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Science and Technology Parks (Stps): Evidence in America, Asia and Europe

Ciencia y parques tecnológicos. Evidencia en América, Asia y Europa

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Abstract

Science and Technology Parks (STPs) and Technology Business Incubators (BIs) are innovation spaces used by the governments of several countries such as science and technology development policy, through national associations or ministerial programs. The overall objective of the study is to map the National Associations and Ministry Programs of Science and Technology Parks of America, Asia and Europe. The main

results: year of foundation of associations from 1984 to 2005; 1,205 members; 515 STPs; 2,210 BIs; 89,577 incubated companies; and 560,599 jobs created. The areas of activity considered most important, energy and environment, information, computing and telecommunications, manufacturing and automation technologies and service for business and industry.

Keywords: Science and Technology Parks (STPs); Technology Business Incubators (BIs); Innovation.

Resumen

Parques Científicos y Tecnológicos (PCT) y Tecnología Incubadoras de Empresas (TIE) son espacios de innovación utilizados por los gobiernos de varios países, como la política de desarrollo de ciencia y tecnología, a través de asociaciones nacionales o programas ministeriales. El objetivo general del estudio es el mapeo de las Asociaciones Nacionales y programas del Ministerio de Parques Científicos y Tecnológicos de América, Asia y Europa. Los resultados principales: El año de la fundación de asociaciones de 1984 a 2005; 1.205 miembros; 515 PCT; 2.210 (TIE); 89,577 empresas incubadas; y 560,599 puestos de trabajo creados. Las áreas de actividad considerados más importante, la energía y el medio ambiente, la información, la informática y las telecomunicaciones, tecnologías de fabricación y automatización y servicio para los negocios y la industria.

Palabras clave: Parques Científicos y Tecnológicos (PCT); Tecnología Incubadoras de Empresas (TIE); Innovación.

Introduction

The economic development of a region depends on the scientific and technological integration among the various actors such as universities, business and government to promote innovation (Sábato, 1968; Etzkowitz; Leudesdorff, 2000; Chesbrough, 2012).

Science and technology parks and business incubators are used by the governments of several countries such as innovation policies through national associations or ministerial programs. Government interest in these innovative tools consist, according to Sanz (2011) and Nepelski and De Pratto (2015), the promotion of business creation, the production of knowledge and technology, which can make these countries more competitive and potential generators technology demanded by other countries.

For Rubin, Aas and Stead (2015) research on business incubators, universities place as a central actor in the promotion of knowledge, which corroborates Mêgnigbêto (2014) that universities play an important role in producing knowledge of a region.

This study had as general objective map national associations and Ministerial Programs of Science and Technology Parks of America, Asia and Europe, through indicators such

as the number of parks and incubators, areas of operation, number of established companies and number of jobs.

Literature Review

In this section, we review the literature of science and technology parks, technological business incubators and innovation.

Science and Technology Parks (Stps) And Technology Business Incubators (Bis)

The Route 128 in Boston and California's Silicon Valley are examples of successful university-industry interaction and are characterized by aspects of geographic approach to conducting research (Etzkowitz; Leydesdorff, 2000).

The first generation of science and technology parks, dating back to the 1950s, on the model of Stanford University, who through various research and development laboratories associations, founded the Stanford Industrial Park in 1951, now known as Stanford Research Park culminating in the creation of Silicon Valley (Standford University, 2015).

In 1959, it was founded in New York, the first incubator in the world, the Batavia Industrial Center. However, only in the late 1970s, the scientific communities accepted this concept of business support services for start-ups, sharing the same space, and from the 1980s, the business incubators have become a rapidly growing industry, culminating in 1985 with the creation of the National Business incubators Association - NBIA (NBIA, 2015).

