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DISSERTATION: **SCIENCE AND TECHNOLOGICAL PARKS – LOCAL SYSTEMS OF INNOVATION: THE CASE OF PATRAS SCIENCE PARK**

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Abstract

The main purpose of the dissertation is to examine the connection between "technology poles", universities and science parks. The case of Patra will be analyzed and compared to other technological parks around the world will give "the secret of success" for such parks. What kind of innovation activities are developed in technological parks? Which is the relation between innovation and university? What policies are used so the Science Park of Patra to be developed? Are these policies effective or not? The theme of the dissertation is the case of Patra. The science park is connected to the local university once it is located close to it. Innovation is produced in enterprises located in and around science and technology parks which form an innovative milieu, resulting in higher regional growth. Are all these really happening in the Science Park of Patra? The evidences will be examined and compared to the national experience of Science and Technological Parks will point the right policies and the deficiencies of Patras Science Park.

Keywords: *innovation, University, Science and Technological Parks, Research Institutes, knowledge.*

Περίληψη

Το κύριο θέμα της διπλωματικής μου εργασίας είναι να εξετάσω τη σχέση μεταξύ των «τεχνολογικών πόλων», των Πανεπιστημίων και των Τεχνολογικών και Επιστημονικών Πάρκων. Η περίπτωση της Πάτρας θα αναλυθεί και σε σύγκριση με Επιστημονικά και Τεχνολογικά Πάρκα του εξωτερικού θα μας δώσει το μυστικό της επιτυχίας για τα Τεχνολογικά Πάρκα. Τι είδους καινοτομικές δραστηριότητες αναπτύσσονται στα Πάρκα; Ποια είναι η σχέση μεταξύ καινοτομίας και Πανεπιστημίου; Τι πολιτικές ακολουθεί το Επιστημονικό Πάρκο Πατρών προκειμένου να αναπτυχθεί; Πόσο αποτελεσματικές είναι αυτές οι πολιτικές; Το βασικό θέμα της εργασίας είναι το Επιστημονικό Πάρκο Πατρών. Το Πάρκο βρίσκεται κοντά στο Πανεπιστήμιο της Πάτρας και συνδέεται με αυτό. Η καινοτομία προκύπτει από τις επιχειρήσεις που είναι χωροθετημένες μέσα και γύρω από τα Τεχνολογικά και Επιστημονικά Πάρκα τα οποία σχηματίζουν ένα καινοτομικό περιβάλλον και καταλήγουν στην περιφερειακή ανάπτυξη. Συμβαίνει κάτι τέτοιο στην περίπτωση της Πάτρας; Μέσα από τα συμπεράσματα θα βρούμε τις σωστές πολιτικές για ανάπτυξη και τα κακώς κείμενα στην περίπτωση της Πάτρας.

Λέξεις κλειδιά: *καινοτομία, Πανεπιστήμιο, Επιστημονικά και Τεχνολογικά Πάρκα, Ερευνητικά Ινστιτούτα, γνώση.*

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CHAPTER 1: INTRODUCTION

The institution of Science and Technological Parks has already completed more than three decades in Europe and two decades in Greece. Most of the times the operation of a Science Park is connected to a University. What happens today in Greece with Technological Parks? Do they operate properly or they are confronting operational problems? It is very important for Technological Parks to have a normal and efficient function once they can contribute to the local and regional development.

Once the role of Technological Parks is so important we must think about the policies that are applied for the development and the effectiveness of Science and Technological Parks. Are these policies effective? If not, what should be done in order to obtain the desired results? The history has shown that there are successful and failed cases of Science Parks. So we have to learn from both of them. The successes will give the right path, the one that leads to success and the failure will give the right solutions so that the mistakes to be avoided.

Science and Technological Parks do not stand alone. They need Universities, research Institutes and other Institutions of higher education. They also need firms, innovation and knowledge. Our approach to the subject is related to the links between all these parts. They are connected to each other, the one completes the others and none of them can stand without the others. There is a logical sequence. It starts from the New Technology Based Firms which are open to new technologies and ends with Science and Technological Parks and regional development. The "intermediate stations" or the links between NTBFs and Parks are innovation, knowledge and its transfer, policies, research, new technology.

The present dissertation has the following structure: in the first chapter we present the literature review of New Technology Based Firms (NTBFs), innovation, knowledge and transfer of knowledge, Universities and Science and Technological Parks. The second chapter is about Greek Science and Technological Parks and the case of Patras Science Park. Finally we present the conclusions and make some comments for Patras Science Park and it strategies.

CHAPTER 2: TECHNOLOGICAL DEVELOPMENT AND LOCAL CONDITIONS

2.1. INTRODUCTION

In this chapter will be presented a part of the literature review about New Technology Based Firms, knowledge, innovation, the role of Universities through time and how all these are connected and finally if and how they contribute to regional development.

2.2. NEW TECHNOLOGY BASED FIRMS (NTBFS) AND INNOVATION

Universities, Science and Technological Parks, knowledge, innovation, regional development, New Technology Based Firms…The technological cycle shows that knowledge and innovation are accumulated in small and medium sized firms or in New Technology Based Firms (NTBFs). Little (1979) supported that NTBFs has the following characteristics:

1. It must not have been established for more than 25 years
2. It must be a business based on potential invention or one having substantial technological risks over and above those of normal business
3. It must have been established by a group of individuals not as a subsidiary of an established company
4. It must have been established for the purpose of exploiting an invention or technological innovation[1].

NTBFs could be characterized as the vehicle for high-technology industrial growth. These kinds of firms along with small and medium sized ones and independent firms can help to the regional development. Small firms have better results in regional innovation policy than large firms, especially when they are found in localized markets, then small firms innovation becomes largely a local phenomenon. Small independent firms can also be highly innovative[2].

According to Rothwell (1983) "the main advantage of small firms is "people embodied" while those of large firms is "resource embodied".

[1] H. Lofsten, P. Lindelof, "Determinants for an entrepreneurial milieu: Science Parks and business policy in growing firms", Technovation 23 (2003) pp.52
[2] Rothwell, Zegveld "Innovation and the small medium sized firm", p.

Segers (1993) supported that "NTBFs enjoy the advantage of dynamic, entrepreneurial management embodied in the system that is flexible and highly responsive to change and who are willing to accept financial, technological and marketing risk"[3]. It is true that it is easier for new firms to embody new technologies and survive in system that may change. The risk they take is smaller than those of large firms once they have too little to lose.

2.3. NTBFS, INNOVATION AND KNOWLEDGE

According to the characteristics of NTBFs innovation plays a really important role for their development. Usually, this kind of firms are located next to each other, sometimes are even clustered and in these clusters knowledge and know-how is easily shared between firms.

So what is the relation between knowledge and innovation and what about technology and regional development? They seem to be connected in a chain and this chain needs all the parts. Through the literature review we will describe the relation between knowledge, innovation, technology and regional development starting from Universities.

The institution of Universities is one of the oldest institutions. University's role in society is changing over time. As the English biologist Thomas Henry Huxley wrote in 1892 "The medieval University looked backwards. It professed to be a storehouse of old knowledge. The modern University looks forward and is a factory of new knowledge" (Thomas Henry Huxley, 1892).

Universities, during the medieval times, used to be "accumulators of knowledge". This type of University was away from the society. At the 19th century the role of University started to change. Since then, this role would become more and more active as years and even centuries would pass. Research had already started in some Universities of the world.

