Innovation in Greece: Technology Park

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Με ατομική μου ευθύνη και γνωρίζοντας τις κυρώσεις που προβλέπονται από τις διατάξεις του άρθρου 18 (Λόγοι και διαδικασία διαγραφής από το ΠΜΣ) του Κανονισμού Λειτουργίας Προγράμματος Μεταπτυχιακών Σπουδών, δηλώνω υπεύθυνα ότι για τη συγγραφή της Μεταπτυχιακής Διπλωματικής μου Εργασίας (ΜΔΕ) δεν χρησιμοποίησα ολόκληρο ή μέρος έργου άλλου δημιουργού ή τις ιδέες και αντιλήψεις άλλου δημιουργού χωρίς να γίνεται αναφορά στην πηγή προέλευσης (βιβλίο, άρθρο από εφημερίδα ή περιοδικό, ιστοσελίδα κλπ.).

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ΠΕΡΙΛΗΨΗ

Μαρία Ταμπάκη: Η καινοτομία στην Ελλάδα: Τεχνολογικά Πάρκα

(Με την επίβλεψη του Αθανάσιου Κριεμάδη, Καθηγητής)

Μέσα από τη αυτή τη διατριβή σκοπός είναι να αναδειχθεί ότι τα Επιστημονικά και Τεχνολογικά Πάρκα της Ελλάδας παρόλο που είναι μικρά σε σχέση με τα Τεχνολογικά Πάρκα των υπόλοιπων χωρών μπορούν να προάγουν την καινοτομία και να «χτίζουν» μια επιχείρηση από την αρχή. Η Διεθνή Ένωση Επιστημονικών Πάρκων αναφέρει ότι το επιστημονικό και τεχνολογικό Πάρκο είναι ένας οργανισμός ο οποίος απαρτίζεται από προσωπικό κατάλληλα εξειδικευμένο και πληρεί όλα τα εφόδια για να μπορέσει να εξελίξει/αναπτύξει τις επιχειρήσεις που βρίσκονται μέσα σε αυτό. Η κοινότητα ακολουθεί μια κουλτούρα που διακατέχεται από την καινοτομία και την τεχνογνωσία και ως σκοπό έχει να κάνει τις επιχειρήσεις που βρίσκονται εντός των θερμοκοιτίδων ανταγωνιστικές και αναγνωρίσιμες στον επιχειρηματικό κόσμο. Ως δημιουργία ενός νέου προϊόντος/αγαθού που προκύπτει μέσα από μια πληθώρα ιδεών και πάνω στην οποία εφαρμόζονται νέες τεχνολογίες, αναφέρεται η καινοτομία. Τα κύρια χαρακτηριστικά ενός Επιστημονικού και Τεχνολογικού Πάρκου είναι: α) η συνεργασία με κατάλληλα καταρτισμένο προσωπικό, β) η συνεργασία με Πανεπιστήμια, γ) η δημιουργία επιχειρήσεων από την αρχή μέχρι την πλήρη ανέλιξή της, δ) η στήριξη της επιχείρησης με κάθε τεχνολογικό μέσο, ε) προσπαθεί να δώσει ανταγωνιστικό πλεονέκτημα στην επιχείρηση, στ) επηρεάζει θετικά το μακροοικονομικό περιβάλλον της επιχείρησης (γνωρίζει επιχορηγήσεις), ζ) στοχεύει στην άνοδο της παραγωγικότητας, η) έχει την τεχνογνωσία και αντιλαμβάνεται άμεσα τον αντίκτυπο μιας μικρής καινοτομίας, θ) στηρίζει την επιχείρηση από τις πιο απλές υποδομές μέχρι την δικτύωση με ερευνητικά κέντρα και ι) έχει άρτια συμβουλευτική ικανότητα. Λόγω των συνεργασιών τους με ερευνητικά κέντρα και οργανισμούς μπορούν να παρέχουν στις start-up επιχειρήσεις πληροφορίες για τεχνητή νοημοσύνη, για τηλεπικοινωνίες, για την νανοτεχνολογία, για τις επιστήμες υγείας και για τη βιώσιμη ενέργεια, αφού η κλιματική αλλαγή επηρεάζει περισσότερο από ποτέ τη διαβίωση του ανθρώπου.

Λέξεις κλειδιά: *Τεχνολογικά Πάρκα, Καινοτομία, Θερμοκοιτίδα, Πανεπιστήμια*

ABSTRACT

Maria Tampaki: Innovation in Greece: Technology Parks

(With the supervision of Athanasios Kriemadis, Professor)

Through this thesis the aim is to highlight that the Science and Technology Parks of Greece even though they are small compared to the Technology Parks of the other countries, can promote innovation and "build up" a business from scratch. The International Association of Science Parks states that Technology Park is an organism that is made up of appropriately specialized personnel and has all the resources to be able to develop the businesses located within it. The community follows a culture of innovation and know-how and aims to make the businesses inside the incubators competitive and recognizable in the business world. A new product can be producted. A new product can be produced through innovation. This product is created from the diversity of ideas and technologies that will be applied. The main characteristics of a Science and Technology Park are: a) cooperation with suitably qualified personnel, b) cooperation with Universities, c) the creation of businesses from the beginning to their full development, d) the support of the business by any technological means, e) tries to give a competitive advantage to the business, f) positively affects the macroeconomic environment of the business (knows about grants), g) it aims to increase productivity, h) it has the know-how and immediately realizes the impact of a small innovation, i) it supports the business from the simplest infrastructure to networking with research centers and j) it has excellent consulting capacity. Because of their partnerships with research centers and organizations, they can provide start-ups with information on artificial intelligence, telecommunications, nanotechnology, health sciences and sustainable energy, as climate change affects people's livelihoods more than ever.

Keywords: *Technological Parks, Innovation, incubator, Universities*

Dedicated to my parents,

Kostis and Rita

In loving memory of

Tampakis Tasos

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Contents

ΠΕΡΙΛΗΨΗ 4

ABSTRACT 5

TABLE CONTENTS 9

FIGURE CONTENTS 11

I. INTRODUCTION 13

Purpose of the study 15

Need for the study (usefulness / importance of research) 15

Definitions of terms 15

Conditions – Limitations 15

II. LITERATURE REVIEW 16

Definition of Innovation 16

Types and taxonomies of innovation 21

Models of Innovation 28

Technological Innovation 38

Models of Technological innovation - Development 42

Science and Technology Parks in World 47

History and differentiations 57

Sectors of development of Science and Technology Parks 66

Science Parks in Greece 76

Science and Technology park of Crete (STPC) 79

Patras Science Park (PSP) 84

Thessaloniki Technology Park (TTP) 88

Attica Technology Park "Lefkippos (A.T.P. "Lefkippos" 91

Lavrion Technological and Cultural Park (LTCP) 95

Technological Park of Thessaly – Averofio Agri-Food (AV. A.TE.PA.THE) 98

Science and Technology Park of Epirus (S.TE.P.-E.) 100

Zakynthos 103

III. METHODOLOGY 104

Case Study - Greece 105

IV. RESULTS 108

V. DISCUSSION 110

VI. CONCLUSIONS 114

VII. REFERENCES 115

TABLE CONTENTS

Table 1: Taxonomies of innovation (Godin, 2006)……………………………….26

Table 2. Characteristics of incremental and radical innovation (Kristic, Skorup & Lapcevic, 2018)……………………………………………………………………27

Table 3. Examples of Incremental and radical innovation………………………..27

Table 4 . All innovation models…………………………………………………..35

Table 5. Doblin Framework (Jasienski & Rzeznik, 2016)…………………………38

Table 6. Types of technological innovation, the intensity of the impact and their results by example…………………………………………………………………....42

Table 7. Type I simulation models of technological innovations……………………45

Table 8. Type II simulation models of technological innovations………………..…46

Table 9. Types of business Incubators……………………………………………….54

Table 10. The differentiation between incubations of United States and Brazil…………………………………………………………………………........60

Table 11. Formal Link with Educational Industry…………………………………..72

Table 12. Informal Link with Educational Industry……………………………...….72

Table 13. Contribution of the science parks. S: survival; G: growth; H: HEI linkage; I: innovation; R: reputation; A: agglomeration; (+): positive effect; (-): negative effect…………………………………………………………………………………76

Table 14. Reasons for the establishment in Technological Park of Thessaloniki (TPT), in Science & Technological Park of Crete (STPC) and in Science Park of Patra (SPP)…………………………………………………………………………..…80

Table 15. Graduated companies from 2000 until 2012………...……………………83

Table 16. Hosted companies in Science Park of Patra and their activities………….86

Table 17. Companies that had successfully housed at Science Park of Patra from 2003 until 2022……………………………………………………………………….87

Table 18. CPERI's Organizational structure and sectors……………………………89

Table 19. Sectors of Institute of Applied Biosciences………………………………90

Table 20. Sectors and companies of Attica Technology Park "Lefkippos"…………93

Table 21. Companies based on the technological and cultural park of Lavrio………97

Table 22. Hosted companies in Science and Technology Park of Epirus and their activities……………………………………………………………………...……102

Table 23 . PRISMA flowchart with the results of descriptive literature review…...108
Table 24. Section of search, papers to use and the dates…………………………..109

FIGURE CONTENTS

Figure 1. Positive effects of innovation…………………………………………...19

Figure 2. Classification of innovation (Davila, Epstein, & Shelton, (2006; 2012)………………………………………………………………………………20

Figure 3. Innovation Matrix (Davila, Epstein, & Shelton, 2006)…...…………………………………………………………………….21

Figure 4. Innovation types (Abernaty & Clark, 1985)……………..……………..23

Figure 5. Categories of innovation………………………………………………..24

Figure 6. Agile innovation System………………………………………………..28

Figure 7. Linear model…………………………………..……………………..29

Figure 8. The linear model considered innovation as a linear path from the research laboratory to the market…………………………………………………………..30

Figure 9. Coupling model…………………………………………………………30

Figure 10. Chain link model………………………………………………………31

Figure 11. Triple helix model……………………………………………………..32

Figure 12. Closed model of innovation…………………………………………...33

Figure 13. Open innovation model………………………………………………..34

Figure 14. Three Horizons model…………………………………………………35

Figure 15. Innovation ambition matrix (Nagil & Tuff, 2012)………………………36

Figure 16. Innovation matrix……………………………………………………...37

Figure 17. Strategic factors of innovation in Greek manufacturing firms (Souitaris, 2001)………………………………………………………………………………41

Figure 18. Technological innovation process (Brown & Karagozoglu 1989, Flor & Oltra 2004, Fritsch & Lukas 2001, Hall & Martin 2005, Hollenstein 2003, Kampas 2003, Nieto 2004)……………………………………………………………………44

Figure 19. Technological innovation – development of a new product……………..46

Figure 20. Basic components od technology incubators in USA (Wiggins & Gibson, 2003)………………………………………………………………………………52

Figure 21. Incubation models of USA and Brazil. Their 6 key dimensions………..60

Figure 22: Distribution of the Japanese science parks during 1970 to 2003 which are linkaged with HEIs. With code "1" are the science parks which either houses research facilities or liaison offices of HEIs and with code "0" are science parks which have partnership with HEIs…………………………………………………………...73

Figure 23 . 5 sectors of Hellenic Institute of Transport…………………………...90

CONTENTS OF ABBREVIATIONS AND SYMBOLS

A.T.P.Lefkippos: Attica Technology Park "Lefkippos"

AV.A.TE.PA.THE.: Technological Park of Thessaly – Averofio Agri-Food

BIC: Batavia Industrial Center

BIG: Belinen Innovations und Grunderzentrum

CEO: Chief Executive Officer

CIE: Centre for Innovation and Entrepreneurship

CPERI: Chemical Process Engineering Research Institute

FORTH : Foundation for Research & Technology Hellas

HEI: Higher Educational Institutes

IASP : International Association of Science Parks

iBO: Institute for Bio-Economy and Agri-Technology

INAB:Institute of Applied Biosciences

ITI: incubator technology, innovation

LTCP: Lavrion Technological and Cultural Park

NBIA: National Business Incubation Association

NCSR: National Center for Scientific Research Demokritos

NTUA: National Technical University of Athens

RTD: Research & Technological Development

S.TE.P.E.: science and Technology Park of Epirus

SPP: science park of Patras

STEP: Science and Technology Park

STPC : Science & Technological Park of Crete

TPT : Technological Park of Thessaloniki

UCSC: University City Science Center

UKSPA: United Kingdom Science Association

UNESCO: United Nations Educational, Scientific and Cultural Organization

UKBI: United Kingdom Business Incubation

WATP: Western Australian Technology Park

ZENIT: Zentrum fur innovation und technik

I. INTRODUCTION

Innovation is a key factor for economic, social, cultural and technological growth for every country. It is necessary to support the creation of new outputs, new procedures, new policies in human resource management and thus the competitiveness of enterprises (Hanaysha & Hilman, 2015; Markatou, 2011; Ponnam & Balaji, 2015; Tu & Hwang, 2013). The policy and management innovation is needed more than ever, especially in recent years when the world is facing a crisis at all levels and especially in the financial one. Our country has been plagued and has not been unaffected by this crisis since 2010. Nowadays firms and industries have to behave differently by conquering new markets, using available resources more effectively and using more innovation.

Innovation is the discovery, invention, implementation and development of new inventions designed the best possible outcome refers to whether it refers to either product or process relates to organizational structure. The term is often used in economic, business and commercial context and related to the relevant sections R&D (Research & Development). In Oslo Manual (OECD, 2005) characterized as innovation data related to science, research and innovation. These data are measured and interpreted according to the company's goal. Business development to be achieved must consist of changes in the scientific field, the technical field, the commercial field and the economic field. New or improved products, procedures, equipment in conjunction with a similar marketing is innovation.

More than ever a major consideration that helps the growth of a country is to find, to create and develop pioneering ware and methods, which in turn depend on the technology hearsay and academic and research institutions. A science and technology park is supported by appropriate infrastructure, the development of knowledge about the business sector and the suitability of the site (near research institutes, university links, educational institutions, technological center of excellence) (Löfsten & Lindelöf, 2002, Hackett & Dilts, 2004; Rothaermel, Agung, & Jiang, 2007; Infyde, 2008). Universally accepted that technology parks with business incubators (BS) have been founded as incentives for economic development and they are an effective way for there to be interaction between the university and industry (Marques 2006; Ratinho & Henriques, 2010). Business incubators provide to companies a supportive environment for start up by offering many facilities such as rental space with convenient conditions and tenancy, administrative services, armament, network, technical advisors, help with financing, creation of a business plan, marketing management, advice on legal matters etc. (Chen, Wu,& Lin, 2006; Lois, Rice, & Sundararajan, 2004; Más-Verdú, RibeiroSoriano & Roig-Tierno, 2015; Schwartz & Hornych, 2008; Schwartz & Hornych, 2010).

The name of the park varies and often referred to as: Science Parks, Technology Parks, technoparks, Parks Research, Technology Business Incubator, Technopolis, etc (Link & Scott, 2003). These organisms can vary quite a bit in size, as to its purpose and extent and series of services, but their common identity may be summarized by the following operational definition. A science & Technology Park is:

- A technology-based initiative that helps establish, develop and promote businesses,
- Connected to a center that has experience and is an expert in the technology. This link is official and functional
- An organization that supports rental companies administratively,
- An organization which creates an environment where there is transfer of knowledge and cooperation between firms.

  (Araouzo-Carod, Segarra-Blasco & Teruel, 2018; Dettwiler et al., 2006; Vásquez et al., 2016a).

The Greek government in 1989 took the initiative to create and develop Science & Technology Parks and incubators for nascent companies. The establishments of technology parks were close to universities and research centers and were designed to help research and development (R&D) corporation (Sofouli & Vonortas, 2007). Science parks are not managed by the state. Local industry is represented by its own persons and together with the members of the ITE make up the board of directors of the science parks. The Science Parks of Crete and Thessaloniki follow an open policy and without significant restrictions on attracting new companies to the incubators. (Bakouros, Mardas & Varsakelis, 2002). The Patras Science Park uses an even more restrictive policy in terms of attracting companies (mainly aimed at companies with high technology, e.g. electronics) (Bakouros, Mardas & Varsakelis, 2002). Science & Technology parks created in Greece are seven (7) and are presented in chronological order of establishment:

1. Science & Technological Park of Crete (STPC)
2. Science Park of Patras (SPP).

3. Technological Park of Thessaloniki (TPT)
4. Attica Technology Park "Lefkippos" (A.T.P "Lefkippos")
5. Lavrion Technological and Cultural Park (LTCP)
6. Averofio Agri-Food -Technology Park of Thessaly (AV.A.TE.PA.THE)
7. Science and Technology Park of Epirus (S.TE.P.-E.)

Purpose of the study

The purpose of this study is to review and show that the Science and Technology Parks of Greece, even though they are small compared to the Technology Parks of the other countries, can promote innovation and "build up" a business from the beginning. All of the seven technology parks encountered in Greece are going to be analyzed (research and technological orientation, the region of influence, areas of expertise and innovations, products, processes, organizational structure, activities, linkages).

Need for the study (usefulness / importance of research)

This review will gather information on all 7 Science and Technology parks in Greece and will provide information on developments in innovation, motivating technology parks, transport and support, industrial innovation and competitiveness.

Definitions of terms

Technology park: is an organization run by a team of experts, who seek to promote creation, grow the company and be innovative

Innovation: new and innovative idea to apply something new or process of implementation, as well as the application of new inventions or discoveries to create new effects.

Conditions – Limitations

Limitations: research will involve only companies hosted in technology parks and for this reason the results cannot be generalized across the business world. Also the results will related with functions and processes of the seven science parks of Greece and cannot be generalized for all technology parks abroad.

II. LITERATURE REVIEW

Definition of Innovation

Innovation is about creating and using new knowledge in order to offer (i.e. design, develop and commercialize) a new product or service that is positively received by the buying public and more generally responds to customer and market needs using new ways.. These needs can be met either from different products - services - ideas - technologies, or more sophisticated products - services - ideas - technologies available on the market. The term innovation means something new, something different that has not been used before and helps to create a new product or process as well as implement new discoveries that will lead to a new result. The term innovation is used quite a bit in business, domestic and commercial planning.The OECD through the «Frascati manual» states that innovation is something new (a thought) which is used to be transformed / modified into a product and then distributed to the market. The new idea may be about a new or redesigned operation, a method of producing a product or distributing it to the market (ΓΓΕΤ,2001). Considering the above, innovation refers to the process. However, innovation may refer to the result, i.e. the new or redesigned product or service that has already been released on the market. We must bear in mind that it is linked to research and development, especially in business (R & D, Research and Development) (http://en.wikipedia.org/wiki/Innovation).

The first report was made around the concept of innovation was by the Austrian economist Joseph Schumpeter (1883-1950). He was a pioneer when he spoke for the first time about innovation management. In his book “Capitalism, Socialism and Democracy” (1942) described the procedure as an opening up of new shoppers (foreign or local or domestic), where the procedure of opening is the same procedure of industrial mutation (destruction of the old to create the new by restructuring of the economic structure). This process is called “creative destruction”. Initially Schumpeter argued that innovation connected with company’s size. A smaller company is more flexible, so you can innovate more easily since they will not trapped in the bureaucratic structures of large firms. But a few years later revised his opinion by saying that larger firms which have some degree of monopolistic power could outweigh the smaller companies, as they will have more resources and market power. Creating a dynamic economic development through new products, through the use of new raw materials, through new organizational methods in the industry, through new combinations is what Schumpeter calls innovation. Unfortunately, the theory of innovation came not through research experiments but the analysis of economic and social systems there are no strong evidence that depending on how large the firm is, the innovation should be correspondingly large.

Freeman (1982) states that an innovation that takes place at the industrial level includes all those activities needed to design, manufacture and market it. this concerns either when a product comes out for the first time on the market (new or redesigned product) or some improved products that are already on the market. Gardiner (1985) points out that innovation is characterized not only by commercializing a fundamental change in an already developed technology (radical innovation) but also by every small change caused to the already existing know-how of the company (incremental innovation). Drucker (1985) argues that innovation can be characterized as a specific tool that businesses exploit to bring about a change in their business or a change in a service. It can occur as a discipline, can be known, it is possible to practice. Finally Porter (1990) states that a company can be competitive and gain an advantage over other companies when it uses innovation. as innovation characterizes the use of new technologies or even new ways that each company acts.

In Oslo Manual (OECD, 2005) proposed as innovation data that have been measured and interpreted and relate to areas of research, science and innovation. The successful development of a company consists of changes that are made either at a scientific level or at a commercial level or at an economic level or all together. New or upturn output, procedures, equipment in conjunction with a similar marketing is innovation. Drucker (1985) says that τhe purpose of innovation is to create a shift between economic and social dynamics of the business. Taking into consideration that this change will then deliberate innovation is an important tool for every Chief Executive Officer (CEO).

Innovation for any firm is not only a chance to development and survive but is an important step that helps in developing its strategy and a direction he wants to follow (Davila, Epstein & Shelton, 2006). For example Apple Computers thought to combine iTunes/iPod/iPhone and a new generation started. It was a triple punch on innovation who help Apple to put its mark on the evolution of business. Massa and Testa (2008) indicate that the definition of innovation varies between the three stakeholder' perspectives (entrepreneurs, policy makers and academics). Academics say that innovation is a quantitative step, it is the result of a research process, which can only be carried out in research companies, university institutes and research centers Policymakers claim that innovation is risk, and entrepreneurs say that innovation can exist at any level (from the lowest to the highest level of a company) and in any department, from the market leader to the salesperson. All play a key role and with a smooth cooperation and appropriate procedures can get the best ideas.

Indeed innovation is a crucial consideration for economic, social, cultural and technological development of a country. It is necessary to support the development of new products, new procedures, new policies in human resource management and thus the competitiveness of enterprises (Markatou, 2011). The policy and management innovation is needed more than ever, especially in recent years when the economic crisis that governs the world and especially in our country. Nowadays firms and industries have to behave differently by conquering new markets, using available resources more effectively and using more innovation.

The innovation involves every part of the economy or production procedure. In terms of business or organization, innovation it has primarily to do either with the manufacture of outputs and services that are new to the shoppers or with the reconstruction/restructuring of processes used by a company to be productive/operate. (Καραγιάννης και Μπακούρος, 2010). A company in order to be competitive with other companies should continuously implement efforts to create new products/services/production methods.This competitive advantage can be categorized in 3 crusial areas: a) revenue of resources where we carry out research and development, applying new forms of technology, increasing production and sales, implementing new investments that are productive and "opening up" to new buyers or expanding the customer base b) the organization must grow and renew itself by creating appropriate opportunities for professional development, making investments, making new hires to renew/strengthen the workforce and keeping optimism c) firm success with fame and opening to new customers, creating a dynamic image of the company, with outputs that are different from the other companies, causing a continuous growth so that the competition can hardly follow it follow (Καραγιάννης και Μπακούρος, 2010).

Innovation appears to SMEs with positive and negative consequences. Positive effects include the capacity to use large networks (Rothwell & Dodgson, 1994), the development of smart alliances (Van Dijk et al., 1997), minimizing bureaucracy (Sivades & Dwyer, 2000), to know the desires and needs of the client (Dahl & Moreau, 2002) and the commercialization of technology (Kassicieh et al, 2002). Moreover, innovation, specifically indicators such as imagination and courage, is used by multinational companies for evaluating their managers (Business Week, 2006). Also helps companies to create a stable environment where the appropriate conditions will be created to develop the advantages so that the company is competitive (Atalay, Anafarta & Sarvan, 2013; Fauji & Utami, 2013; Hoonsopon & Ruenron, 2012; Sjoberg & Wallgren, 2013) (**Figure 1**).

Figure 1. Positive effects of innovation. (Atalay, Anafarta & Sarvan, 2013; Fauji & Utami, 2013; Hoonsopon & Ruenron, 2012; Sjoberg & Wallgren, 2013).

As negative, literature indicates that due to the small size of SMEs is restricted: resources (Hausman, 2005), the implementation of activities related to R & D in house, curriculum development and training of human resources (Romano, 1990). Another important drawback is the reluctance to transfer the authority for decision making (Dyer & Handler, 1994) and excessive involvement in decisions which are taken by the business (Sethi et al., 2001).

