain high rank or title may not actually be the key to the organization's management.

Location makes a significant difference for the application of all four types of knowledge. While tacit knowledge and networking are most obviously tied to geography, it turns out that much of analytical knowledge is as well. A study of research cited in patents, for instance, reveals that papers from nearby universities are more likely to be cited than papers from universities located farther away (Fagerberg 2005).

1.3. The Role of Science, Technology, Research Parks (STPs)[3]

Areas of innovation, of which science, technology and research parks (STPs) are a highly specialized type, play a key role in the economic development of their environment. Through a dynamic and innovative mix of policies, programmes, quality space and facilities and high value-added services, they

- stimulate and manage the flow of knowledge and technology between universities and companies.
- facilitate the communication between companies, entrepreneurs and technicians.
- provide environments that enhance a culture of innovation, creativity and quality.
- focus on companies and research institutions as well as on people: the entrepreneurs and 'knowledge workers'.
- facilitate the creation of new businesses via incubation and spin-off mechanisms, and accelerate the growth of small and medium size companies.
- work in a global network that gathers many thousands of innovative companies and research institutions throughout the world, facilitating the internationalisation of their resident companies.

[3] Accesed at http://www.iasp.ws/the-role-of-stps-and-innovation-areas in March 16, 2015.

1.3.1.Science Parks

The International Association of Science Parks (IASP) defines a Science Park (SP) as "an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.

To enable these goals to be met, a SP stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies, and markets; it facilitates the creation and growth of innovation-based companies through incubation and spinoff processes; and provides other value-added services together with high quality space and facilities."

Moreover, the main goal in SP is increased knowledge spillovers and product of commercialization. Science parks were envisioned as a location where government, industry, and the university could collaborate and share ideas. This collaboration would hopefully result in entrepreneurship and human capital development, which could serve as kernel for developing a regional agglomeration of knowledge workers.

One of the primary reasons for the creation of science parks in the developed world has been the relative resiliency of universities in the face of economic decline. In many regions, which have experienced de-industrialization, universities remain one of the few functioning large institutions and so attempts at economic rejuvenation are centered on the university. A similar logic prevails in developing countries, which are attempting to build an innovative environment from scratch. In either case, ties to a university lend credibility to such developments and imply a long-term commitment by policy makers (Vonortas and Rouge 2015).

Typically, the science park of today can be defined by four "fuctional components" and several physical components. The functional components include the following:

- Businesses: established Mutlnational Corporations (MNCs), domestic companies, and Start-ups
- Knowledge providers: university research and educational infraestructures, applied labs, and facilities usually handled by public bodies

- Industry support services: business incubators and enterprise development areas, usually manged by provate operators; and
- Financial support services: venture capital, regional development agencies, or banks.

The physical components include infraestructure development, office buildings, meeting rooms, transportation, power, and ICT connectivity.

The combination of fuctional and physical components promotes economic development and competitiveness by creating new business opportunities and adding value to mature companies, fostering entrepreneurship, incubating new innovatie companies, generating knowledge-based jobs, and building attractives spaces for knowledge workers.

Many developing countries have created science parks to obtain technology transfer, skills, capital ans exposure to MNC research for both universities and domestic companies; to create employment for graduates with advanced degrees who often do not find employment otherwise; and to slow brain drain (World Bank 2010).

Another impetus for creating SP's was desire to garner greater benefit from science research. In the United States, a great deal of public research funding is funneled through university departments. The rationale for basic research was partially predicated on the assumption that such research would lead to economic growth. As public science funding came under budget pressure in the 1970s and 1980s and as the US faced economic competition from Europe and Asia, science parks began to be seen as method for increasing technology transfer. Since the emergence of the first science parks in the United States during the 1950s, the concept has proliferated with over 400 parks worldwide. In North America there were 174 research parks by the middle of the previous decade which collectively employed over 350,000 workers and occupied over 47,000 acres (Battelle 2013).

1.4. Knowledge Business Incubators[4]

Widely used by local governments to encourage general entrepreneurship, business incubators, which specifically focus on high-tech sectors, are a sort of inversion of the science park model. Whereas science parks try to attract businesses to collocate and hopefully collaborate with

[4] The section draws considerably on Vonortas, N; Rouge, P. (2015) Innovation Policy A Practical Introduction, SpringerBriefs in Entrepreneurship and Innovation. Springer.

universities, business incubators seek to encourage spin-offs and start-ups. Incubators try to create a welcoming environment for entrepreneurship by lowering startup costs and providing consulting services. Key features of incubators are temporary leases in business rental property offered at below market rates, professional business managers, and structured networking opportunities with venture capitalists.

Some of the key services provided by business incubators include:

- Provision of a facility to house client firms, including office space, business services and access to laboratory and other technical resources needed for prototyping, testing and analysis for technology-based clients
- Agreement among stakeholders on the objectives of the incubator, including short-term and long-term expectations about tenants' growth and maturation
- Experienced incubator managers who can design and deliver customized services to address the unique needs of client firms
- Design or use of long-term financial support strategies that draw on locally available investment sources, client fees, and downstream equity or royalty returns
- Reliance upon a supportive community infrastructure to facilitate access to the widest possible range of financial, management, marketing, technical, legal and information resources needed for tenant training, networking, market analyses, regulatory compliance and product development.