According to Graham and Diamond (1997), Noll (1998) and Mowery et al. (2004) "Universities assumed roles in conducting research and training in technical disciplines and in educating students to meet the needs of industry".

[3] Lofsten, P. Lindelof, "Determinants for an entrepreneurial milieu: Science Parks and business policy in growing firms", Technovation 23 (2003) pp. 54

After the Second World War, the role of University was still changing and evolving. It was at that time that Government and industry were funding Universities in order to conduct applied research for science and applied technology development. All the years that followed the World War II were the years of mass production in industry, especially in the US. As a result this kind of production, along with scale economies and linear organization influenced the character of the University. "University at that time could be characterized as "Knowledge factory" which developed inputs (students, research funding) into outputs (prospective employees and research papers). Training students and conducting research remains the bread and butter of the modern University"[4].

The literature shows that in recent decades has emerged a new type of University which is characterized as "Knowledge hub".

"University seeks to animate indigenous development, new capabilities and innovation especially on its region" (Shapira and Youtie, 2004). This model of University, which is so much embedded in innovation systems, shows clearly the intension of the University to foster interactions and spillovers and link research with application. University has always been the core of knowledge, an institution of knowledge but this type of University (knowledge hub) shows that wants to use this knowledge for development and new capabilities.

The change of role of University is not random. According to Florida (1995), OECD (1996) and Chesbrough (2003) "Shifts in advanced economies away from traditional mass production and linear transfer relationships to post-industrial, open and more interactive innovation systems"[5]. These kinds of changes challenge University reorganize research, incorporate educational missions and methods, rethink the ways they exchange and develop knowledge.

2.4. THE MATTER OF KNOWLEDGE AND ITS TRANSFER

A trend that was observed both in US and in Europe was that Governments wanted Universities to adopt economic development and innovation. They wanted the promotion of linkage of University to technology transfer, innovation and local

[4] J. Youtie and P. Shapira, Research Policy 37, 2008, p.1189
[5] J. Youtie and P. Shapira, Research Policy 37, 2008, p.1189

development. University of 20th century is focused on formal or codified knowledge and on developing and transferring tacit and embodied knowledge. We see that the matter of knowledge and its transfer is very important and directly connected to Universities, research and development. The literature about knowledge is extensive. Knowledge is divided in tacit and explicit knowledge. According to Michael Polanyi (1966, p.4) "tacit knowledge is defined as knowledge that cannot be articulated or verbalized. It is a knowledge that resides in an intuitive realm. This notion can be captured in the phrase we know more than we can tell".

"Tacit knowledge is the antithesis of explicit knowledge, in that it is not easily codified and transferred by more conventional mechanisms such as documents, blueprints and procedures" (Kreiner 2002).

"Tacit knowledge is derived from personal experience. It is subjective and difficult to formalize" (Nonaka et al., 2000). This is why tacit knowledge is learned through shared experiences of people who usually interact in the same place (in a University, in a firm and in any such kind of groups)[6].

Tacit knowledge is connected with innovation and innovative organizations. Companies in order to be competitive need to renew their products or produce new ones if possible. This procedure could be named as sustain competitive advantage and according to researchers tacit knowledge can help companies built sustainable competitive advantage.

According to Grant (1997) "managers and academics have recognized knowledge as a key source of competitive advantage".

For Polanyi (1966), Hall and Sapsed (2005) "knowledge is a potentially significant resource to the firm as it may possess valuable, rare, inimitable and non-substitutable characteristics particularly if it has a tacit dimension".

Nonaka et al. (2000) in their unified model of dynamic of knowledge support that "knowledge is described as dynamic, since it is created in social interactions amongst individuals and organizations. Knowledge is context specific, as it depends on a

[6] T. Foos, G. Schum, S. Rothenberg, "Tacit knowledge transfer and the knowledge disconnect", Journal of knowledge Management, vol.10 (1), 2006, pp. 6-18.

particular time and space. Without being into context it is just information, not knowledge. Information becomes knowledge when it is interpreted by individuals and given a context and anchored in the beliefs and commitments of individuals".

We have referred to tacit and explicit knowledge. At this point definitions of these two types of knowledge can be given.

- Explicit knowledge is what can be embodied in a code or a language and as a consequence it can be verbalized and communicated, processed, transmitted and stored relatively easy. It is public and most widely known and the conventional form of knowledge which can be found in books, journals and mass media such as newspapers, television, internet, etc. It is the sort of knowledge we are aware of using and it can be shared in the form of data, scientific formulae, manuals and such like(Nonaka et al., 2000, Kikoski and Kikoski 2004)
- Tacit knowledge is personal and hard to formalize- it is rooted in action, procedures, commitment, values and emotions. Tacit knowledge is the less familiar, unconventional form of knowledge. It is the knowledge of which we are not conscious. Tacit knowledge is not codified, is not communicated in a "language", it is acquired by shared experiences, by observation and imitation (Kikoski and Kikoski 2004, Hall and Andriani 2002).[7]

Firms' competitive advantage is directly connected to both tacit and explicit knowledge once they are complementary and essential to knowledge creation.

According to Kikoski and Kikoski (2004) "tacit knowledge creates the learning curve for others to follow and provides competitive advantage for future successful companies".

Companies in order to be successful have to find a way to create the needed conditions in order to enable everyone in an organization and verbalize tacit knowledge. But how tacit knowledge is used in companies? And most importantly how tacit knowledge is transferred between them? This is fundamental in the innovation process. Rudiger and Vanini (1998) note that "tacit knowledge enables an

[7] R. Seidler-de Alwis, E. Hartman, "The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises", Journal of knowledge management, vol. 12 (1), pp.134.

increased perception of ideas. Therefore, it stimulates creativity and has a positive effect on business activities"[8].

Tacit knowledge is found and accessed in social networks. Every person knows something, has experiences and this is tacit knowledge. "Tacit knowledge can be activated by generating new scientific knowledge, learning-to-learn, by incorporating new knowledge in the design of a new product. It can further be activated in the process of learning new production methods and improving existing technology through minor improvements based on learning-by-doing and based on learning-by-using once the product or process is being employed internally in the organization or by external consumers" (Senker, 1993).

2.5. INNOVATION AND KNOWLEDGE TRANSFER

Once tacit knowledge is connected to innovation and innovation is connected to companies' competitive advantage let's analyze the matter of innovation.

First of all, innovation is necessary if a company wants to survive in a dynamic market environment. The innovation process started in 1960s with linear "technology push" and "need pull" models in 1970s, to continue as "coupling model" in late 1970s to the integrated model of Rothwell (1992). For Tornatsky et al. (1983) "the process of innovation is a process of many discrete decisions and behaviours that unfold slowly over time". For others innovation means the novelty of an idea[9]. Today innovation is connected with the transfer of knowledge. History of innovation has shown that there are innovation waves every fifty years. It is essential for companies to have strategies for the transfer of knowledge in order to promote innovation. As it is already mentioned knowledge is difficult to transfer. The transfer is possible only between partner firms through close and frequent interactions. "The closeness of partners is the key to the degree of tacit knowledge transfer" (Cavusgil et al., 2003). Tacit knowledge transfer requires personal and informal interaction.