Science and Technology Parks are physical or virtual spaces, managed by experts in supporting the innovation process, providing business value-added services, aimed at improving the competitiveness and wealth of a region. They promote various forms of government-industry-academy cooperation and the knowledge and technology transfer, and promoting through incubation and spin-off processes, the creation of related companies to the culture of sustainability, quality, innovation and entrepreneurship (Sanz, 2011).

Bellgardt et al. (2014) sets science and technology parks as a three-dimensional expression that combine innovation, creativity and knowledge to economic resources.

According to NBIA (2015), the business incubation is a process to support the development and successful acceleration of start-ups and nascent companies, providing entrepreneurs resources and targeted services.

Helmers and Rogers (2013), universities geographically close to the companies positively impact innovation in these companies in various ways, such as publication of basic research, licensing inventions, academic spin-offs, consulting projects, human resources training and incubation of business.

Research on business incubators, put universities as key players in promoting knowledge, largely due to the transformation of conventional university research centers to centers focused on technological innovation and that are geographically close to business incubators, technology parks, clusters of innovation and high-tech companies, and there may be scientific-technological transfer between these actors more efficiently (Rubin; Aas; Stead, 2015).

Bellgardt et al. (2014) described the gradual transformation of the Berlin-Adlershof Science and Technology of a science and technology park to a city of science, and conclude that the Triple Helix model is not suitable to mediate the process of planning for this change.

Innovation

Schumpeter (1982) related the process of innovation to economic development and argued that economic changes (new products, new production processes, new market, new sources and raw materials, etc.) are driven by new competitive companies that end up eliminating the old, culminating the process of creative destruction.

Sábato (1968), Etzkowitz e Leydesdorff (2000) e Chesbrough (2012), propose models of innovation, based on strategic alliances between companies, universities and government, in order to propose scientific and technological integration between large and small companies, university spin-offs, government laboratories and academic research groups to promote the creation and patenting new products and processes.

The study Cho (2014) performs a cross-analysis of the transition from traditional roles of universities of Pohang University of Science and Technology -Postech and Sungkyunkwan University - SKKU for entrepreneurial universities by applying the business model of the triple helix business. Corroborating the study Etzkowitz and Leydesdorff (2000), on universities in addition to their traditional roles, play a major role in regional economic development, because of changes in the production of knowledge, becoming entrepreneurs.

Wan, Williamson and Yin (2015) described how new innovation processes may contribute, so there are disruptive innovation and creation of opportunities for companies. Through the case study of 14 (fourteen) Chinese companies achieved results such as the advantages Chinese costs can generate offers that have elements of disruptive innovation, creating opportunities for innovation need proactive attitudes, and adoption of new innovation processes to restructure the focus of innovation and R&D processes - traditional R&D, allow original developments.

Nepelski and De Pratto (2015) explain how developing countries are most competitive knowledge-intensive activities, and through its innovative rapid increase may be potential technology generators demanded by other countries. As a case study, they used China, quantifying flows of technology through patents as a result: this country has

a large deficit in supply of international technology, hampered by the geographical distance and tries to make up for it by acquiring property rights innovation.

Methodology

This research was classified as descriptive as it sought to characterize the national associations of science and technology parks of America, Asia and Europe, through indicators such as the number of parks and incubators, areas of activity, number of established companies and number of jobs. As for how, this study is qualitative (content analysis of documents) and quantitative (tables and donut chart in order to show the proportion between the information analyzed). Regarding the method, the research is documentary, a survey of secondary data was done on the sites and documents of associations and ministries in the period May-June 2015.

The study of the universe encompasses the National Associations and ministerial programs related to science and technology parks and business incubators of America, Asia and Europe. Linked to the International Associations of parks like the International Association of Science Parks and Areas of Innovation - IASP with 16 (sixteen) national associations and the Science Park & Innovation Center Association's Directory - SPICE Group 71 (seventy one) national associations and 46 (forty six) associations by country, some of them connected to ministerial programs.