Business incubators have become even more widespread than science parks, not least because of the fewer resources needed to establish one. Incubators carry additional appeal because of how far along they are in the continuum from basic research to marketable product. The primary rationale for high-tech business incubators is that small, innovative companies are the most likely to create transformative technologies that will benefit society at large, potentially even leading to the creation of new industries especially in advanced economies.

Beginning entrepreneurs have difficulty evaluating the market potential of innovative technology, and even less understanding of the necessary steps towards commercializing a product. This experience gap is a serious barrier to universities that are encouraging their faculty members to spin off new firms. Since such businesses are inherently risky and unproven, they suffer from a lack of investment. Governments seek to correct for this market failure by subsidizing the establishment of

such firms (OECD 2006). Incubators attempt to bridge this gap in three key ways, by providing infrastructure, business support, and access to networks.

1.5. Triple Helix

The model of Triple Helix interactions between university, industry and government (Etzkowitz and Leydesdorff 1997, 1995), alongside its variations such as the Quadruple Helix (Carayannis and Campbell 2009) and Triple Helix twins (Etzkowitz and Zhou 2006), has been commonly used as a normative framework among researchers for understanding interactions between key actors in innovation systems. It has also become a common strategy of many governments in developing innovation policies. One central claim of the Triple Helix thesis is that the interrelations between academia, industry and government provide the optimal conditions for innovation (Leydesdorff and Etzkowitz 1998; Etzkowitz and Leydesdorff 2000).

In spite of the popularity of the Triple Helix model, it has not been without problems. Among many other criticisms, one is that the Triple Helix model pays little attention to national contexts (Balzat and Hanusch 2004; Shinn 2002) and other social settings (Cooke 2005). Therefore the Triple Helix model can hardly provide appropriate rationales on which systematically structured criteria and indicators may be developed for researching, measuring and comparing different empirical cases (Mowery and Sampat 2004), especially when they are in different national and cultural contexts.

2. Science, Technology and Innovation Policy in Mexico

In order to highlight the importance of the use and creation of knowledge for long-term economic growth. It discusses the concept of the knowledge economy, wich is essentially an economy where knowledge is the main engine of economic growth.

The World Bank (2009) has driven a framework that asserts that the investment in the knowledge economy will lead to an effective use of the factors of production. This would tend to increase the rate of productivity growth, and therefore the result of a sustained economic growth.

The framework asserts that sustained investments in these knowledge econ- omy pillars will lead to the availability of knowledge and its effective use for economic production. This would tend to increase the growth rate of total factor productivity, and consequently result in sus- tained economic growth.

This framework is designed and proposed by four pillars that allow to observe the level of development of a knowledge economy and are listed below:

Policy and Institutional Framework. Creating an appropriate economic incentive and institutional regime that encourages the widespread and efficient use of local and global knowledge in all sectors of the economy, that fosters entrepreneurship, and that permits and supports the economic and social transformations engendered by the knowledge revolution.

Innovation System. Creating an efficient innovation system and business environment that encourages innova- tion and entrepreneurship, comprising firms, science and research centers, universities, think tanks, and other organizations that can tap into and contribute to the growing stock of global knowledge, that can adapt it to local needs, and that can use it to create new products, services, and ways of doing business.

Education and Training. Creating a society of skilled, flexible, and creative people, with opportunities for a good education and life-long learning available to all, and a flexible and appropriate mix of public and private funding.

Information Infrastructure (ICT/e-Development). Building a dynamic information infrastructure and a com- petitive and innovative information sector that fosters a variety of efficient and competitive ICT services and tools, available for all sectors of society. This includes not only high-end technologies such as the Internet and mobile telephony, but also radio, television, and other media; computers and other devices for storing, processing, and using information; and a range of communication services.

Mexico has understood that the education and the training of new generations is vital for development by what these four pillars have framed them in the National Plan of Development 2013-2018 (PND) document responsible for guiding government actions in the coming years.

The PND has established five national goals that provide the general framework for the development of sectoral, institutional, regional and special programmes:

I. Mexico in peace
II. Mexico inclusive
III. Mexico with quality education
IV. Mexico prosperous
V. Mexico with global responsibility.

Starting from the goal Mexico with quality education shows the special programme of science, technology and innovation 2014-2018 (PECiTI), which reads as follows:

"Scientific, technological development and innovation make pillars for sustainable economic and social progress."

This objective serves the existing empirical evidence that shows that societies that put knowledge at the base of its transformation and development access higher levels of welfare. To achieve the objective mentioned five strategies are followed:

Strategy 3.5.1

Contribute to the national investment in scientific research and technological development to grow annually and reaches a level of 1% of GDP.

Strategy 3.5.2

Contribute to the formation and strengthening of human capital of high level.

Strategy 3.5.3

Foster the development of vocations and scientific, technological capabilities and local innovation, to strengthen the regional sustainable and inclusive development.

Strategy 3.5.4

Contribute to the transfer and use of knowledge, linking to higher education institutions and research centers with the public, social and private sectors.

Strategy 3.5.5

Contribute to the strengthening of the country's scientific and technological infrastructure.

From these policy actions published establishing the guiding objectives of the PECiTI, whose purpose is to guide the transition of Mexico towards a knowledge-based economy.