According to Davila et al., (2006; 2012) there is a classification of innovation (**Figures 2 and 3**). Three in business model and three in technology innovation. The "value proposition" refers to what you sell and what you deliver in market, a new product or procedure or redesigned proposal for an offer that already exists. The "supply chain" refers to in how a value is created and then how it is marketed (partners, operation, delivery, services). The third element, "target customer", refers to whom the company is going to sell (marketing, sales, customers). The "product and service offerings" includes the products / services which are new entirely and the consumers expected eagerly (ie, mobiles, computers, ipad, etc.). The fifth element "process technologies" includes the innovation that drives the performance of the product / service, and finally the last element "enabling technologies", is the technology which is used from the company to execute its strategy faster and effectively.

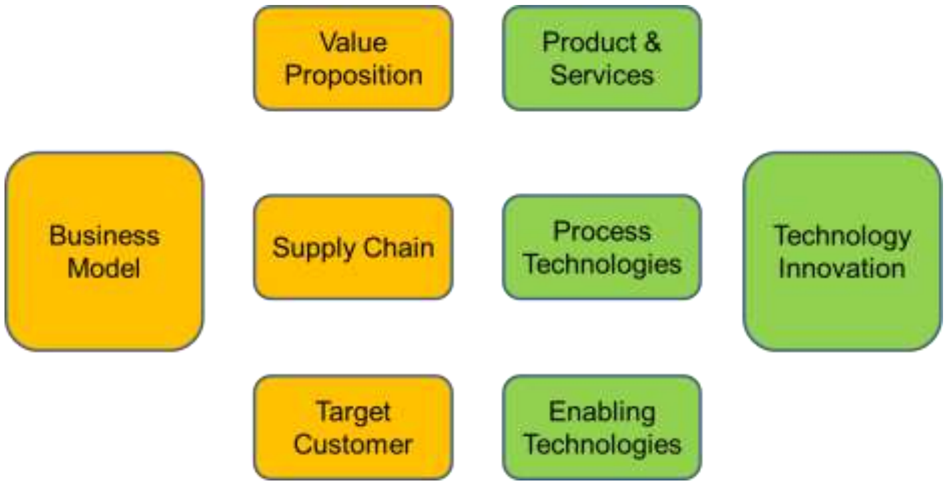


Figure 2. Classification of innovation (Davila, Epstein, & Shelton, 2006; 2012).

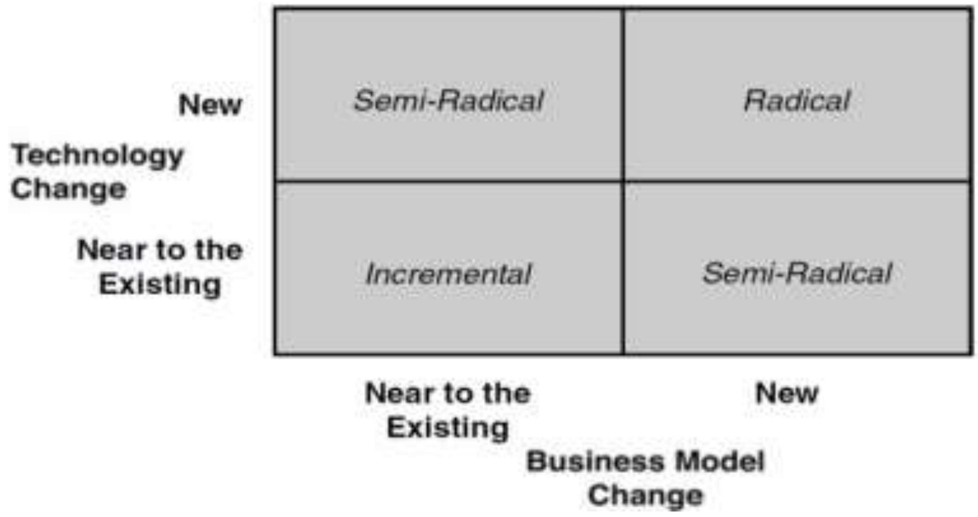


Figure 3. Innovation Matrix (Davila, Epstein, & Shelton, 2006).

Types and taxonomies of innovation

In the literature, many well-defined concepts for types of innovation appear, yet unfortunately there is still a vagueness about the term 'innovation'. Garcia and Calantone (2002) claims that so many definitions on innovation evoke confusion to researchers. For example an innovation which is really new for one researcher, maybe by another can characterized as radical or discontinuous. Researchers claims that innovation has many different attributes and has to be categorized according that (administrative and technologistic, output and procedure, technological and architectural). Cooper (1998) suggests that innovation must be a model with many dimensions which contain 1) output – procedure, 2) incremental-radical and 3) innovations concerning the administrative and technological departments of a company.

According to Schumpeter (1942) innovation is the commercialization of invention. Johnson and Jones (1957) classified innovation into eight (8) categories remodeling / new spare parts / re-promotion / new upturns / new outputs / new user / new market / new clients. Marques (1969) has mention three (3) categories of innovation: systems, radical, incremental. Also a triadic categorization of innovation has be done by Kleinschmidt and Cooper (1991) into three (3) categories, low -

moderate - high innovativeness, and by Wheelwright and Clark (1992) has been categorized into radically new, new generation and incremental.

Pavitt (1984) suggest that innovation should be divided according to the firms that generate it. So he classified firms into the five following categories: 1) the supplier dominates (traditional industries), 2) firms and suppliers of capital goods have the same behavior (machine tools and equipment), 3) science based firms with in-house laboratories of R&D (scientific discoveries), 4) firms that characterized as mass production industries (motor vehicles) and 5) technology based firms in which there are information accumulation (banking, internet). A different categorization of innovation in five sectors has been done by Freeman (1994).

Abernathy and Clark's matrix (1985) categorizes the types of innovations according to the effect they have on the knowledge of the market and the capabilities that the firms have in the technological field. Market knowledge benefits businesses to be one step ahead of a company that is new to the field. The classification comprise four types of innovation: 1) regular innovation (the technologies that are already available to the companies as well as the knowledge of the market are used), 2) niche innovation (provide existing products in mew ways), 3) revolutionary innovation (there is a diffusion of new technologies within companies, connection in the same market but with the use of new methods) and 4) architectural innovation (reorganization) **(Figures 4, 5)**.

Figure 4. Innovation types (Abernaty & Clark, 1985).

Freeman and Perez (1988) suggest that innovation should be divided into the four following categories: 1) incremental, 2) radical, 3) technology and 4) techno-economic. The first category appear more or less in any activity or industry service. The rate of appearance depends on the country and the industry in conjunction with the socio - political – economic - cultural factors. Radical innovations are events that are discontinuous and have the effect of promoting the development of industries through various researches, which researches are always carried out in collaboration with laboratories of either the university or the state. The combination of the first two categories lead to changes in technological systems. When these changes coexist with organizational/administrative innovations then more companies are affected. The fourth type has significant effects on the entire economy, leads to innovation and affects directly every other branch of the economy.

Henderson and Clark's matrix (1990) claims that if you want to manufacture a product it is incumbent upon to know all the components that make up a product/output as well as how the components connect to each other (or architectural knowledge). The combination of both types of knowledge classifies innovation in four (4) categories: 1) incremental innovation (parallel enhancement of architectural and component knowledge), 2) radical innovation (rub out of both types of knowledge), 3) architectural innovation (enhancement only of component knowledge) and 4) modular innovation (enhancement only of architectural knowledge) **(Figure 5)**.

Gaynor (1996) states 4 categories of innovation: 1) radical, 2)incremental (technology), 3)radical system innovations and 4) next-generation technology. This categorization is quite similar to the categorization of Freeman and Perez (1988). Tetra categorization of innovation has be done by Henderson and Clark (1990), Moriarty and Kosnik (1990), Tidd (1995), and by Chandy and Tellis (2000). Tushman, et al. (1997) classified innovation according to impact on shoppers (as Abernathy and Clark above) and technology **(Figure 5)**.

Chandy and Tellis matrix (1998) categorized product innovation according technology (freshness of technology) and markets (customer's requirement) into four types: 1) incremental innovation, 2) market breakthrough (low technology and high market), 3) technological breakthrough (high technology and low market) and 4) radical innovation (high technology and high market) **(Figure 5)**.

(1) ABERNATHY and CLARK MODEL (1985)		
Market knowledge	Technical capabilities	
	Preserved	***Destroyed***
Preserved	Regular innovation	Revolutionary Innovation
Destroyed	Niche innovation	Architectural Innovation

(2) HENDERSON and CLARK MODEL (1990)		
Component knowledge	Architectural knowledge	
	Enhanced	***Destroyed***
Enhanced	Incremental innovation	Architectural innovation
Destroyed	Modular innovation	Radical innovation

(3) TUSHMAN et Al. MODEL (1997)		
Market	Technology – (R & D)	
	Incremental	***Radical***
New	Architectural innovation	Major product, service innovation
Existing	Incremental product, service, process	Major process innovation

(4) CHANDY and TELLIS MODEL (1998)		
Newness of technology	Customer need fulfillment per dollar	
	Low	***High***
Low	Incremental innovation	Market breakthrough
High	Technological breakthrough	Radical innovation

Figure 5. Categories of innovation (Chandy & Tellis, 1998; Henderson & Clarк, 1990; Tushman, Anderson and O'Reilly, 1997).

The innovation by Afuah (1998) and Popadiuk and Choo (2006) classified by technology, shoppers and management characteristics (technological such as output, procedure, service and market such as output, value, place, boost). The technological innovation includes linkages, methods, processes and techniques and their aim is to satisfy some market needs. The market innovation helps to improve the components of the marketing mix (market test, advertising) and the administrative innovation involves innovations that are made within the company either at a strategic level, or in the systems of the business or in the people that make it up.

Regarding the intensity innovation can be labeled by Koberg et al. (2003), Balacharandra and Friar (1997), Atuahene-Gima (1995), Dewar and Dutton (1986) as radical or incremental, by Walsh et al. (2002), Lyn et al. (1996), Andrerson and Tushman (1990) and Robertson (1967) as discontinuous or continuous. In literature there are many dichotomous categorization of innovation. The classification was as revolutionary or evolutionary (Patrakosol & Olson (2007); Utterback, 1996), as major or minor (Katz and Shapiro, 1987), as instrumental or ultimate (Grossman, 1970), changes or orientations (Normann, 1971). Maidique & Ziger (1984) refers as classification of innovation true or adoption, Yoon & Lilien (1985) original or reformulated, Rothwell and Gardiner (1988) innovations or reinnovations, Meyers and Tucker (1989) radical or routine, Christensen (1997) sustaining or disruptive. Others refers as classification of innovation new or incremental (Schmidt & Calantone, 1998) and breakthrough or incremental (Rice, et al., 1998). The most surveys report innovation as radical or incremental (Kessler & Chakrabarti, 1999; Balacharandra & Friar 1997 Stobaught, 1988). In the **Table 1** below represented more surveys with taxonomies of innovation.

Table 1: Taxonomies of innovation (Godin, 2006)

Mees (1920)	Pure science, development, manufacturing
Schumpeter (1939)	Invention, innovation, imitation
Stevens (1941)	Fundamental research, applied research, test-tube or bench research, pilot plant, production (improvement, trouble shooting, technical control of process and quality)
Bichowsky (1942)	Research, engineering (or development), factory (or production)
Furnas (1948)	Exploratory and fundamental research, applied research, development, production
Mees and Leermakers (1950)	Research, development (establishment of small-scale use, pilot plant and models, adoption in manufacturing)
Brozen (1951a)	Invention, innovation, imitation
Brozen (1951b)	Research, engineering development, production, service
Maclaurin (1953)	Pure science, invention, innovation, finance, acceptance
Ruttan (1959)	Invention, innovation, technological change
Ames (1961)	Research, invention, development, innovation
Scherer (1965)	Invention, entrepreneurship, investment, development
Schmookler (1966)	Research, development, invention
Mansfield (1968)	Invention, diffusion, innovation
Myers and Marquis (1969)	Problem solving, solution, utilization, diffusion
Utterback (1974)	Generation of an idea, problem-solving or development, implementation, and diffusion

All the models above report radical and incremental innovations. To avoid any confusion between both innovations Stamm (2003) recorded the differences according nine sectors (timeframe, growth trajectory, to generate ideas and see the window of opportunity, procedure, companies, growth, resource and skills). Incremental innovation represent high level of development, continuous incremental improvement, formal process, customer reaction can be anticipated, players emphasizing on making things happen, the development structure is typically, the distribution of resources has a standardized process and the operating unit involvement start from the beginning (**Tables 2, 3**). Radical innovation has a long term time frame (10 years plus), is discontinuous, the generation of ideas often pop up unexpectedly, the process might hampered, the prediction of customer reaction is difficult, key players are not stable (come and go), the development structure includes R & D laboratories, flexibility required and if the involvement of operating unit become too early there is a risk of great ideas turn out to small. (**Tables 2, 3**).

Table 2. Characteristics of incremental and radical innovation (Kristic, Skorup & Lapcevic, 2018).

Incremental innovation	Radical innovation
continuous (linear improvement of value acquired by the customer)	discontinuous (with or without predecessor; essential, nonlinear improvement obtained by the customer)
based on old technology	based on new technologies
dominant design unchanged	leads to a new dominant design
does not lead to a paradigm shift	can lead to a paradigm shift
implies a low level of uncertainty	implies a high level of uncertainty
improvement of existing characteristics	introduces a whole new set of performance features
existing organization and qualifications are sufficient	requires education, new organization and skills
the result of a rational response or necessity	result of chance or R & D policy, not necessity
driven by market pull (important in the advanced stage of technology)	driven by technology (important in the early stage of technology)
in order to achieve short-term economic goals	in order to achieve long-term economic goals

Table 3. Examples of Incremental and radical innovation. (Kristic, Skorup & Lapcevic, 2018).

Incremental (doing better)	Radical (something new)
New version of the car (2013 model vs. 2014 model)	Hybrid car or electric car
Improved performance light bulbs (longer life time)	LED- bulbs
CDs replacing vinyl records (more storage, more music)	Music streaming services (all music available)
Improved banking sevices at branch banks	Online banking
Improved fixed line telephone services	Skype
Airlines segmenting service offering for different passanger groups e.g Premium Economy	Low-cost airlines opening up air travel to those previously unable to afford it
Redefining the home appliance market in terms of high performance engineered products (e.g Dyson vacuum cleaner)	Redefining industries (e.g Amazon-retailing, Google-advertising, Skype-telecoms through online)

Another type of innovation is Agile innovation (**Figure 6**) (Krstic, Skorup, & Lapcevic, 2018). Through agile innovation can be developed and promoted ideas as best as possible and aim to be productive through their implementation. Cooperation between all partners is encouraged and strengthened, so that there is minimum error/danger when an idea/plan is created. The entire organization must take part in the creation and progress of the most successful ideas. A positive result exists when the planning was done based on the objectives and the appropriate innovation is used.

Figure 6. Agile innovation System (Kristic, Skorup & Lapcevic, 2018).

Models of Innovation

<u>Linear model</u>

The innovation process according to Lundvall (1997) is a procedure which is interactive and has a social character. There are 3 levels of interaction: 1) Innovation consists of several stages which interact with each other 2) stakeholders taking part in the process interact with each other and 3) the different departments of the same business interact with each other (Gaynor, 1996). To enable this interaction it has to be communication and corporation between levels of the company / organization. It must be developed a common code of communication, a common language, a common understanding and mutual trust in order to achieve an innovative process.

For many years, from the Second World War until the 80s model that prevailed in the literature regarding innovation was the linear model (Freeman, 1996; Phillimore, 1999; Quintas, Wield & Massey, 1992). This model has been very influential and has been used by academic organizations (National Science Foundation, 1957a), by economists (Nelson, 1959) and science policies (Mowery, 1983a). At the beginnings the linear model was called science-push model (Vannevar Bush, 1945). According to Bush, the economical and technological development / upwing / innovation need the progress of science and the development of new outputs, industries and workplaces need the basic research which is going to be supported by the government. This model is funded by public resources (**Figure 7)**.

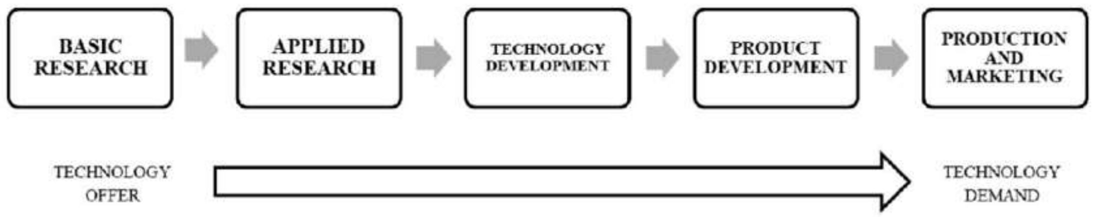


Figure 7. Linear model. (Freeman, 1996; Phillimore, 1999; Quintas, Wield & Massey, 1992).

According to Godin (2006) this model considered innovation as a linear path from the research laboratory to the market (**Figure 8**). So in this model, the new technology starts with basic research (scientific discovery), moved into applied research - invented (development and transformation of discovery into a product), and control commercial market and diffusion (manufacturing and product promotion) (Feldman, 1994; Freeman, 1996; Godin, 2006; Quintas et al, 1992). The innovations are a result of a linear process which is constructed in different steps which are sequential in a hierarchical order. In simple words the linear model means that through science we are going to technology and technology gives all the perspective to satisfy needs of the consumers (Gibbons et al. 1994: 51).

Figure 8. The linear model considered innovation as a linear path from the research laboratory to the market (Godin, 2006).

Linkaged and feedback model or chain-linked model

According to Rothwell and Zegveld (1985), who developed the coupling model, report that innovation procedure can be achieved through a communication network which is complex. These communications paths exists intra- and extra- of an organization and connecting the firms with the science and technology community and the market. **Figure 9** illustrates the stages of coupling model.

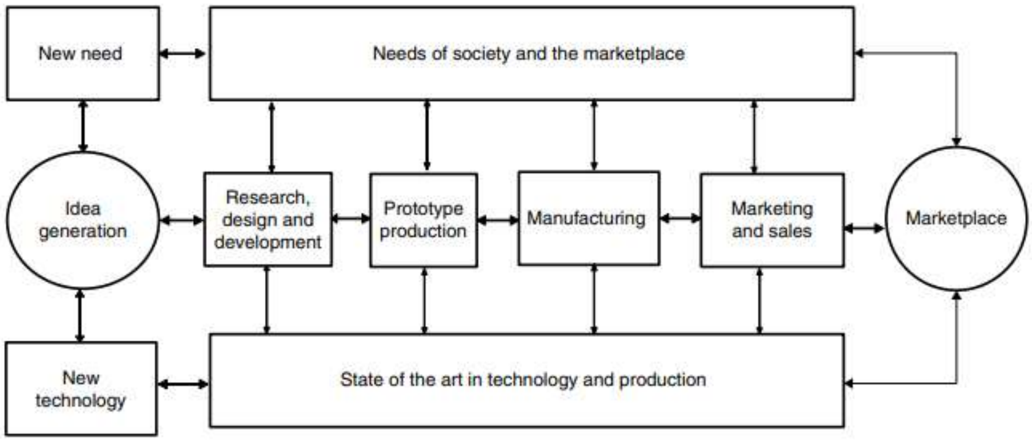
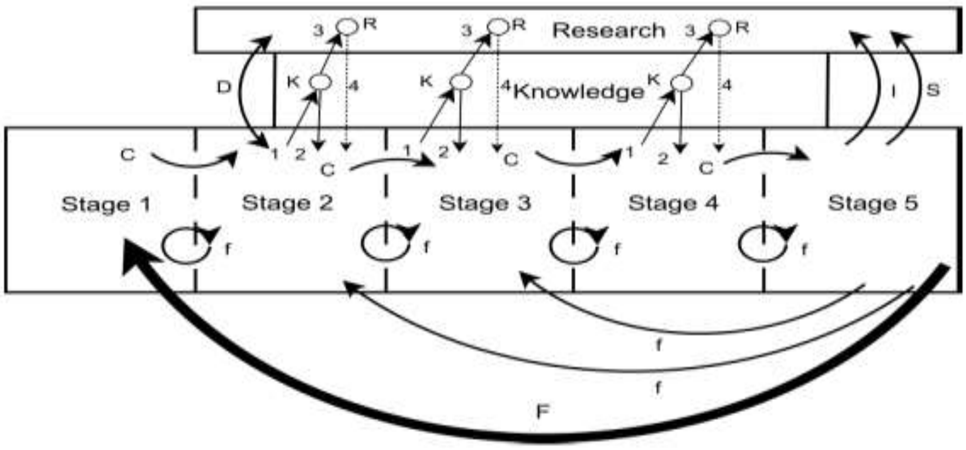


Figure 9. Coupling model (Rothwell & Zegveld, 1985).

Bejii (1988) stresses that the innovation is not only the end product in the last stage of activity but can be occurred during the process in any stage. Innovation may not be sequential but exhibit an iterative nature. Kline and Rosenberg (1986) suggested chain link model. The chain link model consists of re-information and loops which allow the people creating the innovation to look for any knowledge (inter- and intra-) that already exists in the company. Furthermore the innovators through this model can execute extensive research to enable them to solve any problem that arises from the design of a product/process, plan, manufacture until distribution.(**Figure 10**). The chain model consists of fine paths: 1st path (C): central chain innovation, 2nd path: (f) means series of feedback and (F) means linking the last stage with the others, 3rd path: (D) means links between innovation and research and (K) means existing knowledge, 4th path: (D) means knew knowledge which leads to radical innovation and 5th path: (I) means the impact of innovative products on research and (S) means monitoring external developments.



Source: Kline and Rosenberg (1986)

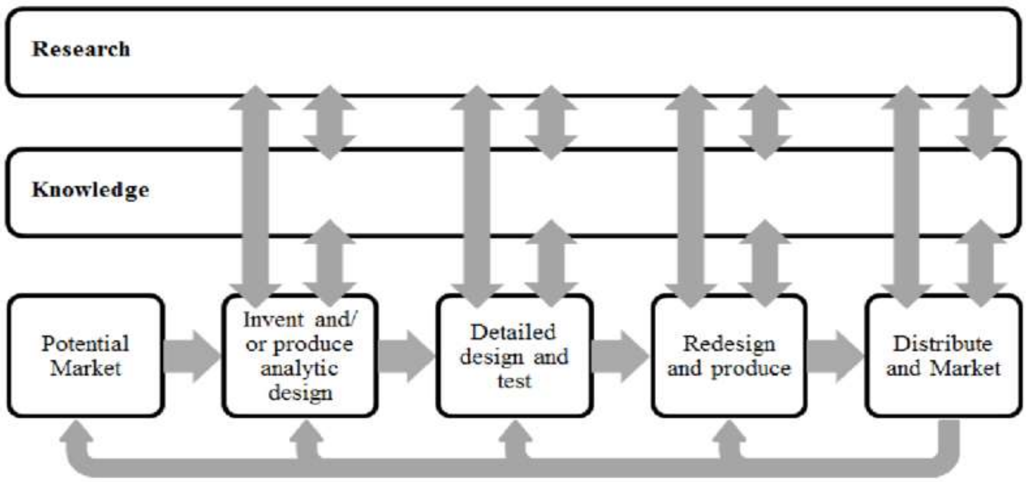


Figure 10. Chain link model (Kline & Rosenberg, 1986).

Another interactive model is the model of three spheres (science, industry and government) who called triple helix model. There is a relation between three spheres (industry, government, academia) (Etzkowitz, 2003; Leydesdorff & Etzkowitz, 1996) **(Figure 11)** and the innovation process depending on chasing relationships among three. In the first variant government is the head which checks the relationship between science and industry. In this form, human capital must be trained by universities. A second form is for each sector to operate separately, individually, based on laissez-faire conditions. That is, industry should operate separately from science and from the government. Academia performing research and educate, government verify smooth operation of the other and companies function by individuals and not by groups of people. In the third variant the interaction between the 3 elements form an environment where hybrid organizations can be created within it such as: incubators, scientific parks or companies.