According to the SPICE Group (2015), 2 (two) associations ended its activities, 24 (twenty four) are not active organizations and 29 (twenty nine) have no homepage. The research sample consisted of 8 (eight) member associations of the following countries, Brazil, France, Germany, India, Russia, Spain, Sweden and United Kingdom, and 2 (two) ministerial programs, China and Israel, because the other associations surveyed had incomplete information and/ or outdated or did not have site.

Results and Discussion

The first technology park (in 1951), and the first business incubator (in 1959) became successful models for developing innovative businesses, culminating in the creation of ministerial programs and global associations, such as Association of University Research Parks - AURP 1986; IASP, 1984; Global Business Incubation Network - GBIN, 1998; SPICE Group, 1991. Besides the multinational, national and regional institutions to support science and technology parks and technology business incubators (Stanford University, 2015; NBIA, 2015; SPICE GROUP, 2015).

For the year of foundation, it was found that 6 (six) National Associations or Ministry Programs were created in the 1980s, 1 (one) Ministerial Program in 1991, and 3 (three) national associations in the 2000s. This difference years of foundation highlights the importance of science and technology parks and business incubators as innovation policy in many countries, although they have, respectively, 64 (sixty-four) and 56 (fifty-six) years from the creation of these innovative tools they remain an essential policy for creation and development of innovative and technological business.

Regarding the number of members, they vary between 27 (twenty seven) and 300 (three hundred) members, which can be centers of innovation, science and technology parks, business incubators, universities, partner companies and even individuals. This interaction between various actors is highly positive for the generation of innovation and entrepreneurship (Sabato, 1968; Etzkowitz; Leydesdorff, 2000; Chesbrough, 2012; Helmers; Rogers, 2013; CHO, 2014). Table 1 shows the relationship of the National Associations and Ministry Programs surveyed, the foundation year and the number of members.

Table 1: Information National Associations or Ministry Programs/ Country Compared to the Foundation Year and the number of Members.

National Associations or Ministry Programs/ Country	Fundation Year	Members
UKSPA - United Kingdom Science Park Association (United Kingdom)	1984	100
ANPROTEC - Brazilian Association of Science Parks and Business Incubators (Brazil)	1987	300
RETIS - France Technopoles Entreprises Innovation (France)	1987	100
ADT - German Association of Innovation, Technology and Business Incubation Centres (Germany)	1988	300
APTE - Spanish Association of Science and Technology Parks (Spain)	1988	68
MOST - Ministry of Science and Technology (Torch High Technology Industry Development Center) (China)	1989	114
MOITAL – Ministry of Industry, Trade and Labor (The Office of the Chief Scientist – OCS, The Technologycal Incubators Program) (Israel)	1991	29
RUITC - Russian Union of Innovation and Technology Centres (Russia)	2000	27
ISBA - Indian Science and Technology Entrepreneurs Park & Business Incubators Association (India)	2004	102
SiSP - Swedish Incubators & Science Parks (Sweden)	2005	65
Total	-	**1205**

Source: Authors (2015). Data ADT, 2015; ANPROTEC, 2015; ASPTE, 2015; ISBA; NSTEDB, 2014; MCTI; UNB, 2014; MOITAL, 2015; MOST, 2015; RETIS, 2015; RUITC, 2015; SISP, 2015; UKSPA, 2015.

The number of science and technology parks range from 7 (seven) and 154 (one hundred fifty-four) and the business incubators, between eight (8) and 1468 (one thousand four hundred and sixty-eight). Of 10 (ten) institutions studied, 8 (eight) also are dedicated to science and technology parks and technology business incubators; the ASPTE dedicated solely to science and technology parks and Moital has the program of technology business incubators. Table 2 shows the relationship between the national associations and ministry programs, science and technology parks and technology business incubators.

Table 2: Information National Associations and Ministry Programs/ Country Compared to the number of Science and Technology Parks – STPs and Technology Business Incubators – BIs.