First of all, addresses the need for a National Investment in Scientific Research and Development Experimental (IDE) which represents at least 1% of GDP, which is regarded to be the turning point for sustainable development.

The formation of national, regional and local capabilities of human capital and infrastructure serves also as well as the institutional strengthening of local level with the aim of achieving balanced regional development.

Finally, the need to take advantage of the knowledge created through the linkage of the various actors, is also made explicit a line particularly left behind in Mexico.

2.1 Investment in Science, Technology and Innovation in Mexico

Expenditure on Scientific Research and Experimental Development (GIDE)

The GIDE, is known as the expenditure of scientific research and experimental development (GIDE). The importance of GIDE within the knowledge economy is due to the purpose in the creation of knowledge, basic and applied, the latter aimed at the generation of products and

processes. Therefore, sources of funding are diverse: business sector, Government, higher education institutions and non-profit organzations.

GIDE/GDP ratio is an international indicator used to measure current and investment expenditure on these activities; its importance lies in that it gives to know the degree of a country's development supported by scientific and technological research. Developed countries spend between 1.5 and 3.8 per cent of their GDP to the GIDE. For Mexico the value of this indicator has been virtually constant for years within 0.5%. In 2012 the GIDE of Mexico represented 0.43% of GDP.

According to a report issued in February 2015 on its website of the National Council of Science and Technology (CONACYT) on advances in earlier raised the PECiTI strategies, it is estimated that the GIDE reached by 2014 to 91,955 million pesos, this based on the survey the National Institute of Statistics and Geography (INEGI) in biennial form. This implies that the GIDE/GDP ratio would reach a rate of 0.54%.[5]

2.2 Scientific and technological infrastructure

After the human capital, the scientific and technological infrastructure provides the ability to more relevant for the development of the STI.

The issue of infrastructure is vital due the infrastructure that links and communicates to the system, each of these institutions and agencies provides infrastructure that supports human capital qualified for research activities.

2.3 CONACYT - Research Centers System

An important part of the infrastructure of the National System of Science, Technology and Innovation (SNCTI) is located in the Research Public Centers System (CPI), coordinated by CONACYT. For its impact on scientific and technological production and the number of members of the SNI working on it, it is considered as the second in importance to the research of the country.

[5] Consejo Nacional de Ciencia y Tecnología (CONACYT) accessed in March 6th
http://148.207.1.115/siicyt/cms/paginas/SeguimientoProgramas.jsp#

The system of CONACYT centers provides a set of 27 research institutions which are diversified in different fields of scientific, technological, social and humanistic knowledge.

According to their different objectives and fields, the CPI system are grouped into three major subsystems: Exact and Natural Sciences (10 centers); Social Sciences and Humanities (8 centers); Technological Development and Services (8 centers); and one specialized in the Financing of postgraduate studies.

The CPI-CONACYT system has an important role in the social work and scientific and technological diffusion that links them directly with the communities in their environments. As a result of its operation this system generates about 75% of the activity of scientific, technological and training of human capital outside the Federal District and has a presence in 28 States and 61 cities significantly contributing to the decentralization of the activities of STI.

2.4 Science and Technological Parks in Mexico

International experience shows that the geographical concentration of companies at sites where you can share capabilities, including access to basic goods and services, and establish links to improve their productive activities is a positive strategy to reduce costs, increase productivity and create jobs.

In Mexico has been boosted the creation of science and technology parks as a mechanism to foster investment, generate knowledge and transfer it, to raise productivity in high-technology sectors.

According to the report of scientific and technology parks in Latin America published by IBD (2012), 35 parks whose development initiative federal Government has been manifested by the business sector, State Governments, and academy were identified. These parks have been developed in different stages and with different strategies.

Therefore, in Mexico is required to strengthen the infrastructure of CTI through the creation and consolidation of clusters, techno-poles, scientific-technological parks (physical or virtual) and new research centers, to strengthen regional development and that they promote collaboration with research groups from other countries.

3. Join Statement United States – Mexico, High-Level Economic Dialogue

When President Barack Obama and President Enrique Peña Nieto announced the creation of the United-States-Mexico High-Level Economic Dialogue (HLED) in may 2013, established a new strategic vision to improve economic cooperation, which mainly focuses on delivering tangible and positive economic benefits to the people of the United States and Mexico.

With this new partnership, "as it has been called", is intended to raise a robust and cooperation dedicated to the discovery of binational solutions, shared economic challenges that strengthen both countries and that provide better opportunities to its citizens. As neighbors and partners, intends to continue placing to North America as the region most competitive and dynamic in the world.

The first HLED meeting took place in the city of Mexico on September 20, 2013. The 6 January 2015, Vice President Joe Biden hosted the second meeting with the cabinet which is located in Washington, DC to continue advancing towards the common interests, strengthen economic and trade ties, likewise bilateral relations closer and more productive, improving competitiveness, create economic and trade opportunities and promote the increase of regional and global cooperation.

As mentioned in the press release the benefits of this economic integration are more than clear, with more than $500 billions in bilateral trade per year and more than $100 billions in cross-border investment. American and Mexicans firms understand the value of an integrated economy, so have designed their production processes more efficient and competitive.

