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Introduction

Modern theories on international trade highlight the importance of technological competitiveness. Therefore, innovation-enhancing expenditure, such as R&D, enables domestic firms to improve the quality of their products. At the same time, clusters are recognized as a decisive factor for innovation through sharing of knowledge among their members, as well as through the creation of new knowledge. Collaboration with innovation providers under such a system ensures competitive advantages for companies as co-operating bodies have the ability to provide specialized know-how to businesses, skilled staff, funding opportunities, R&D processes for the production of new products.

The current deliverable is a **Technology transfer e-guide** concerning the procedures and stages needed to transfer innovation and technology / know-how, since the complexity of the whole process requires a proper assessment of the factors that affect it.

This deliverable was assigned to GNOSI ANAPTIXIAKI Business Development Consultants by the Hellenic Management Association under the contract of 9/3/2018.

The project objective is to develop a database for small, medium and large manufacturing companies, clusters and other business associations operating in Greece, as well as the processing of data that was obtained from the field research and entered into the database. 250 enterprises and Bodies participated in the field research, in particular, 245 enterprises and 5 Bodies. The aim is to raise information on the export activity of Greek businesses, create Guides to strengthen business co-operation initiatives, and capitalize digital tools to enhance incorporation of innovative know-how / technology into local markets.

1 Conceptual Approach of Innovation, Technology and Knowledge Transfer

1.1 Innovation

Innovation is widely recognized as essential condition for business success ensuring growth, sustainability and competitiveness. Innovation is a very broad concept and involves many different stakeholders varying from governments and scientists to business executives, marketing specialists and consumers. The diversity of the involved parties leads to different perspectives to innovation, thus resulting in different understanding of the concept.

From the very general point of view, innovation can be understood as a process from idea generation to commercialization – bringing the idea or invention to the market as a new product, process or service through the phases of idea generation, research and development, product development, marketing and selling a new product or service. The idea becomes an invention, when it is converted into a tangible new artifact. The inventions are necessary seed for innovations, but the inventions do not inevitably lead to the innovation.

Innovation is mostly regarded as the commercial and practical application of ideas or inventions (Trott, 2008; Varjonen, 2006)

Innovations are classified by the type, the degree of novelty and the nature (Terziovski, 2007). Four types of innovation are distinguished:

- product or service innovations,
- process innovations,
- marketing innovations
- organizational innovations together

Also, three degrees of novelty are defined:

⇒ new to the firm

⇒ new to the market

⇒ new to the world (OECD, 2005).

Types of innovation, degree of novelty and innovation nature define the three dimensions of innovation space. Table 1, Table 2 and Table 3 present this classification in more detail:

Table 1.1 - Types Of Innovation (OECD, 2005)

Type of innovation	Characteristic
Product or service innovation	A product innovation is the introduction of a product or service that is new or significantly improved with respect to its characteristics or intended uses.
Process innovation	A process innovation is the implementation of a new or significantly improved production or delivery method. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.
Marketing innovation	A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.
Organizational innovation	An organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to nontradable assets (such as non-codified external knowledge) or reducing costs of supplies.

Table 1.2 - Degree of Novelty (OECD, 2005)

Degree of Novelty	Characteristic
New to the firm	The minimum entry level for a innovation is that it must be new to the firm. A product, process, marketing method or organizational method may already have been implemented by other firms, but if it is new to the firm (or in case of products and processes: significantly improved), then it is an innovation for that firm.
New to the market	Innovations are new to the market when the firm is the first to introduce the innovation on its market. The market is simply defined as the firm and its competitors and it can include a geographic region or product line. The geographical scope of new to the market is thus subject to the firm's own view of its operating market and thus may include both domestic and international firms.
New to the world	An innovation is new to the world when the firm is the first to introduce the innovation for all markets and industries, domestic and international. New to the world therefore implies a qualitatively greater degree of novelty than new to the market.

Table 1.3 - Innovation Nature (Terziovski, 2007; Varjonen, 2006)

Innovation nature	Characteristic
New to the firm	Incremental innovations build on existing knowledge and occur continuously in the organization. These innovations lead to small improvements in products, services or processes.
Radical	Radical innovations produce fundamental changes in products, services or processes
Disruptive	In their most extreme form, innovations can even change the basis of society, for example the transformations resulting from today's computing technologies

1.2 Technology Transfer

The term "technology" has been defined by past researchers from many perspectives and has been given various definitions. As a result, this has influenced both the research design and results, as well as government policies in general (Reddy and Zhao, 1990).

Technology is defined as "specialised knowledge applied to achieve a practical purpose". In other words, scientific knowledge is applied to develop a product or service in order to satisfy an existing or a new need. Technology is therefore the culmination of intellectual and physical ingenuity in order to augment human skill (Van Wyk, 1988).

Another definition of the term considers technology as a scientific and technical knowledge regarding the processes, procedures and work programs, materialized in equipment and / or documentation and the know-how used by people to design, manufacture, exploiting, maintenance and eventual marketing of a product or a category of products or to complete a task or a category of activities.

In general, technology consists of two primary components:

1) A physical component which comprises of items such as products, equipment, blueprints, techniques and processes.
2) The informational component which consists of know-how in management, marketing, production, quality control, reliability, skilled labor and functional areas.

The term "technology transfer" through its name suggests that the subject of the transfer is the technology. The expression is very general but taking into consideration that the term technology

comes from the Greek “technologia” (techno - art, skill and logia - study) is one of major amplitude that needs to be explained.

Technology transfer is the introduction or acquisition in the economic circuit of specific technologies and machinery, equipment and facilities resulted from research, in order to obtain new or improved processes, products or services, required by the market or through which the innovative behavior is adopted, including the work to disseminate information, to explain, to transfer knowledge, to advise and communicate with people who are not experts in the results of basic research and pre-competitive applied in such a way as to increase the chances of application of such results, provided by an owner of the results.

In general, the term technology transfer can generally be defined as the transfer of know-how appropriate to local needs, with simultaneous absorption and diffusion within the boundaries of a country or an organization (Brad, 2010). In scientific literature there is no single, universal interpretation of the concept of technology transfer.

This is because is a relatively new research discipline rather complex which leads to the absence in the literature of some generalized conceptual models able to define very precisely what is the technology transfer and the circumstances in which it is conducted. The purpose of technology transfer is the transfer of research results into the economy.

The following definitions of the term technology transfer come from different sources and have minor variations but a similar meaning:

- Technology transfer is a process that allows the technology to flow from one source to a receiver. The source is in this case the owner or the holder of the knowledge, while the receiver is the beneficiary of this knowledge. The source could be an individual, an organization or a country (Tarek Khalil, 2000).
- Technology transfer is a process in which science and technology are transferred from one individual person or group to another, incorporating this new knowledge into its own way of dealing with things.
- According to the National Aeronautics And Space Administration – NASA (Washington, USA), technology transfer is the process of providing technology developed for a specific purpose of an organization to other organizations for different purposes.
- According to the National Technology Transfer Center- NTTC (West Virginia, USA), technology transfer is the process that uses technology, experience, know-how or facilities for a purpose different from the original organization that developed them. Technology transfer can lead to the commercialization or improvement of the product or process.
- According to the Federal Laboratory Consortium – FLC (New Jersey, United States USA), technology transfer is the process in which existing knowledge, facilities or capabilities that are developed by state funding are used to meet public and private needs.
- According to the Association of University Technology Managers – AUTM (Washington, USA), technology transfer is the formal transfer of innovation, which is the result of scientific research conducted by universities or/and non-profit research institutions, for public benefit in the commercial sector.

- Technology transfer is the process of changing ownership and control over an invention from the creator to a party intending to generate a commercial product or service. It is typically an intermediate step between development activity that generates invention outputs and production activity where commercial innovations are formed (Lane, 2012).

Another interesting aspect is the demarcation of the technology transfer object. Technology definitions have in common the recognition that it encompasses knowledge. This knowledge, however, must have three characteristics: it must be transferable, it must be standardized and it must satisfy a need, to provide a response to an existing problem.

If the technology is well standardized and can be delivered as a standard socio-technological package the demarcation of the technology transfer object is relatively simple. For the technologies that exist in various forms, unstandardized, demarcation becomes more difficult and requires special attention not to endanger the transfer success. Most times, however, technology transfer is adapted by custom applications based on specific requirements and tacit knowledge (Bozeman, 2000)

The main reasons that lead to technology transfer are summarized below (Patil 2010; Ortega et al, 2009):

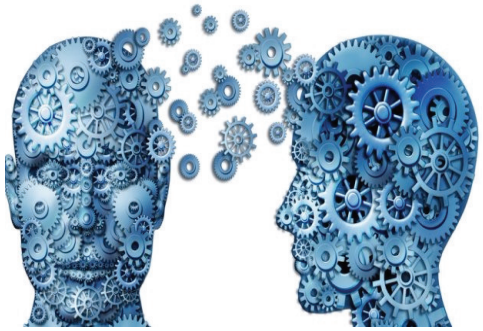
1. ***Lack of manufacturing capacity***. The developer of technology may only have manufacturing equipment which is suitable for small scale operation, and must collaborate with another organization to do large scale manufacturing.
2. ***Lack of resources*** to launch product commercially: The original inventor of technology may only have the resources to conduct early-stage research such as animal studies and toxicology study, but doesn't have the resources to take technology through its clinical and regulatory phases.
3. ***Lack of marketing and distribution capability.*** The developer of technology may have fully developed the technology and even have obtained regulatory approvals and product registrations, but it may not have the marketing and distribution channels.
4. ***Exploitation in a different field of application.*** Each partner may have only half of the solution i.e. the developer of the technology might be capable of exploiting the technology itself in the field of diagnostic applications and may grant exploitation right to commercial partner for the exploitation of therapeutics application.

Technology transfer leads to commercialization because of achieving the mission of the company. The technology surrounding the maintenance function will be investigated and this will be the major function in the company. It will also investigate the sources of technology with respect to the mechanisms that is used to transfer and the barriers to the process of transfer for both the internal as well as external technology transfer.

1.3 Knowledge Transfer

Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.

It originates and is applied in the minds of knowers. In organizations, it is often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms (Davenport, Prusak, 1998).



Knowledge can be divided into **two categories,** namely "explicit" and "tacit knowledge".

- **Explicit knowledge** can be formalized and represented, and thus articulated in formal languages.
- **Tacit knowledge** can be described as an experience that is embedded in an individual such as perspective and inferential knowledge.

In addition, Knowledge includes insights, hunches, intuitions, and skills that are highly personal and difficult to formalize, and as a result are hard to communicate or share with others.

In whatever dimension exists, knowledge must be transferred or moving from one individual to another person. Knowledge transfer within an organization enables employees to work efficiently together.

As a consequence, knowledge transfer acts as key tool of technology transfer, because technology cannot be transferred if there is no knowledge of what is going to be transferred.