[8] R. Seidler-de Alwis, E. Hartman, "The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises", Journal of knowledge management, vol. 12 (1),pp.137

[9] R. Seidler-de Alwis, E. Hartman, "The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises", Journal of knowledge management, vol. 12 (1),pp.138

Knowledge transfer in not always successful. Szulanski (2003) talks about the "stickiness of knowledge". The aspect of "stickiness" has to do with the knowledge source, the knowledge recipient and the context. The stickiness is low when the knowledge source and the recipient share the same context. When the source and the recipient operate in different contexts then the transfer of knowledge is difficult and the cost is higher than it would be in the first case. He also refers to "internal stickiness of knowledge transfer" by introducing three barriers:

- The ambiguity of the mostly tacit knowledge which needs to be transferred
- The lack of absorptive capacity
- The difficult relations between the sender and the receiver of knowledge[10]

These barriers may also interrupt the innovation process. In order to overstep these difficulties companies and other organizations that use tacit knowledge need to focus on human-related factors like motivation, commitment and rewards. This means that employees should be given time, space, and opportunities to interact, transfer and tacit knowledge which is verbally transmitted.

2.6. SCIENCE AND TECHNOLOGICAL PARKS

Science and Technological Parks are an institution that emerged after the Second World War. The first Parks were established in United States of America and followed Europe. Since 1950s, according to historical review, there is information about Technological Parks. Silicon Valley was a pioneer in the development of Science Parks. Silicon Valley is also known as Stanford University Park and dates back to 1950s. In 1959 in North Carolina was established the Research Triangle Park. In Boston, there are Science Parks too, and this can be easily explained because of MIT and other research centers which are internationally renowned. In Europe, the first Technological Park was established in Cranfield of Great Britain in 1968s whereas during 1970s were established the Technological Parks of Cambridge (1972) and Edinburg (1974). In early 1970s, was established in France the biggest technopole of Europe with the name Sophia-Antipolis. Today this Technological Park host more than 1300 enterprises, four Universities and more than 25000 employees. During

[10] R. Seidler-de Alwis, E. Hartman, "The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises", Journal of knowledge management, vol. 12 (1),pp. 142

1980s more Technological Parks were established in Europe. Along with the Technological and Science Parks in USA and Europe, Asia had also well-known Science Parks (Tsukuba Science City in Japan)[11]. During 1980s-1990s a large number of Science and Technological Parks were established in Europe. Today, there are more than 400 Science Parks around the world and this number is still growing. In USA there are more than 150 Science Parks in total, number followed by the 111 Science Parks of Japan. In China the institution of Science Parks were developed around 1980s and today there are about 100 Parks, 52 of which were approved by the national government and the remainder by local government.

According to the International Association of Science Parks (IASP)[12] a Science Park is 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 Science Park:

- Stimulates and manages the flow of knowledge and technology amongst Universities, R&D Institutions, companies and markets
- Facilitates the creation and growth of innovation-based companies through incubation and spin-off processes
- Provides other value-added services together with high quality space and facilities

By definition, Science Parks are located close to Universities and other academic and research institutions. The main concept is that in Science Parks scientific knowledge leads to technological innovation through linear progress. Universities could be characterized as repositories of scientific expertise and research. As a result, Science Parks are trying to connect orienting academe to industry's needs. So Science Parks focus on the linkages between University and industry, on technology transfer and on the application of University research to commercial needs. "The concept of Science Parks originated back in the 1950s. Science parks are usually based around Universities and interact continuously with them. The idea is to provide an

[11] (http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-parks-around-the-world/).
[12] www.iasp.ws

infrastructure of technical, logistic, administrative help that a young firm needs as it struggles to gain a foothold for its product in an increasingly competitive market (Guy, 1996)".

The establishment of Science Parks near Universities is very useful for developing high-tech industries. High-tech industries are usually combined of New Technology Based Firms, small and medium sized firms. Researches have shown that most of the times NTBFs located in Parks are more innovative than firms located off-Parks. Westhead (1997) found that on-Park firms tend to be more R&D intensive than off-Park firms.

In general, NTBFs choose to locate in a Science Park because they both enjoy investment incentives and benefits and because of the clustering effect and technological externality that there is in the Park. In these clusters there seems to be a positive network externality between firms. This network externality effect is emerged through exchange of technological knowledge and technological spillover in the Science Parks, from the advanced knowledge of technological scholars and professionals and from the exchange of information and knowledge among researchers[13].

The relation between NTBFs-University and Science Parks is now more clear. Science research conducted in Universities produces innovation, new ideas and technologies. New Technology Based Firms are open to new technologies, new ideas; knowledge transfer is easier among them. Science Parks can attract and even encourage this kind of firms. So, according to Westhead (1997) "Science Parks reflect the assumption that technological innovation stems from scientific research and a park can provide a catalytic incubator environment for transmitting basic research into the development of technology and production". We shall not forget that the cluster of NTBFs located in a Science Park can create inter-firm networks, linkages with Universities and other high educational Institutions, as well as technological spillover.

Despite all these, the opinions for the matter of Science Parks differentiate between writers and this is seen in literature. Massey et al. (1992) argue that Science Parks are major sources of technology development and geographical proximity between a

[13] C.-H. Yang et al. "Are new technology based firms located on Science Parks really more innovative? Evidence from Taiwan", Research Policy 38, 2009 pp.78

University and a Science Park seems to account for very little in promoting technology transfer. This opinion is based on the fact that many Science Parks were a form of prestigious real estate, with few productive synergies generated.

On the other side, according to Westhead and Storey (1995) a number of firms were located on a Science Parks in order to be close to a University. But, the extent to which this University-industry links existed was less than anticipated.

Vedovello (1997) also supports this finding by saying that "geographical proximity between partners is not an important influence or a driving force for the existence or strength of formal links between University and industry. The proximity is important for the establishment of informal and human relations links".

Little information can be found about the Science Parks of Europe. The institution of Science Parks in Europe experienced a boom during 1980s-1990s.

According to Castells and Hall (1994) there are three main motivations for the establishment of Technopoles and Science Parks: reindustrialization, regional development and creation of synergies.

Storey and Tether (1998) support that the Science Parks role is to enable academics at the local University to commercialize their research ideas and to provide well established business and small business, which are using and developing sophisticated technologies and prestigious accommodation.

The Science Parks of England and those which are located in Europe have been thoroughly analyzed. The main reason for this analysis is for researchers to find out whether Science Parks achieved their role, or if finally they are prestigious constitutions.

For Massey et al. (1992) "Science Park count very little in promoting technology transfer and they are quite unlikely to generate synergies of any kind. They consider Science Parks as 'high tech fantasies' and they are primarily prestigious real estate developments". This means that Science Parks can offer nothing more to located firms than prestige and fame. Furthermore, parks do not have the ability to help firms by developing technology or by generating links between firms.

In 1995, Westhead and Storey made a research about in-science parks and out-science parks firms in the UK. They found out that the probability for a firm to survive in a competitive environment was higher if the firm has a link with a University. The firms that were established in a Science Park were more likely to have a link with a University.

For Gower and Harris (1994a, b, 1996) Science Parks are not only a form of property development. Science Parks have some characteristics that distinguish them from the general property development. One of these outstanding characteristics is that Science Parks provide the facilities to fulfill the function of transferring ideas and the linkage between industry and academia.

2.7. CHAPTER'S CONCLUSIONS

There is no doubt that Science and Technological Parks are firmly connected to Universities, innovation, knowledge transfer and innovative firms. History shows that firms located in Science Parks are more innovative and more intensive in Research and Development than firms located out of the Parks. But for this to happen and be successful there should be the appropriate conditions for knowledge to be transferred and shared between firms. NTBFs are more open to new innovation, new technologies which usually come from Universities. Science and Technological Parks should apply such policies that will attract new firms locate in them and take advantage of the facilities that the Parks can provide them.