According to the press report published on the website of the White House (http://www.whitehouse.gov/the-press-office/2015/01/06/joint-statement-united-states-mexico-high-level-economic-dialogue-1), Vicepresident Joe Biden arguments as follows:

"Already we build things together and many finished products for export, which reflects the high level of co-production, so these efforts through the HLED added strength to regional integration, improving competitiveness, connectivity and productivity under an entrepreneurial and innovative spirit".

In the same way, it should be noted that Mexico and the United States are also close partners in the negotiation of the Agreement Trans-Pacific Partnership (TPP), which is intended to increase the

economic growth, development, prosperity and the increase in the rate of employment in both countries.

For purposes of this document, it is important to note that within the HLED it gives special attention to the issue of the construction of a modern and innovative - knowledge based economy.

In order to build a knowledge-based economy, the region will depend on capacity to foster innovation and provide access to high quality education as well as promote a workforce with the skills needed to confront the global economy.

Indeed, therefore HLED in this section raises a number of actions that search extend the capabilities of both countries to produce products and high value added services which depend on innovation and linkages with different clusters of both Nations.

Under the initiative of Mexico - US Entrepreneurship and Innovation Council (MUSEIC) launched in 2013, was formally signed the cooperation agreement between the United States and Mexico as part of the network of small businesses in the Americas, holding conferences and events designed to improve access to finance and business, just as the training generate strategic alliances and share best practices.

The HLED has enabled to generate a joint commitment for the development of the labour force, including the improvement of quality education in fields such as science, technology, engineering, and mathematics (STEM), through the Bilateral Forum on higher education, innovation and research (FOBESII), the Forum was officially released on May 21, 2014.

Another aspect to highlight is the commitment to increase the educational exchanges for its part, the United States with 100,000 strong in the Americas Iniative and by another hand Mexico Proyecta 100.000. In 2014 the government of Mexico with the support of the United States Embassy in Mexico, provided support to 27,000 students and teachers Mexicans to the United States.

The HLED shows a commitment between both nations in order to boost trade, development and economic growth of the region, also become pillars of the development processes of opening not only economic but also academics and cultural, which implies a more active participation of the business sector, higher education institutions and civil society organizations.

4. Overview of Hidalgo´s Economic Performance

The State of Hidalgo is located in the central region of the country, its territorial extension represents 1.1% of the national total and is composed of 84 municipalities (INEGI, 2010).

4.1 Population

According to the INEGI and the third half of 2013, the State of Hidalgo has a population of 2,810,998 inhabitants which represents 2.4% compared to the national total. Its geographic location allows it to be close to the capital of the country, thus currently, the urban growth of the Federal District and the metropolitan area of the Valley of Mexico, has influenced the hidalguense territory and there is a greater population concentration in the southern of the entity.

In regards to the demographic growth rates, Hidalgo grew at 2.1% for the period of 1980-1990; 1.7% in the period 1990-2000 and the 2000-2010 period also held at 1.7%.[6]

The Economically Active Population (EAP) is 1,155, 062 indiviudals representing 2.2% of national total. The occupied population equals 1, 098, 024 individuals, who also represents 2.2% of the national total and the unemployed population amounts to 57, 038 people amounting to 2.1% of the national total. The unemployment rate of the entity is 4.64%, lower than the national average of 4.82%.

In its demographic composition the 48.3% are men and the 51.7% are women, thus the rate of masculinity is 93.3 men per 100 women. In its population structure with greater number of inhabitants age range is 15 to 64 years with a percentage of the 64.1% compared to the total, while the range of 0-14 years and the range 65 and more, have 29.1% and 6.9% respectively.

The State Commission of Population[7] (COESPO) registered by 2013, a population density of 134.4 people per km^2 and estimated that by the year 2030 will be increased to 160.1 people per km^2.

[6] Censo de Población y Vivienda 2010, INEGI 2010.
[7] Consejo Estatal de Población (COESPO) en Boletín informativo 26/13. Prospectiva Demográfica en Hidalgo, 2013 – 2030.

4.2. Economy

The state GDP was 127 thousand 763 million pesos in 2013 in nominal terms, which represented 1.7% of national GDP. Its average growth rate for the period 2003-2011 was 2.9% above the national average, which placed at 2.5% for the same period. In its sectorial distribution; 4% of the State GDP corresponds to the primary Sector; 39% to the secondary and tertiary 57%.

For 2013, the GDP per capita is 5,886 dollars, an amount lower than the national average (8,635 dollars). The occupied population by economic sector is 55.2 % in the tertiary sector; 22.6 % in the secondary and 22.1 % in the primary sector.

In relation to the Competitiveness Index[8] , the entity has changed its position in the scale of valuation of this indicator, in the year 2008 was ranked the 22 place and by 2010 the entity is ranked 24th out of a total of 32 places.

From the information issued by the Mexican Institute for Competitiveness[9] (IMCO) in 2012, Hidalgo won 11 places in innovation of economic sectors; the number of patents applied by million of people rising from 0.4 to 4.9 in 2010. The number of researchers per 10, 000 individuals of the economically active population rose from 1.9 to 8.7 in 2010.

In Hidalgo are 2.19 % of the economic units (number of companies) at the national level, which means 81,570 companies. The unemployment rate of the entity is at 4.64 %, a value lower than the national average of 4.82 %.