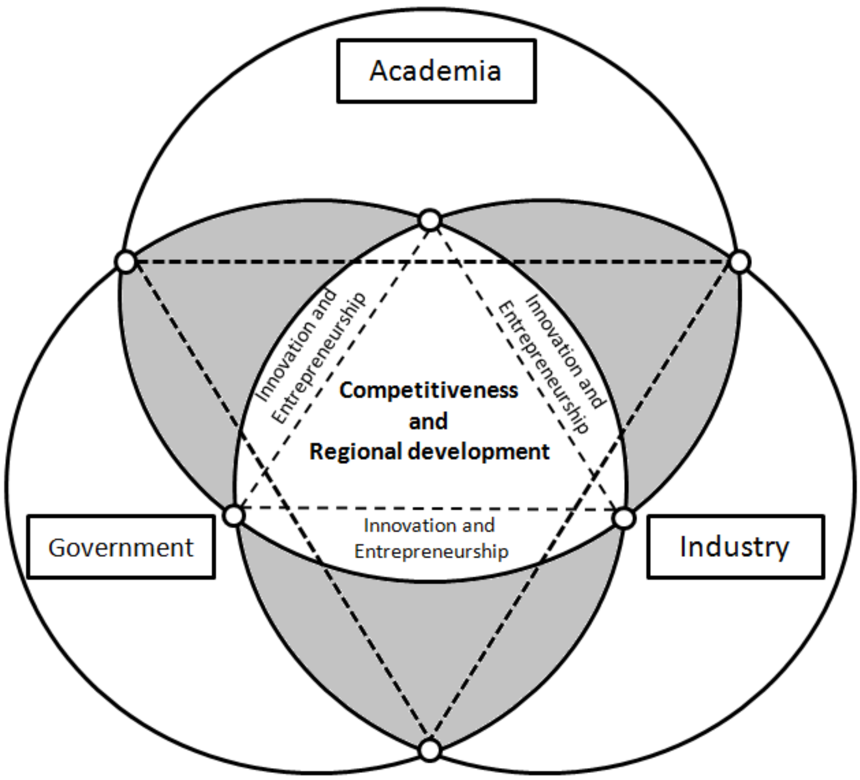


Figure 11. Triple helix model (Etzkowitz, 2003; Leydesdorff & Etzkowitz, 1996).

Another example of interactive models are the open and the closed models of innovation by Chesbrough (2003a; 2003b). In closed model of innovation (**Figure 12**), firms if they wanted to do something for their progress they had to do it by their selves. They had to staff with the best possible employees their laboratories and to create efficient ideas/products to advance directly to the market (Chesbrough, 2003a).

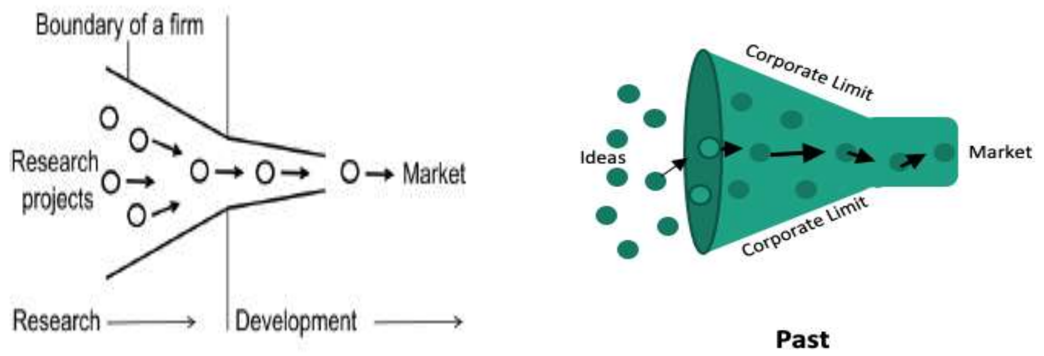


Figure 12. Closed model of innovation (Chesbrough, 2003a; 2003b)

In the open innovation model (**Figure 13**), firms can and should use 1) ideas who developed inside or outside the company and 2) internal and external paths of market (Chesbrough, 2003b). The companies share their ideas and therefore the innovations are much more. The patenting activitites are an advantage of open innovation model. A company which cannot afford for research, could buy invention or a patent from another company. Many companies (ie biotechnology, pharmacy etc.) they want to evolve and use the open innovation model.

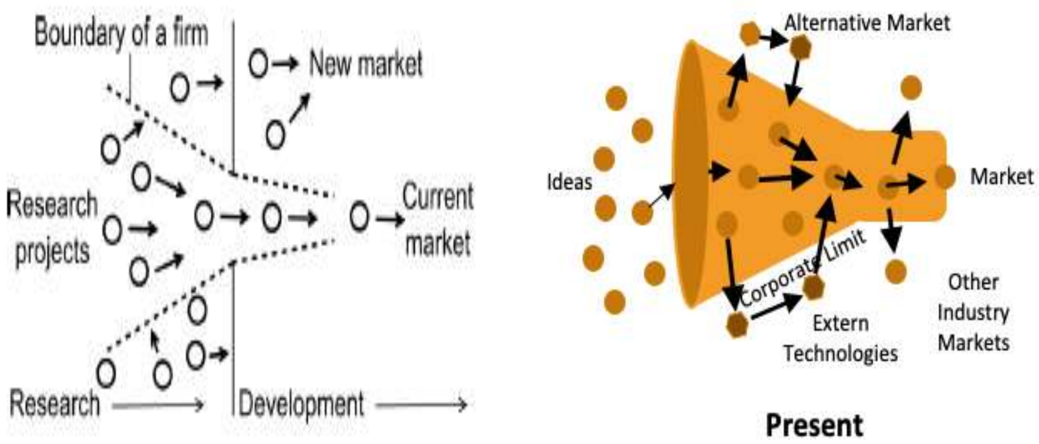
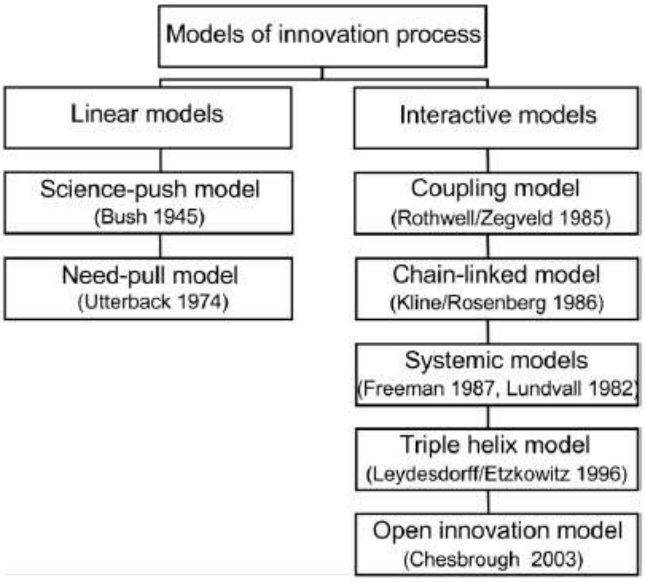


Figure 13. Open innovation model (Chesbrough, 2003b).

The system model argues that companies with low resources are capable to provide innovation if they try to have relationships with well established companies / organizations. The benefits are a lot (Hobday, 1991): 1) small businesses can maintain their "tech weapon" when other organizations support them, 2) The skills and learning accumulated in the network are beneficial for all participants, 3) the best educated employees provide their knowledge through network to the other firms, 4) overcome bottlenecks through combination of skill, 5) innovation comes faster and costs lesser, 6) small innovative companies can entry into industry through network and 7) individual firms are more flexible.

Each country has its own way to produce an innovation. The innovation of a each country depends of the country's size, the level of economics, the educational level and the historical tradition. The system of innovation of each country has to do with the different approaches to innovation and conduce to the improvement and transmission of new technologies. The strength of this model is twofold for small companies: firstly they know exactly their role and their place in innovation and secondly they cope with the competition and the pressure of the large companies. Stakeholder linkages refer to the relationships between 3 sectors (main manufacturers, providers, distributors) (Dodgson, 1993). In **Table 4** represented all the innovation models briefly.

Table 4. All innovation models (Dodgson, 1993; Freeman, 1991; Lundvall, 1992;).



Other types of innovation

The three horizons model (Baghai, Coley, & White, 1999). There are 3 horizons for 3 stages respectively. At each stage the goal is different depending on the requirements for the creation and development of each company. The initiatives taken in each phase vary in relation to the objective of each stage. Different strategies appear and are created in each level (**Figure 14**).

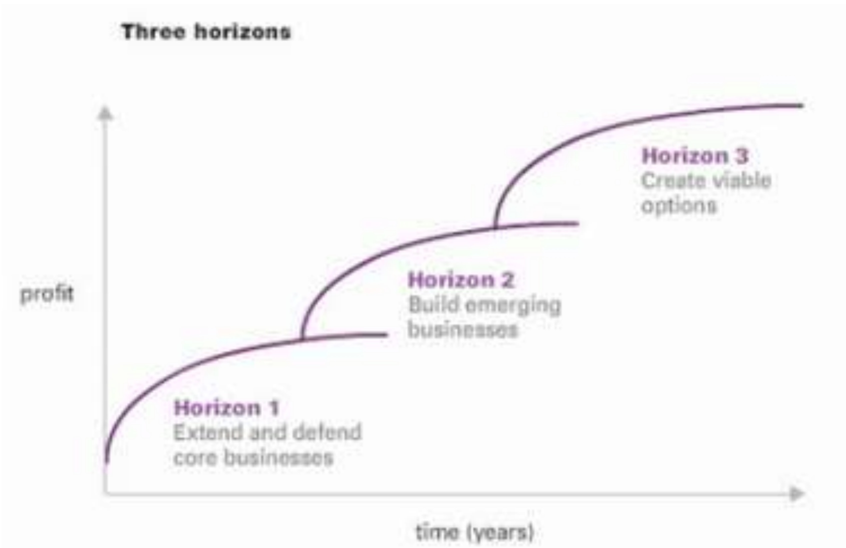


Figure 14. Three Horizons model (Baghai, Coley, & White, 1999).

Among companies there is another model of innovation, Innovation ambition matrix (Nagil & Tuff, 2012). Through this model firms can innovate in products (existing, adjacent and new). In the first stage the innovation is used in the areas that already exist in the company and tries to develop them. In the next stage, the products that have been improved in the first stage are called to face new challenges. In the last stage, new products are created where they are intended for new markets or new customers (**Figure 15**).

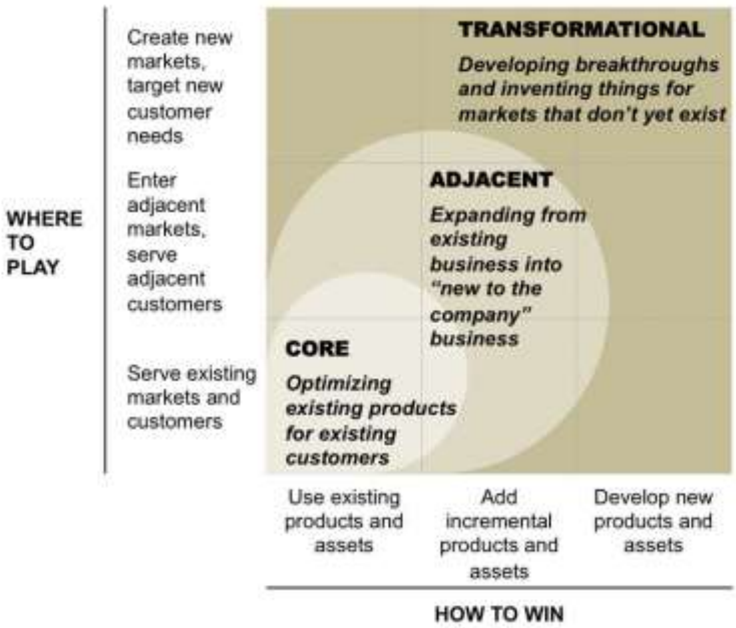


Figure 15. Innovation ambition matrix (Nagil & Tuff, 2012).

The innovation matrix has 4 forms of innovation that refer to technology (**Figure 16**) (Davila et al., 2006).

Incremental Innovation: in the products and processes that already exist in a company, small changes are caused where the aim is to improve them (e.g. shipping time of a product - same day or in 2 days instead of 5 days).

Architectural innovation (a.k.a. 'recombinative' innovation): a change in the whole formation of a product is caused by placing existing elements in new designs, in new ways (e.g. fast foods).

Disruptive Innovation: new value networks are entering the market that aim to disrupt existing traditional services. The use of Netflix has caused a huge change in the way consumers watch TV/movies.

Radical Innovation: By using new technologies and creating new industries, radical innovation tries to reach the buying public. It can direct consumers to the product it wishes to promote. It changes the way consumers buy a product and has the potential to change the way consumers think (Internet) (O'Connor & Ayers, 2005).

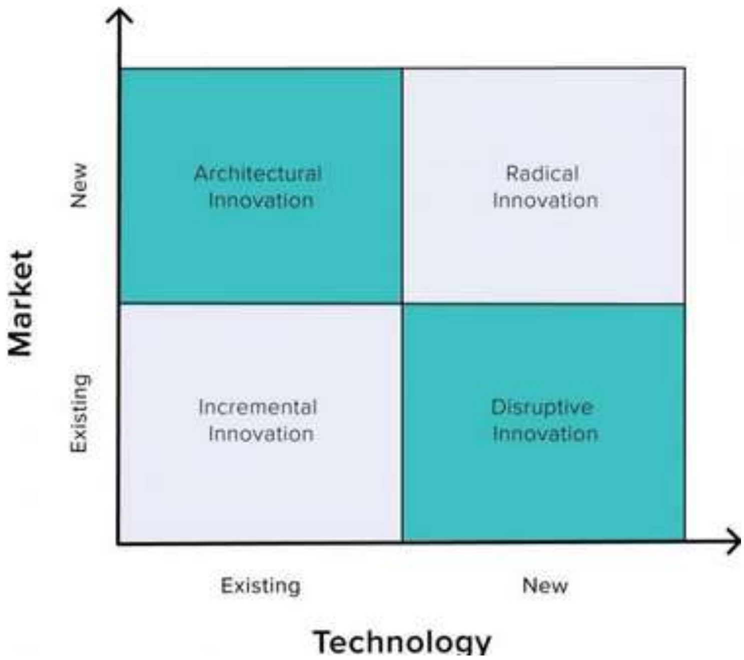
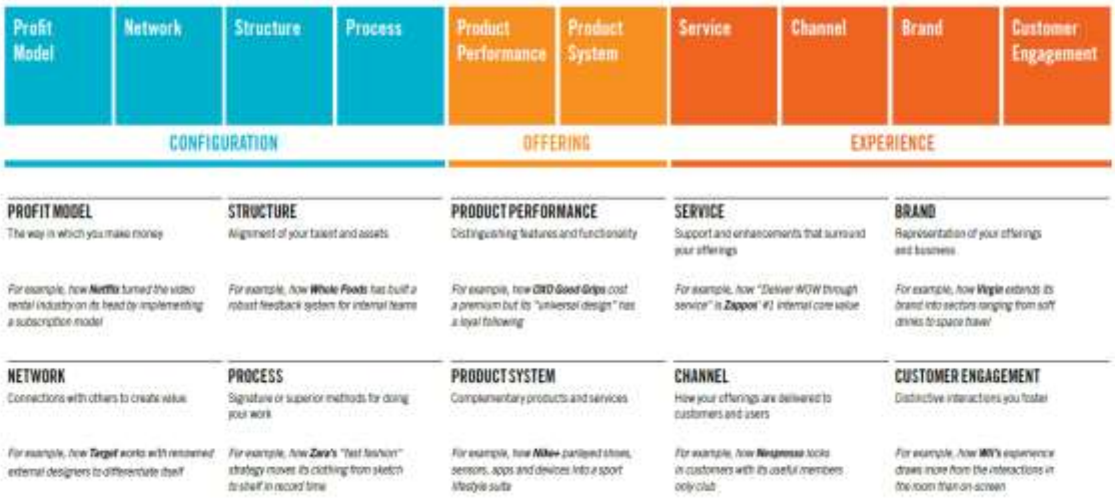


Figure 16. Innovation matrix (Davila et al., 2006).

Another model of innovation is Doblin Framework (**Table 5**) (Jasienski & Rzeznik, 2016). Particular model it is stated that a firm can be more competitive by making a small change in one of the 10 types. If there is a combination between the 10 types then innovation will be greater (new product development, better performance, better investments, advantage over other companies).

Table 5 . Doblin Framework (Jasienski & Rzeznik, 2016).



Technological Innovation

The term technology refers as that which provides the possibility for someone to devote his time to a particular energy and to have a qualitative and at the same time stable result. It is referred to in the literature as both «the art of science and the science of art» (Carayannis, 2001) or «the science of the arts» (von Braun, 1997). The term technology according to the literature is a path followed by manufacture, a key parameter that makes the company competitive, an applied science, a defined procedure, a basic skill, a dynamic ability, expertise, a task completion, a way to achieve a goal and a way to improve quality of life (Eris & Saatcioglu, 2006). Diwan (1991) states in his research that the foundations of technology are 1)market: how big or small the market is, 2)what standards you have/should/want to follow, 3) the innovation you want to implement, 4) the incentives to do so are high, 5)how much capital you have available to invest in all of the above.The effect of innovation can be managed to different areas.

As innovation in a technological process we can define 1) the choice of methods (whether new or advanced) that lead us to the manufacture or delivery of the products, 2) the changes that can be made to the equipment of a company or to the organization of the procreation of an output/service, 3) new knowledge. The purpose of technological innovation is either in production or delivery of new or improved products either in efficient production or delivery of existing products (Coccia, 2019a, 2019b; Coccia & Watts, 2020; Garsia & Calantone, 2002). Satisfying market needs is achieved through technological innovation. adopting new ideas, dealing with a company's problems, reshaping its goals with the purpose of always achieving an advantage, is done through technological innovation (Arthur, 2009; Coccia, 2019a; Coccia, 2021).

Technological innovation distinguished to:

- Introduce a product/output that is new or even if it is a product that has undergone great improvements and with respect to the main characteristics that it possesses. The software network it follows, the specifications it has, the technique it follows, how friendly it is with the buying public/user, the uses it was made for and the intangibles or
- Introduction to the company of a process which may be entirely new or significantly improved at all levels. Development may have taken place in the development procedure or in the distribution of the output or even in the method of delivery. The result that will result from the innovation should be significantly high/positive in relation to cost and volume of production, with the high quality of the product. All of these aim to fully support a product/service.

Additionally, technological innovation is caused by the creation of technological growth, by developments at each technological level, by the various combinations that can be made between already existing technology. By the term technological innovation we do not refer to changes that cause aesthetic interference (http://el.wikipedia.org).

Technological innovation in the production of a new significantly improved output can be done by using together with the original materials (ie raw materials) new technological methods. A combination of the old and the new. Over time, every company tries to use materials that are becoming more and more environmentally friendly. Biotechnology has entered our lives. In medicine, for example, new methods are constantly being used to diagnose a disease, etc. Additionally can be products to provide protection of the user or environment, method of measurement and control procedures and / or quality of products with sensors, incorporating "green" technologies in production / service and reducing energy consumption per unit of product / service (www.faethon.gr/index.php/aboyt-espa/141-2012-02-22-09-52-08).

Technological innovation in trade / wholesaling can be done by different ways. The range of goods is wide and within it there are green products (ecofriendly). Innovation can be produced through green products. At the same time additional services can be added to promote the product. Such as consulting services, or testing a product for some time, or providing some certifications, or being able to exchange goods electronically. in terms of production processes, there may also be the energy "footprint" or load identification and control methods. also it will facilitate the innovation to have a better result the existence of a channel where the producer can inform the customer directly and the customer can control the product at any time he wants. (eg optical disks) (http://www.faethon.gr/index.php/aboyt-espa/141-2012-02-22-09-52-08).

Technological innovation has been instrumental in making national growth and industries competitive with each other (Freeman, 1982; Porter, 1985). It is the driver of competitive success (Schilling, 2005), a process which generates information and knowledge (Nieto, 2004), plays a significant role in business success (Gaynor, 1996) and the progress of new outputs and procedures (Loveridge & Pitt, 1996). Tornazky and Fleischer (1990) report that technological innovation is a new development which helps people lead their dominance in the environment and to do something new. In particular, technological innovation is defined by Schumpeter (1934) any process responds significantly and with a positive sign to market demands. He states that this can be done by introducing 1) a new or improved output at the technologicy, 2) a new or improved procedure during the output of the product. This comes from the interaction that the combination of know-how (technological and scientific) and market conditions can cause.

Souitaris (2001) in his research he examined 105 Greek companies that had processed and wanted to evaluate whether they perceive the rate of innovation. He used a model which included 17 strategic factors (**Figure 17**). The factors are: financial resources, corporate strategy, decision making process, management attitudes, chief executive officer and perception of the dynamism of the business. He concluded that when a new technology plan included in the business strategy then the innovation rate is high. Also the experts of firms which have highly innovative rate were more risky and the needs of customers were perceived quicker and better.

In conclusion technological innovation has become the largest driving machine which drives society since the 80s. In the last 40 years there has been a continuous growth in all areas. For example, cars are changing, while they used gasoline, now there are diesel and electric cars. Everythink that runs on fuel evolves because electric motors are present. The flow of new products is also great in the medical sector, eg pharmaceutical products, technological equipment. Firms may have begun to exist as the realization of an idea but they continue to exist and assert their presence as active members of industrial development due to the successful use of technology and improved production procedures (**Table 6**) (Coccia, 2005a).

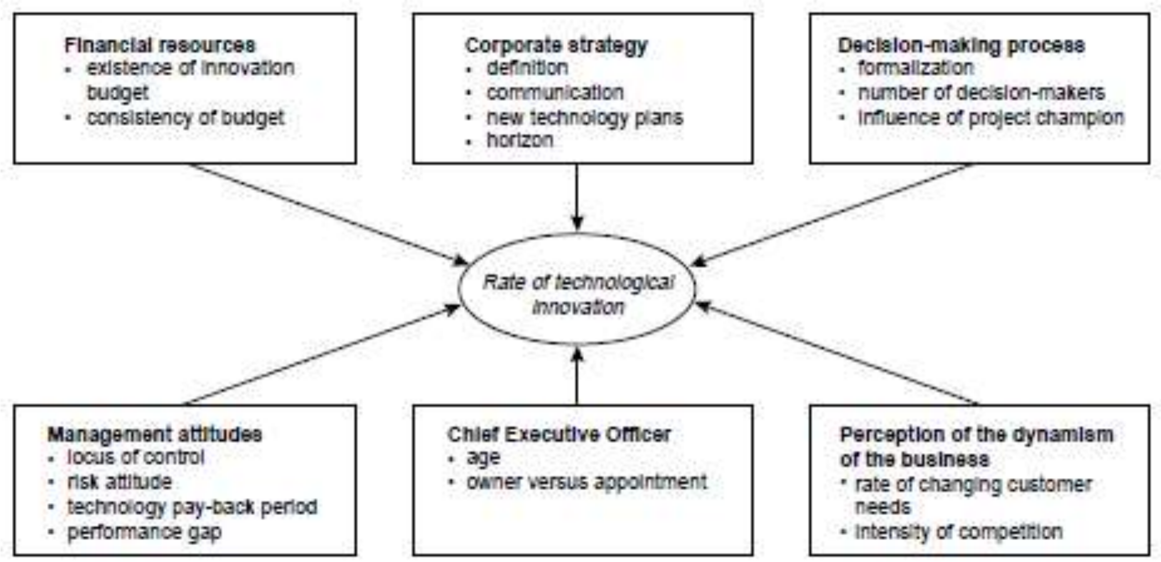


Figure 17. Strategic factors of innovation in Greek manufacturing firms (Souitaris, 2001).

Table 6. Types of technological innovation, the intensity of the impact and their results by example (Coccia, 2005a).

