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Influential Role of Science and Technology Parks in Regional Development Based on Knowledge-Base

PARALLEL 2

Factors of location in city-STP relationships

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Influential Role of Science and Technology Parks in Regional Development Based on Knowledge-Based Economy: Case Study of Isfahan Science and Technology Town, Region of Isfahan, Iran

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Executive Summary: Region is a "*geographical area surrounded by specific boarders and characterized by cultural and social activities which consist of political organizations, industrial firms and academic institution*"[1]. These institutional structures form the triple helix to enhance regional development. Accordingly, economic development is considered one of the most influential factor(s) in each and every regional development[2]. The knowledge-based economy is composed of knowledge providers, target markets and government which involve the application of knowledge to the industry and response to the market needs to create wealth. Therefore, STP is identified as a regional development platform in a knowledge-based economic development program. This paper explains the roles of science towns and/or science and technology parks as one of the most crucial institutional structures in Knowledge-based economy with a particular reference to the first science and Technology town in Iran-Isfahan region with its distinct socio-economical and geographical situation, Isfahan Science and Technology Town (ISTT).

[1] Regional Development in the Knowledge-Based Economy: The Construction of Advantage. **Cooke, Philip and Leydesdorff, Loet**. 1, 2006, The Journal of Technology Transfer, Vol. 31, pp. 5-15

[2] Triple helix circulation: the heart of innovation and development. **Dzisah, James and Etzkowitz, Henry.** 2, s.l. : International Journal of Technology Management and Sustainable Development, 2008, Vol. 7

Introduction:

Region is a "*geographical area surrounded by specific boarders and characterized by cultural and social activities which consist of political organizations, industrial firms and academic institution*"[3] (1). These institutional structures form the triple helix to enhance regional growth and development. Based on this definition, regional development includes three main topics: economic, social and cultural development. Generally regions all over the world compete with one another in order to achieve development; they apply solutions including but not limited to locating of Foreign Direct Investment (FDI), propagating innovation among citizens, developing skills and business opportunities and fresh social and economic opportunities, creating flows of capital and technology, circulating of brains and attracting fresh talents.

Economic development is considered one of the most important and influential factor(s) in each and every regional development. The concept of economic development is an economic procedure which causes fundamental and adequate qualitative changes in the structure of society or region[4]. Nowadays, knowledge is the most important contributing factor to the production in developed industrial societies. The regions in which knowledge is created and then transformed to product pilots and commercial products are the ones that could follow a successful endogenous growth in such global competitive environment.

The knowledge-based economy is composed of knowledge providers, target markets and government which involve the application of knowledge to the industry and response to the market needs to create wealth. Furthermore, the knowledge-based economy is one where the generation and utilization of knowledge significantly influences production[5].

In order for knowledge to play its pivotal role in the economic development, each of the three effective factors in regional development involved in the triple helix (government-universities-industries) calls for essential and adequate infrastructures. In this case, one of the most critical infrastructure and environment to approach the mentioned procedure is Science and Technology Park. The science and technology parks have an influential role in turning ideas to product pilots, creating industrialization technologies and developing the regions by providing suitable business environment, financial and spiritual support, and skillful advisory and management teams.

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[3] Ibid, noted 1

[4] *An Institutionalist Perspective on Regional Economic Development*. **Amin, Ash**. 2, 1999, International Journal of Urban and Regional Research, Vol. 23, pp. 365-378.

[5] **McCall, Tony.** *What do we mean by Regional Development? Dr Tony McCall.* Tasmania : stitute for Regional Development Cradle , 2010

Science and technology parks with the purpose of enhancing their operative role in the region, attempt to direct ideas from universities to science parks (SPs) and create desirable conditions for commercialization. For instance, SPs could prepare the suitable environment by[6]:

- Facilitating the generation and growth of spin-out ideas from universities to SPs' firms and creating wealth in society.
- Attracting external large industrial corporations to locate their knowledge-intensive divisions such as Research and development (R&D) departments in SPs.
- Constructing information networks in collaboration with experienced advisory teams which consist of faculties and representatives of major industries in the region.