Education indicators show that the average grade of schooling of the population of 15 and older is 8 years, lower than the national average figure (8.6 years), by which Hidalgo is located in place 15 (of 32). The percentage of the population that is be able to read and write, is 89.7%, a figure which is also below the national average (93.12%).

According to the summary Executive of the State of Hidalgo, developed by the Ministry of Economy, foreign direct investment (FDI) opportunities exist in the following sectors: automotive

[8] Tomado de Rodríguez César, "La Competitividad en los Municipios de México", CESOP, Centro de Estudios Sociales y de Opinión Pública, 2008. México, pp.1.
[9] Accessed at Instituto Mexicano de Competitividad website www.imco.org.mx in 18th March, 2015.

and auto parts (8 opportunities), logistics and infrastructure (4 opportunities), metalworking (6 opportunities), textile (2 opportunities) and others (1).

4.3. Science, Technology and Innovation in Hidalgo

The State of Hidalgo has a policy and legal framework that allows to execute the actions of Government in the field of STI and is where the creation of a State Agency is established to promote the work in this area by what is established, the Council of Science and Technology of the State of Hidalgo (COCYTEH), it was created in 2002, and which changed its name in 2013 to Council of Science, Technology and Innovation of Hidalgo (CITNOVA), in order to give greater visibility to the innovation and strengthen its presence within the process of generation and application of knowledge to enhance its links with the private sector of the entity, was issued in the official newspaper of the State of Hidalgo in December 2013.

On the other hand another element is very important to focus on in this consolidation of the S&T system is that the current Government has included it within the State Development Plan (PED) 2011-2016, as already mentioned above, in which the State Government takes it as part of its agenda through a series of objectives and strategies including the following:

-Link scientific, technological and innovation capabilities in strategic sectors and regional areas, and
-Foster in the Hidalgo society, the knowledge and application of S&T to enhance its well-being.

According to CONACYT[10] for the National Registry of Institutions and Science and Technology Firms (RENIECYT), Hidalgo are registered 130 organizations and companies, in the public and private sector, to carry out activities related with R&D.

Likewise, with regard to the number of researchers registered in the SNI[11] in the State of Hidalgo, have reported 321 members whom collaborate to several HEI's within the following areas:

Physicist – Mathematics 44
Engineering 64

[10] Accesed at http://www.conacyt.gob.mx/siicyt/index.php/estadisticas-del-reniecyt in March 25, 2015.
[11] Sistema Nacional de Investigadores (SNI), CONACYT.

Social Sciences 49
Biology and Chemistry 61
Biotechnology and Agricultural 55
Humanities 29
Medicine and Sciences of the Health 19

4.4. STI Field Strategic Areas in the State of Hidalgo

Likewise, throught PED for the period 2011-2016, the State of Hidalgo has established as a priority the consolidation of an environment of stability and sustainable economic development that generate positive results in the Hidalgo population welfare and as a central element in obtaining these results, is the promotion of the objectives in the field of science and technology.

According to these objectives and based on the socio-economic features of State of Hidalgo, the CITNOVA has identified eight field strategic areas (FSA's) for boostering the science development in Hidalgo, such are showed in following table :

Table 1 Field Strategic Areas in STI

Biotechnology (Emphasis in Agriculture)	Biodiversity
Renewable Energy	Logistics and Transportation
Materials and Metallurgy	Mechatronics
Information and Communications Technologies (ICT)	Crime Prevention

Source: CITNOVA 2014

These strategic areas are the most important fields, where efforts and actions focus on, however it does not mean, there are not more fields to work out and encourage, but in order to spread the impacts and benefits, these FSA's involve great ratio of the state's budget.

Some FSA's such as biotechonology, mechatronics and ICT in the last years have been boosted and fostered with a strong efforts related number of projects supported and financied, which involved scientific infraestructure such as research centers, laboratories, post graduates scholarships and high specialized master and doctoral programs.

4.5. Strengthening of Funding Sources in the State of Hidalgo

According to CONACYT in 2012, the activities in the field of S&D have been granted by the following funds:

1. Mix Fund CONACYT-Government of the State of Hidalgo.
2. Sectorial Fund of Energy Secretary-Hydrocarbons-CONACYT.
3. Sectorial Fund for education in basic science research.
4. Sectorial innovation Fund (FINNOVA)
5. Stimulus to innovation program (PEI)
6. Institutional Fund for Regional Development of CONACYT (FORDECYT)

Table 2 Numbers and Amount in STI Projects

Fund	*Number of Projects*	*Amount (million of pesos)*
Mix Fund CONACYT-Government of the State of Hidalgo	9	52.6
Sectorial Fund of Energy Secretary-Hydrocarbons-CONACYT	1	35
Sectorial Fund for education in basic science research	5	5.1
Sectorial innovation Fund (FINNOVA)	6	7.3
Stimulus to innovation program (PEI)	43	169.1
Institutional Fund for Regional Development of CONACYT (FORDECYT)	1	1.9
Total	65	271

Source: CITNOVA */ Results until 2013*

4.6. Scientific and Technological Infrastructure

Hidalgo's State has with three science parks; the Scientific and Technological Park of Hidalgo (PCyTH) located in the municipality of San Agustin Tlaxiaca; Technological Park of the Metalworking Industry in the municipality of Tepeapulco; and the Technological Park of City of Knowledge in the municipality of Pachuca.