CHAPTER 3: SCIENCE AND TECHNOLOGICAL PARKS IN GREECE - THE CASE OF PATRAS SCIENCE PARK.

The experience of Science and Technological parks in Greece is very little. Greek Science Parks are so small if compared to the ones in other European countries. Greek parks do not have the critical size to exploit economies of scale. Science Parks in Greece were established with the initiative of government and not with University's initiative. The state through the main Greek research institute, Technological Institute of Greece, financed the purchase of land and the initial investment in infrastructure. The management of the Science Parks is independent from the state but in the administrative council of each park members of the ITE are present together with representatives of the local industry. According to Gower and Harris (1994a) and Storey and Tether (1998) Greek Science Parks follow the European trend.

The majority of the firms located in Greek Science Parks belong to the sectors of microchemistry, information-telecommunications-semiconductors, medical tools, finance, new industrial materials and processes (Bakouros et al., 2002). The size of the firms is relatively small and this can be explained because of the fact that all incubator firms are new and are found in early stages of development. There has been a research about the criteria used by firms in order to decide to be established in a Science Park. The research showed that firms decide to locate in a Park due to image they expect to get from it and to benefit from the Parks' infrastructures.

The role of Science Parks both in developed and in developing countries is being growing. The Science Parks of Europe and USA are already developed and their operation most of the times are satisfactory not to say more than expected. In Greece, the institution is still "under construction". There is much to be done in order for their operation to remind the ones of Europe.

3.1. SCIENCE AND TECHNOLOGICAL PARKS IN GREECE

In Greece, the first technological parks were established during 1990s with the initiative of the Foundation for Research and Technology. Today there are seven technological and science parks in our country:

1. Technological Park of Thessaloniki established in 1988

2. Patras Science Park established in 1989

3. Science and Technological Park of Crete established in 1993

4. Technological and Cultural Park of Lavrion established in 2000

5. Technological Park of Thessaly established in 2001

6. Technological and Science Park of Ipiros established in 2003

7. Science and Technological Park of Athens "Lefkippos" established in 2009

Patras Science Park is interesting as long as it is one of the Parks that demonstrates a normal operation and has some characteristics that remind the Science Parks of the European Science Parks. The Technological Park is found at Palatani, only some kilometers out of the city of Patras. In the same region are located the University of Patras and a large number of research centers and infrastructures which are centered to the University of Patra.

3.2. THE CASE OF PATRAS SCIENCE PARK

Timetable of the Science Park

- **1989:** Patras Technology Park SA (PTP) founded. Shareholders: FORTH/ICEHT and ETADE SA
- **1990:** Construction of PSP building included in "EPET/KPS Subprogramme 1, Task 1.2a" of the General Secretariat for Research and Technology and in PEP of Western Greece Region.
- **1990:** FORTH/ICEHT becomes the lone shareholder of PTP.
- **1992:** Change of name to "PATRAS SCIENCE PARK SA".
- **1994:** Construction of PSP building. International Bidding competition.
- **1996:** July-Construction of PSP building commences.
- **1998:** October-Construction completed, PSP moves in.
- **1999:** Regular operation commences in parallel with operational development.
- **2001:** FORTH/ICEHT transfers all shares to the Ministry of Development of the Greek State

The Park is establishing mechanisms and services in order to promote the creation, operation and growth of "innovative firms". An innovative firm develops activities that are based on innovative technology know-how and is trying to convert the results of scientific research into commercial success as fast as possible. The main objectives of Patras Science Park are the completion of innovative ideas, products and procedures as well as the exploitation of research and development results, the promotion and financial completion of innovative investment and business plans for research and development results exploitation. Moreover, the Park is interested in the development, renewal and widening of the product and services spectrum, for the methods of production, supply and distribution, the introduction of new organizational and administrative methods for enterprises. The acquisition and diffusion of new knowledge is very important along with the provision of new services of scientific, technological, consulting and educational nature and personnel training services for enterprises or any kind of legal entity. Last but not least the Park should attract and install entrepreneurial schemes in its premises.

The Park is characterized as incubator. In the Park is operating the Business Incubator which is one of the most important units of the organizational structure of the Park. Incubator's main objective is to support new firms. These firms with the support of the Incubator will value the results of research and technological development, will create and promote innovation by putting the new product to market. Incubator is a place where new firms will locate giving them the needed infrastructures, and functional services in order to achieve faster development.

Patras Science Park has adopted some criteria for the installation of firms in the Park. The units that want to be part of the Park should have one basic and common characteristic "Transformation of R&D results into Innovation". They should target to the integration of an innovative product or an innovative idea, to the connection of research, innovative technological development with enterprises, to validate and exploit the R&D results and finally to improve the enterprises' competitiveness. Moreover, the new firms should help the Park become an ideal environment for the promotion of innovation and for entrepreneurial operation. The operation and development of such units which are characterized by innovativeness should contribute to the renewal and broadening of product and services spectrum, to the

renewal of the production, supply and distribution procedures and o the introduction of changes in organization and administration methods[14]

In general, in Patras Science Park can join units that fulfill the following criteria:

- Units that through their operation and development plans adopt innovativeness as a way for enterprising operation aiming to a special innovative result.
- Units that aim to create and develop innovative results and through them they contribute to renewal and broadening product and services spectrum, renewal the production, supply and distribution procedures and will help to the introduction of changes in organization and administration methods.
- Units that will contribute in joining research and innovative technological growth with the production area targeting in validation and exploitation of the R&D results and to the improvement of the enterprise organization competitiveness.
- Units that will act in such way so to contribute in creating in Patras Science Park an ideal environment for promotion of innovativeness as entrepreneurial operation, that will promote innovation as a procedure of creating new exploitable entities and to the promotion of innovative products and ideas.

Today there is a major number of enterprises located in the Park. These enterprises seem to meet the criteria that the Science Park has set. Almost all of them are innovative firms which create and develop innovative products and results. They are conducting research and through programs both national and European they are trying to become more and more R&D intensive and to have a respectable place in the competitive market. The firms located in Patras Science Park are:

1. Advent S.A. Advent Energy Technologies S.A.

This company was founded by researchers from FORTH-ICEHT and the University of Patras. It is a spin-off operation of these two academic institutions and is funded by industrial partners (Germanos, S.A., Velti S.A., ILPA S.A.), private investors and the Greek Ministry of Development under the PRAXE B programme for matching

[14] Επιστημονικό Πάρκο Πατρών (2012) Available at: http://www.psp.org.gr/ [Last access: 19/06/2012]

capital. The company develops new materials and systems such as fuel cells and photovoltaic systems, for renewable energy sources. The major effort of this start-up company focuses on a prototype high temperature PEM fuel cell system which is based on Advent's proprietary technology. Advent Technology headquarters are found in Athens and occupies 200m^2 of research and development space at the Patras Science Park. According to the company's working force "PSP location is an ideal location for technology development due to its proximity to academic institutions and its excellent infrastructure capabilities". The company with the innovative products is competitive enough and these products offer the opportunity to the company to participate to international markets.

2. AEIPLOUS Institute for Innovation and Sustainability

Aeiplous is a nonprofit enterprise found in Patras Science Park. The enterprise was founded in 2009 by distinguished university professors, lowers, and economists. Aeiplous has strict professional criteria and its main purpose is to nominate and boost the Sustainable Development. The members of the company have experience in R&D projects which are co-financed by the Third Community Support Framework and the European Regional Development Fund. The company has participated in in organizing and implementing projects such as:

- HuReDePIS (Human Resources and Development Planning on both sides of Ionian Sea)
- SFINX (Integrated Information System for Natural Disaster Management)

The company has also participated in projects and activities implemented under the Regional Innovation Pole of Western Greece. The period September-October 2010, the company developed an important collaboration with the Italian association Metafora 360 in order to implement in Patras a project called "La Technologia GIS" (2010) which provided hosting and work experience to fifteen graduate students in the specific field of GIS.