Therefore, knowledge transfer and technology transfer must work together at the same rate of development in order to achieve the desirable objective.

knowledge transfer concerns connection and not collection, as the latter is considered only in the case of adoption of knowledge. This process does not allow the continuous flow of knowledge from the transferor the transferee. For technology transfer to be implemented, there must be continual flow of knowledge transfer between the involved parties.

In the current competitive environment, knowledge is recognized as a fundamental asset for any organization (Teece, 1998). Thus, knowledge transfer is very important when considering economic strength of a country or company.

Knowledge transfer can be defined as the process through which an organization unit is affected by the experience of another (Argote and Ingram, 2000). In addition, knowledge transfer in the fields of organization development and organizational learning is considered as the practical problem of transferring specific knowledge from one department of an organization to another.

Finally, according to Independent External Challenge Report to Research Councils UK- RCUK (2006), knowledge transfer is the two-way transfer of ideas, research results, expertise or skills between one party and another that enables the creation of new knowledge.

2 Forms of Technology and Knowledge transfer – Benefits and Challenges

2.1 Forms of Technology and Knowledge transfer

The variety of types and forms of technology transfer led to the necessity of systematization of classification features of technology transfer.

According to Rodionova (2001) there could be various classifications of technology transfer that occurs among organizations, as it is presented at the following table:

Table 2.1 Classification of technology transfer in enterprises

Classifications	Types of technology
By shape	• Tangible forms of technology: "turn key" production, processing line, machinery, equipment, tools, etc. • Intangible forms of technology: patents, licenses, knowhow, knowledge, experience, technical documentation, etc.; services: scientific, technical, engineering.
By appointment	Technology of products, technology of processes, technology of management
By means of technology transfer	Commercial and non-commercial, bilateral and multilateral, formal and informal, internal and external technical; engineering; industrial; information.
By the field of dissemination	Interstate, inter-regional, regional, inter-industry, inter-firm.
By the type of technology transfer	Vertical: between parent and subsidiary companies or between research institution and companies) Horizontal: between independent companies
By technological content achievements that are passed enterprise	Technical transfer in materialized form; information in the form of intellectual products.

As it was previously mentioned, technology transfer is the process by which commercial technology is disseminated. This takes the form of a technology transfer transaction, which may or may not be

covered by a legally binding contract (Blakeney, 1989), but which involves the communication, by the transferor, of the relevant knowledge to the recipient.

Among the types of transfer transactions that may be used, the International Code on the Transfer of Technology (The draft TOT Code, 1985) has listed the following:

a) The assignment, sale and licensing of all forms of industrial property, except for trademarks, service marks and trade names when they are not part of transfer of technology transactions;

b) The provision of know-how and technical expertise in the form of feasibility studies, plans, diagrams, models, instructions, guides, formulae, basic or detailed engineering designs, specifications and equipment for training, services involving technical advisory and managerial personnel, and personnel training;

c) The provision of technological knowledge necessary for the installation, operation and functioning of plant and equipment, and turnkey projects;

d) The provision of technological knowledge necessary to acquire, install and use machinery, equipment, intermediate goods and/or raw materials which have been acquired by purchase, lease or other means;

e) The provision of technological contents of industrial and technical co-operation arrangements".

The list excludes non-commercial technology transfers, such as those found in international cooperation agreements between developed and developing countries. Such agreements may relate to infrastructure or agricultural development, or to international cooperation in the fields of research, education, employment or transport (Blakeney, 1989).

According to Jasinski (1999), technology transfer exists in the following main forms;

1. Sales/purchase of result of the R & D work
2. Turnover of licenses, patents. Utility models, know-how
3. Sales/purchase of production techniques, means of automation etc
4. Technological advisory/consulting
5. Technical staff training
6. Exchange of technological information. Jasinski went further to simplify technology transfer into:
    - ✓ Embodied technology transfer (ie the flow of knowledge embodied in new products, materials, tools, machines and similar equipment), and
    - ✓ Disembodied technology transfer (ie other forms of flow of technical knowledge).

On the other hand, knowledge transfers are divided into two components – explicit knowledge and tacit knowledge transfer, depending on the type of knowledge (Li-Hua, 2005). According to scientific literature tacit knowledge transfer is considered more haphazard and in this area knowledge transfer can falter and technology transfer can be impeded.

Sveiby (1997), argues that two main perspective are adopted in modelling knowledge transfer: knowledge can be viewed either as an object, which can be directly observed, stored and successively reuses and transferred, or as a process ie a flow of interacting changes taking place in people who learn.

As it was previously mentioned, knowledge could be divided into tacit and explicit knowledge and explicit knowledge could be easily transferred than tacit knowledge. However tacit knowledge can be easily transferred only by people or group of people who obtain this knowledge.

Moreover, mutual understanding is a key point to the successful transfer of tacit knowledge. Specifically, If both the transferee and the transferor are taking into consideration their location, their values, and their beliefs, then tacit knowledge could be easily transferred. Knowledge transfer means different things to different people. Many authors have defined knowledge transfer in different ways, but one thing is very clear about all the definitions: *knowledge transfer is a continual flow of knowledge that led to innovation for economic development*.

Furthermore, there are **five main types** of knowledge transfer or sharing:

1. Serial transfer
2. Near transfer
3. Far transfer
4. Strategic transfer
5. Expert transfer

Each of these types differs according to the purpose, the method, and the ways in which the transfer of knowledge is implemented (Pham, 2008).

2.2 Benefits, Challenges and Barriers of Technology and Knowledge Transfer

The **benefits and challenges** of technology and knowledge transfer have over the years been a great concern to researchers. Because of the closeness between to these two terms, benefits and challenges are almost common to them.

Samli (1985), modeled the pattern of technology transfer into six dimensions: geography, culture, economy, business, people and government, while Egbu (2000), preceives knowledge transfer in six dimensional ways; people, content, culture, process, infrastructure and technology.

According to the above perceptions, it is obvious that the challenges and benefits of technology and knowledge transfer are similar procedures and that one cannot be implemented without the other.

In particular, one of the main benefits of technology transfer is globalisation of industries. Technology transfer brings organizations together in one large global market place, as technology transfer is implemented properly from developed nations to less developed ones.

Internationalization of domestic market is also another benefit of technology transfer, as it could increase local production and also lead to economic growth of country.

In general, the benefits of knowledge and technology transfer are significant; this is why developed countries continue investing a lot of resources in universities and Research & Development centres. In particular, developed countries, over the years, encouraged the transfer of knowledge from educational institutions to companies by signing partnership agreements. However, in developing countries knowledge transfer is not implemented properly, due to the lack of state funding, as well as the lack of liaision between higher educational institution and companies.

On the other hand, the **barriers** to successful technology and knowledge transfer must be addressed and overcome in an effort parallel to the development of the technology itself. These barriers are summarized below (Cooke & Mayes, 1996):

- Lack of awareness of available technologies and available organizations to assist.
- Lack of the knowledge needed to use the new technology.
- Lack of funds; lack of common interests between the transferring and recipient organization.
- Conflict of interest that would compromise the competitive position of the recipient organization.
- Lack of trust between the transferring and receiving organization; poor communication; lack of resources, such as equipment.
- Lack of time to develop and implement a new process.

Furthermore, the following additional factors can settle obstacles to the successful implementation of technology and knowledge transfer:

- Technical problems, which generally can be overcome, but can add time, cost and frustration.
- Resource limitations, such as uncertainty about funding or poor budget control.
- Changes in a project, such as withdrawal of a partner or the loss of key staff members.
- Organizational problems, such as a partner losing interest in the technological area.

What is more, Husted and Michailova (2002) outline six reasons for knowledge transfer hostility:

1. Potential loss of value, bargaining power, and protection of individual competitive advantage due to a strong feeling of personal ownership of the accumulated, “hard won” knowledge.

2. Reluctance to spend time on knowledge sharing. Knowledge senders may not be interested in knowledge sharing since the time and resources spent on it could be invested in activities that are more productive for the individual.
3. Fear of hosting “knowledge parasites”. Knowledge senders may be reluctant to share their knowledge with someone who has invested less or no effort in his/her own development.
4. Avoidance of exposure. By not sharing knowledge, individuals protect themselves against external assessment of the quality of their knowledge.
5. Strategy against uncertainty. Due to the uncertainty regarding how the knowledge receiver will perceive and interpret shared knowledge, knowledge senders may be highly cautious about revealing the relevant knowledge.
6. High respect for hierarchy and formal power. Knowledge senders may be reluctant to share crucial knowledge for fear of losing a position of privilege and superiority.

3 Requirements on the organization of Technology and Knowledge transfer in Greece

3.1 Current situation analysis

Transferring and utilizing technology and knowledge in developing technologies is vital issue for economic growth. In particular, product technology requires the effective transfer of underlying knowledge (Sahal, 1982). The construction industry integrates both technology transfer and knowledge transfer, and Abbot (1985) rightly suggests that technology and knowledge transfer depends on the recipient's ability to use knowledge to innovate. The transfer encompasses physical assets, knowledge, and human capabilities that enhance efficient organization of a construction project and services.

There is strong evidence in the literature to support the view that technological innovation in manufacturing companies is one of the main reasons for industrial competitiveness and national development (Freeman, 1982, Porter, 1985).

In Greece, are not observed significant innovation and technology transfer activities in most regions of the country. This specifically pertains to Southern Aegean, Northern Aegean, Ionian Islands, Eastern Macedonia and Western Greece regions. However, in some of these regions technology transfer activities are taking place due to participation in actions of the Operational Programme for Research and Technology. In Epirus and Crete, activities in the area of innovation and technology transfer are slowly emerging, with varying success.

As a result, it is obvious that in Greece, although there are projects that are implemented in the context of Research, Technological Development and Innovation programmes, there is still space of improvement. A proper legal framework only exists at national level and in Epirus. In other regions, the inadequate legal framework leads to disputes between competencies of national and regional levels.

In the following paragraphs it is described the Greek-specific socio-economic and cultural context that influences the country's base of technological development, using the framework by Moenaert et al. (1994) as a guideline.

a) Technological heritage: The post-war development of the Greek economy has largely been based on know-how and technologies imported from abroad. Transfer of technologies in the form of foreign direct investment, licensing and capital goods imports has been the main source of technological input into the Greek productive system (Giannitsis & Mavri, 1993). Local industrial research & development is very limited. Moreover, despite the recent growth of public research, the existing institutions of the national technology infrastructure are still insufficient to create a critical mass of research to attract the industry's interest (Sakkas & Spyropoulou, 1995).

b) Administrative heritage: Greece suffers from problematic technological infrastructure such as legislation, intellectual property rights and supply of designers and also outdated educational and training systems, which do not consider the needs of the industry. There is very low geographical

and institutional mobility of personnel which inhibits technology transfer (Tsipouri, 1991). Also, the high-income taxes discourage wealth accumulation and entrepreneurship (Maggina, 1992).

c) Market structure: A distinctive 'socio-economic' condition of newly industrialized countries like Greece is their industrial structure, which comprises small and medium enterprises (SMEs) run by an owner-entrepreneur and a handful of top managers, often members of the same family. Descriptive research in Greece indicated that the majority of the innovative products were developed following the initiative of the owner and a small management team with their own means (Sakkas & Spyropoulou, 1995). Research & development and marketing departments, as well as public support programmes played a less important role as a source of innovative ideas (GSRT, 1996).