Innovation degree	Intensity of the impact of diffusion	Type of technological innovation	Examples
1	*Lightest*	Elementary, micro-incremental	From black to red rollerball
2	*Mild*	Incremental	Progressive lenses
3	*Moderate*	Minor radical innovation	Contact lenses
4	*Intermediate*	Major radical innovation that affects different industries	Laser
5	*Strong*	New technological paradigm	Television
6	*Very strong*	New technological system	Satellites
7	*Revolutionary*	Change of techno-economic paradigm	Electricity; information and communication technology; artificial intelligence

Models of Technological innovation - Development

As mentioned above, innovation is the new idea. Innovation of the technology is the procedure followed to implement the idea of trade (Subrahmanya, 2005) and no development of new products (Stock, Gresi & Fischer, 2002). As technology grows so grows technological innovation. New technologies are used from firms to be able to develop new products, to transform / improve existing products (Cooper & Schendel, 1976) to get as the best conditions to be competitive (Schilling, 2005), successful (Gaynor, 1996) and hence have economic benefits. In other words, technological innovation is the cause behind the growth and success of a company.

As innovation is classified in different categories (product, market, service, customer etc.), so technological innovation is classified in categories according with the kind of underlying knowledge (Schilling, 2005). The process of technological innovation must be managed carefully because without management the success of firm can’t be guaranteed (Harrison & Samson, 2002). A technological innovation procedure is described in **Figure 18** (Brown & Karagozoglu 1989, Flor & Oltra 2004, Fritsch & Lukas 2001, Hall & Martin 2005, Hollenstein 2003, Nieto 2004).

A system model of technological innovation enclosing five sectors: inputs, technological innovation procedure, production, resources and firm innovativeness (Brown & Karagozoglu 1989, Flor & Oltra 2004, Fritsch & Lukas 2001, Hall &

Martin 2005, Hollenstein 2003, Nieto 2004).The inputs include decision (organization structure, technology policy, values of top management) and performance (firm size, organization structure, management, information flows, human resources, culture and climate and organizational policies). Innovation is an important process input that a firm uses. The way of using technology and know-how are important components for the success of a firm. Creativity also takes a decisive role. Stimulation, the way propositions will be selected, the directions to be followed to solve any problems and the implementation of outputs are the steps that help to convert inputs into outputs, e.g. technology, know-how and innovation. Resources are a main sector on a firm's process and competiveness. The resources either originate from within the company either from outside. The resulting innovations has been classified into 5 categories according to Romijn and Albaladejo, (2002): 1) new innovations to the world, 2) innovations that are roughly the same as some that were used in other industries, 3) innovations same as some that were used in other industries but in the same company, 4) innovations that are roughly the same with some used in other companies, competitive and 5) no significant innovation.

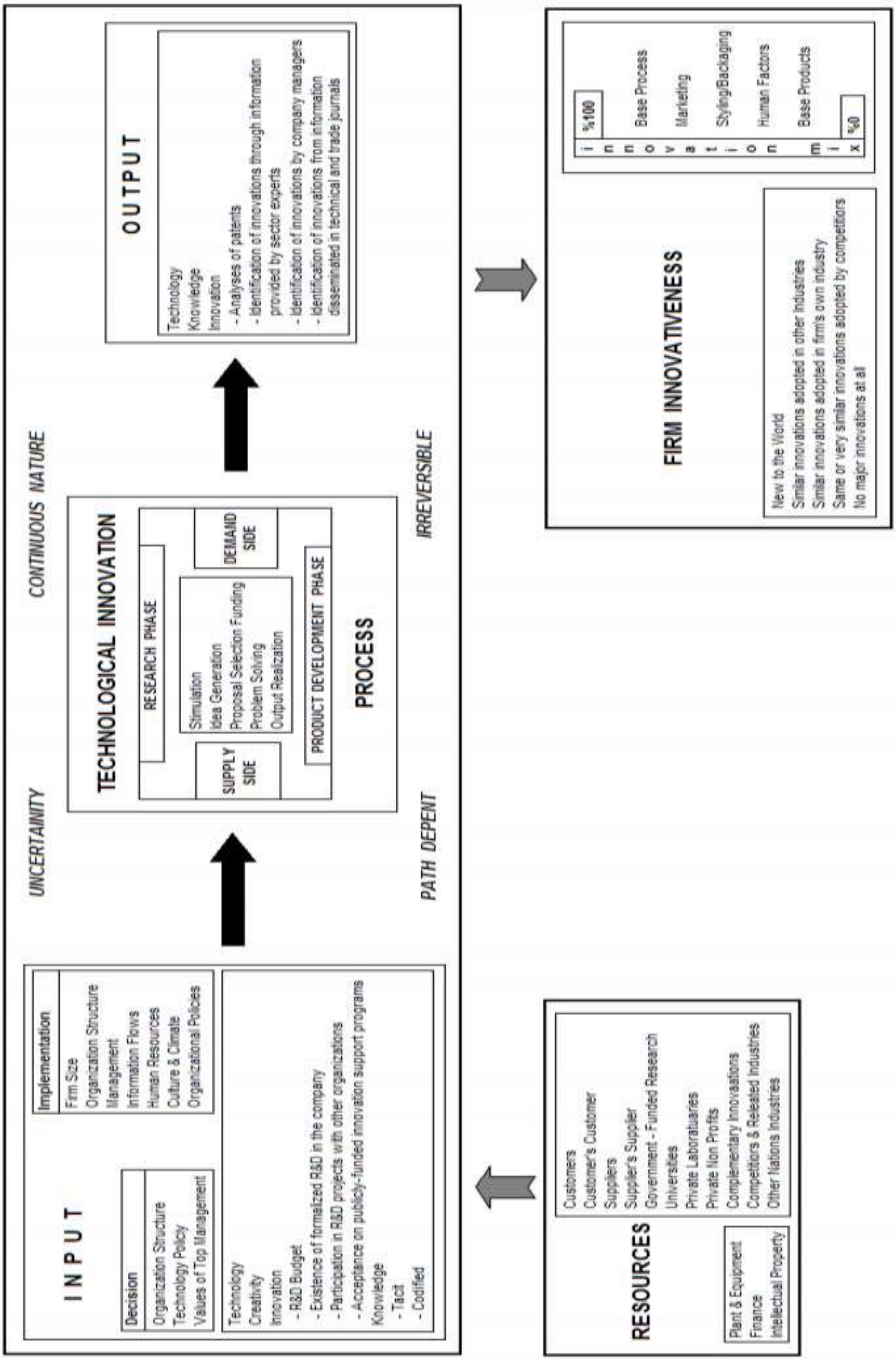


Figure 18. Technological innovation process (Brown & Karagozoglu 1989, Flor & Oltra 2004, Fritsch & Lukas 2001, Hall & Martin 2005, Hollenstein 2003, Nieto 2004).

A systems framework is developed for synthesizing technological innovation. Approaches to innovation systems are made through 2 types: 1) through decision input and 2) implementation input (**Table 7, 8**). These 2 types of input are thoroughly analyzed as well as the effects they cause on each other. The interactions of decision and implementation are examined in light of the goals of the innovation used by an organization. Then, as time passes, they are examined in terms of how the innovation evolves and unfolds through the organization. The growth of a new outputt/good/or service through technological innovation process illustrated in **Figure 19.**

Table 7. Type I simulation models of technological innovations (Feldman, 1991;Fudenberg & Kreps, 1993; Kalai & Lehrer, 1993; Manimon et al., 1990; Silverberg et al., 1988).

	Inference models	*Actions/strategies models*	*Realised performance models*
TYPE I models	• Bayesian updating of decision rules (e.g. Feldman, 1991; Kalai and Lehrer, 1993)	• 'evolutionary' games (e.g. Fudenberg and Kreps, 1993; Kaniovski and Young, 1994) • innovation-adoption models (e.g. Arthur, Ermoliev and Kaniovski 1987)	• learning-by-doing and using (e.g. Silverberg et al, 1988)
	Adaptive models in stationary environments (e.g. Marimon et al., 1990; Arifovic, 1994; Bullard and Duffy, 1998)		

Table 8. Type II simulation models of technological innovations (Lindgren, 1991; Nelson & Winter, 1982; Silverberg & Verspagen, 1994b).

	Open-ended search models	*Behavioural search models*	*Co-evolutionary learning models*
TYPE II models	(e.g. Nelson and Winter, 1982)	(e.g. Lindgren, 1991; Silverberg and Verspagen, 1994b; Dosi, Marengo, Bassanini and Valente, 1994)	(e.g. Windrum and Birchenhall, 1998)

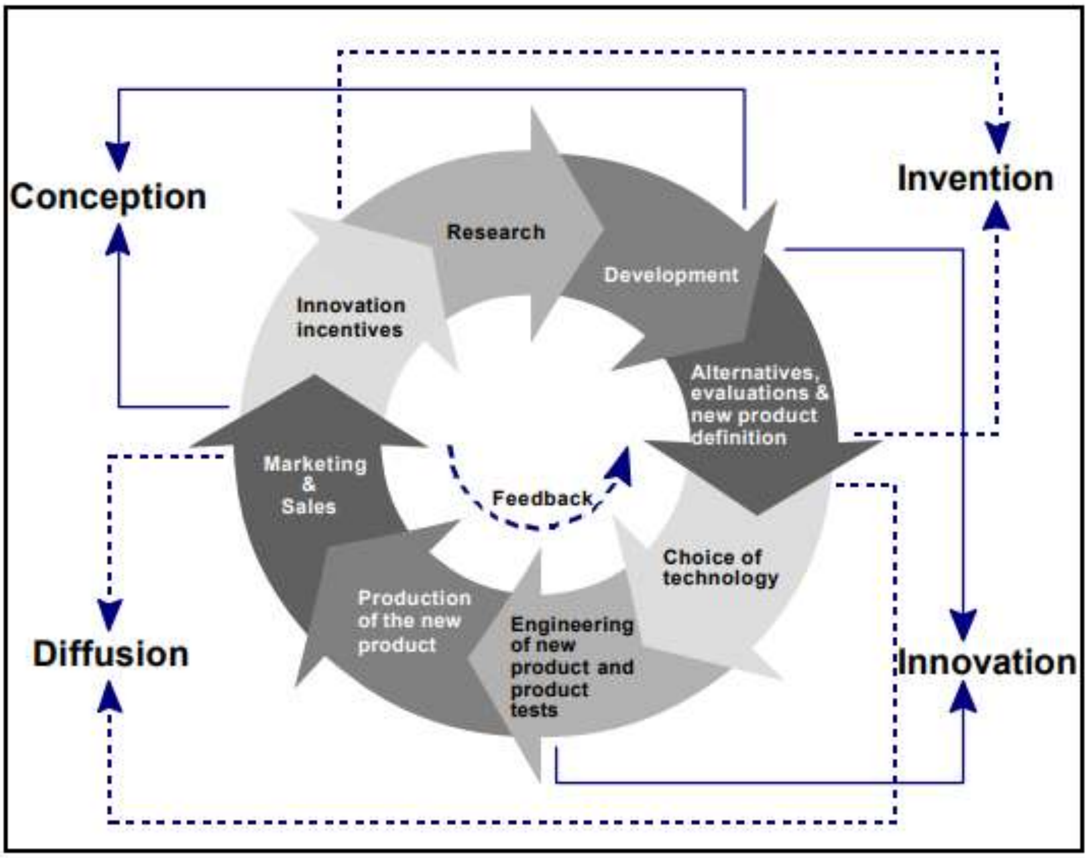


Figure 19. Technological innovation – development of a new product.

Science and Technology Parks in World

The concept of science parks sprang up in the late 1950s. Their bases were often nearby universities so they can interplay with them and their purpose was to furnish facilities and services to startup companies (Guy, 1996). The first science park was constituted in Stanford and then followed Cambridge Science Park in United Kingdom and Sophia Antipolis in France. By the mid-1990s there were 310 science parks in 15 countries in the European Union. On parks there were located 14.790 firms with 236.285 employees (Storey and Tether, 1998). According with International Association of Science Parks (IASP) Technological / Science Park is an initiative (www.iasp.ws):

- which have very important and strong relationships with Universities and Research Institutes,
- which have been constructed in such a way as to promote and enhance the creation and development of knowledge based industries that are housed on Science Parks facilities,
- that support technology transfer, entrepreneurship and local development and finally
- it is managed by a small team of specialists (www.iasp.ws).

On February 6th, IASP adopted official definition about Science Park:

"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; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities"

(IASP International Board, 6 February 2002). The expression “Science Park” may be replaced in this definition by the expressions “Technology Park”, “Technopole” or “Research Park

In 1984 managers founded the United Kingdom Science Association (UKSPA) and in 1985 it refers that Science Park:

- is a grouping of companies which are based on knowledge,
- has linked with Universities, Research Institutions, Higher Educational Institutes (HEI) and centers of Technology and
- encourages other companies to be developed with the support of the high technology and the other tenants. http://www.ukspa.org.uk , (Quintas, Wield, & Massey, 1992).

The crusial differentiation between Science Parks and Technology Parks is that the first one emphasized more in research activities and the second one are oriented more in productive activities. Both of them aimed to profit, job creation and development of region. All these parks can be categorized according to literature (Al-Mubaraki and Busler , 2011; Artz, & Kamalipour, 2003; March-Chorda, 1996; Link and Scott, 2003; NBIA, 2006; Radosevic and Myrzakhmet, 2009) to:

- Science Parks (oriented to research activities)
- Technology Parks (production of goods, rendering of services, industrial research)
- Incubators – Innovation Centers (new innovative firms)
- Technopoles (technology transfer)
- Technoparks (commercial term)

As maintained by International Association of Science Parks (IASP) a science park is an organization whose principal intention is to strengthen and give impetus to innovation and the desire of the knowledge-based enterprise/institution to be competitive (Link & Scott, 2006). Furthermore it stimulates to have continuous knowledge and development of technology between companies, market, R&D institutions, and universities.

As stated by United Nations Educational, Scientific and Cultural Organization (UNESCO) Science Park is a complex of economic and technological growth. Their main purpose is to provide and develop high technology to industry. Also UNESCO claims that science park has four main characteristics: 1) Research and Development promotion by universities and higher education organizations, 2) to make the creation of an innovation and its evolution easier, 3) communication among the universities (knowledge transfer) 4) offer capable environment for interplay (Link and Scott, 2006). The Association of University Related Research Parks (AURRP, 1997) refers that the research and science park should include three elements. The first one is real estate development; the second is technology transfer through an organizational program of specific activities and third partnerships. So science parks embrace technology parks with leaseholders which their occupation are applied research and growth (Link & Scott, 2003).

On the authority of United Kingdom Science Park Association (UKSPA, 1999) science parks have three underlying features: 1) foster innovative firms, 2) linking with knowledge centers (Fukugawa, 2006; Storey & Tether, 1998b) and 3) capable environment for development (Siegel, Westhead and Wright, 2003). So science parks contribution are in formation and increase of innovation firms either by the donation of universities, research institutes, higher education institutes or by "close" relationship between large companies and small innovative firms. Furthermore, Phan et al., (2004) state that technology parks can link the development of new jobs and income and that it is a very important means for interaction between the educational institutes and industry (Aerts et al., 2007; Chan & Lau, 2005; Marques et al., 2006;).

The definition that UKSPA gives for business incubators is that incubators provide significant help to early staged companies / organizations by doing their business plan and manage their finance (http://www.ukspa.org.uk/about_ukspa/faqs_about_ukspa). The definition of National Business Incubation Association is that incubation of companies is a procedure, dynamic, which helps the up growth of young companies. Also they provide technology support, office services, assistance in management and financial stuff (NBIA, http://www.nbia.org, accessed Feb. 8, 2004; Sofouli & Vonortas, 2007).

Incubator is an entrepreneurial firm, a dynamic community, a unit, a manufacturer where innovation generated within emerging organizations (Hackett & Dilts, 2004; Rice & Matthews, 1995). The innovation is measured by the outcomes of incubatee growth and by some indicators of success (Galunic & Eisenhardt, 2001; Hackett & Dilts, 2004). Business incubator is a space which is common for incubatees and it uses an invention system of monitoring and business assistance which is tiered.

Through this system they can control the resources, their links and the consequences of their failure and so they can facilitate the orderly development of enterprise (Hackett & Dilts, 2004).

Furthermore business incubators are a vehicle for development (economic growth, technologic growth, regional development, employment etc.) of companies and enterprises (Mian, 1996; Phan, et al., 2005) and for educational institutes and manufacture to interact (Link & Scott, 2003b; Vedovello, 1997; Aerts et al., 2007). Allen and Kahman (1985) report that incubators are the perfect tools to provide a positive environment for success to companies and mainly to small business. Smilor (1987) assert that incubators can help many enterprises with different specializations but eventually companies principally engaged in technology are tenants.

The first incubator established at New York, at Batavia Industrial Center (BIC) in 1959 (Aernoudt, 2004; Brown, Harell, and Regner, 2000; Lewis, 2002) in a huge building (850,000 ft2) which was separated in partitions (Adkins, 2001). The owner sublet the partitions to a variety of tenants who wanted business advices and financial consultancy (Adkins, 2001) and in 2011 counts 110 tenants who have 1000 employees (http://www.nadsme.sk). In 1960's there was slowly development and diffusion of incubation programs under the cover of the government, but there was also an interest of University City Science Center (UCSC) (Adkins, 2001). In 1970's there was a sprang up of the incubator-incubation project through the National Science Foundation's Innovation Centers Program where the evaluation and commercialization of some technological inventions legislated (Aernoudt, 2004; Bowman-Upton et al., 1989). In 1980's and 1990's the diffusion of incubation increased significantly because of:

1. Bayh-Dole Act (basic research funded)
2. U.S. legal system (recognition of innovation)
3. Profitable opportunities (commercialization of biomedical research).

During this time incubations were established in the rest of the world: Endinburgh – Herriot Watt University (1969), Cambridge University (1969), Australia (1972), Asia (1974), British Steel Industry in UK (1975), Scandinavia (1982), Germany – University of Berlin (1983), Sophia Antipolis Technology Park in France (1985), Latino-American (1986), Africa (1990). (Aernoudt, 2004; Source: Business Incubators within the Regional Development and Transfer of Technologies. INTEG Project. Initial presentation. 2005).

Various models of business incubators were developed which their goal were the support of new enterprises and the financial growth (http://www.nadsme.sk). Nowadays there are more than 60 national and international business incubation associations, which include 7000 incubators, exist all over the world (Monkman, 2010; http://www.nadsme.sk). In 2006 after a mensuration that was made by National Business Incubation Association, United Kingdom Business Incubation (UKBI) and European Committee estimate that there are 1400 incubators in North America generating 100000 jobs, 270 incubation environments in UK, 900 incubation environments in Western Europe generating 27000 new jobs per year (NBIA, 2007; EC, 2002). Only in Europe there are 1200 incubators generating 30000 grows new job per year (European Commission 2002), in Asian countries over 1100 incubators (Kim, 2003). From 2011 onwards the incubators come back to the fore, they are reborn. New experiments such as Virtual Business Incubators can "move", "transport" the large hubs of entrepreneurship (their resources), which led to the growth of the financial and other sizes of each company, to remote locations around the world (eg Silicon valley) (http://en.wikipedia.org).

The strategy of American incubators and innovation comprised of these parts: 1) investment in buildings of innovation, 2) the use of economic tools helps innovation (research, development and transfer), 3) promotion of competitive markets, 4) encouragement of entrepreneurship and 5) to break down innovations for national priorities (White House, 2010). Basic components of Technology incubators in US are shown in **Figure 20** (Wiggins & Gibson, 2003). As maintained by NBIA (2006) and others surveys (Hackett & Dilts 2004a; Hackett & Dilts 2004b; Lalkaka, Feng-Ling & Lalkala 2000; Lalkaka, 2002; Rice & Matthews 1995) incubators are used to accelerate / enhance / promote the healthy growth of entrepreneurial companies through these services: 1) suitable environment and space, 2) provision of suitable administrative organization, 3) suitable advice, 4) direction / training / network building and 5) access to finance.

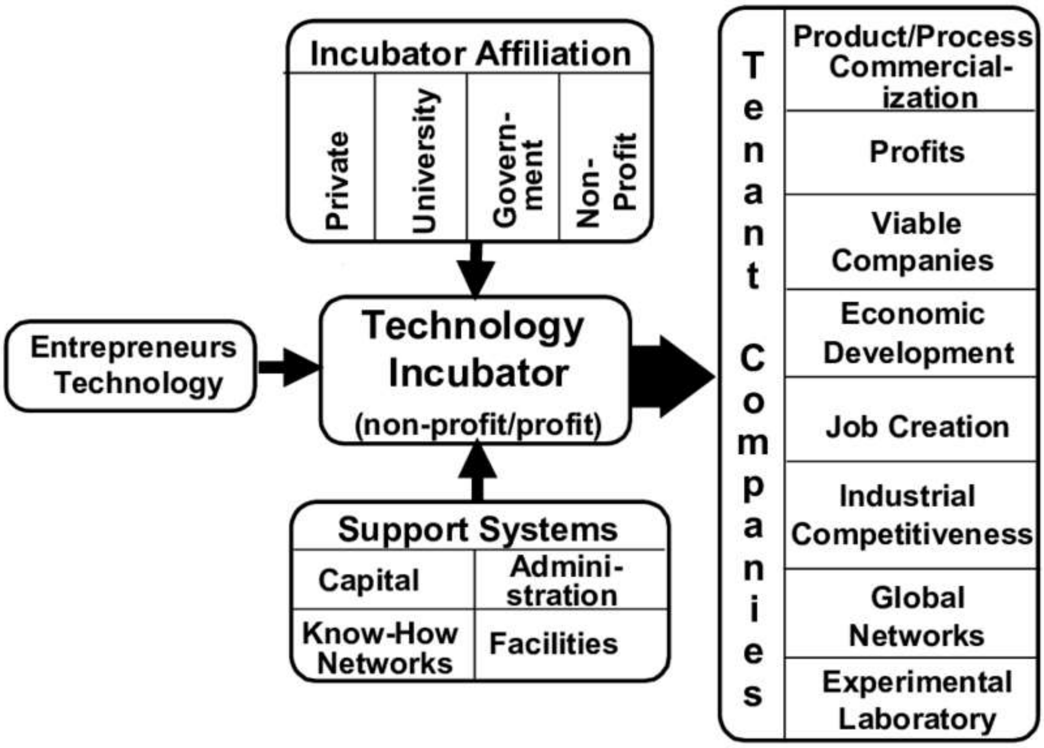


Figure 20. Basic components od technology incubators in USA (Wiggins & Gibson, 2003).

Al-Mubaraki and Busler (2011) reported the goals of business incubation: 1) development of economy, 2) innovation, 3) creation of business activities, 4) management of technology that has been used in other cases, 5) technology to be used commercially, 6) creation of new companies to be strengthened, 7) new jobs to be created, 8) maintenance of jobs that are sustainable, 9) stimulating business growth, 10) to have a low failure rate for new companies, 11) to create value for the interested departments, 12) empowering entrepreneurs and 13) creating a culture of entrepreneurship. Many attempts have been done for dissociation between incubators as a real estate effort or business development (Brooks, 1986; Smilor & Gill, 1986). In the literature appeared many classifications of incubators. According to Porter (1986) these five archetypes can be distiguished by three different dimensions: segment, geography and industry. Segment scope gives an opportunity to start up firms to be developed by different sources. For example university incubators prefer their student enterpreneurs and corporate incubators their employees. Two basic competitive factors for any kind of incubator are geographical and industry focuses. Peters et al. (2004) claimed that business incubator role is not only providing office facilities or training the staff and classified incubators in three types: 1) non-profit incubators, 2) for-profit incubators and 3) incubators linked to universities. The National Business Incubation Association (NBIA) report that for profit incubators ulcerate the most attention. Non-profit incubation is not popular to internet companies / organizations and incubators who are linked to universities affiliated with business models who been used by universities. But according to Hackett and Dilts (2004) non profit incubators are better models for the distribution of community financial resources. Thus, the community commits to its economic policy over time which advanced of entrepreneurship.