Likewise there are three research and development private centers; the Center Italian-Mexican of Innovation and High-Tech Manufacturing of Hidalgo (CIMMATH); Center for Technological Development "Romualdo Telleria Armendariz A. C"; and the Technology Development Center DINA[12]. The state also has a Public Center for Advanced Technology in partnership with the Research Center for Advanced Technology (CIATEQ).

As part of the intangible assets the state has a Technology Observatory of the State of Hidalgo, which it is currently managed by the Autonomous University of the State of Hidalgo (UAEH), in the same way there are 11 incubators accredited by the National Institute of The Entrepreneur (INADEM 2015) under the authority of the Secretariat of Economy, 3 TTO's and 13 Small Business Development Centers (SBDC's), also known as Network Hidalgo "Puntos Mover a México" allocated through the state of Hidalgo

4.7. Knowledge-Based Economy Strategic Projects

Hidalgo is currently developing a number of strategic projects that can play a very important role as drivers of innovation. These projects are included in the PED, being for the most part aimed at the textile sectors, science and technology, logistics and knowledge.

Listed below are each of these projects:

Pachuca, City of Knowledge and Culture[13]

[12] DINA is a Buses manufacturing company, located in the municipality of Tepeapulco, Hidalgo.
[13] The section draws considerably on Plan Rector de "Pachuca, Ciudad del Conocimiento y la Cultura"

Is one of the main strategies of the Government of the State of Hidalgo, based on the model of Quad Helix, creating alliances and interaction with the federal government, public and private universities, companies and research centers; which has as its goal the economic growth of the region, via the applied knowledge and innovation in the same geographical space.

It is described as the establishment in a geographical space, of a cluster of units of knowledge, research and innovation, national and international, with the necessary infrastructure of services and equipment; contributing to develop an knowledge-based economy, which increase and strengthen the productivity and competitiveness of the State and the Central Region of Mexico, with the cooperation and interaction of society, academia, private sector and the government.

Logistic Park of the State of Hidalgo (PLATAH)

Promoted by the Government of Hidalgo in co-investment with private sector, it is born PLATAH, industrial development that Hidalgo's skilled labor integrates with the potential to promote industrial growth, not only of the State of Hidalgo, but also of Mexico.

PLATAH is strategically located in the heart of the State of Hidalgo to 30 minutes from the Mexico City, it is characterized as a logistics platform linked to the main railways in the ports of the Gulf and the Pacific, specifically Veracruz, Lazaro Cardenas and Manzanillo; as well as its land connection to the Valley of Mexico, through the highways, the Arco Norte and the Mexiquense External Circuit.

The National Center of Innovation of the Textile-Clothing Industries[14]

This is an initiative of the government of Hidalgo, backed by the federal government, also by the National Chamber of The Textile Industry, the National Chamber of the Clothing Industry, INADEM, CONACYT and the National Polytechnic Institute (IPN).

This project will have as its first objective to boost the competitiveness of the textile sector not only in the region but also in the rest of the center of the country. Likewise, it will work to enhance the competitiveness and the development of the textile and clothing industries in Mexico, through

[14] The section draws considerably on Plan Maestro del Proyecto de "Centro Nacional de Innovación de las Industrias Textil – Vestido"

science, development and research, the high-level training and the integration of the value chain as it will serve as an intermediary between the agents involved in the development of the textile and clothing sector (Triplex Helix).

The National Center of Innovation of the Textile-Clothing Industries gives continuity to the development of components of the innovation ecosystem that drive regional development, contributing to the infrastructure development that allows transit to the State of Hidalgo to the knowledge - based economy.

Among the elements that involves this Center of Innovation, are given below:

1. Linking and communication that would allow them to be a bridge of communication and cooperation with the rest of the actors of the National Center
2. Business intelligence and use information on products, customers, and competitors, for the short- and long-term planning
3. Standardization and certification where can evaluate a product, process, system or service so that it conforms to the rules, guidelines or certified of agencies dedicated to the national standardization or internationally
4. Research Industrial development and to achieve an increase in innovation that involves an increase in sales and in the competitiveness of firms
5. Start-up to enable cooperation and contribution to the development of the scientific sectors through the technology creation and difussion.

The Science and Technologic Park of Hidalgo (PCyTH)[15]

The PCyTH is a public space and as part of the Scientific and Technological Infrastructure of the State of Hidalgo and within the ecosystem of innovation foster and boost actions aimed at the use and service of the facilities, with the aim to support entrepreneurs, researchers, the scientific community, public and private schools and the HEI's.

As part of the priority areas and essential that the PCyTH in conjunction with the Council for Science, Technology and Innovation (CITNOVA) gives special attention to the following areas: Agrobiotechnology, Logistics, Metalworking and ICT.

[15] The section draws considerably on Plan Maestro del Parque Cientifico y Tecnológico de Hidalgo

Its target is to foster scientific and technological development through stimulate the link universities - business in strategic areas for development, and boosting the formation of hight level human capital which contribute to the social welfare and economic perfomance and competitiveness of Hidalgo.

The PCyTH provide services of high added value for KIE, by providing infrastructure and services for the development of its activity under the best conditions and quality performance.