Another important condition of the Greek market structure was the traditionally high level of tariff barriers, which protected manufacturing industries from foreign competitors. The level of competition started to rise in 1992, when Greece joined the European common market and abolished the tariffs on most of the products manufactured within the European Union.

d) Entrepreneurship: The mentality of the Greek citizens, known for their preference for independence, makes owning a business particularly appealing, even if the financial rewards are less (Maggina, 1992).

e) Culture: On the other hand Greeks feel threatened by high levels of uncertainty and risk (Hofstede, 1991). High uncertainty avoidance can be an obstacle to technological innovations with high inherent financial risk and can lead to a conservative strategy aiming for the survival of the small firm rather than its growth.

3.2 Critical factors on successful Technology and Knowledge transfer

In general, there are three conditions that must be met for successful technology and knowledge transfer:

1. *Alignment of Mission:* The technology must enhance, simplify, and supplement the mission and the strategy being pursued by the "scout." It must be the answer to a problem that the scout is charged with solving by his or her stakeholders. When technology "pushers" try to convince scouts that they should be solving a different problem, the pushers, and the deal, will fail.
2. *Resources and Time to Market:* The cost to innovate is immediate and certain, yet the value of the innovation is future and uncertain. There is an entire industry dedicated to predicting the value of future innovation, yet it is not an exact science and the elusiveness of the return and when it will be seen is a critical issue to be considered.
3. *Company Exclusivity:* Technology companies (and their owners) scale quickly when they have a superior value proposition and a sustainable competitive advantage. Innovation is a critical element in building a sustainable competitive advantage. For technology providers, this exclusivity model is not always good business since investment in innovation has a return if and only when an exclusive partner successfully commercializes and scales; if it does not occur, the upfront costs for innovation are not recovered.

Another critical issue for the successful transfer of technology and knowledge is the involvement of stakeholders. The multiple dimensions of technology transfer mean there are many potential stakeholders, including innovators, developers, owners, suppliers, buyers, recipients, users, consumers, financiers, donors, governments (including policymakers and regulators), insurers, international institutions, and non-governmental and community-based organizations. The stakeholders involved in any specific transaction will depend on the type and status of the technology and the associated nature of the transfer pathway[1]. All stakeholders must have the necessary knowledge and skills to perform the roles and tasks expected of them in technology transfer. High levels of awareness, motivation, and empowerment within the public and private sectors and in civil society will help ensure that people, communities, and broader organizations can adapt continuously to new circumstances and challenges that drive and arise from technology transfer.

Furthermore, government policies influence technology adoption through taxation, imports/exports, innovation guidelines, education and capacity-building, regulatory programs, institutional development, credit, and investment. Factors such as low investment in training, education, and Research and Development, the reduced linkage between research and application and the concentration on new research rather than documentation and dissemination of results also contribute mainly to the inefficient technology transfer process.

Additionally, in many models of technology and knowledge transfer, investment capital and risk are the critical implementation factors of a successful relevant project. Obtaining innovative technologies is not always enough requirement, since the investment risk on new technologies remains high.

The beginning phase of a company has distinct stages, each with different levels of organization, with specific key points that distinguish one stage from the other. These key points can be activities such as technology reconciliation, team management skills, market availability and efficiency, etc.

The adoption of technology must be accompanied by a well-developed business plan, many aspects of which may be different from the values of the technology itself.

In particular, the preparation of a business plan could be proved as the key decision tool to support the implementation of a technology transfer project. Specifically, an effective business plan can provide investors with valuable information in order to identify competitors and market entry barriers, as well as demonstrate a viable competitive advantage, defining the appropriate strategy to overcome the above challenges.

It also has to identify the prospect growth, the main assets of the company and the market potential. In the context of diffusion of technology, a business plan should clarify the appropriate actions that is to be implemented in order new technology become attractive to market.

Beyond initial investment, there is also a need for continued investing, which often involves various stages of venture capital. Each stage requires additional trading and poses an added risk of business failure before successful adoption of the new technology. Moreover, investors are expecting

immediate results, especially if the technology is not proven or the market is theoretical, and this generally makes it difficult, for emerging technologies to move along a commercialization path.

Last but not least, regarding the organization requirements, a team concept is always the best approach to accomplishing a successful technology transfer project. Typical technology transfer core team will be comprised by representatives of different departments of the company.

1. *Project Manager*: For overall responsibility, coordination and progress communication to management. His or her role may be enhanced as necessary by additional staff & responsibility & authority delegated as appropriate.
2. *Regulatory Affairs*: For coordination of the appropriate regulatory filings, advice on approval timing, content of the filing documentation & response to regulatory inquiries
3. *Engineering*: To coordinate associated capital projects & direct & control construction, equipment acquisition, installation & qualification.
4. *Material management*: To include those units responsible for pure chasing, Strategic planning, resource allocation & supply chain activities. This member (or members) will analyse & recommend the most favourable manufacturing strategy in consideration of internal capability, business partnership & tax advantages for the corporation.
5. *Manufacturing operations*: To represent the originating site and receiving location production activities. These representatives should have sufficient authority to commit the necessary personal & plant resource to accomplish the project within the defined cost & time limitations.
6. *Research and Development*: To support the technical issues and resolve problems. This group provides the process expertise and would be expected to train and direct the production trials at receiving site.

4 Legislative framework on Intellectual and Industrial Property

4.1 Intellectual Property

According to art. 18 para. 18 of Greek Law 2557/1997 the international term “intellectual property” is rendered in Greek as “dianoitiki idioktisia”. Intellectual property includes both copyright and related rights and industrial property such as inventions, models of usage, rights on vegetal varieties, signs, industrial plans and protected geographical names of origin.

Intellectual property includes the rights that arise from the creation of a product of the intellect, which is an intangible asset.

Greek Law 2121/1993 (Official Journal A/25/04.03.1993) is the main legislative framework for the “Copyright, Related Rights and Cultural Matters” about intellectual property issues.

4.1.1 Hellenic Copyright Organization

Hellenic Copyright Organization (OPI) is a legal entity under private law, located in and placed under the supervision of the Ministry of Culture and Sports.

It was established according to art. 69 of Law 2121/1993 and its operation is subject to its statute, Presidential Decree 311/1994 (Official Gazette A/165/1994).

OPI is administered by a seven-member Board of Directors. The main purpose of the Organization is to protect the authors and rightholders of related rights, to take steps for the implementation of Law 2121/1993 and the international conventions, to supervise the Collecting Societies and to undertake law preparatory work on matters pertaining to copyright and related rights. In the context of its responsibilities, OPI deals with any issue, in general that might occur in the field of copyright and related rights and represents Greece before the competent international organizations, as well as the Instruments of the European Union

It supervises the operation of the system for protecting the authors and the related rights rightholders; safeguards the rights of the users and the public; balances the interests of copyright sectors with those of industrial property sectors; incorporates and adjusts in Greece the latest evolutions in community and international level, contributing in this way to the promotion of creativity and culture.

Furthermore, OPI organizes seminars for the purpose of training and informing judges, lawyers, administrative personnel, authors, rightholders of related rights and students on matters of copyright and related rights and also provides information on matters of copyright and related rights.

4.1.2 Copyright

Copyright protects all original intellectual literary, artistic or scientific creations, expressed in any form, and especially written or oral texts, musical compositions, with or without text, theatrical plays, with or without music, choreographies and pantomimes, audiovisual works, fine art works, which include drawings, paintings and sculptures, engravings and lithographs, architectural works, photographs, applied arts works, illustrations, maps, three-dimensional works regarding geography, topography, architecture or science, translations, adaptations, customizations and other alterations of folklore works or expressions, as well as collections of folklore works or expressions or other simple events and facts, such as encyclopaedias and anthologies, if the selection or arrangement of their content is original.

Furthermore, copyright law protects databases which, due to the selection or arrangement of their contents, constitute intellectual creations. Such protection does not extend to the contents of databases and is without prejudice to any rights subsisting in those contents themselves.

Computer programs and the preparatory material for their engineering are also protected. The protection is provided in any form of expression of a computer program

Based on both national (art. 6 par. 2 of Law 2121/1993) and international law (art. 5 par. 2 of the International Berne Convention), entitlement and exercise of author's rights are not subject to any formality. Therefore, no formal procedure or the collaboration of a governmental or non-governmental service is required for the recognition of author's rights on a work, as it is the case for the acquisition of rights on other intangible assets (e.g. registering a trademark).

There are several practices one can undertake to secure the author and to make sure that there is an element of proof of paternity. The following two are the most commonly used: The first is the deposit of the Intellectual work to a notary. This practice provides a rebuttable presumption confirming the date, which can be evaluated by Court in the event of legal proceedings on the violation of the rights on that work.

The second practice is the postage of a registered letter whose sender and recipient is the author himself (or the recipient can be a third person) (we recommend the postage of two registered letters). On receiving the letter which contains the work, the author stores it in a safe place and keeps it sealed. In case a dispute about this specific work ever occurs, the letter will be unsealed by a judge before the Court and will confirm its content.

4.1.3 Author's rights

As far as author's rights are concerned, they include both the economic right and the moral right of the author of the intellectual property. The economic right, as the name suggests, gives the author the ability to exploit the work and benefit from it financially. The authorities included in the property right are the following:

- The right to record the work, i.e. the right for its first integration onto a data carrier consisting the basis for its further reproduction
- Reproduction of the work, i.e. the production of one or more copies of this work
- Translation

- Adaptation, customization or other alteration
- The authority to distribute the original work
- The import of its copies that were produced abroad
- Rental and public lending
- Public performance, i.e. any performance that makes the work available to a number of people greater than close family members and immediate social environment
- Broadcasting from the radio or television
- Cable, wireless or other type of presentation to the public (broadcasting the work over the Internet)

In case someone executes any of the aforementioned without having the author's permission, he violates the author's economic right, regardless of whether this is done for financial benefit or not.

Apart from the property right, the author also possesses the moral right, which renders the special nature of copyright law, as it includes the personal relationship that connects the author with his work. The moral right includes the moral authority for the work's publication, i.e. the authority to decide if, when and how the work will be made available to the public, the authority to recognize the authorship on the work and especially the authority to mention the author's name on the copies of his work and in every public usage or even his right to retain his anonymity or to use an alias. The most practical authority of the moral right is the authority to maintain the integrity of the work, i.e. to prohibit any distortion, abridgement or other modification of the work. Furthermore, there is also the right of access, i.e. the authority of the author to have access to his work, even if the work's economic right or ownership belongs to a third person, in which case access must be granted in a way that causes the minimum possible annoyance to the rightholder. Finally, the moral right also includes the moral authority of repudiation, which gives the author the right to repudiate contracts of transfer or exploitation of literary or scientific works, if this is necessary for the protection of his personality, due to changes in his beliefs or circumstances, and with the obligation to compensate the counter party for his positive damages. The peculiarity of the moral right does not lie only in the fact that it is independent from the economic right, but also in that it cannot be transferred.