Carayannis and von Zedtwitz (2005) reported an overarching incubator model which consisted of five defining services: provision of office space, office secretarial support is granted, they are given the opportunity to have access to financial funds, support for the start of the company and access to networks. In 2003 Von Zedwitz and in 2005 Von Zedwitz and Grimaldi refers a five type classification of incubators:

1) regional business incubators,
2) university incubators,
3) virtual incubators,
4) independent commercial incubators, and
5) company-internal incubators.

Regional business incubators and university incubators are non-profit objectives, virtual incubators and independent commercial incubators are for-profit objectives and the last one is connected with multinational companies.

Incubators provide to enterprises appropriate infrastructures, facilities, equipment, procedures, environment, assistance in business plan, technical and managerial expertise for start up (Peters, et al., 2004; Von Zedtwitz & Grimaldi, 2006; EC, 2002). Some other typical services are: training (Aerts, Matthyssens & Vandenbempt, 2007), networking (Bollingtoft & Ulhoi, 2005; McAdam & McAdam, 2008), coaching (Peters et al., 2004), capital (Sofouli & Vonortas, 2007) and virtual support (Durao Sarmento, Varela & Maltez, 2005).

Differentiation between incubators exists because of their service offering (Hansen et al., 2000). In the literature there are five services that are mentioned:

1. office space etc.
2. secretarial support services (secretarial / mail etc)

3. access to resources

4. advisory support

5. Networking services

Business incubation performance achieved when 1) the incubate is growing profitable, 2)is growing and goes on to be profitable, 3) is only marginary profitable, 4) the operations inside the incubation has been completed while the businesses were still in the incubator and thus any losses were minimized and 5) in the same situation with number 4 but the losses were large (Hackett & Dilts, 2004).

Business incubations outcomes as reported by Al-Mubaraki and Busler (2012) must include creation of job, wealth, business, economic model and entrepreneurial climate.The contribution of manager – incubate dyad is also an important aspect of the success of the incubator, because a manager modulate an incubator to “fit” with the environment (Rice, 2002). Types of business incubators, their characteristics and their success are listed in the **Table 9**.

Table 9. Types of business Incubators (Al-Mubaraki & Busler, 2012; Hackett & Dilts, 2004; Rice, 2002).

Incubator Model	Formal vs. Virtual	Niche	Characteristics of Tenants/Graduates	Success Variables
Public (non-profit)	**Formal**	• Manufacturing • Light Manufacturing • Transportation • Retail/Services • Administrative • Tourism • Agro-business • Rural incubators • Mixed used • Empowerment Incubators	• Selection criteria focuses on potential of job creation • Mainly tenants from the local community • Graduates are usually micro-businesses (with less than 5 employees) • Not always growth oriented • Tenants remain in the local area after graduating	• Prioritize short stays (not more than 2 years) • The higher the turnover the better (more jobs created locally) • Management should focus on public relations, partnerships with local high schools and trade schools • Financial Responsibility is a must • Provide basic business assistance, counseling, training, • Workshops and presentations from business consultants • Willingness of the community to contribute
Private (non-profit)	**Formal**	• Depending on the interest/orientation of the corporation behind the project • Often correlates to the regional industrial cluster	• Selection criteria considers job creation potential and creation of linkages with larger firms • New and established businesses • A mix of firms belonging to one industry sector	• Take advantage of tax incentives to redevelop old buildings (revitalization strategy) • Dependant on rents and other services for financial balance • Manager(s) familiar with industry • Presence of entrepreneurial climate
Private (for-profit)	**Formal & Virtual**	• Telecommunication • Biotechnology • Nuclear • Engineering consulting • Human resource consulting • Food processing • Financial services • 'Urban incubators'	• Technology based firms • The tenants exemplify a mix of knowledge intensive enterprises • Highly educated in specific field • Often more established businesses get through the selection criteria	• Presence of venture capital and other alternative financing options (business angels) • Proximity to high-tech clusters • Availability of highly-skilled labour • Manager/President is expert in one of the technological fields • Manager pursues the success of the tenant firms with a venture capitalist attitude (performs due diligence) • Financial gain from IPO of the graduates • Provide advice on global exporting, finances, industry-specific marketing • Industry funded

Incubator Model	Formal vs. Virtual	Niche	Characteristics of Tenants/Graduates	Success Variables
Educational	Formal & Virtual	• Telecommunication • Biotechnology • Medicine • Pharmaceutics • New materials • Avionics • Defense/military • 'technology incubators'	• Researchers and highly educated professionals • Science based and knowledge intensive firms • Large portion of firm's costs go to R&D	• Access to R&D grants • Presence of local entrepreneurial base • Presence of venture capital and business angels • Collaboration among University and industry • Support from other business dev offices • Larger firms in vicinity pertaining to the industry sector • Financial success dependent on university funding

Technopole is a center within which technology (high-tech) manufacturing takes place and includes information-based quaternary industry (Artz, & Kamalipour, 2003). The quaternary industry is a combination of sharing and generating information, R&D, technology transfer, communication technologies, business planning (financial, management, etc.), consultation and other knowledge based services (Busch, 1967; Selstad, 1990). All these may be developed by initiative either of government, either of private sector or by co-operation of both. Large and small companies settle down in technopoles under the condition that there will be networking between them.

Radosevic and Myrzakhmet (2009) and Link and Scott (2003) claims that Techno-parks as instrument of innovation promotion boost economic growth in new startup companies and especially for new technology-based tenant firms (NTBFs). It was considered that "close" contact among tenants and innovators would help to solution to initial problems, such as infrastructural, financial, faster growth and survive.

March-Chorda (1996) report that the definition of Technopoles by the Programme on Technopoles Research and Development in France, is that Technopoles in their territorial area can settle down the four following groups:

- Higher educational institutions (HEI)
- Research institutions
- Companies (small sized and medium sized - SMEs) which have the edge on technology
- Institutions and agencies which their purpose is innovation, creativity and development.

So Technopoles are an agglomeration which includes activities that are structured highly innovative.

After a personal interview with March-Chorda (1996) Reverdy in 1992, who is an expert in the study of university – industry relationships, expressed the opinion that Technopoles have a lot of competences for R&D, technology transfer and diffusion of it. In the same year in another interview with Quessada, the managing director of Angers Technopoles, concluded that the tenants of Technopoles has to be private companies, the new firms must be supported so they can be creative, the collaboration between entrepreneurs in the sectors of technology, communication and exchange of information is necessary.

There are five differences between Technopoles in France and Science Parks in UK:

- Inside the Technopoles can established one or more Science / Technological Parks
- The size of Technopoles is larger than Science Parks
- The goals of Technopoles are wider than those of Science Park in the sectors of collaboration and exchange of competences and skills.
- The main and most important direction of Technopoles is the emphasis on the network as it creates strong ties between actors (economic and social) and with the outside world.

History and differentiations

The Science and Technology Park (STEP) according Saitakis (2006) is an institution that developed after the 2nd World War, initially in the United States and then in Europe and the world. The first major technological parks were created in the 50's at Stanford (1951) and North Carolina (Research Triangle Park, 1959). Then followed the Boston due to the presence of MIT and other renowned research institutions and large enterprises as well as other areas of the U.S. (Texas, New York, etc.) In Europe, the 1^{rst} Technology Park appeared in the late 60’s in the UK (Cranfield, 1968) while in the 70's created the Science Park (SP) in Cambridge (1972) and Edinburgh (1974). In the early 70's up to the Cote d'Azur (France) Technopolis largest in Europe, known as Sofia-Antipolis. Currently hosts more than 1300 companies, 4 universities and over 25000 employees. During the 80's, began the creating of Science Parks in other European countries, firstly in Germany and then to Austria (Stenberg, Behrendt, Seeger & Tamasy, 1996). After the decade of 90’s, began the development of Science Park in India and China. Nowadays there are 600+ Science Parks all over the world.

In United Kingdom the British governments supported the growth of science parks. This initiation was also linked by local authorities, universities, educational institutes and financial institutions (Siegel, et al., 2003). The first science park was founded in 1972 in Cambridge and Heriot – Watt. By the 1999 there were 46 fully operational science parks (USKPA, 1999). UKSPA (1999) refers that science parks have three fundamental characteristics: 1) to help design and development of innovative firms, 2) to provide suitable environment for interaction between large and small companies and 3) to encourage and upgrade knowledge center relationships with official and business linkages. The science park’s strategy can be created, according to Carter (1989), either by a university (lead and foundation), either by the collaboration of universities – HEI’s – private investors or by \ative venture strategy. The reinforcement of universities and higher educational institutes was due to ensure that science parks research would be more relevant to industry so there would be more job opportunities for HEI employees and students (Siegel, Westhead and Wright, 2003). All the firms those are located inside the science park attempt to commercialize biotechnology, telecommunications, computer science, energy and industrial applications.

The government and especially universities of the United States have a crucial role in establishment, growth, support and funding of incubators and research science parks (Al-Mubaraki & Busler, 2010; Chandra & Fealey, 2009). In 1951 the first university science park was established. Until 1983 there were two or three university science parks in United States, from 1984 they developed rapidly until 1996 and then decreased (Link & Scott, 2003; 2006). If the territory where the research science park is established next to a university campus or simply located next to a university then the university can advice on and take place on the strategic direction of the science parks development. Also more than one university can be affiliated with a research science park. If the territory where the research science park is established is off campus and the land is a private property of someone else, there still elements to suggest that there is an administrative relationship between universities and parks (Link & Scott, 2006). In the US there are some types which are based on six dimensions. These dimensions are innovation, culture, incubators services, strategic focus, entrepreneurship and incubators funding (Chandra & Fealey, 2009; Ekholm & Haapasalo, 2002). The innovation is very active, the culture is risk taking, the incubators services are tangible and intangible, the incubators resources comes from government, business and universities, the entrepreneurship is very active and the strategic focus is on transfer technology and economic development (Al-Mubaraki & Busler, 2012).

In Brazil the government contributes to support business incubators through universities and industries (Almeida, 2005). The main goals of Brazilian government are the technology and social development. The models of Brazil constitute by the same six dimensions of United States models (innovation, culture, incubators services, strategic focus, entrepreneurship and incubators funding). The differentiation between incubations of United States and Brazil is in the dimension of strategic focus where Brazil except of transfer technology foster entrepreneurship and creates jobs **(Table 10**) (**Figure 21**) (Al-Mubaraki & Busler, 2012). Furthermore, as reported by Chandra and Fearley (2009) and by Chandra and Aruna (2007) the Brazilian incubators provide a unique service and innovative climate for growth, development and consultancy of new businesses.

Table 10. The differentiation between incubations of United States and Brazil (Al-Mubaraki & Busler, 2012).

Dimension	US	Brazil
1) 2) Strategic focus	1- Mixed type 2- Transfer technology 3- Economic development	1-Mixed type 2-Foster entrepreneurship 3-Jobs creation 4-Transfer of technology
3) Entrepreneurship	Very active	Very active
3) Incubators funding	1- Government 2- Business 3- Universities	1- Government 2- Business 3- Universities
4) Incubators services	Tangible and intangible	Tangible and intangible (weak)
5) Culture	Risk-taking	Risk-averse
6) Innovation	Very active	Very active

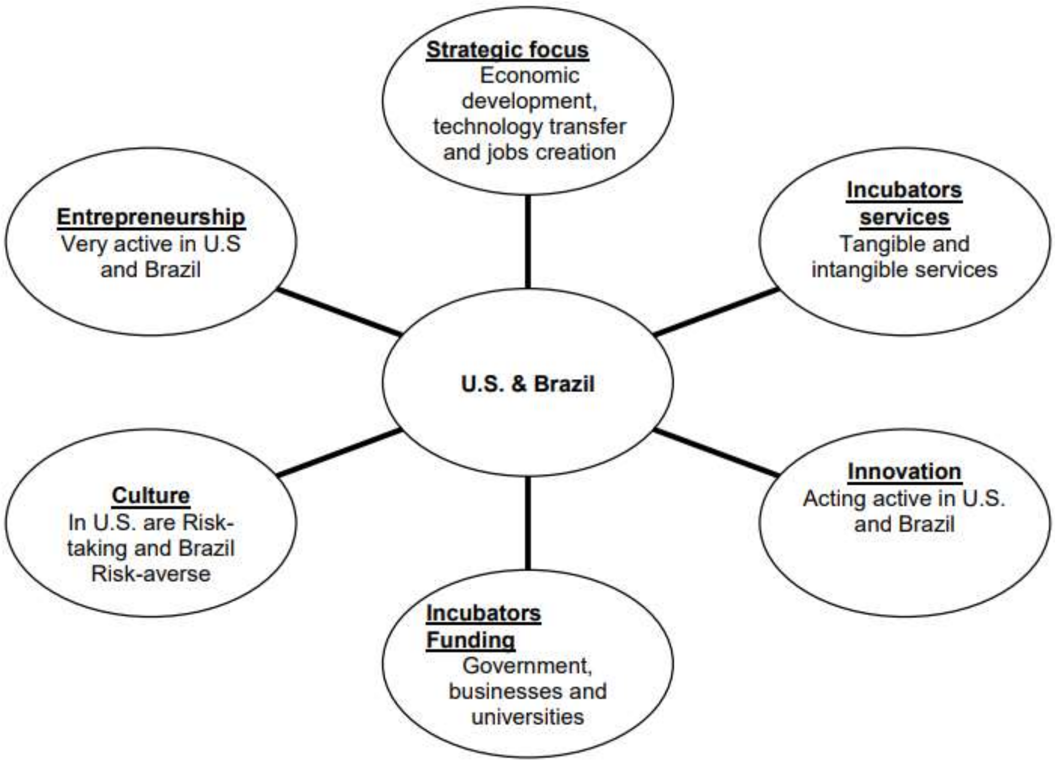


Figure 21. Incubation models of USA and Brazil. Their 6 key dimensions (Al-Mubaraki & Busler, 2012).

In Germany there are much more innovation centers than science parks and according to UKSPA the innovation centers subject to science parks. In 1983 the University of Berlin established the BIG (Belinen Innovations und Grunderzentrum) and after that in region of Nordhein-Westfalen in West Germany was established ZENIT (Zentrum fur innovation und technik) (Aernoudt, 2004). The purpose of innovation centers is to equip facilities and know-how in firms which want to growth new high technology outputs and services. The study of Schwartz and Hornych (2008) reported that access to specialized equipment and facilities plays an important role in how companies dealing with information, knowledge and know-how will survive. It is notable that the networking is restricted into the incubator because the incubators in German are sector-specific incubators and there is big competition between them. A year after, another study analyzed the survival rate of 352 companies after their graduation from 5 German business incubations (Schwartz, 2009) and they found that the performance of a company when it is hosted into an incubatior is a crucial index for the future course of the company. Also they noticed that after the graduation there was an immediate negative effect to the ability of a company to be sustainable.

At the end of 1960's until 1984 was established in France, northwest of Antibes and southwest of Nice, the first Technopoles called Sophia-Antipolis. The challenge of Sophia Antipolis was to create a sense of community. The main goal was to build strong relationships between people from different intellectual horizons. The exchange of ideas, skills, competences and technology would turn out on innovation and so an international environment was about to be born.

There are two models of Technopoles: the first one called "pole model" and the second "agglomeration model". The "pole model" is focusing mainly on property and therefore has to invest in land and buildings. The promoters want the Technopole to become a centre of technological excellence by the strong financial support of sponsors. In the "agglomeration model" the goal is the stimulation of economy of the local area and surroundings. The set up of technological poles become by this model who wants to be the supervisor of advanced companies, research institutes and technical bodies. Nowadays the enterprises that are hosted are in the fields of biotechnology, pharmacology, electronics, higher educational institution and computing. Also the European headquartes of W3C (World Wide Web) is located there (http://www.sophia-antipolis.org).

The “Foundation Sophia Antipolis” recognized as a public utility, modified its status on 2006 and become "Foundation of sheltering research". So now it has to create research projects which has to be founded by public or private sector. In the world there are only three foundations which hold this title:

- “la Fondation de France”,
- “la Fondation de Recherche Médicale” et
- la “Fondation Sophia Antipolis” (http://www.sophia-antipolis.org).

The Science Park in Russia was founded in 1990 in Tomsk and the second in St. Petersburg (Electrical Engineering University, TEEU) where it was given 20% of the R&D money (Kihlgren, 2003; Lesage & Bayou, 1993). There was a stage program called “Technology Parks and Innovations” to maintain the growth of Science parks which are non-profit organizations. That means that the profits must be reinvestment into the company and so in that way they could developed their infrastructure and services. The eccentricity of technology parks in Russia is that some companies are located close to university or close to other institutes which are releated to the technology parks. The development of new ventures and organizations based either to universities either to the state.

According to Schukshunov and Variukha (1997) there are ten features of Russian technology parks:

- the subsidy received by each tenant can be from three to twenty-one funders
- the 93% of companies hosted at the technological park are individual enterprises
- companies that can accommodate up to twenty
- companies can mainly collaborate with universities, local authorities, research centers and scientific and other industrial enterprises.
- companies that have their own facilities is only 15 %, while the remaining lease
- all provide office premises

- provide assistance to the financial management, marketing and organization of the company in 60 % of companies that host
- incubator is provided to 44 %
- 20 % of technology parks manage to satisfy the companies that host with the premises that provide
- influence on the surrounding area as far as the social / technological / financial development has been succeeded by only 24%.

Science parks in Russia, especially in St. Petersburg's area, are more powerful in providing effective financial advice in relation to the management. Also transfer of technology was little because high technology products had limited demand.

In the Nordic countries were constituted a lot of innovation centers where the media and high tech firms were established and benefited by the strong bonds between universities and industries. As reported by IASP (2007) there are 14 science parks in Sweden and 7 in Finland. Main areas of activity of companies established in science and technology parks of Sweden are biochemistry, biotechnology, pharmaceutical, health sciences and food technology and of Finland's are automation, biochemistry, computer science, electronics. Many researchers examined incubators in Finland (Abetti, 2004; Autio & Klofsten, 1998; Hytti and Maki, 2007; Totterman & Sten, 2005). Autio and Klofsten (1998) analyzed the management policies of 2 incubators and concluded that success is due to their inclusion in the local environment. For this reason, the generalization of these results, in particular the adoption of policies should be done with caution and great attention. Abetti (2004) examined 16 incubators in Helsinki in some sections: survival rate, if they creat new jobs and their sales policy. Although the goverment funding was little incubators tried and succeed to creat jobs for skilled personnel. These positions helped to bring the survival rate to 95% and increased sales by 160% per year. Additionally, Totterman and Sten (2005) concluded that incubators, except from the provision of infrastructure and capital to businesses should provide strategic business networking. Furthermore, Hytti and Maki, (2007) claims that the incubation period should be as good as possible and depending on the companies can be flexible. In Holland, in 1984, was established the science park of Groningen into the university campus. The main goal of Groningen was to promote commercialization of new products, new businesses, and support for young entrepreneurs from the park such as professors, students, alumni and administrative staff. In 1985 were builded up two innovation poles: BTC (Bedrifs Technologisch Centrum Twente BV) and Defit Innovation Center. As reported by Nijkamp, Oirschot and Oosterman (1992) the innovation poles didn't supported by government's foundation at all. In Amsterdam created a great Technopolis, which was not planned by the government and still showed massive growth over five years. The reasons for the growth are mainly the international airport, the international scientific climate and its proximity to Belgium. On the other hand the government of Belgium reenforced creating science parks. Every university of the country ceded area to one Science Park and simultaneously could be linked with more than one Science Park. In 2001, Thierstein and Wilhelm analyzed nine incubators in Switzerland. They concluded that incubators are privately owned in most cases and they have profit on a full cost basis. Furthermore the incubator settlement (ITI) centers has not been used for regional economic development.

In Italy the form of interconnection between research and technology and the organization of technological development and transfer of technology supported by private initiatives and local development agencies. Seferzis (1993) says that in the science park of Bari participate universities, research centers, private companies and financial institutions. Its aim is to contribute to the integration of technology, investigate the market for new outputs and services, promote new production systems and administrative and organizational restructuring of private enterprises and local government. Especially in the industrial triangle of Torino-Ivrea-Navarre there is a parallel involvement of private companies, banks, research institutes, government bodies and trade unions which are designed to accelerate the modernization and creation of new units of high capacity (Σεφερτζής, 1993). The Science Parks in Spain have as their main aim to emerge as poles for local development. This can be achieved through acceleration of technological modernization of traditional productive activities and attracting companies oriented to new technologies but no in new industries. The Science Parks of Barcelona and Madrid oriented in technology transfer in the textile industry, the Park of Valencia oriented in technology transfer to SMEs in traditional industries and the Park of Andalusia oriented in software, computer science and automation (Gamella, 1988).

Asian countries and especially India have adopted the park model and 4 of them are members of the International Association of Science Parks (IASP 2007). These Indian science parks specialized either in information technology (IT), either in biotechnology (biotech) or within a sector (ie. Marine Biotech Park in Vishakapatnam - biotech products using marine organisms) and there are not linked to any university (Vaidyanathan, 2008). The differences among science parks of west and Indian are that Indian science parks are mostly export oriented whereas the others are focused on Reaserch & Development. The software parks have spread up in all regions of India with the government being a catalyst factor which was encouraging collaboration among private, public and foreign sector (Vaidyanathan, 2008).

In China the first science park was founded in 1985 by the collaboration of government and the Chinese Academy of Science (Walcott, 2002). In park location Shenzhen there are industries which provide electrical information, new materials and biotechnology and cooperate with some countries (Japan, US., Holland, England and France). In Zhangjiang the type of industries are pharmaceutical, electronics, information technologies (IT), silicon-chip manufactures, in Suzhou are electronics, light industrial and food, biopharmaceutical, chemical and in Xian are biomedical, engineering, software, optomechanic and electronics (Suzhou Industrial Park Administrative Committee [SIPAC] 2000).

In Japan the establishment of science parks began in 1985 by the management of local authorities (Fukugawa, 2006). Their main role was to develop the region economy through innovation which was mostly inside the small local firms. The survey of Tokyo Institute of Technology (TIT) (1998) shows that there are 158 science park in Japan and the two thirds of them are linked with a HEI or have a partnership with a HEI or house a HEI. The other one third promote new technology based firms to establish HEI linkage, they act as a “firm hotel” (Lofsten & Lindelof, 2002).

In Taiwan the government established the first science park in 1980 in Hsinchu city (Chen, Wu and Lin, 2006; Lai & Shyu, 2005). Technology park has played a catalytic position in the growth of high technology. Appropriate facilities in combination with the well trained and qualified staff, adequate incentives, providing technology and the full range of office led to an increase in companies, sales and hiring. In 1999, 292 high-tech companies located in Hsinchu Science Park, 82.000 employees worked there, the annual sales were about NT 650 billion and more than 40 companies use and follow ISO9000. Nowadays Taiwan through Science Park, which beckon high-tech investors, has become the third largest exporter in computers (Chen, Wu and Lin, 2006; Hsu & Chiang, 2001; Lai & Shyu, 2005; Lee & Yang, 2000).

Western Australian Technology Park (WATP) was established in 1985, near the center of Perth,. Although WATP is built next to the area's universities, the influence of the university is not appropriate and according to the literature is an initiative of the government. In an evaluation carried out in 1989, the results showed that there was no interaction between university and WATP plus there was no difference in the link between WATP and companies outside the park and firms within the park. The interaction between tenants was little. For this reason created an advisory committee to manage the interactions between tenants, the buildings and their operations, to promote R&D, transfer of technology, to activate more the university and to involve closely with International Association of Science Parks (IASP). In 1998, after a recount, found 64 organizations housed on the park where 58 companies had 1300 employees (21employees per company) and the 3/4 of enterprises producing R&D.