The main key factors to accomplish these objectives are: accessibility of technical professions, venture capital, information transfer networks and infra/substructures. Additionally, the infrastructures include universities, knowledge-based enterprises, government, supportive institutions, dealers, market and investors.

This paper explains the roles of science towns and/or science and technology parks as one of the most crucial institutional structures in Knowledge-based economy. In particular, it argues from an economic point of view how the science park has involved and what its efficacies are. This paper focuses on a case study of the Isfahan Science and Technology Town (ISTT) as a successful organization in west Asia in Iran-Isfahan region with its distinct socio-economical and geographical situation.

Background:

A region can be defined as "any large, indefinite and continuous part of a surface or space, or a unit for geographical, functional, social, cultural or political reasons". Based on this definition, regional development is a clear multidimensional concept with a great variety in economic, social, political, and cultural factors. For instance, quality and quantity of labor force, capital and investment availability, natural resources, entrepreneurial culture, and technological development could be some of the most significant ones. In this field, 'region' has been used precisely to signify the governance of policies and factors to assist processes of development in different fields such as economic, cultural and social development.

Regional development indeed focuses on providing wealth and welfare for regions. Improvement in economic circumstances of the region could affect the other factors. Economic development is considered one of the most important and influential factor(s) in each and every regional development. Economic development is a procedure which causes fundamental and adequate qualitative changes in the structure of society or region.

In recent years, the most precious resource in the New Economy is neither commodities, nor capital, nor labor, nor services[7]. Nowadays, Prosperity in economic regional development depends on the

[6] *SCIENCE PARKS, CLUSTERS AND REGIONAL DEVELOPMENT*. **Ylinenpää, Håkan.** Dublin : 31st European Small Business Seminar , 2001.

ability of policy makers to generate and apply knowledge. One of the most important prerequisite(s) for a successful economic development is innovation and entrepreneurial activities. Therefore, regional development policies move increasingly towards knowledge and innovation. In recent years, it is also persuasively proved that innovation and entrepreneurial qualities have a great impact on regional welfare resulting a balanced regional development[8].

Hence, knowledge becomes by far the most important factor determining the necessity of regional development. Today's most advanced economies are shifted so far towards knowledge making it an equally significant factor as capital and workforce[9]. From an economic perspective, knowledge enhances productivity and induces innovations in regions. In these economies, there is a preferential shift in the type of production from the traditional commodities and capital to knowledge. According to the globalization process, the necessity of knowledge economy is undeniable[10].

It was Schumpeter who first introduced the concept of knowledge in economy by recognizing its importance[11]; his reference to the combination of knowledge and economy stemmed from the heart of innovation. The term of knowledge-based economy has entered the structural aspects of technological knowledge (and its relevant issues such as Intellectual Property (IP), its application and sustainability, etc.) to the nature of industry and economy. One of the most important factor(s) in knowledge-based economy is having the ability to create new ideas, products and create markets for them at local, regional, and global levels. It is a critical element in today's economic regional development. Consequently, the knowledge-based economy's contribution to economic, social and political environments causes growth in society[12]. Principal factors such as economic dynamics of the markets, continuous knowledge-based innovation, and governance drive a rapid growth of knowledge-based economy.

In accordance with traditional economy, the main role players were industry and government, whereas in knowledge-based economy, knowledge generation systems play a key role in economic development. Laboratories, research centers, and universities facilitate interaction with government and industry to apply valuable knowledge in economy and generate new wealth through innovation. The model of the triple helix of industry, government, and universities for regional development based on knowledge-based economy has been developed. The Triple Helix model suggests, knowledge generation organizations such as universities in region, provide more opportunity for many economic enterprises to have chance to access not only global knowledge but also local developed knowledge related to regional capabilities and issues[13].

In 1990s, collaboration between government, industry, and universities mentioned in Triple Helix model raised some issues. In order to resolve the mentioned issues, Science and Technology Parks

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[7] **Administration, U.S Economic Development.** - *A Practitioner's Guide To Economic Development Tools for Regional Competitiveness in a Knowledge-Based Economy.* s.l.: U.S Department of Commerce, 2009.