4.1.4 Related rights

Besides the protection of the authors, technical progress has created the need to protect performers performing artists, producers of audio and/or video data carriers, as well as the broadcasting organizations. These natural and legal persons make a great contribution to public performance, reproduction, propagation or production of certain copyrighted works. Due to the technical ability to record and the ease of multiplication of the copy works, these contributions need to be protected, so that they are not subjected to appropriation and unfair exploitation by third parties. To this end, new legislative regulations have been instituted, in parallel with copyright, and the category of the so-called "related rights", i.e. related to copyright, was created. The Greek law Law 2121/1993 recognizes related rights for:

- artists who render or perform (art. 46)

- producers of audio and/or video data carriers (art. 47)
- broadcasting organization (art. 48)
- publishers of printed documents, responsible for typesetting and pagination (linear right - art. 51)
- persons publishing unpublished works by authors who are no longer alive (art. 51A)
- databases manufacturers

The law contains an indicative enumeration of the performers performing artists, which includes actors, musicians, singers, chorus singers, dancers, puppet show artists, shadow theatre artists, variety theatre or circus performers.

For each of the categories of related rightholders, the law recognizes rights of different content. (articles 46-53)

The protection of related rights leaves intact and in no way affects the integrity of copyright protection. None of the provisions "on related rights" can be construed in any way that infringes this protection.

4.1.5 Piracy

Piracy is a term that in colloquial language expresses the infringement of intellectual property and refers to the *manufacture, distribution and selling of unauthorized copies (pirated copies) of material that is protected by intellectual property*.

Copyright piracy is demonstrated in various forms and pertains mainly to the sectors of music, audiovisual works, computer programs, publications, radio/television broadcasts and the internet.

The piracy of assets that incorporate author's rights, is a worldwide phenomenon that has taken disconcerting proportions. The World Customs Organization, in a recent research, announced that 5% of the world trade has to do with products of piracy. The European Union, respectively, noted that 5 to 7% of the world trade is based on piracy, which amounts to an income loss of up to 300 million Euro. OECD, while conducting a research on the same level, estimates that the losses suffered by the world trade due to piracy are over 5%. The same alarming figures apply also to the loss of job positions due to the phenomenon of piracy. This loss is estimated approximately to 120,000 job positions per year in the USA and 100,000 positions in the EU.

- Revenue loss for the Greek State due to reduced VAT collections and customs duties
- Loss of jobs
- Decrease in the number of related cultural enterprises, and as a result, no development potential for the related cultural – and not only - industries
- Decrease/Hesitation in the investments of foreign capitals
- Threat to the consumer protection
- Jeopardizing of the country's authority
- Inability to enforce relevant laws and implement international obligations.

4.2 Legislative framework on Industrial Property

4.2.1 Industrial Property

Industrial property consists of two major branches:

- ⇒ the intangible goods, which are protected by special laws. This sector includes in particular the law of technical devices (eg patent), the law of aesthetic creations (eg industrial designs) and the law of distinctive features (e.g. name, brand name, trade mark)
- ⇒ the (unfair) competition.

Industrial property is the concept of intellectual property rights reserved exclusively for economic exploitation.

In particular, it is a set of rules that protect the patent and industrial design, trade mark, industrial design, geographical designations of origin, etc. Industrial property is thus distinguished from intellectual property, which, although it does not exclude economic exploitation at all, relates primarily (at least historically) to works of art and speech.

The main reason for existence of Industrial property is historically the financial reward of the avant-garde, based also on the property rights theory of motivating research and developing innovations.

Technology transfer, inventions and technological innovations are protected by Law 1733/1987 (Government Gazette 171/A/22.9.1987), as amended by Law No. 3966/2011 (Government Gazette 118/A/24.5.2010).

4.2.2 Hellenic Industrial Property Organization

Hellenic Industrial Property Organization is the only legally qualified institution for the protection of inventions and industrial designs. It also provides technological information from worldwide patent databases.

The organization, in accordance with the provisions of Law 1733/1987, contributes to the technological and industrial development of the country, through the exercise of competences such as the granting of patents, and other relevant certificates.

Additionally, Hellenic Industrial Property Organization has established 3 Regional Sub-offices (libraries) in Thessaloniki, Patras and Herakleion of Crete, in order to provide information and personalized assistance on industrial property protection and research results and to promote the technological information in the greater Greek region.

In the framework of its competence, the organization aims at stimulating much further the innovation and its contribution to the modernization and reinforcement of the industrial property protection system.

More precisely, through the implementation of various programmes, it aspires to the increase of the number of inventors, enterprises and other legal entities (e.g. universities, research centres) employing the industrial property system, and gives all its energies to the development of new

products and services and the continual adaptation of the same system to the changing needs of the Greek users.

The potential access to huge non-commercial patent data bases, the devoted personnel singularly specialized on related matters and, particularly, the know-how acquired through a 20-year experience on the domain of the industrial property protection constitute the guarantee of a reliable sector expert in questions concerning the technological information and the protection of patents and industrial designs.

4.2.3 Patent

Inventions are creations which are new, which involve an inventive step, and which are susceptible of industrial application. The invention may relate to a product, a process or an industrial application.

A patent is a title of protection with duration of 20 years, granted to the inventor or beneficiary for an invention, which is new, involves an inventive step and is susceptible of industrial application. An invention is considered "new" if it has not been known to the public by any means (written or oral or in any other way), before its filing date, involves an inventive step if, in an expert's opinion, it is not based on the existing state of the art in any obvious manner and it is capable of industrial application where it can be produced and used in any field of industrial activity.

According to Hellenic Industrial Property Organisation, the procedure for granting a patent includes the following steps[2]:

1. Filling the application
2. A 4-month term from the filing date for any corrections to be made or omissions to be supplemented
3. An examination, conducted by OBI in order to confirm whether the invention is "new" and involves an inventive step drafting of the search report or search report will written opinion
4. A 3-month term from the date of notification of the search report, for comments by the applicant on the search report
5. Drafting of the final search report or final search report will written opinion
6. Grant of the patent

4.2.4 Utility Model Certificate

The Utility Model Certificate is a *title of protection valid for 7 years issued to the proprietor for any "new" and capable of industrial application three-dimensional object with a predetermined shape and form, which provides a solution to a technical problem*.

The procedure for obtaining a Utility Model Certificate includes:

[2] https://www.obi.gr/OBI/Default.aspx?tabid=215

1. Filing of the application
2. A 4-month term from the filing date for any corrections to be made or omissions to be supplemented
3. Granting of the Utility Model Certificate

4.2.5 Industrial Designs & Models Registration Certificate

An industrial design is *the outward visible appearance of the whole or part of a product resulting from the specific features thereof, such as the lines, shape, color, etc.*

Certificate of registration of a design or model is the entitlement to protection which is granted to the person entitled as to a design or model which is new and has an individual character.

The procedure for the granting of the certificate is short and simple.

After the elapse of 4 months from the date of the filing of the application and provided that this is in order and complete, Hellenic Industrial Property Organization issues the relevant entitlement to protection. Its maximum term of force is 25 years (from the date of the correct filing of the application), should the beneficiary so wish and the renewal fees are paid normally (every five years).

5 Mechanisms involved in innovation and technology/ know-how transfer procedures

A technology transfer mechanism is defined as any interaction between two or more entities (countries, enterprises, individuals), through which, the technology / know how is being transferred.

There are many criteria that can be used to classify technology transfer, but none of them includes all the dimensions of technology transfer. The distinction of technology transfer can be made to (Radosevic, S., 1999):

Conventional mechanisms such as:

- ☑ Foreign Direct Investment - FDI.
- ☑ Licensing agreements.
- ☑ Franchising.
- ☑ Marketing and management contracts.
- ☑ Technical assistance contracts.
- ☑ Turnkey contracts.
- ☑ International subcontracting.
- ☑ Creation of strategic partnerships and joint ventures.
- ☑ Exports.
- ☑ Purchase or leasing of capital goods / mechanical equipment such as instruments, tools, appliances, machinery, etc.

Non-conventional mechanisms such as:

- ☑ Reverse engineering.
- ☑ "Reverse" brain-drain.

(a) Foreign Direct Investment - FDI

Foreign direct investment - FDI, are those realized outside of the investor's country, but within the boundaries of the enterprise that invests. In national income balances, foreign direct investment includes direct or indirect cashflows, reinvested earnings, debt capital and equity capital. The foreign investor has full control over the transferred technology resources and the investment includes a "package" of assets and intermediate components such as capital, technology, administrative capabilities, market access and business capabilities.

Foreign direct investment is realized mainly within parent companies and their subsidiaries. Parent companies are usually multinationals. In developed and developing countries, multinational companies are the main means of transport and diffusion of technology (Rugman, 1983).

While multinational companies are seeking profit, they also try to improve the operational efficiency of their investment or to produce specific technical products. At the same time, parent companies

decide whether or not to make an investment by investigating the chances of repatriating their funds (Kazis & Perraki, 1984).

In any case, multinational companies transfer technology through their international production networks. According to Aggarwal (1982) the positive effects of multinational companies on technology transfer are:

1. They have the ability to replace the local capital needed in countries that are less economically developed.
2. As a result of technology transfer from the multinational company, auxiliary industries and new jobs can be created, resulting in additional national income.
3. It is likely that additional revenue will be generated by multinational company's activity, which will create additional government revenue as well.
4. Technology transfer from the multinational company can improve the country's export capability, since with the adoption of high technology the country's export market is being expanded.
5. The foreign trade deficit may be reduced or there will be an increase in country's foreign exchange reserves.
6. Multinational companies sell technology at a marginal cost that does not include a significant part of the fixed cost that would be spent if technology have been developed domestically.

The negative impacts of technology transfer on multinational companies are the following:

1. The outflow of dividends or profits, foreign executives' wages, royalties, interest payments, and other money remittances may be expensive for a country
2. Technology transfer on an extensive scale, may destroy the domestic industry.
3. Multinational companies are likely to use the country's scarce financial resources, causing difficulties in raising funds for local industries.
4. Similarly, other resources that are in scarcity, such as skilled personnel, raw materials, etc. may be binded by multinational companies detrimental to the domestic industry.
5. Due to technology transfer from multinational companies, parallel industrial production may not be developed.
6. The existence of a multinational company may be considered by other domestic industries as a model, resulting in developing inappropriate technologies in their attempt to follow it.