Sectors of development of Science and Technology Parks

Region Development

Science parks as we referred above are vehicles for development, a dynamic community, perfect tools to provide positive environment for success to companies, instruments for regional development and an invention system of monitoring and business assistance. In world economy the sustainability of enterprise and employability is not certain. If a new enterprise wants to be successful, creational and growing requires using the best knowledge, practices and the most advanced methodologies. Suitable management, training, strategy, motivational counseling, information and Communication Technologies of Information are essential. All these can stimulate high technology based firms, increase local employment and thus contribute to regional development (economic growth, premises, ect.) (Autio &

Klofsten, 1998; Cooper, 1985; Galunic & Eisenhardt, 2001; Hackett & Dilts, 2004; Rice & Matthews, 1995; Marrifield, 1987; Mian, 1996; Peters, et al., 2004; Phan, et al., 2005).

Examples of region development are British Steel Industry, Cambridge and Aston science park in the United Kingdom, Helsinki in Finland, in Germany , in Austria, in South Europe (Italy, France, Spain and Portugal), MIT, Silicon Valley Massachusetts in USA, in Stockholm Royal Institute of Technology, in Gothenburg Chalmers Institute of Technology, Ideon Science Park in the Southern part of Sweden (Aernoudt, 2004; Lofsten & Lindelof, 2002; Park, 2002; Quintas, Wield and Massey, 1991; Ylinenpaa, 2001).

In UK the largest park is Cambridge which is host to Laser Scan and some others companies. In 1986 the proportion of independent firms was 21% and in 1990 was 14%, in contrast with Aston Science Park where the proportion of new start independent companies is 56% (Quintas, Wield and Massey, 1991). Cambridge Science Park has high cost of rental and thus new startup companies who couldn’t afford to locate inside the park choose to establish their facilities around/near the Park. In this way Cambridge succeeded to approach as many branches as possible belonging to companies (multinational companies). In Aston Science Park the percentage of new startup companies is the highest in UK because this Park had funding and the staff reduction of university benefits park because all academic staff gone to work in the park (Quintas, Wield and Massey, 1991).

The Association of Technology and Business incubator center in Germany estimates that over 300 innovation centers support regional economic growth and development by revitalizing neglected areas (Aernoudt, 2004). Every year there are 1000 startups where the technology and knowledge transfer is constant and help unemployment to be reduced. In Austria in the province of Carinthia was established a virtual incubator which through online assistance helps new startups companies to minimize their initial expenses and in South Europe incubation is mainly part of regional development (Aernoudt, 2004).

In Finland in 1995 there was only one incubator and by 2000 there were 16 active (Aernoudt, 2004). There were 3 types of incubators, mixed type (art and tourism), technological and economic development in which there was supply of business ideas and many potential for enterprises to be established in the region concerned. The region of Oulu today is one of the most powerful region in the Nordic countries and the science park is one of the most glaring in the world (Ylinepaa, 2001). Key role in that development plays NOKIA Corporation, which established in Oulu in 1975, and cooperates with a research lab, which has been founded by the Finnish government, and nowadays occupies 3000 employees.

In Sweden the Swedish Board for Industrial and Technical Development introduced suitable infrastructures to enhance growth in the economic sector in localities which are deprived and depressed (Lofsten & Lindelof, 2002). Furthermore the central government provides support to industries (e.g. SAAB, VOLVO, ERICSSON) in sectors such as R&D, technology transfer, diffusion, employment opportunities and also allows the interaction of local authorities, universities and financial institutions (Lofsten and Lindelof, 2002; Park, 2002). Inside Ideon Science Park in 1990 there were 100 companies, in 1995 115 companies and in 2001 increased to 182 (rise 58%). In Lund region in 1990 there was 5392 companies, in 1995 there were 6198 companies and in 2001 there were 9178 (rise 48%). Furthermore the diffusion of know-how in sectors such as education and research increased to 18.2% which indicates that Ideon science park is the “brain” of region (Park, 2002).

In Greece, according to Global Entrepreneurship Monitor, (GEM, 2006) many people aged 18-64 64 that have started doing business. But there is a view that opportunities for Hellenic businesses are rare, because it is difficult for government to support financial companies, due to not well supportive business environment. Thus Greek potential entrepreneurs in one hand they they are very confident in their knowledge and skills and they want to start a new career but in the other hand they are possessed by an intense fear of failure. The main mission of Foundation for Research & Technology Hellas (FORTH) and Technological and Science Parks of Greece is to play a crucial role in the commercialization and the way it will utilize the results of the researches to enhance the growth of the local society and economy. Thus, the strengthening of something new in technologies, the transmission of knowledge and the creation of new outputs and services are done to meet the Greek society's requirements for modernization., development, financial growth and innovation will be successful and helpful in region growth (Saitakis, 2003).

Entrepreneurship

The Scientific and Technological Parks whose main role is to use knowledge and technology to create a culture where we allow the entrepreneur to make a decision, even a risk for the company and increase competitiveness (Κελεσίδης, Σαϊτάκης, Φραγγιαδάκης, Ατσαλάκη, Φουρφουλάκη και Παπαδάκη, 2006). The interaction between science and technology parks with academic and research institutions has lead to the development of innovative high-tech firms (spin-offs).

There is a significant and growing emphasis on entrepreneurship in Universities and Research Centers (Donzuau et al., 2002) and largely a social need that these institutions can contribute to economic development (Powers & McDougall, 2005). There are also reports that low rates of flow of knowledge and technology from institutions in the production chain is the norm rather than the exception (Donzuaou et al., 2002). Many initiatives around the world support these technology transfer and entrepreneurship particularly by students and researchers in other countries (Finland, Sweden, Norway, Germany, France, USA, Spain, Netherlands)2. In view of the authors is the first activity undertaken as «Φυτώριο Ιδεών» in Greece.

In Norway in 1982 began the scholarship program aimed at providing time, skills and financial support to scientists and academics to determine if it was the right time to start a business. Has been regarded as a great success, with business creation rate of 89% and survival rate of 74%, but it was considered that it helped a lot in creating new jobs (Reitan, 1997).

The University of Arkansas, and the Authority of Science and Technology in the United States of America employed I^2 (Innovation Incubation), Innovation – placing in an incubator in order to increase companies start-ups in Arkansas. Runs as a service matching of needs of the new knowledge-based enterprises with laboratory equipment and staff of the University for the development of originals (www.innovationincubator.org).

In Germany at the University of Bielefeld, the Institute for Transportation Innovation handles a pre-incubator to support spin-offs from the University. Provide training and also support them by giving a legal umbrella for the operation of enterprises. The basic idea was followed from an act that the universities did together, coordinated by the University of Bonn with the program in USINE and best practices available on the project website (www.usine.uni-bonn.de).

In Sweden, the Centre for Innovation and Entrepreneurship (CIE) at Linkoping University tender students and researchers a 1 year course to potential entrepreneurs by providing access to mentors, support for writing business plans and support group meetings. They have created more than 40 companies in the first 5 years of the project. Similarly in Finland implemented the program SPINNO offered to aspiring entrepreneurs networking, education, access to major organs and simultaneously there is a flexibility in intellectual property. In Holland it was implemented in TOPS, Temporary Positions Entrepreneurship, a project which was considered as a very important success, providing aspiring entrepreneurs again support for one year through access to technical staff, mentors and interest free loans.

The European Union has helped hundreds implementing measures relating to innovation, one of which is the Innovative Action for the Region of Crete, CRINNO - Crete Innovative Region for 2002-2005, coordinated by the District of Crete and includes 13 proceedings. One of the actions is the "Entrepreneurship University Students - UNISTEP that implements the Nursery Ideas. It is well established that Greek students receive a good education in scientific domains engineers but entrepreneurship is very low, as in other countries (Carayannis et al., 2003), but very different from other countries such as USA and Singapore (Carayannis et al., 2003; Wang & Wong, 2004). Through the implementation of appropriately designed educational seminars, which have a specific purpose, and the implementation of «Φυτώριο Ιδεών», this project aims at creating an entrepreneurial culture to students and researchers. All the above mentioned activities aimed at creation of a favorable climate for the cultivation of innovation and entrepreneurship in areas where knowledge is developed and is expected by society that young entrepreneurs that will support the local and national economy will come from these places.

Academic knowledge

Universities and all the higher education institutes are important generators of knowledge. Through academic research and technology transfer by universities industries are encouraged to development, production, innovation, wealth creation, job creation, national and regional economic growth (Link & Siegel, 2003; Lofsten & Lindelof, 2002; Malecki, 1991; OECD, 1993; Westhead & Storey, 1994). The Association of University Related Research (USA) (AURRP, 1997) refers that a research park includes three elements: 1) development of a real estate, 2) technology transfer through an organizational program of activities and 3) association among universities, government, local authorities and private sector. In UK, UKSPA specify that higher education institutes and science parks should have formal links (Quintas, et al., 1992). They concluded that the firms (spin-off firms) founded inside the science park helps them to start their own commercial enterprise and the links between universities facilitate the transfer of technology and knowledge.

Westhead and Storey (1995) concluded that a company which has a link with a university – higher education institute has more potentials to be competitive and its going to survive. Gower and Harris (1994a; 1994b; 1996) claims that the knowledge transfer, idea transfer and the linkage between universities and industry are functions which science parks provide. Vedovello (1997) examined three main categories of industry and university links: formal, informal and human resources links and concluded that most of the companies had some kind of link with higher institutes, mainly informal. Bakouros, Mardas and Varsakelis (2002) examined the science parks of Greece and the links between industry and universities. In **Table 11** and **12** are listed how many of the 17 companies of Technological Park of Thessaloniki, Science Park of Patra and Science and Technological Park of Crete, having formal or informal links with reserchers from the university . Their results are similar with the survey of Vedovello (1997). The distribution of operation of science parks in Japan, according to Tokyo Institute of Technology (TIT, 1998) shows that 75% of the science parks has either a partnership with higher institute or there is a higher institute inside the park (**Figure 22**).

Table 11. Formal Link with Educational Industry (Bakouros, Mardas and Varsakelis; 2002).

	TPT	TSPC	SPP
Analysis and testing in HEI department	None	None	None
Engagement of HEI academic staff for consultancy	1	2	1
Establishment of joint research	2	3	3
Establishment of research contract	2	3	2

Table 12. Informal Link with Educational Industry (Bakouros, et al., 2002).

	TPT	TSPC	SPP
Personal contact with HEI academic staff	4	5	3
Access to specialized literature	3	4	2
Attendance at seminars and conferences	2	4	3
Access to HEI equipment	1	2	1
Access to HEI department research	2	2	3
Attendance at general education/training programmes	0	1	2
Recruitment of recent graduates	3	2	3
Students involvement in projects	2	4	2
Recruitment of more experienced scientists	1	2	2

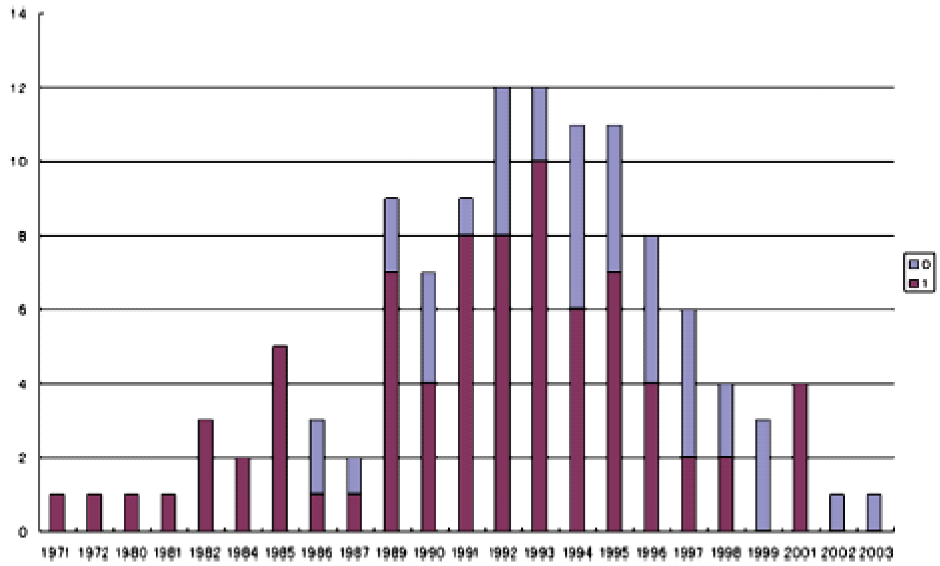


Figure 22: Distribution of the Japanese science parks during 1970 to 2003 which are linkaged with HEIs. With code "1" are the science parks which either houses research facilities or liaison offices of HEIs and with code "0" are science parks which have partnership with HEIs (TIT, 1998).

Nelson (2001) examined if universities can enter to the process of issuing permits (licensing) and recognizing patents through diplomas without, however, changing anything regarding their role. The responding rate was 53.4% and the universities through their provost had to respond to a 5-Likert scale (1=strongly disagree and 5= strongly agree) about the influence of science parks on their academic mission. Most of them agree that a science park can influence research results and university grants, and disagree that it has an influence on the position that the PhD graduates will have. Etzkowitz, Gulbrandsen and Levitt (2001) refers that university is gradually involved with industry by forming companies through academic research.

Link and Scott (2006) analyzed the geographical relationship among science park and research institutes. They hypothesized that the knowledge flows better when a park tenant is closer to university. Their findings showed that science parks which are linked to research institutes, operated by private organization and have a focus on technology grows sooner than the overage which is 8.4% per year. Adam and Jaffe (1996) believe that when a tenant park is closer to university the communication costs less. Ziberman and Heinman (2002) acknowledge that the role of American Research

University has change from provider of educational services and knowledge to a crucial element in the industrial innovation infrastructure.

Link and Scott (2002) examined the universities of the United States and concluded to these:

1) The connection among university and science park is very positive and crucial. When their connection is official, then it will result in positive benefits. There will be an increase in research results (eg publications and patents).
2) The purpose of the university is been influenced by how far or close is a science park to the university. Specifically the closer is a science park to university the better for doctoral graduates because appeared more opportunities for employment.
3) Universities which are more active in R&D affects positively the science park's propensity to patent.
4) The relationship between universities and research science parks influences positively the rate, the intensity and volume of publications.
5) The interaction between universities and parks changes over the life. The impact acts upon patenting activity may not be great at first but through the time this changes and furthermore the reputation plays a crucial role in hiring specialized staff.

Innovation

There are 7500 incubators all around the world which 2500 of them are linked with universities and foster innovation (technological and industrial) (Knopp, 2010; Monkman, 2010; Smilor and Gill, 1986). The goal of innovation incubators is to encourage innovation to the commercial sector through technology. The successful transfer of new technologies has many benefits: 1) exploring the economy, 2) the technology discovered can be commercialized, 3) raising the universities, 4) each center will have a specific research mission, 5) increasing revenue, 6) more people will work in the positions that will be constantly created and 7) will create immediate solutions to any problems presented in society (Fisher, 1998).

Felsenstein (1994) examined Science Parks as seedbeds (creates an environment for growth) or enclaves of innovation for firms on and off parks. The sample was 160 high technology companies of Israel which some of them were inside the Science Park and the others were near Science Parks and local universities. He claims that 1) one firm can influence/interact with another when they are located within universities and science parks but this interaction will be low-level; 2) where the Science Park is founded affects the level of innovation indirectly and little. In addition, it is reported that the area of the Science Park could be attractive due to the perceived location and prestige rather than the positive elements of technology and know-how transfer.

When an academic institution has relationships/links with companies that are established outside the park then their interaction is low. but when it is connected to companies established within a park then the degree of innovation is higher (**Table 13**) (Colombo & Delmastro, 2002; Lindelof & Lofsten, 2004). Colombo and Delmastro (2002) refers that on-incubator Italian companies have better development rate than the off-incubator firms, the use of technologies that is advanced, taking part in international R&D programs and the collaboration with universities is better and finally the access to public subsidies is easier.

Mubaraki and Busler (2012) examined innovation incubators of the United States from 1970 until 2010 and concluded that their main goal is to make the technology commercial and the growth of economy. Their findings suggest that 1) the flow of technology and the technology commercialization leads to economic growth and adds value to the market, 2) incentives for research increased due to innovation incubators and 3) over 8000 invention were produced. All this leads to the conclusion that science parks play a crucial role in the policy of technology in favor of NTBFs.

Table 13. Contribution of the science parks. S: survival; G: growth; H: HEI linkage; I: innovation; R: reputation; A: agglomeration; (+): positive effect; (-): negative effect Mubaraki & Busler, 2012).

	Unit of analysis	Method	Period	Region	Sample	Results
Monck et al., 1988	Firm	Matched pair	1986	UK	183–101	G, H
Van Dierdonck et al., 1991	Science park	Descriptive	1988	Belgium, The Netherlands	68(B), 71(N)	H
Felsenstein, 1994	Firm	Log-linear	Unknown	Israel	73–89	I(+), H(+)
Westhead and Storey, 1994	Firm	Matched pair	1986, 1992	UK	75–62	S, G(+), I, H(+)
Westhead and Storey, 1995	Firm	Matched pair	1986, 1992	UK	75–62	S(+), H(+)
NISTEP, 1996	Science park	Descriptive	1994	Japan	111	H
Vedovello, 1997	Science park	Case study	1993	UK	1	H(+)
Westhead, 1997	Firm	Matched pair	1986, 1992	UK	75–62	S, I
Phillimore, 1999	Science park	Case study	1998	Australia	1	H(+)
Lofsten and Lindelof, 2001	Firm	OLS	1994–1996	Sweden	163–100	G(+)
Lofsten and Lindelof, 2002	Firm	Matched pair, OLS	1999	Sweden	134–139	G(+), H(+)
Colombo and Delmastro, 2002	Firm	Matched pair, Tobit	2000	Italy	45–45	G(+), I, H(+), R(+)
Lindelof and Lofsten, 2003	Firm	Matched pair	1999	Sweden	134–139	I
Link and Scott, 2003	University	Ordered probit	2001	US	28	I(+), R(−)
Siegel et al., 2003c	Firm	Stochastic frontier estimation	1992	UK	89–88	I(+)
Appold, 2004	County	Switching regression	1960–1985	US	3024	A
Ferguson and Olofsson, 2004	Firm	Matched pair	1995, 2002	Sweden	30–36	S(+), G
Lindelof and Loftsen, 2004	Firm	Matched pair	1999	Sweden	134–139	I(+), H(+)

Science Parks in Greece

In today's global economy, where the economic crisis has hit several European countries, it is vital to continue the development in a country. More than ever a crucial element that helps the development of a country is to find, to re-create and develop outputs and services that are innovative, which in turn depend on the technology flow and academic and research institutions. A science and technology park is supported by appropriate infrastructure, the knowledge that is constantly developing around business and the suitability of the site (near research institutes, educational institutions, technological center of excellence). The name of the park varies and in bibliography we can find terms such as: Science Parks, Technology Parks, technoparks, Parks Research, Technology Business Incubator, Technopolis, etc. These organisms can vary in the scope of services, but their common identity can all be enclosed by following definition. A science & Technology Park is:

- A good action that helps to establish and develop companies that want to rely on technology
- Can connect and interact even with a center of technological expertise
- An organization that provides each company with the necessary facilities and appropriate administrative support.

State is not involved in the management of science parks. Their board of directors is made up of people who represent the local industry. The scientific parks in Crete and in Thessaloniki have a policy that can be described as an open policy and does not have any significant restrictions. Attracting new businesses and placing them inside the incubator is more relaxed. (Bakouros, Mardas & Varsakelis, 2002). Patras Science Park (PPS), as mentioned above, uses a stricter policy because it is interested in attracting companies that they deal with high technology (eg electronic equipment and new materials). (Bakouros, Mardas & Varsakelis, 2002).

The Greek government in 1989 took the initiative to create and develop Science & Technology Parks and incubators for nascent companies. The realization of this project took place with the help of various grant programs. The establishments of technology parks were close to universities and research centers and were designed to help research and development (R&D) corporation (Sofouli & Vonortas, 2007). The 1^{rst} Science and Technology Parks established in Greece in the early 90's (the first Policy Wave) at the initiative of the Foundation for Research and Technology (FORTH), was the Science and Technology park of Crete (STEP-C), the Patras Science Park and the Thessaloniki Technology Park (TTP). Shortly afterwards created STEP "Lefkippus" from National Center for Scientific Research Demokritos (NCSR) in Athens, The Technology & Science Park of Attika "Lefkippos" (TE.SPA "Lefkippos"), the Cultural Technological Park of Lavrion from NTUA , the Innovation Pole of Thessaly in Volos and the Scientific Technology Park of Ioannina (Bakouros, Mardas & Varsakelis, 2002). Recently co-funded Project "ΕΛΕΥΘΩ" created private incubators and there are private initiatives underway to establish technology parks in the region of Attica and Thessaloniki. All existing STEP Greek state initiative created in collaboration with research and academic institutions and the GSRT (www.gsrt.gr)

In Greece technology parks are smaller than the rest in other countries of Europe and there is the impression that the STEP is not successful (there are successful businesses eg FORTHnet in the Science and Technology Park of Crete (STEP-C)). However, the running time is relatively small, and there are other inherent weaknesses such as gaps in the institutional framework for the exploitation of the knowledge generated by universities, lack of funding new businesses (Business Angels, Venture Capital), lack of intermediaries, little demand for technology services from local businesses and difficulty attracting foreign investment (Bakouros et al., 2002).

Bakouros et al. (2002) asked companies what criteria did they use to sellect the installation in the science park. Findings indicate that 13 of the 17 companies choose to establish in the science park, firstly because of the prestige they want to gain from the science park (they expect to gain) and secondly to gain as much as possible from the science park infrastructure. **Table 14** shows the reasons for the establishment in Technological Park of Thessaloniki (TPT), in Science & Technological Park of Crete (STPC) and in Science Park of Patras (SPP). According to the authors differentiations in many points (expected and reality), between the technological parks and the companies that want to be members of them, are because of three factors: 1) their size is small, 2) political participation of enterprises in technological Parks are different ΄ and 3) the short duration of operation.

Table 14. Reasons for the establishment in Technological Park of Thessaloniki (TPT), in Science & Technological Park of Crete (STPC) and in Science Park of Patras (SPP) (Bakouros et al., 2002).

Reason	Expected			Reality		
	TPT	TSPC	SPP	TPT	TSPC	SPP
Image from location in a SP	6	6	1	6	5	1
Parking facilities	3	2	1	3	2	1
Communication and transportation connections	3	4	1	3	3	0
Administrative and common services	5	2	3	5	1	3
Rent	2	2	1	1	2	1
Shared equipment	5	2	2	5	2	2
Access to the university's facilities	1	1	2	0	0	2
Access to the research institute's facilities	1	5	1	1	4	1
Image from the cooperation with a university or research institute	1	2	2	1	1	2
Recruitment of recent university graduates	3	3	1	1	1	1
Synergies between incubator's firms	5	3				1
The founder was employed previously at the university or research institute	3	3	1			1
Low cost of knowledge transfer	2	1		0	2	

Science & Technology parks created in Greece are seven (7) and are presented in chronological order of establishment:

1. Science & Technological Park of Crete (STPC)
2. Science Park of Patras (SPP).
3. Technological Park of Thessaloniki (TPT)
4. Attica Technology Park "Lefkippos"
5. Lavrion Technological and Cultural Park (LTCP)
6. Averofio Agri-Food - Technological Park of Thessaly (AV. TE.PA.THE)
7. Science and Technology Park of Epirus (S.TE.P.-E.)

Science and Technology park of Crete (STPC)

The Science and Technology park of Crete (STPC) was founded in the late 1980s and was established in 1993 as a move carried out by the Foundation for Research and Technology-Hellas (FORTH). It is supported financial by EU, by Greek National

Government and the Region of Crete (Sofouli & Vonortas, 2007; Saitakis, 2003; www.stepc.gr/index.php). STPC supported the growth of companies (~ 45 companies) and developed many programs to strengthen and growth Innovation in the region and upgrade the energy of companies in the district. The Park has 4000 sq.m. of the floor (about 100 offices and 12 laboratories). The hosted companies are small and deal with technology and services. It is a big advantage the presence of FORTH in the University and the Hospital of Crete since there are many laboratories in the surrounding area (scientific and research) which can support the newly established companies with any technology.The Park is managed by the Management Company of STEP-C (EDAP S.A.) (http://www.stepc.gr/index.php, Saitakis, 2003)

Specifically, STPC:

1. Offers companies to have services and incubating facilities so they can start up and promotes youthful and academic entrepreneurship.
2. Provides expertise services , all in the same place.
3. Through innovation to exploit the full potential of each business.
4. Helps companies to uphold their copyright
5. Support in the best possible way their interests and needs
6. Offers technology transfer (either product development or innovation initiatives
7. Promote important research results of Foundation for Research and Technology-Hellas (FORTH) and other research organizations.
8. Encourages companies to settle in the Park and to cooperate with researchers at Foundation for Research and Technology-Hellas (FORTH).
9. Supports established businesses on safeguarding and managing intellectual property.
10. Collaborates with local agencies and contributes to the development of the Region of Crete.
11. Projects under Research & Technological Development (RTD), collaborates with partners from Greece and other countries on regional innovation, promotion of entrepreneurship and technology transfer.