[8] T*echnology-based regional development policy: case study of Taedok Science Town , Taejon Metropolitan City, Korea.* **Oh, Deog-Seon.** 2, 2002, Habitat International, Vol. 26, pp. 213-228.

[9] Ibid, noted 4

[10] Ibid, noted 5

[11] Ibid, noted 1

[12] Accelerating client growth - the strategic route to STP sustainability and regional economic development. **Rowe, David.** Copenhagen: IASP, 2011.

[13] Ibid, noted 4

(STPs) were suggested as a critical infrastructure and environment. Science and Technology Parks (STPs) are organizations whose main goal is to increase the wealth and welfare of their host regions by encouraging the culture of innovation and entrepreneurship[14]. The main responsibilities of an STP are encouraging and managing the knowledge and technology flow among knowledge generation organizations, companies, and markets, facilitating the creation of innovative products and technologies through supportive processes, and providing the facilities for technology transfer[15]. Moreover, a Science Park is designed to encourage the establishment and growth of knowledge-based companies and other types of organizations normally resident in the region.

A well-organized STP helps to increase job opportunities, generate related technologies, and contribute significantly to improve socioeconomic status as well as create welfare and wealth in the region. Strengthening local institutional firms, enhancing social capitals (human networks, communications, and social norms), consolidating social structure, and providing means to maintain sustainable regional development could be mentioned as some of results of the Science and Technology Parks in the development of the region[16]. Significant consequences of Science and Technology Parks in economic development can be listed as:

- Reallocation of resources (migration), human and physical resources to achieve new opportunities.
- Adoption of new and environmentally friendly technologies
- Improvement in life quality of regions' residents
- Creation of new jobs and establishment of firms
- Reducing unemployment rate in the region
- Training smart citizens

The main roles of STPs as one of the fundamental infrastructures for regional development are: restructuring research capabilities in universities and laboratories, defining cooperative ventures, and engaging the industries according to their needs. Consequently, STPs are viewed as engines of economic growth and cited as one of the important means for the promotion and revitalization of regional development through the advancement of regional technology[17]. They can create new knowledge and deploy that knowledge in practical industrial and economical ways and thereby contribute to economic growth, development, and prosperity.

The Role of ISTT in Regional Development

Province of Isfahan is located at the heart of Iran's central plateau and 240 km in south of Tehran (Iran's Capital). Due to its geographical position, centralization of different types of industries such as

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[14] **Gatti, Gabriele**. - *Science and Technology Parks and Innovation Networks Science and Technology Parks and Innovation Networks as Strategic Factors for Regional Development as Strategi*c . Prague : AREA Science Park, 2010.

[15] *Creating a knowledge-based city: the example of Hsinchu Science Park*. **Chen, Stephan and Choi, Chong Ju.** 5, 2004, Journal of Knowledge Managemen, Vol. 8, pp. 73-82.

[16] *The strings between global and local dimensions of sustainable growth*. **Noronha Vaz, Teresa de and Nijkamp, Peter.** 4, 2009, Entrepreneurship & Regional Development: An International Journal, Vol. 21, pp. 441-455.

[17] *Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development* . **Feldman, Maryann P. and Bercovitz, Janet.** 1, 2006, Journal of Technology Transfer, Vol. 31, pp. 175-188.

steel manufacturing, textile, and refineries, and being a connection point for North-South Transit Corridor, it has always kept the attention of policy makers and the government. It is worthwhile to notice that art, science and industry are closely knitted in the lives of people of Isfahan; they always combine their knowledge, profession, art, and zeal with their unique economic approach in order to prosper and develop their region in economic, cultural, and social fields.

Suitable climate for the development of agriculture and existence of local industrial infrastructures are among factors that help this province to be known as an economic pole. In addition, presence of eleven universities (governmental and private) with more than 300,000 students in different academic levels provides an opportunity for the region to be transmuted into a scientific pole[18].