Today members of AEIPLOUS are still operating under projects such as:

- ECO-INNOVATION
- SOUTH-EAST EUROPE
- INTERREG IVC

The 7th Framework Programme gives the chance to the company to participate in important interregional and transnational projects like the ECOPORT 8 Environmental Management of Transborder Corridor Ports, MINI-EUROPE Mainstreaming Innovative Instruments for SME development in Europe, SWAM Sustainable Water Management and STInno Sustainable Innovations and Treatment in Industrial Waste Water Clusters.

Since the begging of 2011, AEIPLOUS is one of the Partners of ATRIUM Architecture of Totalitarian Regimes of the XXo Century in Urban Management, a SEE Programme project approved under second Call for proposals. The company is always seeking for new partnerships in other European and national programs[15].

3. Brite Solar

Brite Solar was established in Mid.2009 with R&D facilities in Patras Science Park and Marketing/Sales in the US. The company's executive team is also consisting of University's professors who have international experience in the research of nanomaterials. Brite Solar is developing Solar Panel Technology based on Dye Sensitized Solar Cells, using new composite organic/inorganic lightweight nanostructured materials. The company aims to enter the Building Integrated PV and smart eco-buildings markets. Company's technology is targeting this market through joint manufacturing and distribution agreements with various companies around the world.

4. DIAPLOUS

DIAPLOUS specializes in hardware components for visual perception. It has developed a smart camera which has been successfully used in custom industrial inspection systems. It is now developing the next-generation for smart cameras which offer advanced functionality at a very low cost.

[15] http://www.aeiplous.org/main.php?lag=en [Last access: 11/06/2012]

5. DIGITAL SKY

Digital Sky was founded by Electrical and Electronic Engineers with post graduated studies in telecom business and a strong experience in the telecoms market and wireless broadband connectivity. The company offers a new concept of next generation products in telecommunications, combining cutting-edge technology solutions, with ease of installation, maintenance, use and focus on service. "The park is located just a few kilometers from Patra and offers all the facilities for business and technology of a modern building" say the company's employees. Digital Sky shares its experience and knowledge in rapid deployment of large scale telecom projects for the mobile industry. This experience may be used in the implementation of EU programs and subsidies founded by "Information Society". The company can provide financial information, design development and implementation for EU programmes for economic and technical development.

6. (H)ELBIO S.A.

HELBIO was established in 2001 as a spin-off company with purpose to commercialize fuel processing technology developed at the University of Patras. Professors of the University are in the executive team of this company too. The company is activated in the development and commercialization of hydrogen and energy production systems from renewable sources integrated with fuel cells. HELBIO has established collaborations with European Institutions and participates in national and European research, development and demonstration projects.

7. INBIT- Institute of Biomedical Technology

INBIT is a nonprofit organization. Founded in 1991 INBIT constitutes an initiative that supports and helps the development of Biomedical technology sector in Greece with emphasis to the sectors of quality and management. The Institute addresses to organizations, groups and individuals who share involvement in quality development in healthcare. INBIT is supported by international organizations found both in Europe and in United States. These relations and cooperation guarantees a constant monitoring of the advances in the field worldwide. INBIT coordinates and participates in a number of Greek and EU projects and Concerned Actions, in the field of

Biomedical Technology and Quality Assurance. INBIT has been the coordinator of a series of European and Greek R&D projects or has participated in many others as partner. Some of these projects are the following:

- BEAM II (Biomedical Equipment Assessment and Management). The program was called "Health Telematics". Program's duration was 1993-1996 and was funded by EU and DG XIII
- "BIOTECHNET II" Development of Applications and Services in the field of Biomedical Technology. The program was EPET II, lasted three years from 1994 until 1997 and was funded by the Greek General Secretariat for Research and Technology.
- "MELETI" Medical Engineering Listed Education and Training Information. The program was Leonardo Da Vinci, lasted two years (1998-2000) and was funded by the European Union.
- "OLYMPIA" Integrated Electronic System for the Surveillance and Ordering of Medical Devices. The program was ADAPT, lasted two years (1997-1999) and was funded by the Ministry of Labour and Social Insurance and the European Union
- Greek Data Base for Medical-Technological Products. The programme was EPET II, lasted two years (1998-2000) and was funded by Greek General Secretariat for Research and Technology.
- Development of Recording System and Management of Results of Quality Control of Medical Equipment.

8. THINK SILICON

Think Silicon Ltd is a start-up company founded in 2007 by IC Design Engineers with extensive experience in the design of ASIC devices and embedded Systems. Its founders have long working experience as a team in the field of Semiconductor IC Design. The personnel are specialized engineers and scientists with a background in Semiconductors, Telecommunications, Electronic Design Automation and Information Technology. The company's vision is to provide silicon proven, highly configurable IP semiconductor modules for complex SoCs according to industry standards. The company is based on the Patras Science Park, located in Western

Greece and currently consists of 5 engineers. The Patras Science Parke is an incubator and cluster of technology companies in the area.

9. VELTI

Velti is a leading global provider of mobile marketing and advertising solutions for brands, advertising agencies, mobile operators, and media companies. Velti is a publicly-held corporation based in Jersey, with over 500 employees worldwide, that trades on the London Stock Exchange's AIM under the symbol VEL since 2006. Velti began trading on the NASDAQ Global Select Market on January 28, 2011, under the symbol VELT. Velti hosts in Patras Science Park a software development team that undertakes part of the new product development and research efforts of the company.

10. Industrial Systems Institute ISI

The main aims of ISI are the active participation and substantial contribution at high-technology sectors, which relate to integrated industrial systems, with the objective of increasing the competitiveness of the Greek industry, through application of state-of-the-art technologies.[i] ISI was established in 1998 as a private non-profit organization and is placed in Patras Science Park.

11. ELDRUG

Eldrug is a research Spin-off High Technology Company. It was established in June 2006 with an investment of 1.000.000 Euros from Greek Pharmaceutical Company VIANEX own by Giannakopoulos family and a grant of 720.000 Euros from the Greek Ministry of Development. The idea for the creation of the company came from researchers-professors of the University of Patras, the University of Athens and from the University of Boston from the Departments of Medicine and also from three young researchers. In January 2010, seeing the advancements made over the 2 years of ELDRUG's re-invested for another 1.000.000€ VIANEX aimed at the exploitation of Pharmaceutical Technology and Innovative Lab produce that was produced in the Laboratories of the Department of Chemistry in the University Patras. The goal of ELDRUG is the Research and Development of Innovative Anti-hypertensive Products, including the most potent under the name of ELSARTAN. The spin-off

with experience and know-how of its researchers in the Planning and Discovery of Pharmaceutical Products possesses the rights of ELSARTAN and relative synthetic derivatives.

12. Econais

Econais is a startup company established in 2008, specialized in telemetry and Wi-Fi applications. Its founders are University graduates, with previous experience at the fields of Wi-Fi technologies.

13. IRIDA LABS

Irida Labs is a high technology Greek company established in 2007. Its founders are post doc graduates from the Department of Physics of the University of Patras. The main services target in the field of Information Processing Embedded Systems, implemented by qualified management and engineering experts.