To summarize, it is crucial that multinational companies be controlled by local government. In advance, a misguided approach of technology from the host country may increase the gap between the upper economic level (capital-intensive technologies or technology) and the low economic level (local labor-intensive technologies). Also, due to the activity of multinational companies, in a less

developed country, there is a possibility only several sectors to be developed detrimental to other equally important.

(b) Licensing agreements

Licensing agreements grant the licensee the license to use or exploit the licensor's know-how on issues such as production, technology, quality, organization and education or to accept specific services by him, as well (Doinakis & Mpakouros, 2006; Giannitsis & Mavri, 1993). The company that decides to acquire technology through licensing agreements aims to (Giannitsis & Mavri, 1993):

- Maintain and / or improve its position on the market.
- Improve its efficiency.
- Promote new products or use more efficient production procedures.
- Diversify its product when it is established that it loses ground in the market and gain a competitive advantage over its local or foreign competitors.

The enterprise that is the licensor aims to (Giannitsis and Mavris, 1993):

- To ensure monopoly revenue due to its technological innovation.
- Transfer more of its profits abroad and remit them in the form of royalties. Revenue from royalties' payments is usually more favorably taxed than profits.

Enterprises that own a technology innovation prefer to transfer it to a country through technology agreements in cases when (Caves, 1982):

- There are entry barriers (small market size, state restrictions) in the host country for foreign investment.
- They do not themselves have sufficient know-how, experience or the funds required to expand into foreign markets.
- This technology is evolving rapidly.

Companies are discouraged from concluding licensing agreements when (Caves, 1982):

- ☒ The total cost of trasfering technology to a foreign enterprise (they do not participate themselves) is large.
- ☒ The "opportunity cost" of capital in the host country is larger than that in the home country.
- ☒ The cost of transferring technology to a subsidiary is less than that to foreign - independent enterprise.

(c) Strategic alliances and Joint Ventures

Business alliances can take different forms, without including either arm's length relationships or acquisitions and mergers. The development of these alliances has increased greatly in the 1980s, but initially included "affiliated" companies. These were enterprises that had concluded secret contracts between themselves to promote their common interests. While the definition of foreign direct investment is relatively easy, the concept and content of alliances between enterprises is difficult to identify. The difficulty lies in the existing controversy for what is the exact content of these alliances. Several researchers note that in the context of an alliance between two enterprises, a bilateral flow of technology takes place, while other researchers state that in addition to the technology flow or R&D, an alliance also includes production and marketing partnerships. Whatever the content of alliances between enterprises, these alliances are a reality.

(d) Technical assistance and cooperation

This type of technology transfer presents many similarities to technology transfer through people. However, this technology transfer mechanism has some particular characteristics (e.g., financial, organizational) that differentiate it from others. In many cases, this mechanism does not produce the expected results and leads to a waste of financial resources. However, this mechanism is still significant concerning the money transactions.

(e) Subcontracting

Subcontracting is a technology transfer mechanism that was developed at the same time as the international search for production. A subcontracting is considered as an order of an enterprise-contractor to another company (the subcontractor) for the manufacture of intermediary products to be used by the contractor in the manufacture or assembly of final products which will be placed on the market.

Apart from the difficulties presented for both contractors and subcontractors, international subcontracting agreements are considered as an effective way of accelerating industrial growth. That is because subcontracting is a mechanism that offers comparative advantages. Also, these subcontracting agreements allow for the mobilization and better use of the of the countries human resources.

In addition to the workforce mobilization, the development of international subcontracting contributes to the dissemination of technological knowledge in the less developed countries and that was strongly observed in subcontracting enterprises in East Asia.

At the same time, international subcontracting could generate inflows of foreign capital and thus act as a catalyst in attracting other investments that both would allow for an increase in local added value and would help diversify output. Subcontracting agreements should be the first step towards the creation of joint ventures. This is justified by the fact that the subcontractor has learned the client's production processes and has gained his trust, so he can cooperate more closely with him in the future. In this case the transfer of technology is accelerated and the network of subcontractors is viable.

(f) Exports

Foreign markets are a source of demand but also a source of knowledge if the buyer works closely with the seller. The recognition of buyers as a source of knowledge, is not a fully accepted technology transfer mechanism. This is due to the underestimation of buyers, the internal or external market, as a source of knowledge for improving products. The experience of the countries of East Asia shows that the transfer of information, requirements and knowledge from the buyer to the supplier of the products, through commercial activity is an important source of knowledge for the seller of the products. Information coming from buyers is a kind of free "advice" to improve capacity. Close and long-term cooperation between vendor and buyer provides the first information relevant to the international market, product specifications and appropriate production methods.

This "circular" relationship between the seller and the buyer is beneficial to both parties, because the information from the buyer is incorporated into the products, which they become more competitive (seller's benefit) and these improved products are distributed to the market in the interest of the buyer. Thus, the knowledge provided by the buyer reaches him in the form of an improved product.

The quantity and quality of the knowledge transferred is closely related to the type of communication the buyer has with the seller. Close and efficient communication means a greater flow of knowledge from the market. It is impossible to measure the technological knowledge that is transferred in this way. On the contrary, it is possible to measure the results of this knowledge transfer providing that, its effects are obvious on the products. Another indicator of knowledge transfer, in the above way, is the organizational framework and the extent of buyer-seller relationships. The extent to which the vendor will convert the information he receives from the market into real technological knowledge, integrating it into his products and production processes, depends on his ability to assimilate knowledge.

(g) Capital goods

Technology could be deemed as an unknown percentage of an imported product total value. Among all products, capital goods are considered to include the most important technological content.

The importance of capital goods to the economic development of a country is critical, as it is considered as the basis for developing and assisting other sectors, either new to the industrial sector in the country or banned from inflows into capital goods. The existence of even a limited industrial base for the production of capital goods is an important asset for entering into new markets (e.g. electronics sector).

Although domestic capital goods production is considered as a major asset for overall growth, the importance of proper use and management of imported capital equipment should not be ignored. In the case of Greece, where this sector does not have a broad base, its development and restructuring is secondarily. For Greece, which almost exclusively imports capital goods, the proper adaptation, use, management and improvement of foreign-based equipment may be a better strategy than the domestic production of the equipment.

Over the years, the technological content of capital goods has become confusing. As a result, countries with a generally limited technological background and capabilities will not be able to take advantage of embedded technology in capital goods. Thus, the importance of importing capital goods as an autonomous technology transfer mechanism has diminished. However, if technology transfer acts supplementary to other mechanisms suitable for the transfer of intangible assets, such as subcontracting, transfer of staff, etc., it is converted to an essential technology transfer mechanism.

(h) Technology transfer through people, printed publications and exhibitions

The importance of people mobilization, as a technology transfer mechanism, has been recognized since the industrialization of Europe and the United States. The blooming of highly dynamic Asian economies has clearly revealed the benefits of brain-drain (immigration of a country's scientific workforce).The brain-drain phenomenon, was until recently accused of excluding negative consequences. However, turning brain-drain into brain-gain and improving contacts with scientists and engineers who have migrated underlines the importance of transferring technology through people. This phenomenon is very extended in the electronics industry in East Asia, and does not belong to conventional technology transfer mechanisms. The development of this electronics industry is mainly due to the repatriation of technological workforce and reverse engineering.

Innovations in the production process (and not only), due to their tacit nature, are transferred with this mechanism. Many organizational changes (e.g. Japanese management modes) are now available to the public through international literature. However, their transfer is more efficient when combined with visits to relevant industries.

Also, the plethora of publications, technical journals and scientific writings, provides knowledge that would otherwise be difficult to locate. For example, the current engineer has the power to monitor (and should) progress on his profession by reading technical magazines or books, visiting exhibitions and attending lectures. The alternatives offered through this technology transfer mechanism are innumerable.

(j) Turnkey Contracts

With this mechanism of technology / know-how transfer, an enterprise exports technology, administrative experience and even mechanical equipment. Under turnkey contracts the technology supplying company agrees to undertake the full range of technical and managerial operations required to establish a business in full operational condition to the local owner. Typically, the turn-key arrangement expects the provider of technology to transfer a "package" of all elements of the technological know-how required to set up and operate for a limited period in a new production facility.

The multinational company may undertake a turnkey contract because of its “embracing arrangement”. Some turnkey agreements include additional items such as training of local personnel and the provision of technical assistance. Some may include process technology, though this is not a typical form while others may require the technology supplier to manage the plant for a period before handing it over. Such package deals provide ample opportunities for transfer pricing practices.

Advantages of turnkey contract include the following: 1) when technology is complex, the ability to assemble and operate it gives the proprietor a considerable advantage. Thus, turnkey contract is a way of maximizing profit from the ownership of technology. This is specially the case when FDI may not be a viable route for international entry of the firm due to host country restrictions on FDI or the risks associated with the latter (Hill, 2001, p. 368).

Hill mentions three disadvantages of turnkey contract: first, the company entering the contract has no long-term prospect in the host country and second, a company involved in such a contract may potentially help to create a competitor.

(k) Franchising

Franchising refers to a license provided by the franchisor to the franchisee for the use of specific components of the franchisor under its name and refers to a product, method of operation, production and packaging, or marketing programs. In particular, the provider authorizes the recipient to produce or process products in accordance with his instructions and then sell them with the franchisor's trademark, so there is an exploitation of foreign technology / know-how (Papadakis, 2002).

The technology is not complex and difficult to transfer or copy. The goods are not easily tradable across national boundaries (e.g. hamburgers that need to be cooked on spot at the point of consumption). There is a need for continuous quality control to assure consumer loyalty. Thus, exporting may not be a viable option. Licensing would be inappropriate in view of the importance of continuous quality assurance. As incomes have continually grown in developed countries as well as some developing countries in the past five decades and as the pattern of food, drinks and petrol consumption has changed due to a faster pace of life and work, demand for fast food, bottled drinks etc. has increased tremendously.

Franchising, thus, has emerged as a very popular form of international business in response to these trends. In practice, like in the case of licensing, problems arise. Some of these problems include government regulations, problems of finding suitable franchisees, lack of host country investment, control of franchisees, adapting a franchise to local needs and trade mark obstacles (Shamsavari, Adikibi & Taha, 2002).

(l) Management Contracts

They refer to agreements where one enterprise provides another one package of business management skills in some or all of its management areas, in exchange for a percentage on sales. It is therefore a clear way of transferring know-how, having the advantage that this kind of expansion does not respond to high cost, while the enterprise can be expanded into a target-market that will generate more revenue comparing to the cost of acquiring know-how (Hout, Porter & E. Rudden, 1982).

6 Guidelines for stages of innovation and transfer of technology / know-how

6.1 Models of technology transfer

Several models were developed by economists and specialists in the area of technology transfer. E. Souder (1990), developed a model to analyze the process of technology transfer among enterprises, called "Technology Transfer Process Stage".

The model consists of four stages:

1. *Prospecting stage*

Consists of analytical research and decision-making activities aimed at screening alternative technologies and selecting the ones that fit the user's requirements.