Most of the industries located in the Province of Isfahan have been developed on the basis of natural resources as their raw materials. Such industries produce a broad range of products which face a fierce competition in the global market. Conversely, new and high technology industries are able to acquire suitable economic opportunities due to their highly specialized products. Therefore, the Iranian government is keen to focus on generating, developing, and transferring the technology to this region. As stated in Triple Helix model, all three segments, industry, government, and universities are available in the region of Isfahan. As mentioned before, STPs as fundamental infrastructure connect these three segments, implement knowledge-based economic development, and spread out the innovation and entrepreneurship culture in the region

Establishment of Isfahan Science and Technology Town (ISTT) in Isfahan was a move initiated by academia, industries and the provincial government with supports offered by the central government. ISTT not only has created several STPs and Technology Business Incubators in the region, it has also been able to influence the regional development plans due to its organizational structure which has the provincial government of Isfahan as the head of its executive board. ISTT's proximity to Isfahan is a remarkable advantage for firms and industrial units in the region, enabling them to establish links with the universities and industries in the region and to expand their economic activities. Also ISTT's proximity to Isfahan University of Technology provides a mutual advantage and opportunity for industry and university. The collaboration between researchers from the university and professionals from the industry results in regional development through the advancement of regional technology.

According to the characteristics of this region, ISTT's mission can be defined as:

- To provide opportunities for improving collaboration between industry and university to apply knowledge in industry.
- To support and lead new technologies toward regional sustainable development (environmentally friendly technologies)
- To provide opportunities for generating, developing and transferring new technologies and creating the basis for knowledge-based economic development in region by knowledge-based enterprises.

In order to accomplish its mission, ISTT's top management develops and runs several solutions and programs. For instance, international relations and commercialized technologies program. ISTT has also run a program called Technology born Industries since 2009, aimed at developing technologies needed for high tech industries by attracting venture capitals in the region.

[18] **Iran, The Statistical Center of.** *Statistical Yearbook of Province of Isfahan.* [Report] Isfahan : The Statistical Center of Iran, 2011

STP is one of the effective structures in technological development as well as knowledge-based economic development and job creation. In order to analyze the impact of ISTT on regional development in Isfahan, a cross-sectional analysis based on numbers of companies, employment, wealth generation, and turnover was used. The role of ISTT on regional development can be divided into four parts:

- To create wealth and welfare
- To exploit potential human resources/ Job creation
- To generate knowledge
- To increase and improve innovation and competitiveness

Wealth creation in knowledge-based economy is resulted by transferring the knowledge to industry and market. Developing Knowledge-based enterprises to generate new and high technologies create wealth for innovators and entrepreneurs. The average turnover of the companies located in ISTT has increased 217% from 2009 to 2012 (See Figure 1). The growth rate of knowledge-based enterprises established in ISTT during the last five years indicates the growing significance of knowledge-based economy in region (See Figure 2 and 3).

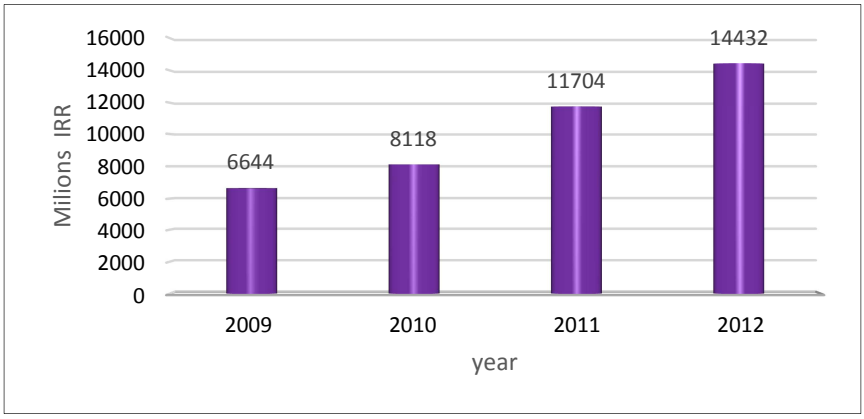

Figure 1- The Average turnover of K-based Enterprises located in ISTT[19]

[19] **ISTT.** *ISTT Annual Report*. Isfahan : Isfahan Science and Technology Town, 2011-2012.