Though, there are some enterprises that left the Science Park. Most of the times, the main reason is the lack of space. The enterprises at their establishment are small or medium sized. Some of them, after a period of time, are still of the same size but some others have grown a lot and the Park doesn't always have the needed place for these enterprises to move. As a result they are forced to leave the Park and move to more suiting facilities. Some examples of such enterprises are the following:

1. Analogies

Analog Integrated Electronic Systems S.A. (Analogies S.A.) is a privately held, early stage fables semiconductor design company, founded in March 2006. Analogies' founders have been researchers from the University of Patras and semiconductor industry business managers, with long standing experience on semiconductor design, as well as inequity holding company that provided the majority of the startup funds. Analogies have its principle operations office in Patras Science Park in Patras, Greece and a satellite office in the Microelectronics Innovation Center in Athens, Greece.

2. Nanoradio

Nanoradio AB was founded in March 2004. It's a Swedish semiconductor supplier targeting the cellular handset and consumer electronics market. NANORADIO has developed a state of the art technology for integrated circuits with focus on the critical success factors for handheld products, namely, current consumption, physical size, total cost for customer and customer support. NANORADIO Hellas was established in 2007 aiming to provide Verification and Software design services based on a group of talented engineers with many years of industrial experience and a proven record of delivering WLAN turnkey solution.

3. Bytemobile

The products of Bytemobile are putting together, are making simpler and faster the application of advanced wireless data services into mobile phones, lap-tops, and PDAs. The company was established in 2000 by Mr. Polychronopoulos who was professor at the University of Illinois along with one colleague and some University students, when they found that there was a problem with wireless data transmission. By the end of 2005, Bytemobile entered the market of IP services with Unison TM. The company has clients from the whole world (Asia: China Mobile, Vodafone, United States of America: Cingular, Telefonica). Since July 2011 Bytemobile has left the Science Park because of lack of space. The company needed more space once it was developing more and more. The Park could give some more offices but as stated from the company's employees "we needed a connected place, connected offices, at the same floor and not on different floors". Today the company is found near the Park with a workforce of more than twenty people who are graduates of the Polytechnic School of Electrical and Computer Engineering. They participate at the development and quality control of the company's basic products. Bytemobile used to cooperate with the University in European Projects but now the only cooperation is the internship of University students in the firm. Moreover, the company helps by funding some student meetings at the University. The chances for students to find a job in the company are connected to their skills.

Moreover, there are enterprises that were established out of the park from the beginning but they have relations with this and the research centers. One of these enterprises is CBL (Chemical and Biopharmaceutical Laboratories). The company was founded in 1990 in order to provide novel chemistries in peptide synthesis. CBL

is one of the largest peptide material suppliers in the world. The company offers peptide starting materials, peptide intermediates and industrial and commercial-scale manufacturing of proprietary and generic GMP and non-GMP peptides. Since its establishment, CBL has maintained strong roots as a peptide technology company, demonstrating the role of utility of technology in commercial applications.

3.3. THE CASE OF ATMEL

George Perlegos was born in Greece. At the age of 12 moved to the United States. He earned a master's degree in electrical engineering at Stanford University and after that he was for seven years a subordinate member of the corporate world at Intel. During the late 1970s and early 1980s Perlegos was working for Intel Corp. as a designer engineer and noticed the potential for a promising product in the semiconductor market. He was interested in nonvolatile memory chips and the applications these chips could have in commercial and military markets. During 1980 nonvolatile memory chips were used in microwaves, dishwashers and other machines of this kind. In 1981 co-founded a memory chip manufacturer named Seeq Technology. After this he laid the ground for ATMEL which is an acronym for Advanced Technology for Memory and Logic. In 1980s Perlegos leaves the security of working for Intel and starts his own company. He already had the needed experience that would make him the most successful leader in the semiconductor industry. During 1980s-1990s ATMEL is one of the fastest growing semiconductor companies in the United States. During 1980, Atmel was winning a really good place in the semiconductor industry. ATMEL's workforce and Perlegos achieved to keep costs low, to identify the lucrative market niches and then supply these markets with high performance chips that were using less than the half of power consumption of the competitive memory chips. Soon the smart moves of the company attracted a core customer base consisting of large corporations such as Motorola, Nokia, Ericson and even manufacturers producing military equipment. It was a great achievement for ATMEL, for a new company to have such clients and this happened because of direct corresponding and catering to the needs of these customers. The management structure of the company is one reason for this deep-pocketed clientele. In general the structure of the company was flat; everyone could propose was he thought that would be good for the company and this helped the company move easily to directions which seemed to be attractive

and lucrative. Perlegos used the management structure that Intel used to have. The two companies thought differed in a specific area. While ATMEL was gaining place at the market of nonvotile memories, Intel decided to change its product from memory chips to flash memories. This new technology was working well in laptop computers but could not be used in appliances like the wash machine or the oven.

At the end of 1980s, ATMEL had done very well. It was a profitable company even if at the first years the situation was difficult. When Perlegos decided to enter the chip business, a considerable capital was required. This capital was found through the first contract that ATMEL signed with the General Instrument Company. Perlegos invested 30.000 dollars thanks to the contract which reached the amount of 5.1 million dollars. From that moment ATMEL entered the business world and was working mainly as designer without having massive capital costs from launching a memory chip venture. After General Instrument there were other companies that signed contracts with ATMEL like Sanyo Semiconductor. But of course there are always problems especially in the sector of business. In 1987 Intel blamed ATMEL for patent infringement. This forced ATMEL to redesign the chips. According to Perlegos, the lawsuit helped his company once the money invested in redesigning the chips, leaded ATMEL to the top of the companies designing memory chips. After all these, ATMEL launched a new flash memory chip which could store data faster and consuming less battery that the one of Intel. At this time, there was no doubt that ATMEL was one of the leading memory chip designers in the country.

The following years ATMEL is placed in Colorado Springs. Perlegos tries continually to find new applications for the company's memory and chips. By the end of 1990's sales had reached the amount of 76.9 million dollars. It was at that time that the company needed capital in order to be expanded. For this to be done, Perlegos turned to public ownership in 1991. But even more money would be needed for ATMEL to extend during the 1990s. In 1993 ATMEL bought the Concurrent Logic which was a manufacturer of field programmable gate arrays. After this acquirement ATMEL announced the establishment of a second manufacturing facility in Colorado Springs. In 1994, began the production at the new expanded facility. This new facility managed to double the earnings of the enterprise (59.5 million dollars), the sales reached up to 69 percent. The main reason for the company to be successful until that

time was its capability to be trustworthy, continuing to design and manufacture products that were the best in the market. The company was funding research and development activities, taken under consideration that in 1994 devoted nearly 50percent of the revenues to R&D. Ten years after its founding, ATMEL was the top manufacturer of Eeprom chips. But there were much more to be done. In 1995, ATMEL produced a dozen product lines, each tailored for and targeted to specific market niches. In 1995-1996 ATMEL acquired another chip market, the French chip market named European Silicon Structures, which was renamed to ATMEL-ES2. The company had already started the fabrication of a new plant in San Jose, near its headquarters. In 1996, ATMEL acquired a computer chip company which was specialized in semiconductors that could produce sound in multimedia computers, musical instruments and karaoke machines named Digital Research in Electronic Acoustics and Music S.A. (DREAM). The presence of ATMEL in France had now been increased. After this acquirement, Perlegos was still company's president and chief executive officer and was looking to establish another manufacturing plant in Colorado Springs in order to make ATMEL meet the oncoming market demands for its chips and also advance the company's transformation into a large-scale manufacturer.