2. *Developing Stage*

Consists of physical and laboratory R&D activities focused on enhancing, elaborating, embodying, and tailoring the selected technology from stage 1 to meet the user's requirements.

3. *Trial Stage*

In trial stage the developed technologies are field tested.

4. *Adoption Stage*

Consists of final development, technology modification, and user's implementation activities. In fact, E. Souder declares that the activities of four stages may overlap, some technologies may be so desirable that the user adopts them during their prospecting or developing stage, thus bypassing certain stages.

There are certain roles in the model, that E. Souder describes them as follows: The disseminator role, sponsor role, developer role, implementer role. Those roles, influence the flow of activities through the stages of transfer.

The disseminator role: Involves making potential users aware of appropriate technologies and generally serves as a broker between supplier of technology and its users. Examples of disseminator are libraries, librarians, and information specialists.

The Sponsor Role: Covers political and financial support for various activities as well as for disseminators, developers and implementers. Government-funding agencies are examples of sponsor's role players.

The Developer Role: Involves the conduct of laboratory and field trial R&D.

The Implementer role: Deals with selling, customer development and trouble shooting.

E. Souder claims that the model can be used to help select the contingent set of best practices within each stage of technology transfer process. He illustrates the process of selecting as follow: First, consult the model to determine the stage of transfer process at which activities are to occur and then implement all the essential practices for that stage.

It is clear that the model is appropriate as a guiding model for firms, whether it is a buyer or seller with similar level of competitive advantages, who wish to formulate transfer policies by using those best practices in the way that was suggested. It could fit very well the buyer and seller of technology within intra- firm trade.

Another model is called "Technology Acquisition Model" developed by Adikibi (1984). The model is known to be a very simple, practical and realistic one, and could be adopted and applied to any country searching for a systematic explanation and analysis of the process of foreign technology acquisition. So, it is a model that explains the technology transfer among enterprises of developed and developing countries.

Technology Acquisition Model is based upon four stages:

1. *Physical Transfer Stage*

The first stage comprises the actual movement of technology elements such as plants, machinery, equipment, patents, personnel from the home to the host country. This stage is completed when the structure of production is set up to commence operations. It is suggested that a duration of 3-8 years is required for the completion of this stage. Certainly, the duration depends largely upon the level of development of both countries, home and host.

2. *The Anchorage Stage*

This stage is critical in the acquisition of foreign technology, without which the know-how remains alien to the host country. In the first phase of this stage, low level of technology anchorage, and the dominance of foreign input is noticed, especially in the case of a 100% wholly owned subsidiary. The preparation of detailed training programmes and the provision of the training facilities take place in this phase of anchorage process.

The second phase is the transitory phase from I (foreign input dominance) to phase II, which is characterized by domestic factor dominance. The major characterization of this stage is training of the local employees. It includes in-plant, out-plant and overseas programmes geared towards implanting the technology and developing indigenous personnel capabilities. Phase II will be the longest in duration and the most difficult to accomplish.

Finally, in phase III, all the expected evidence of complete anchorage of technology appears, such as effective control in the areas of management, production, technical and financial functions; substantial decrease in the import of factor-inputs; production under the management by local personnel. Phase III will be shorter in duration than phase I and II, and it represents the stage where the technology is ripe for diffusion into the industry.

3. The Diffusion Stage

The diffusion stage has two main features. The first of these is the emergence of "imitator" indigenous firms within the industry which copy the basic and standardized designs and techniques of production in the industry. The second phase of the Diffusion Stage manifests in three ways. "Imitative Production" involves production of goods similar to those of the technology transferee. The other comprises the development of indigenous enterprises in the industry which compete with the transferee enterprise; the third feature is the increased number of host country nationals knowledgeable in the technology compared with number in the Anchorage stage. At this stage licensing of advanced technology for production becomes a beneficial and efficient method of co-operation with foreign counter-parts, because the basic know-how of the industry has now been diffused in the system. Unlike the Anchorage Stage, the completion time of the Diffusion Stage is expected to be much shorter. He adds the factors that may affect the duration include, among others, the entrepreneurial drive of nationals, the profit potential in the industry, the government support and the national business environment.

4. The Assimilation Stage

The main features of this system refer to the high degree of concentration on R&D and the deeper understanding of the technology process, in order to determine whether to adapt or modify the technology to suit local needs. This stage has no completion time, because the adoption and modification of any know-how is a continuous process.

The purpose of this model, as was declared by its developer, is to analyse and assess the process of technology transfer to and within the industries in the developing country. This could justify the absence of feedback arrows, for the indication of flow of information from developing country industries to the parent firm in the developed country.

In summary, the decision-making process for the conclusion of technology transfer agreements by multinationals includes a broad framework of activities that are distributed at different stages. According to Tihanyi and Roath (2002) these stages are the following:

- Selection of the investment country
- Selection and evaluation of the type of technology to be transferred. The assessment of the life-cycle phase (growth, maturity, decay) of the technology product will be transferred in accordance with the possibilities on the part of the recipient.
- Selection of the implementation methodology of the agreements by the transferor, taking into account the potential capabilities of the transferee.
- Determination of the role of the recipient
- Determination of the economic goals of the project.
- Training of the recipient's employees in order to cope with the changes that will be made due to the technology transfer.
- The establishment of a monitoring and control mechanism of the transferor, which will identify and resolve any errors and weaknesses that will arise during the technology transfer process and

its adoption by the recipient. This will ensure the successful implementation of the whole process

6.2 Example of technology transfer

Pagar S. et al. (2014) presented an example of technology transfer in pharmaceutical industry and in particular, during the development of a formulation. As they stated, it is important to understand the procedure of operations used, the critical and non-critical parameters of each operation, the production environment, while also equipment and excipient availability should be taken into account during the early phases of development of formulation.

(A) Development of technology by R&D. (Research Phase)

(a) *Design of procedure and selection of excipients by R&D* – Selection of materials and design of procedures is developed by R&D on the basis of innovator product characteristics.

(b) *Identification of specifications and quality by R&D* – Quality of product should meet the specifications of an innovator product.

(B) Technology transfer from R&D to production (Development Phase)

R&D provides technology transfer dossier (TTD) document to the product development laboratory, which contains all information of formulation and drug product.

(C) Optimization and Production. (Production Phase)

(a) *Validation Studies* - Production is implemented after validation studies that can verify that process is able to stabilize the product, based on transferred manufacturing formula. Manufacturing department accepting technology is responsible for validation and the R&D department transferring technology, should take responsibility for validation such as performance qualification, cleaning and process validation.

(b) *Scale up for production* - Involves the transfer of technology during small scale development of the product and processes. It is essential to consider the production environment and system during development of process. Operators should concentrate on keeping their segment of the production process running smoothly.

(D) Technology Transfer Documentation

Generally interpreted as document indicating contents of technology transfer for transferring and transferred parties. Each step from R&D to production should be documented, task assignments, responsibilities and acceptance criteria for completion of technology transfer should be clarified. It is duty of Quality Assurance department to check and approve the documentation for all processes of technology transfer.

(a*) Development Report* – The R&D report is a file of technical development, and R&D department is in-charge of its documentation. This report is an important file to indicate rationale for the quality design of drug substances and its specifications and test methods. The development report is not prerequisite for the application for approval; it can be used at the pre-approval an inspection as a valid document for quality design of a new drug. The development report contains:

1. Data of pharmaceutical development of new drug substances and drug products at stages from early development phase to final application of approval. Information of raw materials and components.
2. Design of manufacturing methods.
3. Change in histories of important processes and control parameters.
4. Specifications and test methods of drug substances.
5. Validity of specification range of important tests such as contents impurities and dissolution.
6. Verifications of results.

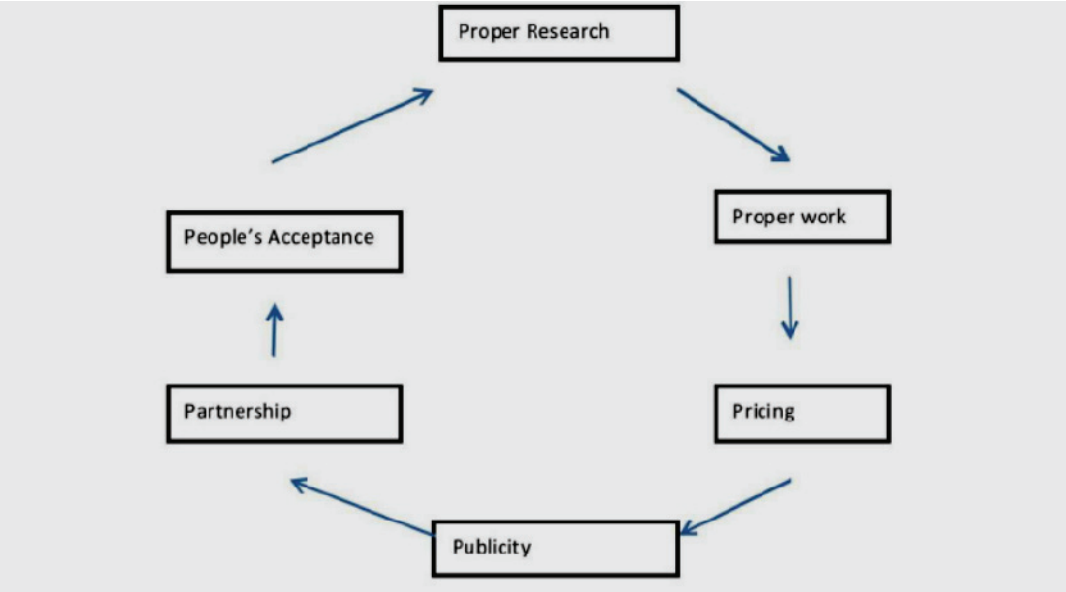
(b) *Technology Transfer Plan* – The technology transfer plan describes items and contents of technology to be transferred, detailed procedures of individual transfer and establish judgment criteria for the completion of the transfer. The transferring party should prepare the plan before the implementation of the transfer and reach an agreement on its contents with the transferred party.

(c) *Report* – Completion of technology transfer is to be made once data are taken accordingly to the technology plan and are evaluated to confirm that the predetermined judgment criteria are met. Both transferring and transferred parties should document the technology transfer report.

(d) Exhibit – After taking scale up batches of the product, manufacturing of exhibit batches takes place. In case of exhibit, batch sizes are increased along with equipment and their processes. This is done for filling purpose in regulatory agencies.

6.3 Contents of technology transfer

Figure 5.1 P's of perfect technology transfer



Source : Sagar Pagar et al (2014)

- **Proper Research –** Proper research means research that presents reproducible results and issues which will guide future investigations.
- **Proper work -** Refers to institutional bodies and guidelines which must be in place before hand in order any administrative decisions not to get delayed.
- **Pricing –** Is the most difficult and critical area of technology transfer. - High prices may result to an unsold technology. - Low prices may result to revenue loss.
- **Publicity -** It is important to identify and then approach the buyer and that means to adopt targeted Publicity. Specific journals, websites, letters to manufacturer, personal selective visits etc. are some common approaches which can help in locating technology buyers.
- **Partnership -** Partnerships are important to ensure the technology is successfully adopted.
- **People's Acceptance -** It is useless to try to develop a technology which people will not accept e.g. due to religious reason/social concerns etc.