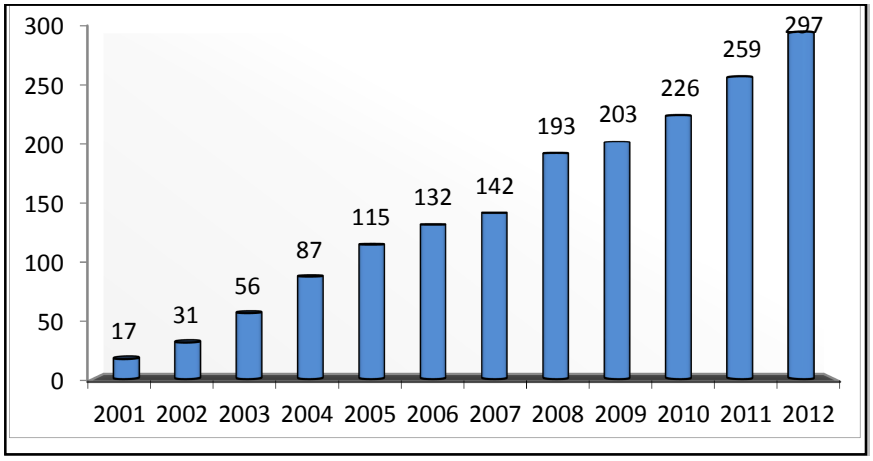

Figure 2- Number of K-based Enterprises located in ISTT[20]

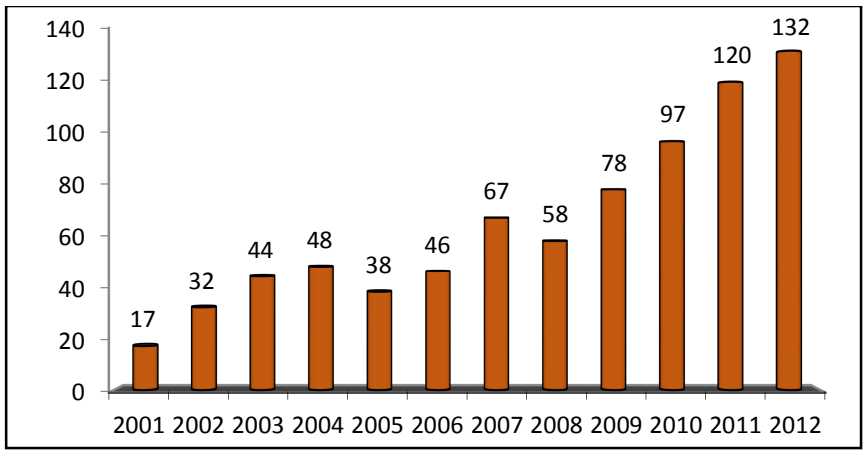

Figure 3-Total Number of accepted K-based Enterprises in ISTT[21]

Unemployment rate is one of the main issues in Isfahan region. Therefore, establishment of Knowledge-based enterprises in ISTT and its science parks provide these enterprises with invaluable opportunities to employ well educated individuals from top ranking universities of the region. In this field, if we look at the industrial sector, most of the jobs in ISTT are R&D-related ones. On the one hand, access to up-to-date knowledge is vital for these enterprises to thrive. On the other, recently graduated employees are able to transfer their knowledge to the companies. This creates a win-win scenario which reduces the unemployment rate. The growth rate of university graduates employed in Knowledge-based enterprises has increased 521% from 2005 to 2012 and the number of people who are employed in knowledge-based enterprises in ISTT in 2012 is around 5,137(See Figure 4).