National Associations or Ministry Programs/ Country	Science and Technology Parks – STPs	Technology Business Incubators – BIs
ADT (Germany)	154	150
MOST (China)	114	1.468
UKSPA (United Kingdom)	68	33
APTE (Spain)	50	-
RETIS (France)	43	32
SiSP (Sweden)	33	40
ANPROTEC (Brazil)	28	400
ISBA (India)	18	50
RUITC (Russia)	7	8
MOITAL (Israel)	-	29
Total	**515**	**2.210**

Source: Authors (2015). Data ADT, 2015; ANPROTEC, 2015; ASPTE, 2015; ISBA; NSTEDB, 2014; MCTI; UNB, 2014; MOITAL, 2015; MOST, 2015; RETIS, 2015; RUITC, 2015; SISP, 2015; UKSPA, 2015.

The sectors considered most important for development of these countries were energy and environment, information, computation and telecommunication (ICT) and software engineering, manufacturing and automation technologies and service for business and industry - 12%, biotechnology and health and pharmaceuticals, eletronics and micromachines and nanotechnology - 11%; materials - 9%. Sectors of agriculture and florestry, cultural industry and humanities - 8%; and others - 5%. In Table 3, the priority sectors of activity for the countries of science and technology parks and business incubators studied.

Table 3: Mains Sectors in Science and Technology Parks – STPs and Technology Business Incubators – BIs.

Main Sectors	%
Information, Computation, Telecomunication and Software	12
Energy and Environment	12
Service and Business for Industry	12
Biotechnology, Health and Pharmaceuticals	11
Eletronics, Micromachines and Nanotechnology	11
Materials	9
Agriculture and Florestry	8
Cultural Industry and Humanities	8
Others	17
Total	**100**

Regarding the number of incubated companies, they range from 180 (one hundred eighty) to 54,683 (fifty six thousand six hundred eighty-three) companies, generating between 800 (eight hundred) and 151,562 (one hundred fifty-one thousand, five hundred and sixty-two) jobs. We can see through these data that the science and technology parks and business incubators, constitute an effective policy of production of knowledge and technology and income generation (Table 4).

Table 4: Information National Associations and Ministry Programs/ Country Compared to the number of incubated companies and employment generated.

National Associations or Ministry Programs/ Country	Incubated Companies	Employment Generated
MOST (China)	54.683	147.000
RETIS (France)	10.000	800*
APTE (Spain)	6.452	151.562
ADT (Germany)	5.800	46.000
SiSP (Sweden)	5.000	72.000
UKSPA (United Kingdom)	4.000	75.000
RUITC (Russia)	1.800	30.000
ANPROTEC (Brazil)	939	32.237
ISBA (India)	723	5.000
MOITAL (Israel)	180	1.000
Total	**89.577**	**560.599**

Source: Authors (2015). Data ADT, 2015; ANPROTEC, 2015; ASPTE, 2015; ISBA; NSTEDB, 2014; MCTI; UNB, 2014; MOITAL, 2015; MOST, 2015; RETIS, 2015; RUITC, 2015; SISP, 2015; UKSPA, 2015.

* Number of employment generated in association.

Conclusion

This study sought through evidence (documentary and bibliographic research), describing innovation indicators such as number of members of the National Associations or ministerial programs, technological and scientific parks, business incubators, incubator companies and jobs. For this we used tables, generated from the data collected. For the years of different foundation, we look at the importance that this tool has for economic development in the countries studied. Members of national associations are made up of different institutions, such as science and technology parks, business incubators, universities and companies, showing the relevance of the scientific-technological integration in the production of knowledge applicable to the market and the exchange of information between these organizations, which enriches the movement of parks and incubators. As to information on science and technology parks and business incubators, he realized the importance of supporting these innovative mechanisms such as developing the economy, generate income and become aware of different technological areas where commercial production; even this variety of sectors enables the development of skills of the countries in various segments of the technology.

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