7 Technology transfer / know-how centers and other institutions supporting the transfer of technology / know-how in Greece

Technology transfer facilitator organizations are the ones that enable and, in many cases, drive technology transfer. These might be technology transfer broker organizations, technology transfer offices established in research institutions or collaborative university industry consortiums, consulting companies or any organizations that facilitate and support technology transfer process.

In Greece, there are several public and private organizations supporting the transfer of technology / know-how, whose main objective is the creation, promotion and exploitation of methods and tools at local and international level for the development of technology / know-how. Some of them are the following:

7.1 Centre for Research and Technology Hellas[3]

The Centre for Research and Technology-Hellas (CERTH) founded in 2000 is one of the leading research centres in Greece and listed among the TOP-20 E.U. research institutions with the highest participation in competitive research grants.

CERTH has important scientific and technological achievements in many areas including: Energy, Environment, Industry, Mechatronics, Information & Communication, Transportation & Sustainable Mobility, Health, Agro-biotechnology, Smart farming, Safety & Security, as well as several cross-disciplinary scientific areas.

Today CERTH includes the following five institutes with indicated major fields of research:

- **Chemical Process & Energy Resources Institute (CPERI)**: Sustainable & Clean Energy, Environmental Technologies, Chemical & Biochemical Processes, Advanced Functional Materials.
- **Information Technologies Institute (ITI):** Informatics, Telematics and Telecommunication Technologies.
- **Hellenic Institute of Transport (HIT):** Land, Sea and Air Transportation as well as Sustainable Mobility services.
- **Institute of Applied Biosciences (INAB):** Agri-biotechnology, Health Translational Research, Informatics for big bio-data.
- **Bio-economy and Agro-technology Institute (IBO)**: Agrotechnology, Mechatronics, Biomedicine and Kinesiology.

[3] https://www.certh.gr/root.el.aspx

Main objective:

CERTH focuses on strengthening its partnerships with Greek enterprises as well as Greek regional development bodies in an effort to enhance the competitiveness of producers by exploiting the specialized services of the Center.

In this context, CETRH responds positively to any potential proposal or initiative that involves innovation and growth dynamics, aiming to transform scientific knowledge into profit and to create successful partnerships.

The benefits of the members of this network are:

- The development of innovative products and services with competitive nature.
- Improvement of their products and services.
- Upgrade of their production process.
- The reduction of their operating costs through technological interventions.
- The coverage of their laboratory needs with specialized analyzes and tests.
- Acquisition of experience after exploitation of appropriate European and national financial instruments.

7.2 Corallia Cluster4

Corallia is a "Greek Technology Clusters Initiative" and is the first institution established in Greece (2006) to organize and systematically manage and develop clusters, with the strategic goal of creating integrated productive and innovative ecosystems in which coordinated actors operate in specific sectors and regions of the country in knowledge-intensive, high technology and export-intensive industries. Corallia is Unit that belongs to of the "Athena Research Center in Communications and Knowledge Information Technologies" (www.athena-innovation.gr) and is under the auspices of the General Secretariat for Research and Technology of the Hellenic Ministry of Education, Research and Religious Affairs (www.gsrt.gr). The vision of the founders of Corralia is to create a Greek environment with the right framework conditions to allow sciences, innovation and entrepreneurship to flourish (again). The mission of Corralia is to underpin and accelerate the development of cohesive and productive innovation ecosystems, within which actors operate in a coordinated manner, in specific sectors and regions of the country, and where a competitive advantage and export orientation exists. Moreover, Corralia intends to become a pan-

[4] http://www.corallia.org/el/about-corallia.html

European best practice cluster initiative/ organization supporting Greek world-class innovation clusters.

Main objective:

Corallia acts as a catalyst to **enable favorable conditions for the development, exploitation and promotion of innovations** developed within the clusters. For the development of these "*favorable conditions*", it undertakes and implements specific supportive actions, which aim at individual strategic objectives, such as:

- Achieving **economies of scale.**
- Networking **globally.**
- **Capitalization** of business research.
- **Internationalization** of Greek businesses.
- Education and vocational **training**.
- Increasing **employment.**
- Creating a **common identity** and boosting **entrepreneurship.**

In particular, Corallia is referred as an important initiative that has helped to "strengthen competitiveness, entrepreneurship and innovation in knowledge-intensive and export-oriented sectors where Greece has the capacity to build a sustainable, innovative ecosystem". Corallia has already developed and currently supports the growth of three highly-specialized cluster initiatives in Greece, in knowledge-intensive thematic sectors, namely *the gi-Cluster (gaming and creative technologies & applications)*, the *mi-Cluster (nano/microelectronics-based systems and applications)* and the *si-Cluster (space technologies and applications)*. In addition, it manages the operation of three InnoHubs in strategic locations in Athens and other cities of Greece, *the a1 innohub and a2 innohub (HQ) in Maroussi* and the *p1 innohub in Patras*, while at the same time implementing a series of initiatives for acceleration of young entrepreneurship.

Finally, Corallia invests in international collaborations, in order to promote the extroversion of Greek entrepreneurship, to exchange good practices and promote partnerships with corresponding European and international initiatives.

7.3 The General Secretariat for research and technology5

The General Secretariat for Research and Technology (GSRT) is a modern public service assigned with the task of defining, as well as coordinating the implementation of, the national policy for Research, Technological Development and Innovation. It supports the activities of research and industry bodies through competitive research programmes highlighting economic performance and a socially fair allocation of outcomes. Furthermore, it supervises research and technology bodies, which provide local communities with

[5] http://www.gsrt.gr/central.aspx?sId=119I428I1089I323I488743

the skills necessary for producing knowledge and boosting innovation. GSRT actively follows EU and international developments in the field of RDI and represents the country to the EU and International Organisations within its competence.

In the face of the current economic conjecture, investing in science, research and technology becomes a key strategic priority towards a socially and economically sustainable model of development, based on highly-qualified human resources and novel ideas.

Primary strategic goals:

The main **strategic goals** of General Secretariat for research and technology are:

- Defining and promoting a comprehensive strategy for research, technology and innovation.
- Fully exploiting the highly-qualified research staff to boost economic growth, generate new employment and reverse the current trend of expert Greek scientists migrating abroad.
- Transferring and facilitating the uptake of innovative technologies by the country's industry, through targeted use of research outcomes.
- Supporting initiatives to raise awareness among Greek people in the fields of Research and Technology.
- Supervising and funding Research and Technology Bodies across the country.
- Promoting international S&T cooperation with EU and third countries and making best use of the opportunities to participate in relevant EU, bilateral and international initiatives.
- Evaluating the outcomes of research & innovation projects, with a view to adjusting research policy on an ongoing basis.

Programming Period 2014-2020:

GSRT Policy and Actions

The **Strategy for Smart Specialisation** constitutes the main guidance for defining and promoting the Research and Innovation Policy for the programming period 2014-2020. It highlights areas where Greece has already achieved, or can achieve, a competitive advantage. Priorities emerge as a result of the so-called entrepreneurial discovery process aimed at identifying new business opportunities to put into use newly-produced knowledge and integrate it into value chains. This process is carried out through continuous and active consultation of all actors involved in the innovation "ecosystem" (including private enterprises, higher education institutions and research centres, ministries, regional authorities, etc.), with private enterprises and the industry at large also playing a central role.

Smart Specialisation Strategy Priority Areas:

- Agro-food sector.
- Bioscience and Healthcare / Pharmaceuticals.
- Information and Communication Technology (ICT).
- Energy.
- Environment and Sustainable Development – Climate Change.
- Transport and Logistics.
- Materials – Manufacturing.
- Cultural and Creative industries – Tourism.

Actions planned by GSRT in each of the above areas are aimed at developing innovative products and services, transferring knowledge, supporting research staff and further developing and using research infrastructure. The European dimension (synergies and complementarity with the "Horizon 2020" strategy and other activities within the European Research Area) is strongly promoted; top priorities also include fostering an innovation culture and broadening the participation of social partners in research institutions.

7.4 PRAXI Network 6

PRAXI Network is an organization providing technology transfer services to SMEs and research organisations throughout the country.

Primary strategic goals:

Its mission is to enhance the competitiveness of Greek enterprises and research laboratories by linking research to production, promoting innovation, supporting entrepreneurship and transnational cooperation.

It started out in 1991 through the initiative of the Foundation for Research and Technology (FORTH) and SEV Hellenic Federation of Enterprises, and later the Federation of Industries of Northern Greece (FING). Since then it has been undertaking significant initiatives leading to the development of technology partnerships between Greek and foreign companies and organizations, initially operating as one of the European Commission's "Innovation Relay Centers" and then as a member of the European Business Support Network Enterprise Europe Network and Coordinator of the Greek Network. In parallel and since 1999, PRAXI Network is an official information and advisory body for the Framework Programmes for "Research and Technological Development" and "Horizon 2020" taking on the role of the National Contact Point (NCP).

[6] http://praxinetwork.gr/el/

7.5 The Athens Center for Entrepreneurship and Innovation-ACEin[7]

The Athens Center for Entrepreneurship and Innovation-ACEin is the incubation center of AUEB offering support to researchers and potential young entrepreneurs in order to develop innovative business ideas and bring them to the market. ACEin puts significant effort in supporting students pursuing either undergraduate studies and executive master's or doctoral degrees and researchers who wish to turn their innovative entrepreneurial ideas or scientific research results into a sustainable business model and subsequent start-up company.

The Centre helps the new ventures to develop their ideas and to move from the stage of idea in developing the concept and exit to market progress, while increasing the chances of success through constant interaction with the market. This process of progress, development and maturation of each new business idea for a product / service indicates that each group requires a different approach to teaching, mentoring, support services and networking activities. The approach used to provide such support actions based on multiple levels by the process of development and maturation of business forms. Distinguished the following main stages of the idea / maturity group (based on the Lean Startup methodology):

- Stage 1: Development of business concept / model.
- Stage 2: Concept Imprinting and first feedback from market.
- Stage 3: Develop concept and subsequent feedback from the market.
- Stage 4: Final preparation to exit the market.
- Stage 5: Launch and development.

This methodology covers this whole spectrum through a multi-layered approach, which ensures both the provision of adequate support and knowledge development, depending on the stage reached in each business format, and the encouragement and support for transition from one stage to another.

The Center offers more than just physical resources. The key strategy is to offer training on how to establish and run a start-up, services from experts, mentoring and networking. In parallel, the Centre organizes innovative actions in the context of its wider synergies with the market in certain sectors, in order to introduce innovative solutions in specific market segments.