Given the features and needs of the firms from different sectors, the PCyTH has focused on to attend the following types of companies:

• Technology-based companies and start ups
• Knowledge Intensive Enterprise (KIE)
• STI Departments of large companies

The infrastructure provides the following advantages and business opportunities for the sector:

a. Concentration of specialized services (incubator, acelerator, risk finance, technologic observatory, etc)
b. Linking and collaboration with KIE's
c. Applied Research and Development through the HEI's
d. Technology Transfer Services
e. Spaces and access suitable for the activities of collaboration in STI
f. Electronic Connectivity

Conclusion

In last 25 years, the processes of economic integration have accelerated and increased competition between firms, countries, and regions in the same way. This has led to adjustments of productive systems, the transformation of the labour market and increase of the population in their standards of living.

As Vazquez-Barquero (2010) explains, regional development has among its main objectives, try to shorten the gap between inequality and poverty, as well as the dynamics of clusters, knowledge networks, the formation of new urban spaces, relations and interactions of regions policentricas, diffusion and creativity in the innovation and the development of local policies that have an impact on the different levels of Government-led strategies. All this as part of the new forces of economic growth and development, where also assigns a important weight to the scientific infrastructure and technology, taking with high consideration the territorial development.

The economic dynamics of cities, regions, and countries are very different from one another. Each locality or territory has active material, human, institutional and natural and cultural resources that in overall define its potential for development.

The economic expansion depends, increasingly, for the production of goods and knowledge-intensive services. Some significant requirements for this expansion is based on the investment in knowledge associated with the skilled human capital and linked to the basic and applied sciences (Aboites and Soria 2008).

It is important to point out that these initiatives in many cases have also been undertaken by the federal and state governments, as a catalyst to boost regional and local development; however in many countries, such as is the case of China, Korea and Singapore has been an element that has provided support to a whole development strategy based on knowledge.

In the case of North America, the United States has done a job as a pioneer in the creation of models of science parks and various support programs that provide support to small and medium-sized enterprises (SME's) based on the intensive use of technology, as well as to implement a whole system of innovation, which has been an example for many countries, including some in Europe by imitating the model.

On the other hand, some Latin American countries such as Brazil, Panama and Mexico have undertaken a path toward this model of knowledge-based economy, investing heavily in scientific and technological infrastructure, not only in more laboratories or equipment, but also go beyond, investing in capital goods to create goods and services with greater added value, driving the ecosystem of STI with the sole objective of improving the social and economic circumstances.

Some examples in Mexico of projects fostered by the public sector, but supported by the private sector and that have created ties with the academic sector are The Information and Communications Technology (ICT) cluster in the State of Jalisco and Queretaro's Aerospace Park.

Another case is The Technological Institute of Monterrery (ITESM) for instance is located in a cluster that emphasizes applied research by managing a small set of incubators, helping firms access angel capital and venture funds, and providing IP-related services.

Nevertheless, to ensure that innovation will continue to grow and generate benefits that enhance productivity and economic opportunities, depends strongly on the commitment of those responsible politicians to promote an ecosystem that encourages development.

While Mexico has the structural conditions needed to establish a strong strategy of the knowledge-based economy, there is much to improve, since many of the efforts are quite disjointed, with still weak ties between industry, universities and the government.

Another important challenge is the low investment in research and development, as well as the country's complex tax policies. Improve these structural conditions, requires a political commitment, continuing dialogue and a long period of time to account for the results.

In the case of the State of Hidalgo, as was commented on prior, it has aligned the national strategy in the field of STI, to strategic projects that are driven by the State of Hidalgo and backed by the federal government, in order to establish an innovation ecosystem that enables the different involved investing and generate greater employment.

While the State of Hidalgo has made investments in the field of STI, there is a long way to go, therefore these strategies are the basis to continue betting to a knowledge-based economy.

Indeed, these aspects were considered and analyzed in this paper, allow us to understand the position which keeps the State of Hidalgo, and due to these circumstances the following actions are suggested in order to continue their development and economic growth, which are listed below:

1. Establish effective communication channels through a legal framework of long range, allowing stakeholders of the triple helix to make key decisions, with a strong orientation towards a real coordination, strengthening ties with public and private organizations, maximizing the cost -benefit of investments.

2. Continue and strengthen the generation of national and international ties of which have already established strong links with some governments and development agencies (e.g. Korea, Singapore, Panama and some universities as Georgia Institute) in order to share the best practices and support processes that have marked its development.

3. Foster an active role and catalyst of the universities in the creation, dissemination and commercialization of knowledge.

4. Continue investment and creation of intangible assets as well as the impulse of actions that foster entrepreneurship and strengthening of knowledge- intensive enterprises (KIE).

5. Provide to PCyTH, an active rol and support can encourage the survival of existing technology-based fims as well as encouraging their further development.

6. Establish performance measures through indicators that allow to assess its benefits and impacts, not just the unit of measure, but to go towards a system of comprehensive assessment that allows ir to evolve at the different levels and stages of implementation of the different projects.

7. Design and build new financing strategies focused on new schemes such as the capital of risk, investment angel, crowfunding and others, encouraging the development of new projects, as well as the promotion of innovation in the creation knowledge-intensive good and services.