The company in 1995 used to have an annex in Patras Science Park. But after some years the company grew a lot and the facilities of the Park were not enough. So the company left the park for larger facilities (larger building and more place for the employees). After leaving the Park some of the employees left behind and almost all of them established new firms which were spin offs of ATMEL. These firms are Nanoradio, Think Silicon, Sitel and E-conais. The founders of these firms used to work for ATMEL and had a lot of experience which helped them establish new companies.

3.4. UNIVERSITY OF PATRAS

Next to the Science Park of Patras is found the University of the City. The University of Patras was founded in 1964 as a self-administrated academic institution supervised by the Greek Government. The intention since its establishment was to concentrate on science, technology, economics, business administration and social sciences. The role of the University is to set an example of a highly qualified Institution of higher

learning and to serve as a incentive for the modernization of the Greek higher educational system with priority given to fields where highly trained personnel will be needed for the realization of country's economic development. The opening of the University took place in the 30th of November 1966. That day the city celebrates its protector St. Andrew and for that reason the emblem of the University is the X cross where St. Andrews is crucified on. Patras University is the third largest University in Greece if we think the number of student's potential, the faculty members, administrative personnel, number of departments and accredited students titles. There are twenty-four Departments, with a large number of sectors and a great range of disciplines, which operates 112 laboratories and 14 clinics fully equipped. Except from the distinguished path in education, the University of Patras has made excellence in the fields of basic and applied research. It has acquired international prominence for pioneering and wide ranging research in areas such as Environment, Health, Biotechnology, Mechanics, Electronics, Informatics and basic science. The University of Patras has a reputation for quality and innovation research and participates in a large number of research programmes, scientific organizations and research groups. An important goal of the University is the promotion of its relations with the European and international environment. This goal is achieved through the cooperation of the members of the academic community with foreign Universities and research centers. They participate in International Educational Programmes, Networks and University Unions. Another main objective is the creation of knowledge through the promotion of the scientific research. University's research activity is supported by its workforce (faculty members, postgraduate and undergraduate students, postdoc researchers etc.) and the state of the art infrastructure (laboratories, clinics, computers, experimental scientific instruments etc.) and represents the major factor for the improvement of Education and Learning. The University of Patras demonstrates a remarkable research activity and a reputation for quality and innovative research. Scientific projects are the basis of the research work in Universities. The University of Patras participates in all major European and National Scientific Programs. Finally the university receives funding from the State, the private sector or the European Union for the development and promotion of the scientific research. The University in order to promote the scientific research is closely cooperating with Research Institutes that are placed in the University Campus Area. These Institutes are the following:

- Research Academic Computer Technology Institute which cooperates with the Department of Computer Engineering and Informatics.
- Institute of Chemical Engineering and High Temperature Processes which cooperates with the Department of Chemical Engineering.
- Industrial Systems Institute which cooperates with the Department of Electrical and Computer Engineering and the Department of Mechanical Engineering and Aeronautics.

Also, there are some Institutes that have been founded by the Senate:

- Institute of Nanocrystalline and Amorphous Materials which cooperates with the Department of Engineering Sciences.
- Institute of Environmental and Applied Biology which cooperates with the Department of Biology.
- Institute of Genetic Diseases and Biomedical Research which cooperates with the Department of Biology and the Faculty of Medicine.

3.5. RESEARCH INSTITUTES

The Institute of Chemical Engineering Sciences (ICE-HT) was established in 1984, as an Independent Academic Institute. In 1987 ICE-HT became one of the founding Institutes of FORTH (Foundation for Research and Technology, Hellas). FORTH comprises seven Research Institutes (4 in Heraklion, 1 in Rethymno, 1 in Patras and 1 in Ioannina) and reports directly to the General Secretariat for Research and Technology (GSRT) of the Ministry of Education, Lifelong Learning and Religious Affairs. The seven Research Institutes of FORTH cooperate creatively as an integrated network for RTD. . ICT-HT runs a major number of projects in cooperation with numeral industrial enterprises, Universities and Research Institutes from Greece and other EU-member countries and EU competitive R&D programmes and also directly by industrial enterprises. ICT-HT mission is:

- Scientific research.
- Cooperation with industrial companies in EU and other countries.
- Development of innovative technological products and production processes.

- Participation in the creation of spin-off companies.
- Cooperation with other research & development organizations.
- Training and advanced education of new researchers.
- Active participation in the development of the Region of Western Greece.
- Significant contribution to the technological and economic growth of Greece.

Another Institute that is located in the area of University is Computer Technology Institute and Press "Diophantus". This Institute was founded in 1985 as Computer Technology Institute and had the headquarters in the city of Patra. The Institute was established as Non Profit Private Legal Entity, supervised by the General Secretariat of Research and Technology. Since 1992, CTI has been supervised by the Ministry of Education and Religious Affairs as a financially, administratively and scientifically independent institution. In 2001 it was renamed as Research Academic Computer Technology Institute. In 2011 its name changed again to Computer Technology Institute and Press and was established as the technological pillar supporting CTI in education and as a publishing body of Greek school books and electronic educational materials. CTI is also the administrator of the Greek School Network. The Institute focuses on the Research and Development in Information and Communication Technologies (ICT). In ICT have been educated hundreds of students, scholars, new scientists in sectors of new technologies and this helped their transmission. ICT has organized in Greece about thirty scientific conferences of international status (some of them left USA for first time and took place in Europe not to say in Greece) and this happened due to ICT's notable scientists (e.g. STOC, ICALP, SPAA).

The Industrial Systems Institute is another one Institute located in Patras Science Park. It was established in 1998 as a private non-profit organization under the auspices of the General Secretariat for Research and Technology of the Ministry of Development.

ISI is a Research Institute focused on cutting-edge technologies which are applied to industrial and entrepreneurial environment having as final objective the innovation and the competitiveness of Greek Industry. The general objective of ISI is to conduct

applied and technological research and the development of methodologies, products and services which are relevant to scientific and technological sectors of particular interest such as information and communication systems for production processes.

General aims are fulfilled through the following activities:

- Research and Development of high-technology products, as well as services, in high-tech sectors of ISI interest, either autonomously or jointly, with high-tech industries and enterprises
- Support of Greek industries, in order to adopt leading-edge technologies, and to obtain a competitive advantage
- Prototyping and validation of products and services
- Development of high - added - value interventions and innovations, custom made for the needs of the industry
- Support of high-tech firms, related to design and development of high - added - value competitive products
- Cooperation with technological and manufacturing partners in the area and in the country, aiming at better linking of research and production and better exploitation of research results
- Internationalization of activities, particularly in relation to EU countries, through competitive programmes and direct contracts from industry
- Studies and funded research and technology programmes in the areas of ISI interest
- Elaboration of research programmes and market surveys, aiming at commercial exploitation of research results
- Participation at large development projects of national scope, in cooperation with public and private organizations[16]

So which is the relation between Patras Science Park, University of Patras and Research Institutions? The fact that University's graduates established firms in the Park does not mean that there is relation between the Park and the University. Interviews with people who work at Patras Science Park showed that the main reason

[16] Ινστιτούτο Βιομηχανικών Συστημάτων (2007) Available at: http://www.isi.gr/en/ [Last access: 12/06/2012]

for the firms to locate in the Park is the necessities that provides. Actually, the Park offers to new firms the needed infrastructures for them to make their first steps. These infrastructures include buildings and low operational costs which are needed for the start uppers. Moreover, the Park is located next to the University and the Research Institutes/Centers which is also important for the start-ups. The main problem of the Park is that it has no strategies that could attract new firms and entrepreneurs. Additionally to this, the Park should acquire new lands because as the firms are growing there is no space for them and they are forced to leave the Park. This fact though is not that bad, because as it was mentioned by executive members of the Park "the Park is and should always be an incubator. We want no stability but turbulence, fluid dynamics. The Park is here to help new firms to live, mature and then we want them to leave Park. Of course this is not always possible, because all firms do not have the expected development so in these cases either they liquidate or they want some more time in the Park and this is totally accepted and understood".