[7] https://acein.aueb.gr/the-center/

Technology transfer issues are a strategic objective of the Center. An important operation of the centre is to support the exploitation of the research results of the Economic Universitiy of Athens entire academic community (professors, researchers, doctoral students, postgraduate students).

The Center uses a specific methodology based on best practices from the market and abroad to promote a solution that suits any academic team according to the requirements of the research result and its business maturity. After a series of criteria for assessing the business maturity of the research result, the different strategy scenarios are defined and the right decision for exploitation is always taken in cooperation with the team.

The exploitation scenarios can be either simple securing rights and concluding contracts with enterprises or creation of new startups or spin offs, from research and other members.

Depending on the exploitation strategy, the academic team is supported by the Center with a range of services to make the next steps towards establishing a viable business or to secure its intellectual property and conclude contracts with interested enterprises. Some of the services provided are the evaluation of the technical and business maturity of the research result, intellectual property issues, market analysis, business model development, economic assessment of the idea and / or technology, legal support, etc.

Primary strategic goals:

The main strategic pillars of The Athens Center for Entrepreneurship and Innovation include:

Education: A carefully designed mixture of lectures, team assignments/ workshops, case studies and action learning. The courses are taught by faculty members and specialized industry experts.

Networking: Organization of various networking activities at national and international level, team development activities, access to the European network of University-based incubation centers, networking and dissemination activities, participation in international exhibitions and events.

Consulting Services: Teams are benefited from professional services (provided by experts) which vary depending on the team business maturity level, their specific needs and the capabilities of the Centre. The consulting services are provided in various fields, such as business planning, marketing, branding and design, IT development activities, accounting and legal issues etc. and are offered through personalized meetings with experts.

Competitions: Access to mentors with proven corporate, startup and venture capital experience and successful track record. Motivation through a series of events, competitions and award schemes.

Exploitation of research output: An important part of the Centre's approach is the systematic exploitation of the research produced within university and research laboratories. This is tackled

through a concrete Technology/ Knowledge Transfer methodology and a number of activities, such as providing continuous information/ motivation to the research teams, adequate assessment of the prospects of scientific achievements, collaborative identification of the most appropriate exploitation plan per research result (e.g. setting up a business, selling research and development services, concession permits) and providing specialized consulting services, depending on the business readiness, maturity and needs of each research team.

7.6 Athena Research Center[8]

The mission of Athena Research Center is to conduct outstanding research in Informatics and Computational Sciences and to ensure this research has an impact on society, tackling global challenges and addressing local needs. Athena Research Center studies a broad spectrum of research issues within these fields, including some raised by other sciences, industrial applications, or societal challenges.

The scope of activities of Athena Research Center includes all Information and Communication Technologies, from the perspective of both Computer Science and Computational Sciences, and covering all software and hardware aspects. These include all areas of informatics, data science, robotics, automation, signal processing, artificial intelligence, networking and digital communication, and modelling.

Multidisciplinarity is at the foundation of the research philosophy of Athena Research Center, which carries out R&D both at the level of information technology itself and at the level of specific applications. Computational sciences thus form a strong component of the Athena Research Center activities, including - but not being limited to - computational linguistics, archaeology, engineering, medicine, biology, biodiversity, earth observation, space science, mechanics, and the arts.

Together with research, innovation is also a fundamental pillar of the mission of Athena Research Center. Research institutes, spin-off companies, and three highly-specialised clusters in knowledge-intensive thematic sectors create a fertile technological innovation ecosystem within the Center. Collaboration between all actors, including systematic efforts to bring research results to market, has always been mutually beneficial.

Vision and strategy of the Athena Research Center:

The vision of Athena Research Center is to serve the full spectrum of the research lifecycle, starting from basic and applied research, continuing on to system and product building and infrastructure service provision, and ending with technology transfer and entrepreneurship. The fundamental role

[8] https://www.athena-innovation.gr/en/identity

of Athena Research Center is to build knowledge and devise solutions and technologies for the digital society. Its value lies in the unique collection of skills and know-how of its researchers and professional staff and its national and international reputation.

The overall strategy values of Athena Research Center are developing along these axes:

- A research plan that targets fundamental and applied challenges with high potential impact, aiming at high-quality, novel, and deep results, with informatics at the core of synergies with other sciences.
- A technology transfer plan with a global focus and special attention to the Greek environment.
- A young researcher development plan based on identifying and supporting original talent.
- A strategic co-operations plan aiming at key industrial companies, governmental agencies, regional authorities, and international research and higher-education organizations.
- An educational plan that targets at designing and participating in local and international graduate programs.

7.7 Center for renewable energy sources and savings (CRES)[9]

The Centre for Renewable Energy Sources and Saving (CRES) is the Greek organization for Renewable Energy Sources (RES), Rational Use of Energy (RUE) and Energy Saving (ES). Its main goal is the research and promotion of RES/RUE/ES applications at a national and international level, as well as the support of related activities, taking into consideration the principles of sustainable development.

CRES operates in two main fields of activity:

- ☒ As a National Energy Centre,

working on energy planning and policy for RES, RUE and ES in accordance with the policy of the Ministry of Environment, Energy and Climate Change and developing the necessary infrastructure for the realisation of RES/RUE/ES investment projects.

- ☒ As a Research and Technological Centre for RES/RUE/ES,

through applied research on new energy technologies and by technically supporting the market for the penetration and implementation of these technologies.

CRES has a dynamic presence both in Greece and internationally, with innovative research results and a large number of contracts for the Greek Government, the European Commission and

[9] http://www.cres.gr/kape/present/present_uk.htm

Governments of non-European countries, concerning the planning, evaluation and realization of energy investment projects.

In line with its mission, CRES:

- Is the official consultant of the Greek government on matters of RES/RUE/ES in national policy, strategy and planning.
- Carries out applied research and develops technologies which are both technically/economically viable and environment-friendly.
- Undertakes demonstration and pilot projects, to promote the above technologies.
- Implements commercial RES/RUE/ES applications in private sector energy projects, local authorities, professional associations, etc.
- Provides technical services and advice, in the form of specialized know- how and information, to third parties.
- Disseminates technologies in its areas of expertise and provides reliable information and support to interested organizations and investors.
- Organizes and/or participates in technical and scientific seminars, educational programmes, specialized training courses, meetings, etc.

Within the scope of its activities as a Research and Technological Centre, CRES provides the link between basic research and industry, aiming at the development of local technological products and services. Through this activity, CRES has obtained important know-how, participating in many research projects and networks.

In parallel, by co-ordinating and participating in a respectable number of pilot and demonstration projects, the Centre has assisted the market in accepting and adopting new energy technologies. CRES has provided important services to private investors and local authorities, exploring the techno-economical possibilities for the application of RES/RUE/ES projects.

It has carried out national, European and international investment projects for RES/RUE/ES, contributing substantially to the evaluation of investment proposals, the technical monitoring of the projects, the briefing of investors, public organisations, industry and other relevant sectors, as well as raising public awareness of RES/RUE/ES. As an advisor to the Greek State on matters of national energy policy, especially RES/RUE/ES, CRES has worked for the development and realisation of business initiatives and investment ventures, participating in the planning, co-ordination and monitoring of integrated programmes and projects at national, regional and local levels.

7.8 A.U.TH research Committee – Technology Transfer Office [10]

[10] https://www.rc.auth.gr/Content/Display/RC_TECHNOLOGY_TRANFER_OFFICE

The Technology Transfer Office operates within the scope of the Research Committee, and supports the University research staff, as well as organizations and institutions in the public and private sector that are interested in collaborating with the University for research and technology transfer matters. The mission of the Technology Transfer Office is to use and disseminate the University research results for the benefit of society, through procedures that are consistent with academic principles and codes of conduct.

Its operational objectives are:

- To provide support services to the Research Committee on information exchange between the University and industry in order to promote research results and the research potential of AUTh.
- To support the conversion of research results into patents, licenses and copyrights, and to promote their utilization.
- To support the establishment of spin-offs and to enhance project implementation contracts on behalf of public and private sector organizations.

The Technology Transfer Office, independently or in cooperation with other AUTh departments, offers the following services:

- Assessing commercial interest in technological innovations.
- Financing the pre-commercial development of new technologies/products with commercial interest.
- Identifying potential partnerships.
- Protecting and managing Intellectual Property rights.
- Supporting the establishment of Spin-offs and Startups.

7.9 Center of Technology Transfer and Development[11]

The major principles of the Center of Technology Transfer and Development include both research support services to the research community but also enhancement of innovative and integrated actions to the regional innovation system in the scope of technological and social innovation. The Center of Technology Transfer and Development of the University of Crete retains as main objective the diffusion and exploitation of the producing analytical, synthetic and theoretical knowledge through the attainment of collaborations and partnerships with regional and extra-regional research and productive actors. Catalyst in this process constitutes the long-term building of steady relationships both with research departments of the University and with business firms, development agencies, local government bodies and innovation actors in European and international level.

The central role of the Center of Technology Transfer and Development includes the provision of research and technology management services to the research community, the formulation and implementation of integrated actions towards an effective and mutually beneficial collaboration among regional actors, the attainment of extra-regional collaborations on certain technological and innovation areas of expertise and the knowledge exchange, diffusion and exploitation through the strengthening of the regional innovation system's functions.

The primary objectives of the Center include the following:

- Intensive watch and mapping of academic and research excellence and the mobilization of research mechanisms (laboratories, research groups) through the support and dissemination of good practices.
- Exploitation of research and technological outputs which result from the research activity of the University and the increment of added value through the knowledge diffusion in the social environment.
- Enrichment of systemic and 'triple helix' links amongst University, research institutions, regional enterprises and governance actors and the enhancement of the 'regional system of innovation' via knowledge exchange activities.
- Support of innovative ideas and actions oriented to concepts of entrepreneurship.
- Organization of seminars related to entrepreneurship, innovation and technology development.
- Provision of specialized technology transfer services to research laboratories of the University and researchers and the support of multidisciplinary research and collaboration.

[11] http://www.kemeta.uoc.gr/

- Dissemination of information and specialized consulting for current opportunities in national and international level.
- Active involvement in the implementation of research and projects in regional, national and international level.

The major activities of the Center include:

- Mapping of technological, innovative, economic and social environment.
- Intermediation among potential technology partners and formulation of partnerships via the identification of technological or socio-economic opportunities.
- Intermediation amongst various scientific and technological fields, in analytical, synthetic and social sciences and enhancement of multidisciplinary initiatives.
- Innovation management and consulting on issues of partnership-building for technology development and innovation.
- Provision of technology transfer services to researchers, students and entrepreneurs.

The Center of Technology Transfer and Development constitutes a node of knowledge diffusion, which amplifies the interaction between the business and academic community, contributing to the formation of partnerships and associational actions oriented to the knowledge diffusion, and attaining of new regional advantages via the use of knowledge sources.

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