8. Establish a culture that emphasizes the intellectual property rights (IPR), as well as the promotion of legal and regulatory changes that facilitate the commercialization, transfer and licensing of ideas, projects, prototypes and patents.

It is critical for the public sector and different makers commit themselves to long-term and continue fostering innovation-based entrepreneurial spirit as well as the intensive use of the knowledge. Likewise, the government of the state of Hidalgo must continue its active role in this strategy, its actions must be based on the budget and drive commitment to a new approach to development.

The clusters and enterprise networks from India, China and US (e.g. Research Triangle Park - North Caroline) were not built overnight, were a period of time between 10 to 15 years to generate their real effects on society.

It is the right way to think about these new engines of development, which, among its main results have been the impetus for the generation of better jobs, and the improvement in living conditions at local and regional level; as well as the development of goods and services based on the innovation as part of the new challenges and global circumstances.

REFERENCES

Aboites, J; Soria, M. (2008). Economía del Conocimiento y Propiedad Intelectual; Lecciones para la economía mexicana. Siglo XXI (36-43)

Banco Interamericano de Desarrollo (2012). Los Parques Cientificos y Tecnológicos en América Latina; Un análisis de la situación actual. Publication code: IDB-MG-131

Best Practices in State and Regional Innovation Initiatives (2013): Competing in the 21st Century. Washington, DC: The National Academies Press.

Carayannis, EG. Campbell, DFJ. (2009) "Mode 3" and "Quadruple helix": toward a 21st century fractal innovation ecosystem. International Journal of Technology Management 36:201–234

Hoover, E. M. (1937). Location Theory and the Shoe and Leather Industries. Cambridge.

Instituto Nacional de Estadística, Geografía e Informática, Encuesta Bianual del Gasto en actividades de investigación científica y desarrollo experimental 2013-2014.

Etzkowitz, H; Leydesdorff, L. (1995) The Triple Helix–-University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development. EASST Review 14:14–19

Etzkowitz, H; Leydesdorff, L. (eds) (1997) Universities and the global knowledge economy: a triple helix of university-industry-government relations. Printer, London

Etzkowitz, H; Leydesdorff, L. (2000) The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. Research Policy 29(2):109–123.

Etzkowitz, H; Zhou, C. (2006) Triple Helix twins: innovation and sustainability. Science and Public Policy 33(1):77–83

Edquist, C. (2005). Systems of innovation: perspectives and challenges. In J. Fagerberg, D. Mowery, & R.R. Nelson (Eds) The Oxford Handbook of Innovation. Norfolk: Oxford University Press.

Marshall, A. (1890). Priciples of Economics. Macmillan.

Plan Maestro del Proyecto "Centro Nacional de Innovación de las Industrias Textil –Vestido". (2013)

Plan Rector de "Pachuca, Ciudad del Conocimiento y la Cultura" (2014)

Plan Maestro del Proyecto "Parque Cientifico y Tecnológico de Hidalgo". (2011)

Shumpeter, J.A. (1934). The Theory of Economic Development. Cambridge.

Vázquez-Barquero, A. (2010). The New Forces of Development; Territorial Policy for Endogenous Development. World Scientific (12-15)

Vonortas, N; Rouge, P. (2015) Innovation Policy A Practical Introduction, SpringerBriefs in Entrepreneurship and Innovation. Springer (75)

World Bank (2009). The Knowledge Assessment Methodology.

World Bank (2010). Innovation Policy: A Guide for Developing Countries. https://openknowledge.worldbank.org/handle/10986/2460 License: CC BY 3.0 IGO." (310)

Westhead, P. Batstone, S. and Martin, F. (2002). Enterprise & Innovation Management Studies. Technology-Based Firms Located on Science Parks: the Applicability of Bullock's `Soft-Hard' Model. Vol. 1, No. 2, 2000, 107±139

GLOSARY

COESPO (Consejo Estatal de Población)
CONACYT (Consejo Nacional de Ciencia y Tecnología)
CPI (Centros Públicos de Investigación)
EAP (Economically Active Population)
FDI (Foreign Direct Investment)
FIT (Fund for Technological Innovation)
GDP (Gross Domestic Product)
GIDE (Gasto en Investigación Científica y Desarrollo Experimental)
HEI (High Education Institutions)
HLED (High-Level Economic Dialogue)
IASP (The International Association of Science Parks)
IBD (Interamerican Bank of Development)
ICT (Information and Communication Technologies)
INEGI (Instituto Nacional de Estadística, Geografía e Informática)
IMCO (Instituto Mexicano de Competitividad)
IPN (Instituto Politécnico Nacional)
IPR (Intellectual Property Rights)
ITESM (Intituto Tecnológico de Estudios Superiores de Monterrey)
MNC (Multinational Corporation)
MUSEIC (Mexico - US Entrepreneurship and Innovation Council)
PECiTI (Programa Especial de Ciencia y Tecnología)
PND (Plan Nacional de Desarrollo 2013-2018)
R&D (Research and Development)
SME (Small and Medium Enterprise)
SNI (Sistema Nacional de Investigadores)
STEM (Science, Technology, Engineering, and Mathematics)
STI (Science, Technology and Innovation)
PCyTH (Science and Technologic Park of Hidalgo)
TTO (Technology Transfer Office)