[20] Ibid, noted 19
[21] Ibid, noted 19

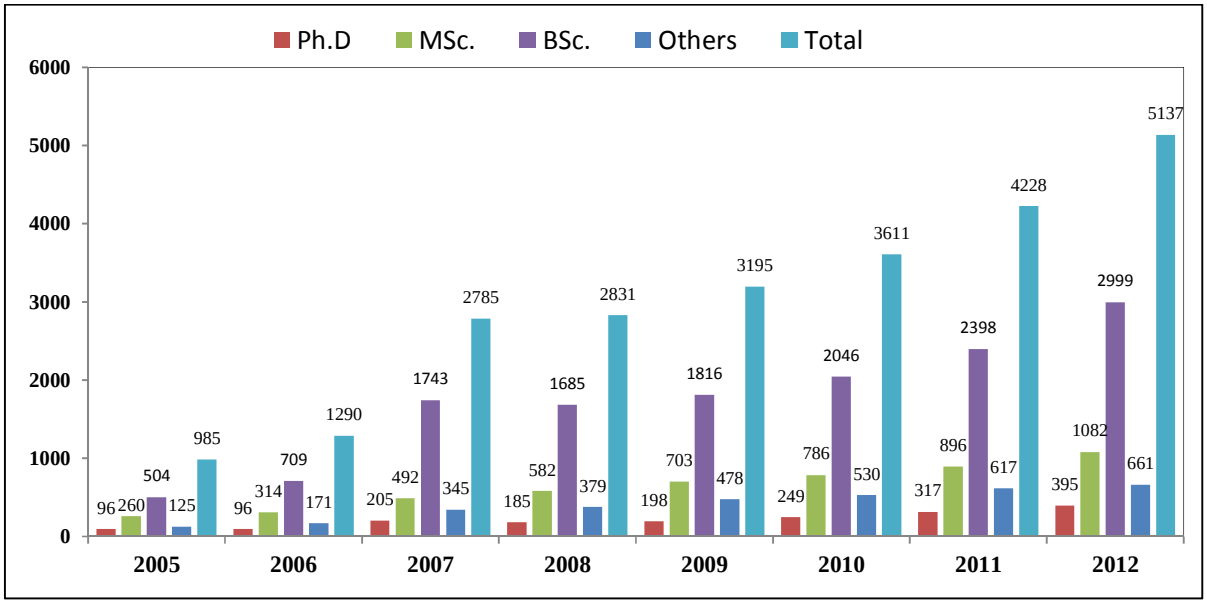

Figure 4-Human resource distribution based on graduation degree[22]

Knowledge creation and its deployment in practical industrial and economic ways are achieved by ISTT and its knowledge-based enterprises. Hence, they contribute to economic growth, regional development, and prosperity. The number of registered patents, inventions, and innovations can be an indicator of knowledge generation in the region (See Figure5).

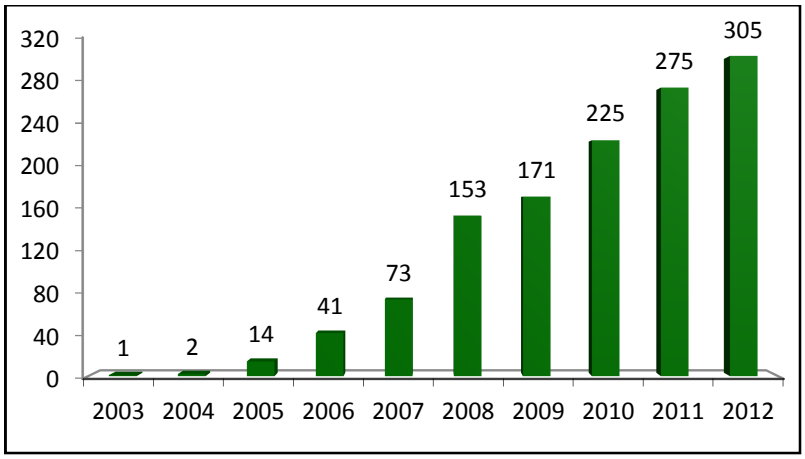

Figure 5-Total Number of Registered Patents by K-based Enterprises in ISTT[23]

Technology Born Industries Program:

Nowadays, Iran is one of the pioneer countries in generating science and technology, while through lack of solutions and operational programs; there is no possibility to apply the generated knowledge in industries. One of the significant programs in ISTT called Technology Born Industries since 2009. The