Services provided by STEP-C for tenants it includes benefits such as supporting each company with secretarial support, having a distribution board, providing internet and network, being able to use the libraries of the centers (research library), being able to search in the patent file, it is licensed to enter into agreements, to secure and protect its intellectual property, to have a post office, meeting and meeting spaces, and to be able to use the logo of Park and IASP (http://www.stepc.gr/services.html**).**

The companies that have been hosted in STPC are about thirty and various specialties. **Table 15** lists all the companies' details (Company name, service, year of graduation from the technology park). The companies that have been housed in STEP-C (tenants) until 2012 are:

- CYTECH Ltd
- MITOS S.A.
- KATREA TRAVEL
- PIRAEUS BANK S.A.
- NOVELTECH
- INFOTRAFFIC S.A.
- BEMMO
- PHAISTOS NETWORKS S.A.
- LASTMINUTE
- TUV HELLAS S.A.
- MEDOTICS
- INDUSTRIAL PROPERTY ORGANISATION
- TERN
- FORTHNET S.A.
- FORTHCRS S.A.
- PRAXI NETWORK
- Hellenic Telecommunications & Post Commission
- N.PAPANIKOLAOU & ASSOCIATES

The companies which now housed in STPC:

- Anixenet (Hybrid broadcast broadband TV (or "HbbTV")
- The best company (bestprice.gr)
- Biomimetic (laser nano-texturing of glass)

- Biopix-T (diagnostic device – rapid test)
- Oxygen pelatologio (Cloud/cash register)
- Code BGP (platform, monitor, detect, protect)
- Cythech mobile solutions (translate business needs into technology)
- Datatrek (development and Appp Growth)
- EETT (telecommunications and posts)
- Enartia (World Press and Cloud services)
- enzyQUEST (molecular PCR-test)
- EUROPEAN PUBLISHING
- EXAPSYS (High Performance Computing)
- JADBio (automated mated machine learning)
- Mitos (Conference Organisation Meetings & Events Managemenτ)
- Mcbs (mediterranian cloud booking services)
- NEURCOM (software solutions)
- NEUROLINGO (linguistics at work)
- NOVELTECH (softwares)
- ORama (health / surgical care)
- PHAISTOS networks
- Πράξη (enabling innovation)
- Hellenic Industrial Property Organization
- Qcell (camera systems)
- SMATHI (network device)
- SPECTRICON (toolkit/microscopy)
- SUNLIGHT (platform
- SyNoesis (therapeutics)
- Theferries.com (booking platform, seatrips)
- Piraeus Bank
- TRAQBEAT (innovative systems)
- TUVHELLAS S.A.

Table 15. Graduated companies from 2000 until 2012 (http://www.stepc.gr/graduated_companies.html).

Company Name	**Activity**	**Graduation**
GREEN INNOVATION PARTNERS	Renewable Energy Systems	2011
PALMERA Ltd	Computer Science Applications & Telematic services	2010
NANOCHRONOUS LOGIC Inc	Develops Design-for-Variability (DFV) EDA tools for ASIC, SoC and FPGA circuits implemented with deep sub-micron standard cell libraries.	2010
ALGOSYSTEMS SA	Integrated Business Solutions in the Information Technology area in the Automation and Control industry & Metrology support services	2010
INFOCHARTA Ltd	Digital Maps Development	2009
ULAC	Union of Local Authorities of Crete	2008
BLUEVIBE	Development of wireless telecommunication system	2008
VIRTUAL TRIP Ltd	Research and Development of New Internet Technologies and Applications	2007
ISD SA	Development of Integrated Systems	2007
CRETE ONLINE OE	Online Tourism Services	2006
SYNAPTIC Ltd	Development of Bioinformatics Software and Automated Production Control Systems	2006
ELLEMEDIA TECHNOLOGIES Ltd	Research and Development of Telecommunications Systems	2006
FOOD STANDARD SA	Quality Consultants	2005
PLEFSIS SA	Computer Science Applications and	2004

Patras Science Park (PSP)

Patras Science Park (PSP) moved into its newly premises 25 years ago and the building is located in Platani, opposite the Rion – Antirrion bridge. Over 30 years promotes innovation. It features buildings and related facilities, organized in such a way as to provide and develop services and products compatible with the objectives of the SPP. The operational framework of PSP provides business exploitation of Research & Development, promotion of innovation, reinforcement of competitiveness and suitable environment for innovation (Sakkas, Saitakis & Alexandropoulou). SPS have a total area of 3,800 m^2 and are divided into three categories: 1) Major Areas (including Headquarters, Services and Treasury, LAN Center, Reception, Restaurant), meeting rooms, exhibition hall, Technical Center Networks, 2) Spaces installation companies - Cells (1480 m^2), 3) Airy, (820 m^2) that include public areas (elevators, stairwells, corridors, toilets), Warehouses, Office maintainers, space conditioning and electrical installations and other areas (pump, fire complex, producing vacuum, nitrogen center, etc.). The goal of the PSP is to create a modern Innovative Business District in the dist4rict of Western Greece, which will be a tool to "enhance" innovation - technological and business units (http://www.psp.org.gr/index.php?option=com_content&task=blogcategory&id=40&Itemid=57). In **Table 16** are listed the hosted companies and their activities and in **Table 17** are the companies that had successfully housed at Science Park of Patra.

Specifically, the objectives of the SPP are:

1. The integration of innovative ideas, outputs, services, procedures and companies development of scientific and technological research.
2. Online Knowledge Production Organizations (GEO), mainly in the Region of Western Greece (RWG).
3. Developing, updating and broadening outputs and services and the methods used for production.
4. The creation of methods that will help organize the business appropriately and be able to manage any situation that arises.

5. The achievement of new knowledge and its transmission, and to provide all kinds of services, science, engineering consulting and training, and specialized training for staff in companies and generally to any natural or legal person.
6. Attracting and installation of firms or parts of firms clusters and linked through network with other external firms or parks.
7. Attracting foreign investment in high technology sectors that will benefit from the Development Act or similar mechanisms (http://www.psp.org.gr/index.php?option=com_content&task=blogcategory&id=40&Itemid=57**)**

Table 16. Hosted companies in Science Park of Patra and their activities (http://www.psp.org.gr/index.php?option=com_content&task=blogcategory&id=40&Itemid=57).

Hosted companies	Activities
ADRINE	Innovative engineering
ADVENT Technologies	Developing innovative new materials and systems for renewable energy products
Aeiplous	Sustainability
AEON	professors and postdoctoral researchers
AEROPONICS HELLAS	eading know-how in aeroponics
APPOPLOO	developing innovative software products and services
Brite Solar technologies	utilizing innovative materials and deposition techniques to deliver a new class of glass materials for building construction
CIVICS	Codefunnels
Competence Center Hellenic Center for Additive Manufacturing (HCAM)	the first and only Center for Competences in 3D Printing technologies, in Greece and North-East Europe
DATAMIND	Digital media
DIGITAL SKY	wireless communications
European Aeronautics Science Network (easn)	fundamental research in Aviation & Space
eConais	algorithms
Erasmusbnb	International students, can book a place, fast, easy and secure.
Hellenic Industrial Property Organisation	qualified institution for the protection of inventions and industrial designs
HLectron	Medical systems – cancer treatment
INBIT	Biomedical Technology
iSi	active participation and substantial contribution at high-technology sectors
innotomia	analyses the impact of emerging technologies from different angles and

Table 17. Companies that had successfully housed at Science Park of Patra from 2003 until 2022 (www.psp.org.gr/index.php?option=com_content&task=blogcategory&id=20&Itemid =85).

Successfully Housed Companies	**Activities**
ATMEL	Microchip technology (2003)
ΠΟΑΔΕΠ	Observatory of 4 major road axes of Western and Southern Greece (2011)
NANORADIO HELLAS	Software Engineer (2011)
Bytemobile European Development Center	Self-phones, lap-tops, PDAs (2011)
BEM S&S	Soft engineer (2012)
TOBEA EPE	Engineering (2013)
ADAMANT COMPOSITES	Advanced Materials & Structures (2013)
IRIDA Labs	On – device vision intelligence (2014)
InEdu	Education (2014)
ANTCOR	Network technologies (2014)
ALGOSYSTEMS	Solution provider (2015)
Omega Technology	IT services (2018)
KEK IBEPE	Education (2018)
EETT	National Regulator (2018)
Odus	Intelligent Information Management solutions (2019)
HELBIO	Hydrogen & Energy Systems (2019)
ELDRUG AE	Biotechnology (2019)
ALTHOM	Engineering (2019)
ANALOGIES	Electronic systems (2020)
FFN	Holistic Care (2021)
Probus Productions	Health & Wellness Services (2021)

www.psp.org.gr/index.php?option=com_content&task=blogcategory&id=20&Itemid =85

Thessaloniki Technology Park (TTP)

In 1990 was founded Thessaloniki Technology Park (TTP). This action was carried out by the Chemical Process Engineering Research Institute (CPERI). Thessaloniki Technology Park was financially supported by a large amount of money (4.000.000.000 drachmas) from the Operational Program of Research and Technology of GSRT and the Community Framework Support Program of DGXVI, of the European Union (Sakkas, Saitakis & Alexandropoulou). The Thessaloniki Technology Park having 7500 s.m.of surface, including:

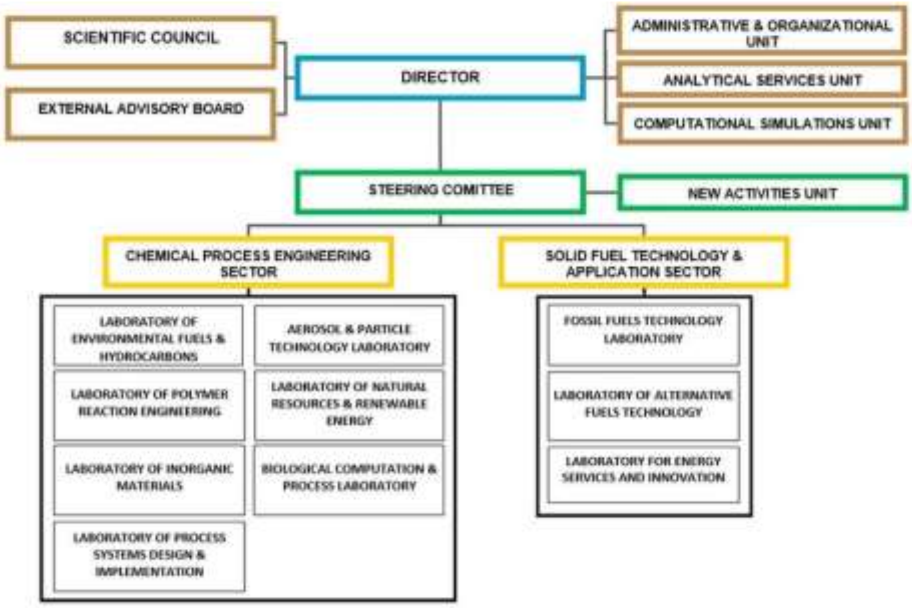
- CERTH (Centre for Research and Technology) / CPERI (Chemical Process Engineering Research Institute) research laboratories / pilot plans
- An Incubator Building
- An Administration / Conference Centre and the Library /Scientific Information (www.thestep.gr/active.aspx?mode=en{a8ddb4bb-5921-4995-a496-c3f9804bec11}View)

The Centre for Research and Technology – Hellas (CE.R.T.H.) was established in March 2000. Has a non-profit nature, is under the auspices of the General Secretariat for Research and Technology (GRET), the Greek Ministry of Development and is a private law entity, located in the Thessaloniki Technology Park (TTP). Its mission is its research to deal with technology and how it can be applied and at the same time to manufacture new products that will have an impact (social, industrial, economic). It supports production and development in sectors related to telecommunications, transport, technology, exploitation of solid fuels etc. Its structure includes the Central Offices and five Research Institutes:

- Chemical Process Engineering Research Institute - C.P.E.R.I (**Table 18**)

(was founded in 1985, researched areas: design, synthesis, modelling, evaluating and development of a) novel catalysts and reacting systems for industrial applications, b) physicochemical process system and c) physicochemical processes and equipment with emphasis on water purification) (Sofouli & Vonortas, 2007; https://www.cperi.certh.gr/en/about-cperi/organization)

Table 18. CPERI's Organizational structure and sectors (Sofouli & Vonortas, 2007; https://www.cperi.certh.gr/en/about-cperi/organization).



- Informatics & Telematics Institute - I.T.I.

(was established in 1998 as an independent non-profit organization, researched areas: Informatics, Telematics and Telecommunications, interactive transmission of 2D and 3D images, television educational technology, interactive media and virtual reality systems and applications in education) (https://www.iti.gr/iti/index.html).

- Hellenic Institute of Transport - H.I.T.

was established in 2000, it is extremely excellent in the transport department because the services it offers are specialized. in terms of organization it provides very good infrastructure, it works in harmony in all departments, there is direct cooperation and interaction with organizations dealing with similar issues. It designs and standardizes vehicle technology while simultaneously assessing impacts land, sea, air and multimodal transport. The sectors of Hellenic Institute of Transport appear in **Figure 23** (https://www.imet.gr/index.php/en/).

Figure 23 . 5 sectors of Hellenic Institute of Transport (https://www.imet.gr/index.php/en/).

- Institute of Applied Biosciences - INAB

the mission is carrying basic and applied research in the Life Science and exploit new technologies in a) health, b)well-being, c)development of medicine, d)use of new methodologies, e)biotechnology and bioanalysis (https://www.inab.certh.gr/about-us). Sectors of Institute of Applied Biosciences appear in **Table 19.**.

Table 19 . Sectors of Institute of Applied Biosciences (https://www.inab.certh.gr/about-us).

AGRIBIO SECTOR	BIOMEDICAL SECTOR	HORIZONTAL RESEARCH DISCIPLINES
Laboratory of Plant Biology and Breeding	Laboratory of Molecular Genetics, Epidemiology and Clinical Diagnostics	Laboratory of Bioinformatics
Laboratory of Applied Plant Systems Biology	Laboratory of Medical Biotechnology	Laboratory of Metabolomics and Systems Biochemistry
Laboratory of Plant Stress Biology and Signaling	Laboratory of e-Health	Laboratory of Biostatistics and Experimental Design
Laboratory of Animal Biology and Breeding	Laboratory of Clinical Pharmacology	
Laboratory of Food Science and Nutrition		
Laboratory of Microbial Processes		

- Institute for Bio-Economy and Agri-Technology (iBO)

the mission is carrying basic and applied research in the field of Agrobiotechnology and exploit new technologies in the a) seed test and in the production/propagation of plants b) food and beverage production and testing, c) protection of the environment, d) evaluation of the biodiversity, e) preservation and utilization of genetic resources, f) exploitation of agricultural by-products and of biomass, g) development and exploitation of bio-diagnostic methods of organisms and h) standardization and molecular testing of food and beverages). (https://ibo.certh.gr/**)**

Attica Technology Park "Lefkippos (A.T.P. "Lefkippos"

The Attica Technology Park "Lefkippos" is located in areas of National Centre of Scientific Research "Demokritos" in the green suburb of the mountain Ymitos (Sakkas, Saitakis & Alexandropoulou). Opened in 2009 and has a new building, 2.000 m^2 (with 50 cells from 20 m^2 to 45 m^2 each). It also features a 300 m^2 building comprising 20 cells each 14 m^2 and operated since 1991. Purpose of Attica Technology Park "Lefkippos" is to support the growth of new firms and strengthen their exertions to commercially take advantage of innovative ideas and technologies (http://lefkippos.demokritos.gr/**).** The Attica Technology Park "Lefkippos" wants to monitor the developments taking place in the areas specified, adjust the developments based on the needs of Greek production, develop linkages / relationships with research organizations in Greece and abroad, to be able to deliver the results of its investigations and to become a reality and finally want to contribute to education and training of human resources (http://lefkippos.demokritos.gr/about-us/).

Services provided by the Attica Technology Park "Lefkippos" to hosting companies are:

- Incubator
- Accelerator
- Office space
- Business support
- Access to laboratory facilities of NCSR "Demokritos".

- Participation in educational programs of NCSR "Demokritos".
- Use the library of NCSR "Demokritos".
- Conferences and meetings in the Auditorium of NCSR "Demokritos", capacity 420 people, with simultaneous translation facilities, and three smaller rooms seats 40, 40 and 80 people.
- Use of the meeting rooms.
- Internet and Wi-Fi.
- Production and distribution of electricity and water.
- Postal services, photocopier, fax.
- Sanitation
- Save 24.
- Parking.
- Access to information on European and other programs.
- Procedures to safeguard intellectual property.
- Legal support.
- Information on financial instruments.
- Financial advices/
- Technology audits.
- Mediation with other parties to assess the possibility of exploitation of products.
- Marketing Services (http://lefkippos.demokritos.gr/about-us/).

Sectors and companies of Attica Technology Park "Lefkippos" appear in **Table 20** (http://lefkippos.demokritos.gr/our-companies/). There are 7 sectors. Each of them have categorized the firms according with their main purpose and through Attica Technology Park "Lefkippos" trying to boost every company to grow up.

Table 20. Sectors and companies of Attica Technology Park "Lefkippos" ((http://lefkippos.demokritos.gr/our-companies/).

Sectors	**Companies**
Advanced Materials , Nanotecnology & Devices	- Akronic (telecoms, automotive, aerospace and Internet of Things) - AM4GR (Additive Manufacturing (AM) / 3D- Printing Technology - AMEN (research and development of innovative technologies) - CIRCUITS INTERGRATED (Technology) - DELTA MATERIALS PROCESS & innovation (solving research and industrial problems by applying appropriate engineering tools) - IMD LABORATORIES (Biodiagnostic center) - Nanometrisis (software company) - Nanoplasmas (structural and chemical modification of materials)
Information Technology and Telecommunications	- Centaur (uses Smart Sensors and Artificial Intelligence to offer unprecedented visibility and insights into stored crop conditions, so that premium quality can be delivered every time). - Future Intelligence (telecom engineering) - HYPERNETICA (software) - I-matik (high technology Products and Solutions targeted for

	Medical) - Infitheon (Security applications) - LEΩ Space Photonics R&D (modern satellite systems) - Linked Business (tools to discover and understand your market trends, potential customers and competitiveness) - Purebills (eReceipting and ePayments cloud Solutions and Services) - SC!FY (technology systems) - Scio (agri-food value chain) - SYNDESIS (health and wellness market) - Up2metric (innovative custom software solutions) - VERTLINER (Intelligent Systems for the construction sector) - Yodiwo (digital systems)
Environment & Climate change	- Artemis Engineering Consultants Aerosurvey (environmental research) - NEEST ("Green" Energy and Environment Protection) - Plinios (weigh and assess environmental risks)
Health & Life Sciences	- BIOEMTECH (drug research and biotechnology) - Fasmatech (mass spectrometry and ion mobility instrumentation design and development) - Novagrica ("green" economy) - **PhosPrint (**laser bioprinter developer) - **ProtAtOnce (**biomarker discovery) - **SYN innovation laboratories (**Pharmaceutical company)

Enginneering – transport	- Give (a)nalyse fast & accurately all kinds of engineering problems
Energy	- Cyrus (Hydrogen compressors for transport applications) - Pleione Energy (technological applications for the energy and space sector) - Ricreation Energy & Research (renewable-energy sources and waste heat exploitation) - TESLA
Other	- SingularityU (promotion of ideas, innovative technologies, design, culture and art) - Matternet (build and operate drone logistics networks for transporting goods on demand) - Optagon photonics (optical sensors in biomedical, food quality monitoring and metrology applications).

Lavrion Technological and Cultural Park (LTCP)

Lavrion Technological and Cultural Park (LTCP) is an organization that promotes anything that has to do with science, research programs, know-how, start-up companies and culture. In Lavrio there used to be a a company where he did mining and belonged to France. In the same location the Technological and Cultural Park was developed in 1992. It was an initiative of the National Technical University of Athens (NTUA). Aims of LTCP is to link science and technology in order to promote history and culture of Athens. The region surrounding the LTCP placed, where the premises of the park are, is a important place where it needs architectural and industrial interest (Sofouli & Vonortas, 2007; https://www.ltcp.ntua.gr/).

Lavrion during 18th century was one of the most innovative Greek centers of industrial activity. But in 1989 one of the largest mining industries and stopped the chain reaction was extended to other major industrial units of the area resulted in social disintegration. The National Technical University of Athens (NTUA) undertook the construction of the area with the local community and national scientific initiative. Created a model based on the technology, economic and social-cultural development. The most important difference between LTCP than any other technological park in the country is that emerging enterprises are an organic part of an integrated environment (social, technological, cultural), an environment that has social values and norms, and is inextricably linked to the emerging new knowledge-based economy. By the summer of 1995 the LTCP funded with 15,23 million Euros by EU and state of Greece. Restored and upgrated 17 from the total 42 buldings, two new buldings constructed the environment was reconstructed and a heavy polluted part of the grounds 10,000s.q. was rehabilitated (www.ltp.ntua.gr). These days the services provided by LTCP specialize in areas of technology where the technology needs to be very modernized (telecommunications, robotics, environmental technology, shipbuilding etc.)., etc. (http://www.ltp.ntua.gr).

The total area of the LTCP site is approximately 250,000 sq.m. There are 3 building complexes housing a total of 18 buildings where services related to administration and culture are housed and supported. The LTCP has: a lecture hall with modern audio-visual equipment, seminar rooms that are fully equipped, an outdoor hall, with a capacity of approximately 500 people, several outdoor spaces for events, 580 sq.m. with audiovisual equipment.

The companies housed in the park are consistent with the character of the park and are shown in Table 21:

• construction companies

• companies that use and produce alternative energy sources.

• laboratories doing applied bioengineering research, etc.

• Companies dealing with industry projects

• Companies with specialized knowledge of technology • Software companies (http://www.ltp.ntua.gr).

Table 21. Companies based on the technological and cultural park of Lavrio (Sofouli & Vonortas, 2007; https://www.ltcp.ntua.gr/).

COMPANIES	email-website	FACILITIES
Company for the Utilisation Management of the NTUA property	info@ltp.ntua.gr www.ltp.ntua.gr	organization, management and operation of TCP
KB IMPULSE	info@kbihellas.com www.kbihellas.com	Telecommunications (Satellite Ground Station)
PYROGENESIS S.A.	mvardavoulias@pyrogenesis-sa.gr www.pyrogenesis-sa.gr	Surface treatment of metals, Technology Plasma Pyrolysis
TWIN PEAK AE	info@twinpeak.gr nmik@twinpeak.gr www.twinpeak.gr	Telecommunications Satellite Ground Station, VOD
ATP LABATORY UNIT	kschatz@central.ntua.gr www.atpstation.thermo.mech.ntua.gr	Certification of Suitability Media Handling perishable foods in international traffic
Industrial Educational Museum	btproto@yahoo.com info@ltp.gr www.ltp.ntua.gr	Laboratory specialized in Environmental Measurements
HANDICRAFT – INDUSTRIAL EDUCATIONAL MUSEUM	b-bem2003@yahoo.gr www.bbem.edu.gr	educational programs

Environmental Education Center	kpelav@yahoo.gr http://kpe-lavriou.att.sch.gr	educational programs
NANOPHOS	iarabatz@nanophos.com www.nanophos.com	Nanotechnology
BIC of Attica	d.karydis@bicofattika.gr alivieratos@bicofattika.gr www.bicofattika.gr	Consulting
Q-FREE	yamart@hellasnet.gr www.q-free.com	International Society for Technology Service Equipment
Metallurgy Laboratory	paspali@central.ntua.gr www.h2susbuild.ntua.gr	Pilot research program for hydrogen production

Technological Park of Thessaly – Averofio Agri-Food (AV. A.TE.PA.THE)

In the first year of millennium The Technology Park of Thessaly (TE.PA.THE.) was founded. A public company for Industrial Research & Technological Development SA (MIRTEC) and 38 other stokeholders, primarily organizations and businesses in the region of Thessaly helped TE.PA.THE. established. The Region of Thessaly, the Greek Government and the EU supported the TE.PA.THE. (~520,000 euros). In Technology Park of Thessaly worked together academic, research and government organizations, which are designed to ease the transmission of know-how from research institutes to private business. The basic purposes of the Technology Park of Thessaly were to :

• there is a growing positive trend towards the establishment of companies dealing with technology specialization.