Another problem that the Park is confronting is that is has no direct relations with the University or the Research Centers except for the students who can attempt six months of workshops either in the firms of the Park or in the Research Centers. Some of these students may have the chance to work in the firms of the Park or in the laboratories of the Research Centers. From the interviews we resumed that the firms themselves are trying to have co operations with other firms of the Park or with enterprises which are found in Science Parks of Europe. The majority of the firms are already members of national and European Operational Programs.

From the other side there is the dipole of University and Research Institutions. This relation is static. The Departments of the University are cooperating with the Research Institutes. The Research Academic Computer Technology Institute is cooperating with the Department of Computer Engineering and Informatics. The Institute of Chemical Engineering and High Temperature Processes is cooperating with the Department of Chemical Engineering and the Industrial Systems Institute is cooperating with the Department of Electrical and Computer Engineering and the Department of Mechanical Engineering and Aeronautics. Unfortunately, this cooperation has a managerial character. There are no long-term objectives especially for the technological results. Once University is the source of knowledge it has to

adopt strategies which will help knowledge to be diffused and used appropriately. Operating in such a way University will be able to promote local and regional development and obtain more cooperation with the Institutes and the Park. According to Youtie and Shapira (2008) "such strategies may include the attraction or development of particular kinds of human capital and talent, the embodiment of a significant emphasis on tacit knowledge in technology transfer programs, and the engagement of relational knowledge enablers that seek out tacit knowledge and link it with other individuals and organizations to exploit it thus integrating the University in new relationships that foster innovation within the region".

Among the Science Park, the University and the Research Institutes there is cooperation. They all cooperate in funded research programs either they are national, European or regional/local programs. This disappointing evaluation of three decades with interventions, investments and lot of initiatives is not because of lack of human resources. The reason should be sought in the culture and the mentality that were cultivated with the interventional policies and the predominant structures. The emphasis that was given at physical infrastructures and funding did not allow to human resource and institutional consolidation to emerge and show how important they are. All activities are developed in a social vacuum. Formal and informal mechanisms of interaction and communication between the members of these institutions and the local and regional society are absent.

3.6. CHAPTER'S CONCLUSIONS

In general, Patras Science Park is demonstrating a normal operation. It hosts a large number of high-technology firms, it is near the University and the Research Institutes and it has developed relations with them. Nevertheless, the vicinity with the University and the relations they have developed do not seem to be powerful actors which could attract new firms to the Park. The firms that are located to the Park decided to do so because of the necessities that the Park could provide to their first steps and not because it could help them financially or because it could offer them prestige and fame. Patras Science Park lacks of strategies and policies through which it could attract new firms and even firms from abroad. There is a rich human resource which comes from the University but this human resource cannot apply, share and transfer the knowledge it possess because of lack of the appropriate policies.

CHAPTER 4: CONCLUSIONS

The main theme of the dissertation is Science and Technological Parks and the case of Patras Science Park. In Greece Science and Technological Parks have already completed twenty years of existence. Technological Parks, as history has shown are most of the times connected to Universities. The right operation of a Science Park is really important because it can even end up contributing to local and regional development.

The literature review proved that Science Parks are part of a cycle that opens with New Technology Based Firms and closes with Science and Technological Parks. In this cycle there is the matter of knowledge and its transfer, innovation and Universities. NTBFs which are open to new technologies and have better absorptive capacity than large enterprises are usually gathering together in order to share knowledge, technology and the know-how. Gathering together they shape kinds of cluster which tend to be highly innovative. Of course, NTBFs are located near Universities once they are the result of what is learned in Universities. This is the right place for a Science Park to be established. The Park with the appropriate policies will come and boost the already existing firms but will also create the appropriate circumstances in order to attract new firms in its land. This could be called a normal operation of a Science Park.

In Greece, the institution of Science Parks is not so developed. This may be explained because the institution is relatively new. How easy is for Greek Science Parks to follow the steps of the Parks of the rest of Europe or even the examples of United States' Science Parks? The case of Patras Science Park could probably explain what happens with Science and Technological Parks in our country.

Patras Science Park is located near the University of the City and next to a large number of Research Institutes as we have already mentioned. In the Park are located a lot of firms which are high-technology firms. Most of them were established by University's graduates in cooperation with professors of some of University's Educational Departments. There are firms which were established in the Park and then they left it because of lack of space. This is normal and expected from the executives of the Park but the problem is that this kind of firms is rare. This means

that from the already existing firms in the Park how many of them have a product ready to come to market? How many are competitive and have a good place in the market?

Moreover, the firms that choose to be established in the Park are doing so only because in the Park they will easily find a building to move in and lower operational cost than they would find out of the Park. It is obvious that the park do not have a strategy for attracting new companies in its area. From its birth, emphasis was giver to the infrastructures and funding, leaving aside the importance of human recourse and institutional thickness. Furthermore, formal and informal links between the Park and the local society are absent too. All activities are developed in social vacuum.

The absence of fundamental strategies and policies from the side of the Park is obvious. The University near the Park is the core of the system in Patras. But its cooperation with The Park is restricted. Firms should be encouraged to cooperate with University's Departments in local, regional, national and European Programs which can be promoted by the Park. The cooperation that we found between the Park and the University is only when students are going for six months learning in the firms of the Park or some operational programs that the firms found and in them they are cooperating with the University.

A similar situation is found for the co operations between firms of the Park. As we mentioned the transfer of knowledge is of high importance for the promotion of innovation. Park's firms are also cooperating in operational and other programs but this also happens with their initiatives and not with the Park's initiative. We did not manage to make clear if the employees of the firms have the opportunity to move from one firm to another in order to share their tacit knowledge and innovation.

Previously we referred to the cycle which starts with NTBFs and ends with Science Parks. Science Park should be able to intervene in the market by transforming technology into product which will be sold in the market. But this achievement presupposes that there will be the right pull in the Park. This means that NTBFs should be established by graduates-students and not by professors who are chasing fundings which will give them money but will offer nothing to innovation and technology. Besides that, Science Park should concentrate both on products that have

already been produced and did not go out in the market yet and on those products which are at the last production stage and have come of the University or the Research Centers. The Park should have a mechanism that will find or create an operating entity for these new products.

In order for the Park to obtain a normal and effective operation it should have checked from the beginning the record needs and the activity logs of the research areas along with the recording of the local industrial needs. After this, there should be a strategy in order to promote the co operations between local industry and the labs of University or the labs of the Research Centers.

Finally, the ideal for Patras Science Park and generally for Science and Technological Parks is the existence in them or around them of a Funding organization like a Seed Capital and Venture Capital Fund which could offer financial help to new firms.

It is important to understand that none of the previous can stand alone before the competitive market and the competitive environment. New Technology Firms, Universities, research Centers and Science and Technological Parks through their cooperation and through the cooperation with firms and Universities of the world can have a good place in the competitive market.

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