[22] Ibid, noted 19
[23] Ibid, noted 19

program aimed at developing and applying technologies for high industries by attracting venture capitals in the region. The process of this program is divided into 4 levels: Bench marking, semi-industrial production, technology evaluation, finding VCs, and finally entering industry. During last three years, 26 technologies have been entered industry via Technology Born Industries and under supervision of ISTT. The process of Technology Born Industries program is displayed below (See Figure 6):

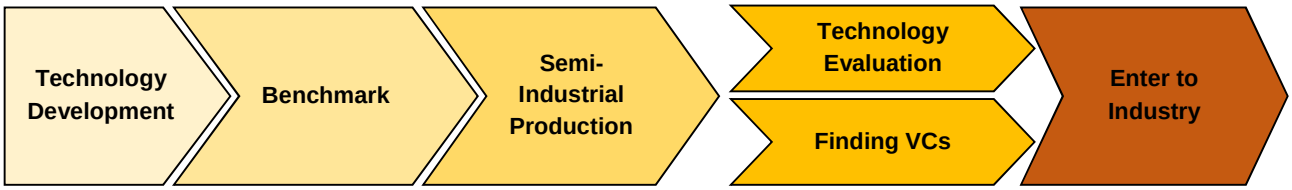

Figure 6- Technology Born Industries Program Process

Since 2009, the Technology Born Industries Program drove rapid growth rate in Commercializing and industrializing Technologies in the region. ISTT as a reliable connection center, provides safe environment for knowledge-based enterprises to share their knowledge and technology as well as for VCs to invest on them (See Figure 7).

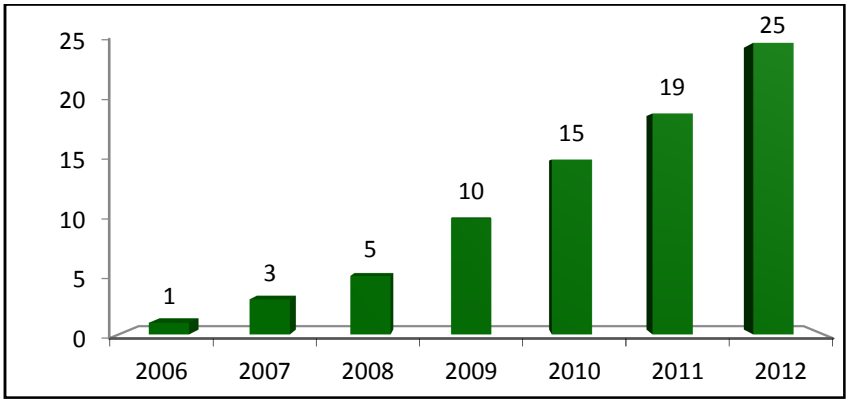

Figure 7- Total Number of Technologies entered Industries via Technology Born Industries Program[24]

It seems that the number of knowledge-based enterprises, the number of patents and inventions, and generated and developed technologies have resulted in the creation of competitive environment in innovation and entrepreneurship in the region. The outcome of this environment can be employment growth, wealth and welfare creation, technology generation, and sustainable development[25].

Conclusion:

This study expresses that several institutional factors (such as universities, industries, geographical position, and culture) have direct influence on regional development. Establishment of STPs would

[24] Ibid, noted 19
[25] *Science Parks in Sweden as Regional Development Strategies: A Case Study on Ideon Science Park.* **Park, Sang-Chul.** 3, s.l. : IA&SOCIETY, 2002, AI & SOCIETY , Vol. 16, pp. 288-298.

centralize the knowledge-based enterprises. These enterprises aim to develop the region by generating knowledge, employing professionals and well educated human resources, new technologies and innovations. Following successful commercialization of their products and services, they enter the market competition and finally create wealth. By facilitating trading environment, providing infrastructures, developing supportive programs such as technology born industries, STPs such as ISTT help increase the pace of regional development.

It seems that the true role of ISTT has been to boost the knowledge creation capacity of the region by spreading out the culture of innovation and providing related infrastructures. It can be clarified that the highest priority of the ISTT is to continuously attract knowledge-based enterprises which can act as engines of economic growth through the advancement of regional technology and knowledge.