• Challenge older or underdeveloped companies to become better by introducing technology that is new

• to create the conditions to help the local community and the region in such a way as to aim for continued development (Sofouli & Vonortas, 2007).

In the late 2010s Averofio Agri-Food Technological Park of Thessaly (AB.A.TE.PA.TH.) was founded and established through Senate so that it has an administration and is also related / connected to a university (Park in Larissa and Gaiopolis university). The central objective of the Averofios Agri-Food Park is to create the right conditions so that the results of research carried out within a university can be directly linked to companies and the local community, so that development can occur in any field desired by each department. Thessaly is a focal point of Greece because of the plain, which is a source of agricultural products for the whole country. Creating innovation in any field aimed at rural development should be linked to tradition (https://averofio.uth.gr/en/structure).

The purposes of the Averofio Agri-Food Technological Park of Thessaly include:

- Targeted research, support, creation and growth of innovative adjustments and entrepreneurship in the field of agri-food, such as development of biotechnological applications in the certification of traditional products, production of high-quality products and food of animal and plant origin while simultaneously preserving, as well as highlighting and enriching natural resources and restoration of the natural environment with exemplary actions, breeding of purebred animals of high genetic value with modern management methods, certification of their breed, correlation of molecular and microbial markers with desired characteristics, correlation of genetic diversity and resistance or susceptibility to diseases - production of biological products and recording and improvement of ecological footprint of farms.
- technical support to all businesses and agencies active in agri-food in their efforts for technological, digital and productive upgrading with modern environmental conditions.
- Documenting the biodiversity on which the agro-food production of Thessaly is based and creating a genetic material trust.

- Education, training and training, through the Lifelong Learning Training Center (K.E.DI.VI.M.) or the Vocational Education Center (C.K.E.) of the Foundation, on issues such as alternative forms of production and new technologies for optimal agricultural production, the management and protection of the environment, the application of scientific discoveries for the production of products with a reduced environmental footprint, the breeding of productive animals using the most innovative methods, the identification and reproduction of indigenous aromatic and medicinal plants, the production and the promotion of innovative products with special and beneficial characteristics for human health, the application of innovative cultivation systems and the development of genetic improvement techniques,
- Development of information and familiarization activities with the agri-food sector and the individual activities of the primary sector, promotion and highlighting of the agri-food culture, the history of Agricultural Education, the contribution of the Averofei Agricultural School as well as recreational activities, such as thematic exhibitions and workshops, organized visits, demonstrations and guided tours of the premises of AV.A.TE.PA.TH.
- Creation of infrastructure for the use of animals in human therapy (e.g. therapeutic riding) (https://averofio.uth.gr/en/areas-action).

Science and Technology Park of Epirus (S.TE.P.-E.)

University of Ioannina in 1999 founded the Science and Technology Park of Epirus. The Management Company "Scientific and Technological Park of Epirus" has undertaken the operation of the park since 2003. The mission of the park is to introduce innovative new outputs and technology in the public and private sectors, ie the knowledge generated from universities and research centers will disseminates in businesses that are within the incubators. Also aims to act as "incubator" of the four capitals of the Regional Unit of Epirus (http://www.step-epirus.gr)**.**

The Science and Technology Park of Epirus (S.TE.P.-E.) is installed in a building 4,457 m² located on campus. The building is built on a plot of 16 acres and the premises granted by the University of Ioannina for 25 years. It consists of a ground floor area 2,919.42 square meters, includes 17 incubators, convention center 320 m and 2 meeting rooms 44 m² (15-20 people) and available exhibition or laboratory space 700 sq.m. (http://www.step-epirus.gr/facilities.htm).

The rules of S.TE.P.-E. indicate that many companies who have settled in the park incubators have the right to use the mark S.TE.P.-E, to advertise that they are members of the park and receive all services provided by the park with corresponding reductions in force (http://www.step-epirus.gr/services.htm). In the incubator there is the initial installation / hospitality of business. The goal is to support established businesses at all levels to be able to follow their business plan and set new business goals. Each incubator include modern conventional (offices, libraries, offices) and electronic equipment (computers, network printers, fax). S.TE.P.-E. has 23 companies and 3 support structures. The **Table 22** lists the hosted companies and their activities. On established businesses in S.TE.P.-E. provided free internet access, free use of national telephone network, information from S.TE.P.-E. search for activities and associated companies located in technology parks, which are members of IASP, use of conference rooms and equipment and logo, placement of logo in neon sign at the entrance of the building, mail, use the printer and copier, use of parking for both employees of the company and its customer and access to all other services at special prices (https://www.step-epirus.gr/index.php/el/hosted-companies/eteries).

Table 22. Hosted companies in Science and Technology Park of Epirus and their activities (https://www.step-epirus.gr/index.php/el/hosted-companies/eteries).

Hosted Companies	**Activities**
BIOHELLENIKA	Nanotechnology
COMITECH	Information Technology, Telecommunications
BIOHELLENIKA	Stem cell
Conventus	Technology
Endustria	Innovation
Future Intelligence	Information Technology, Telecommunications
INKO	Instructions
ISBS HELLAS LTD	Digitization, electronic archiving
K-REN	Supply and installation of electronic equipment
MACTEL ATE	Telecommunications
MEDALLIED	Production and marketing, medical applications software products
Nestor Innovations	Enterprise Grant from subsidized programs
OBERON	Technology
PLAN TECH	Computer science
Q base R&D	Computer science
Q & D	Consultancy in the field of providing students / technical advisory and support

Zakynthos

Another science park exists on an island in the Ionian Sea, in Zakynthos. It is a collaboration between two states of Greece and Norway. Norway made the first move to approach Greece and proposed to create a park to protect the environment, for example reducing water consumption and re-watering. For this goal the Norwegian University of Life Sciences (UMB), the Technological Educational Institute of the Ionian Islands (TEI) and Therianos Farm and Villa in Zakynthos collaborated. In addition, within this park, students will be able to be trained, research can be produced, companies can be informed about the results of research and companies can be promoted to develop. Through Erasmus programs, students from both countries will have the opportunity to visit the respective facilities and thus this effort to develop environmental technology will pass from generation to generation.

III. METHODOLOGY

The bibliography search was done using the international search bases (Taylor and Francies, Plos One, Scholar etc) as well as the magazines referring to business management were used.

The platforms were used to search for articles/papers on innovation worldwide and then in Greece, as well as the role of Technology Parks. The keywords used initially were 'innovation', 'incubators', Research and Development'. This search showed 30,000 articles-sources, while when the search was limited in time from 1950 (because a historical review was needed) it showed 17,400 articles.

To limit the articles were used the terms 'innovation', 'categories', 'open innovation', 'close innovation', 'triple helix', 'triple', 'matrix', 'types of innovation', 'models' were used of innovation', 'taxonomies of innovation', 'radical and incremental innovation', 'agile innovation', linear model', 'coupling model', 'chain link model', 'three horizon model', 'technological innovation',' strategies of innovation in Greek firms', 'models of technological innovation'. The articles used in the specific topic from this search to write this paper are 83.

The next thematic section of the literature review concerns technology parks worldwide and for this reason the keywords used for the search are the following: 'science and technology parks', 'Cambridge', 'Sophia Antipolis', 'United Kingdom Science Association' , 'categories of science parks', techopoles', 'technoparks', 'International Association of Science Parks', 'United Nations Educational, Scientific and Cultural Organization (UNESCO) and Science Park', 'definitions of science parks', 'differentiations of science and technology park', 'sectors of development', 'USA', 'Brazil', 'Japan', 'Portugal' 'France', 'Sweden'. The articles used in the specific topic from this search to write this review are 48.

Articles with the following key words were searched for the incubators that exist in technology parks and the connection they have with scientific institutions and research laboratories: 'incubators', 'development', 'technology incubators', 'goals of incubators', ' services of incubators', 'types of incubators', 'dimensions of incubation models', 'Batavia Industrial Center', 'Edinburgh', 'Cambridge University', 'Australia', 'Asia', 'Scandinavia', 'Germany', ' Latin American'. 52 articles were used.

Finally, articles related to innovation and Technology Parks in Greece were searched. The following keywords were used: 'Science & Technology Parks', 'incubators', 'universities and research centers', 'R&D', 'Science & Technological Park of Crete (STPC)', 'Science Park of Patras (SPP)' , 'Technological Park of Thessaloniki (TPT)', 'Attica Technology Park Lefkippos', 'Lavrion Technological and Cultural Park (LTCP)', 'Averofio Agri-Food - Technological Park of Thessaly (AV. TE.PA.THE)', 'Science and Technology Park of Epirus (S.TE.P.-E.)', 'Zakynthos'. 10 articles were used.

Case Study - Greece

The Greek government in 1989 took the initiative to create and develop Science & Technology Parks and incubators for nascent companies. The establishments of technology parks were close to universities and research centers and were designed to help research and development (R&D) corporation (Sofouli & Vonortas, 2007). Science parks are not managed by the state. The people who represent the industry of the place where you find the Technology park together with the members of the ITE make up the board of directors of the science parks. The Science & Technological Park of Crete (STPC) and the Technological Park of Thessaloniki (TPT) have an open policy and attracting new companies to the incubators. (Bakouros, Mardas & Varsakelis, 2002). The Technological Park of Thessaloniki (TPT) in collaboration with Federation on Industries of Greece, Universities and Research Centers, carry forward and enriches the field related to technology, tries to use any research whose result helps the positive development of a commodity or a commercial movement and generally tries to have a transmission of knowledge between all these bodies. The Science Park of Patras (SPP) uses an even more restrictive policy in terms of attracting companies (mainly aimed at companies with high technology, e.g. electronics) (Bakouros, Mardas & Varsakelis, 2002). The mission of the Science and Technology Park of Epirus (S.TE.P.-E.) to be the main pillar that will strengthen all sectors (public / private) with technology that is either old and enhanced or with new (innovation). This will be achieved through the incubator which is the basic and most important element that helps the company grow. All the services provided by the incubator cover the company from the simplest thing to the most complex (from installation site/building to specialized equipment. The Lavrion Technological and Cultural Park (LTCP) is a pioneering project of the National Technical University of Athens that aims to reuse the old facilities of the French firm in Lavrio to create a development hub that will bring together research and business activities. European and National co-financing is provided and high-tech institutions and companies are hosted as well as service providers.

Greek technology parks can receive funding either from the state, from incubators, or from private individuals (Business Angels). The state subsidy can provide and ensure liquidity that comes from European funds (grant, leasing, tax exemption, subsidy for the cost of created jobs). In this way, the state tries to give incentives to engage in entrepreneurship and increase investments. A key advantage is that the grant money does not have to be repaid. But the disadvantages include the bureaucracy which is time-consuming and the funding is given after evaluating the competing proposals. The incubator sells its services and funds start-ups with fast growth prospects by offering them both space and equipment. He also takes care to provide a network of contacts with customers and suppliers thus ensuring the company's first steps in the market and receives in return a percentage of the company's share capital. Its main purpose is to create a proper infrastructure and basis for professional development and consolidation of the business in the market. There are also business angels who are private investors mainly consultants, entrepreneurs and successful executives who work in small businesses providing them with small capital, experience and knowledge. The most important goal of this cooperation is the development of these firms which leads to the common benefit of all participants (2018). They make various decisions which depend on many factors such as whether the market is developing or competitive, whether it has high distribution costs and whether the product meets the needs of the market. An advantage of business angels is that they provide capital and advisory support to interested businesses, which helps the business strengthen its position in the market. After one to two years, when the growth of the business has reached a satisfactory level, the investor exits the business and sells his share to another investor or to the business itself. In our country this form of financing is not particularly widespread as it is internationally. On the one hand, a key disadvantage is the necessary sale of part of the company's equity shares, a fact to which many companies are opposed and show reluctance to accept sophisticated investors.

An important center that promotes and ensures the proper functioning of the Technological and scientific Parks of Greece is the Hellenic Innovation Redistribution Center (IRC Hellenic) which is aimed at small and medium enterprises, research and technological centers and universities. It finds suitable partners from Europe and supports the technology transfer process from Greece to Europe and vice versa.

IV. RESULTS

The results of the descriptive literature review are presented in a summary table by using PRISMA 2009 flowchart **(Table 23)**. In **Table 24** appears the Section of search, papers to use and the dates.

Table 23 . PRISMA flowchart with the results of descriptive literature review.

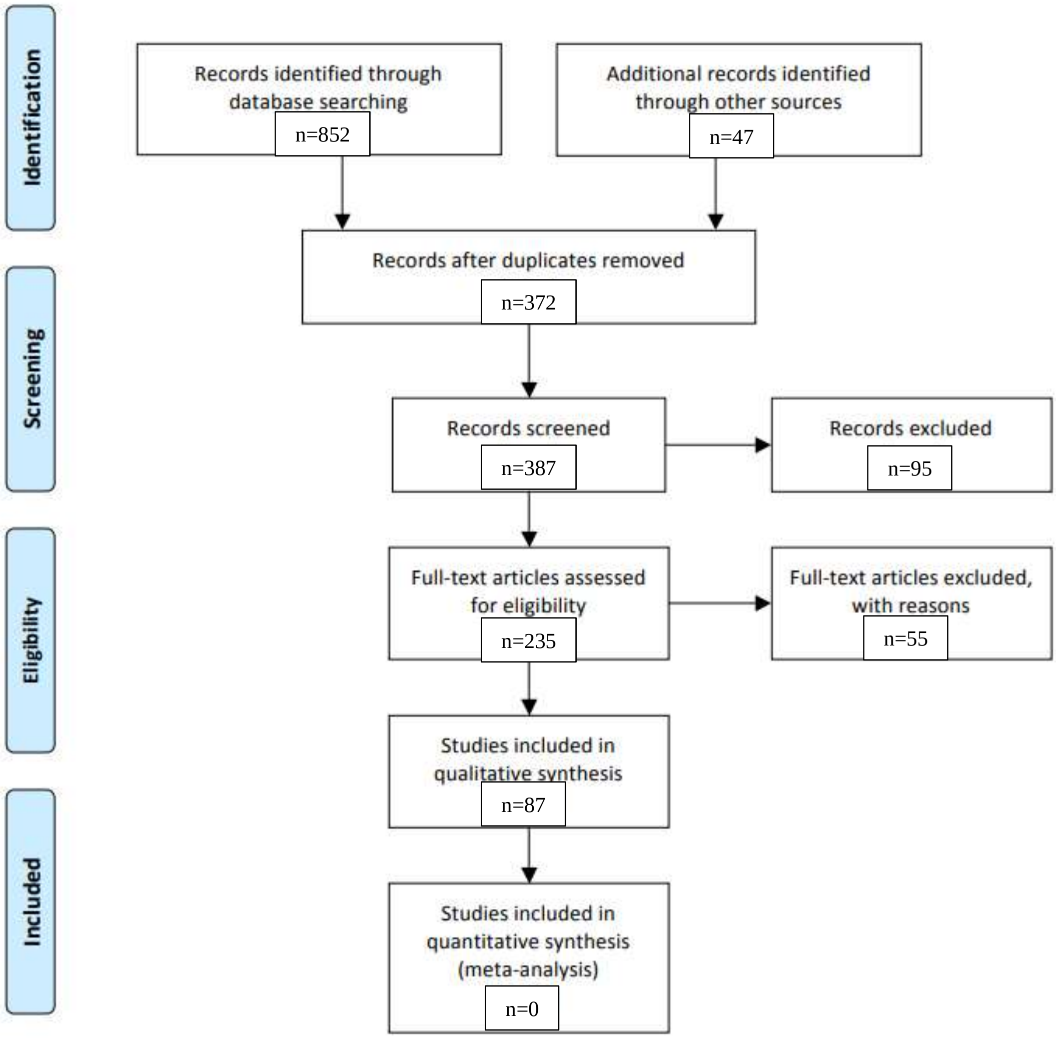


Table 24. Section of search, papers to use and the dates.

Section of search	Papers to use	Date from	Date to
incubators	52	1986	2015
R&D	43	1983	2007
innovation	83	1959	2013
Parks	56	1992	2016
Greece	10	1993	2011

V. DISCUSSION

For the growth and development of businesses, funds (small or larger amounts) must be used for investments, existing or more advanced machines must be used (production increase), there must be activity and there must be a new distribution network for the product (new or old product). All these can be realized through one very decisive factor, innovation. The financial progress of the company will directly benefit the company and its consumer public who will receive in their hands a product that meets their needs (Davila, Epstein & Shelton, 2006). The creation of new outputs, new models in firms, new markets changes the way businesses produce and market a product (Markatou, 2011). One sector that has benefited enormously from innovation is the IT sector. A business to be sustainable, profitable and grow/evolve over time should follow a policy that will be drawn up by scientific staff and entrepreneurs who are successful in the field (Chesbrough, 2003a). These groups of people knows very well all about entrepreneurship and innovation. The use of innovation causes an increase in the productivity of a product with the result that they bring huge benefits to consumers because the product satisfies and serves the buyer and businesses because the company reshapes its profile and evolves. The increase in productivity leads to the growth of the company, to an increase in revenues, so the wages of the employees also increase as a consequence (Saitakis, 2003). With the increase in the employee's income (salary increase) at the same time, he becomes a potentially stronger consumer, because he will want to purchase more goods and services. This chain is completed with the recruitment of new employees since the company's income will increase from the purchases of the consumer public.

As far as science and technology parks are concerned, they are necessary because through the innovation they provide to small start-up companies, they cause improvement / development in the company, in the space in which they develop and, by extension, in the society (Artz, & Kamalipour, 2003; Link & Scott 2003; Radosevic & Myrzakhmet, 2009). Companies that were in decline, for example the industrial area of Lavrio, were revitalized by the creation of Technology Parks. Companies that went bankrupt due to the financial crisis of 2010 can be helped through the know-how provided by Technology Parks. The cooperation of the Science and Technology Parks with Universities and Scientific Institutions is imperative

(Araouzo-Carod, Segarra-Blasco & Teruel, 2018; Dettwiler, et al., 2006; Vásquez et al., 2016a;). PhD students through their programs and research labs can provide innovative ideas. There will be a transfer of know-how directly to those involved with the innovation (https://averofio.uth.gr/en/structure). In addition to the universities through this collaboration there will be an influx of resources/financing/grants to its facilities. The university, with the increase in its resources, will be able to implement more programs/research, resulting in an increase in know-how (Löfsten & Lindelöf, 2002, Hackett & Dilts, 2004; Rothaermel, Agung, & Jiang, 2007; Infyde, 2008). Another important factor is the connection of Science and Technology Parks with ministries, General Secretariat of Research and Technology, different government departments. The knowledge must be transfered from the research institutions to the production units and must lead to an increase in the competitiveness between the companies, thus contributing to the competitiveness of the Greek economy. It would be beneficial to promote the cooperation of our country with other countries, as in the case of the Zakynthos Park (Norway's cooperation with Greece).

By the term Business Incubator (Incubator) is meant a company that provides newly founded companies with fast growth prospects with financing, premises and equipment (such as building facilities, Office equipment - stationery, furniture, computers and internet for network development, etc.), secretarial support services (how it should be organized properly and efficiently), consulting services (whether it concerns the accounting department for financial exemptions , either the legal department or the personnel department for the way the company will be staffed) (Chen, Wu,& Lin, 2006; Lois, Rice, & Sundararajan, 2004; Más-Verdú, RibeiroSoriano & Roig-Tierno, 2015; Schwartz & Hornych, 2008; Schwartz & Hornych, 2010). In addition through the incubator the network of contacts with customers and suppliers grows and expands significantly and in return receives a percentage of the equity capital and/or payments from the start-up company. Incubators can provide their services in various ways, either in terms of the structure with which they are organized or in terms of the type of consumer audience they are called upon to serve, or both.

Creating the right environment each time, the incubators focus on firms dealing with technology or in a blend of light industries and technology and service firms. They address in industries such as food processing, medical device technologies, ceramic technologies, and software development. They support the creation of micro- business and the needs of women and minorities (Hwang, 2013). A big shift has been made towards businesses dealing with the environment and telecommunications. For the growth of new ideas, the development of new goods, researchers of various specialties as well as start-ups must collaborate. This cooperation can bring benefits to both parties. On the one hand, researchers will be able to see people's needs and reactions, and on the other hand, the company will have access to all the surveys, resulting in additional education (Link & Scott; 2002).

Incubator services must include support for new businesses before, during and after their exit from the incubator. In order to maximize the efficacy of the Incubators, it is necessary to connect them with a network of development companies, institutes and programs that will link in such a way just to promote innovation, competitiveness and technology. It should be part of the wider strategy to develop and promote entrepreneurship and innovation from the beginning until the company is fully developed and widely recognizable.

In Greece, the technology and science parks were established at the end of 1980 and their geographical distribution (in Lavrio, Thessaloniki, Thessaly, Patras, Ioannina, and Heraklion) followed a logic of decentralization and connection with the country's regional universities (Bakouros, Mardas & Varsakelis) , 2002). The initial goal was to expand the facilities of these research centers and create incubators for new businesses. According to the decision of the General Secretariat for research and innovation (2009) the educational staff should take part in the business activity. The action decided is aimed at strengthening the growth of business innovative activities, the utilization of patents with potential for commercial exploitation, the implementation of innovative investment plans and the utilization of knowledge produced by researchers and by businesses with innovative activities in Greece and abroad.

The rapid economic developments, as there is still an economic crisis in our country, should be the most important factor so that businesses can be oriented. SMEs are the basic part of economical growth (Gamella, 1988; Massa & Testa; 2008; Saitakis, 2003). Self-taught entrepreneurs based on their many years of experience should drop their defenses against the new/innovative and let go of new techniques and innovations. They will have to adapt to the new systems of strategic planning, present their vision and set their company's mission. They need to take even more advantage of government subsidies and grants to ensure their competitiveness and to be easily sustainable. Human resources that are specialized and scientifically qualified must be absorbed by science parks and prevent them from leaving abroad (www.obi.gr). Research and innovation productivity would increase due to the association of more and more universities with technology parks (Hackett & Dilts, 2004; Hanaysha & Hilman, 2015; Infyde, 2008; Löfsten & Lindelöf, 2002; Markatou, 2011; Rothaermel, Agung, & Jiang, 2007; Ponnam & Balaji, 2015; Tu & Hwang, 2013).

VI. CONCLUSIONS

Greece through EKPA is ranked 156th in the world and 67th in the European Union for 2022 based on the social impact of its research activity according to the results of the SCImago Institutions Rankings /SIR). This information should be immediately exploitable by the state. This ranking values and evaluates the Universities using five-year data up to two years before the announcement of the ranking (e.g. 2016-2020 for 2022) and ranks the universities based on three main axes – aspects of their research work: a) Research performance , b) In the innovation produced by the research project (innovation output), c) On social impacts – impact of the research project (societal impact). High-quality research institutes should join and cooperate with already existing Science and Technology Parks, establish international collaborations, continue to have technological impact and increase social impact. All this at the same time as financing either through the state with different requirements or through business angels who in Greece have not taken an active role. Significant investments combined with new institutional reforms in terms of innovation policy must be made to lead the country to sustainable development.

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